Appendix B
Geotechnical Summary Report

This report was prepared by the staff of Anchor QEA, LLC, under the supervision of the Engineer whose seal and signature appears hereon, as required by Chapters 18.43 and 18.220, Revised Code of Washington (RCW).

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Former Reynolds Metals Reduction Plant – Longview

ANCHOR QEA

Geotechnical Summary Report

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TABLE OF CONTENTS

TABLES

FIGURES

GRAPHICS

ATTACHMENTS

ABBREVIATIONS

ASCE	American Society of Civil Engineers
ASTM	ASTM International
BFM	bonded fiber matrix
CAP	*Cleanup Action Plan*
CDID	Consolidated Diking Improvement District
CPT	cone penetration test
cy	cubic yard
DSR	*Pre-Design Investigation Data Summary Report*
Final EDR	*Final Engineering Design Report, Version 2*
Former Reynolds Plant	former Reynolds Metals Reduction Plant
FOS	factor of safety
g	gravity
H:V	horizontal to vertical
MCE	maximum considered earthquake
N-value	standard penetration resistance
NA	not applicable
NAVD88	North American Vertical Datum of 1988
pcf	pounds per cubic foot
PDI	pre-design investigation
PGA	peak ground acceleration
psf	pounds per square foot
RI/FS	*Remedial Investigation and Feasibility Study*
SPT	standard penetration test
SU	site unit
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WDNR	Washington State Department of Natural Resources
WSDOT	Washington State Department of Transportation

1 Introduction

This *Geotechnical Summary Report* presents the geotechnical design and evaluation for the former Reynolds Metals Reduction Plant (Former Reynolds Plant) in Longview, Washington. This *Geotechnical Summary Report* is an appendix of the *Final Engineering Design Report, Version 2* (Final EDR), prepared in accordance with the cleanup action as specified in the *Cleanup Action Plan* (CAP; Ecology 2018a) pursuant to Consent Decree No. 18-2-01312-08 (Ecology 2018b).

1.1 Site Description

The site is located at 4029 Industrial Way near Longview, Washington, in unincorporated Cowlitz County. The property includes about 460 acres and is currently operated as a multimodal bulk materials handling facility. The site is approximately 10 feet above mean sea level and bounded by the Columbia River to the south; Consolidated Diking Improvement District (CDID) drainage ditches to the north, west, and east; Industrial Way along the northern boundary; and private property to the east.

1.2 Purpose

The purpose of this appendix is to document the geotechnical engineering evaluations essential to the development of the design of the various remedial actions required by the CAP (Ecology 2018a).

1.3 Report Organization

Section 2 presents the site and subsurface conditions that exist at the site. Section 3 details the geotechnical engineering evaluations that were conducted for the proposed design, and Section 4 details the geotechnical engineering evaluations that were conducted regarding stability of the CDID levees. Section 5 provides construction considerations and recommendations for the design implementation. Lastly, Section 6 details the limitations of this report.

2 Site and Subsurface Conditions

Site and subsurface conditions have been investigated previously as well as during the pre-design investigation (PDI) conducted in February 2020. This section will provide a summary of the site geological conditions as they pertain to geotechnical analyses. Additional details about general site use, historical conditions, and environmental aspects are provided in the *Remedial Investigation and Feasibility Study* (RI/FS; Anchor QEA 2015).

2.1 Previous Investigations and Studies

Geotechnical evaluations included a review of existing subsurface data collected at the site coupled with review of well installation logs, as well as online resources for information to support field observations. Data sources included the following:

- RI/FS (Anchor QEA 2015)
- *Geotechnical Data Report (Draft), Upland Bulk Handling Facility and Shiploader Dock* (GRI 2012a)
- *Stockpile Area (Task 1) Design Memorandum, Upland Bulk Handling Facility* (GRI 2012b)
- *Geotechnical Data Report* (Anchor QEA 2011)

2.2 Subsurface Investigation and Laboratory Methods

2.2.1 Geotechnical Investigation

Soil data were collected for each individual site unit (SU) in accordance with the *Pre-Design Investigation Work Plan* and subsequent work plan addenda (Anchor QEA 2019, 2020, 2022) and are presented in the *Pre-Design Investigation Data Summary Report* (DSR; Appendix A of the Final EDR). Sonic borings were conducted as part of Anchor QEA, LLC's, investigation of the subsurface conditions at SU2, SU6, SU7, and SU10. When advancing these borings, standard penetration tests (SPTs) were conducted every 5 to 10 feet beginning at ground surface for each of the borings, and soil samples were collected along the entire depth of the boring for subsequent laboratory analysis. The standard penetration resistance (N-value) was calculated as the total number of blows needed (using a 140-pound hammer falling a distance of 30 inches) for the sampler to penetrate the final 12 inches of an 18-inch sampling interval. Results of the SPTs are included in the boring logs in Attachment A3 of the DSR (Appendix A of the Final EDR).

Following the initial PDI, additional soil data were collected to support foundation design of two stormwater structures proposed within the vicinity of SU7 in accordance with the 2022 PDI work plan addendum (Anchor QEA 2022) and are presented in the DSR (Appendix A of the Final EDR). Direct push borings were conducted as part of Anchor QEA's investigation of the subsurface conditions north of SU7 and between SU6 and SU7. When advancing these borings, SPTs were conducted continuously from ground surface to a depth of 10 feet and then at 5-foot intervals thereafter, and soil samples were collected along the entire depth of the boring for subsequent laboratory analysis. Results of the SPTs are included in the boring logs in Attachment A3 of the DSR.

Anchor QEA visually classified and documented the lithology encountered to characterize soil layers with depth. Geotechnical samples, both undisturbed in situ and grab samples, were collected for laboratory testing.

Cone penetration tests (CPTs) were performed within SU2, SU6, SU7, and SU10 in addition to the sonic borings. CPTs provide penetration resistance, sleeve friction, friction ratio, and measurements of porewater pressure with depth. Additional information regarding sample collection is provided in the DSR (Appendix A of the Final EDR).

2.2.2 Laboratory Methods

During the initial PDI, a total of 224 soil samples collected from the 21 soil borings, using a split spoon or thin-walled Shelby tube sampler, were selected for geotechnical analysis and submitted to an independent geotechnical laboratory, HWA GeoSciences, Inc., in Bothell, Washington. Selected soil samples were analyzed for the following parameters:

- Moisture content (ASTM International [ASTM] D2216)
- Organic content (ASTM D2974)
- Atterberg limits (ASTM D4318)
- Particle size (ASTM D6913)
- Particle size with hydrometer (ASTM D7928)
- Specific gravity (ASTM D854)
- Hydraulic conductivity (ASTM D5084)
- Bulk density (ASTM D7263)
- One-dimensional consolidation (ASTM D2435)
- Consolidated undrained triaxial (ASTM D4767)
- Compaction (ASTM D1557)

An additional 14 soil samples were collected from the soil borings performed in February 2022, using a split spoon sampler, and these samples were submitted to an independent geotechnical laboratory, Materials Testing & Consulting, Inc., in Olympia, Washington. Selected soil samples were analyzed for the following parameters:

- Moisture content (ASTM D2216)
- Organic content (ASTM D2974)
- Atterberg limits (ASTM D4318)

- Particle size with hydrometer (ASTM D7928)
- Specific gravity (ASTM D854)

The results of this testing are included in the DSR (Appendix A of the Final EDR), and laboratory reports from HWA GeoSciences and Materials Testing & Consulting are attached to the DSR.

2.3 Geology

Generalized lithologies have been created for each SU using the PDI boring logs, combined with additional information collected during previous investigations. The following is a description of the generalized subsurface soil profile with a discussion of the key characteristics of the major soil units encountered during the investigation, listed in order from the ground surface downward:

- **Existing Landfill Cover.** Within the footprints of each SU, some thickness of cover material or fill was encountered. Cover material overlying waste deposits generally consisted of a very loose, wet, silty, sandy topsoil with a thickness of 0.4 to 10 feet.
- **Waste Material.** Explorations within each SU found waste material consisting of black or white mud or landfill debris. The thickness of waste across the SUs varies, ranging from a few feet to more than 20 feet thick. The waste types have different strength, workability, and compaction characteristics as discussed in subsequent sections of this document.
- **Levee Fill (Silty Sand to Sand).** Several investigations were made along or adjacent to the existing CDID levee near SU2, SU8, and SU10. The levee was determined to be composed of loose to medium dense silty sand to relatively clean medium dense sand, topped with a thin gravel base course. It is Anchor QEA's understanding that the existing levee extends landward from its crest at a slope of approximately 6 horizontal to 1 vertical (6H:1V) beneath the existing grade. The configuration of the riverward side of the levee is variable, ranging from steeper 3H:1V slopes with limited extra fill to flatter slopes with 20 to 50 feet of overbuild.
- **Silt.** Native very soft to medium stiff silts with varying percentages of sand were encountered beneath all SUs, generally starting below SU waste or levee fill and persisting to an undetermined depth. The index properties of this unit varied across the site. In the northeast portion of the site, the silt had varying amounts of organic material present, with some interbedded layers of organic silt.
- **Sand.** Native very loose to medium dense sands with varying percentages of fine-grained particles were encountered beneath all SUs, generally starting below an approximate elevation of 0 foot North American Vertical Datum of 1988 (NAVD88) at the southeastern portion of the site and below an elevation of 10 feet NAVD88 at the northwestern portion. The sand unit is at times interbedded within the silt layer.
- **Silty Sand.** The interface between the two preceding units (silt and sand) were often presented through interbedding of very loose to loose silts and sand, as well as through a

general mixture of the two. This unit was found generally beneath the silt layer, and deeper sand or silt units, and was observed to vary in thickness across the site.

- **Peat.** A highly organic peat soil was encountered underlying SU7 in the northeast corner of the site. The peat ranged from 2 to 11 feet thick and was found within the top 20 feet of each boring.

Section 2.4 provides details regarding the lithology observed at each SU along with assumed geotechnical engineering soil parameters used for analyses.

2.3.1 Geologic Hazards

The Former Reynolds Plant is located in Longview, Washington, which is positioned in proximity of Mount St. Helens and on the banks of the lower Columbia River. According to the Washington State Department of Natural Resources' (WDNR's) Washington Geologic Information Portal (WDNR 2020), the greater Longview area is subject to the outfall from a volcanic event, has a history of being affected by regional seismicity, and without the presence of the CDID levee, would be prone to wide-scale flooding.

Historical WDNR records note occurrences of seismically induced soil liquefaction events resulting in boils of water emanating from the subsurface throughout Longview, including reports of homes in the area being lifted off their foundations during an earthquake. Likely as a result of these historical occurrences and the known presence of saturated and very loose sandy soils, the Liquefaction Susceptibility Map of Cowlitz County, Washington (Palmer et al. 2004), identifies the lowland area surrounding Longview as having moderate to high liquefaction susceptibility. In addition, WDNR's portal (WDNR 2020) notes that the area is within the path of pyroclastic flows, lahars, ejecta, ash, and rock fall generated by historical volcanic eruptions. Buried ash layers associated with historical volcanic eruptions have been encountered during subsurface investigations in the area.

The closest known fault line is the St. Helens active area. In addition, the Cascadia subduction zone lies approximately 30 to 60 miles west of the site along the Pacific coast.

2.3.2 Hydrogeology

As described in the RI/FS (Anchor QEA 2015), there are several water-bearing zones beneath the site. These include the Lower Alluvium, the Upper Alluvium, and the surficial soils. The on-site water supply wells are completed within the Lower Alluvium. However, the shallow groundwater within the Upper Alluvium and the surficial soils is most relevant to the geotechnical analysis.

Observations from site hydrogeologic investigations and monitoring well logs indicate that groundwater conditions encountered in the upper soils vary by location due to natural variations in the top of the Upper Alluvium, the history of site development, and the composition of surficial soils overlying the Upper Alluvium.

Seasonal variations in groundwater elevations were noted in the shallow water-bearing zones. Groundwater elevations were higher (with variation up to 2 feet) in the wet season than during the dry season. This is attributed to the higher rates of precipitation and resulting groundwater recharge during the wet season, as well as the higher Columbia River levels that typically occur during winter months. The extent of seasonal variation differs at each well location.

2.4 Generalized Soil Properties

The specific soil conditions encountered at each SU are described in Sections 2.4.1 through 2.4.3, and the soil properties assumed for the stratigraphy observed are summarized. The unit weight of the materials was estimated using typical values for the soil types identified in the explorations relative to the densities reported by the laboratory and estimated from index testing properties. The parameters for cohesionless soils (e.g., sand, silty sand, and non-plastic silt) were estimated based on empirical correlations to relative density (NAVFAC 1986) based on N-values from SPT testing. The parameters for cohesive soils (e.g., silts and clays) were estimated from laboratory strength tests (CU-TX tests) or empirical correlations.

Additionally, CPT data were analyzed by Anchor QEA using CPT interpretation software, CPeT-IT v.3.0 software by GeoLogismiki, to infer soil lithology based on the CPT measurements at depth. Friction angles, unit weights, and corrected N-values generated for site soils using interpreted CPT data were compared with the correlations to SPT blow counts at nearby sonic core borings within the same SU. The resulting comparisons were used to develop soil properties to be used during the project design.

The lithology discussed for SU materials is displayed in the PDI boring logs in Attachment A3 of the DSR (Appendix A of the Final EDR).

2.4.1 Site Unit 2

SU2 is located at the western portion of the Former Reynolds Plant site and generally consists of the CDID levee separating the SU and the Columbia River to the south and a gently sloping landfill north of the center line of the levee. The landfill, which is approximately 21 acres, is surrounded by constructed berms consisting of silty sand fill material (see TP-C-1); these berms act to confine the waste material within. Waste material within the landfill is covered by a relatively thin layer of landfill cover material consisting mainly of silty sand. Figure B1 depicts the approximate extents of the current SU2 and SU1 deposit area. Three geologic cross sections were created across SU2, located at the northwestern end, middle, and southeastern end of the SU as SU2 A-A′, B-B′, and C-C′, respectively, shown in Figures B2 to B4. The northern and central portions of the waste material found at SU2 is underlain by approximately 10 feet of silt, 10 to 15 feet of silty sand, and then is followed by silt to an undetermined depth. The southern portion of SU2 waste material is also underlain by 10 feet of silt and 10 to 15 feet of silty sand; however, these units overtop a sand unit that is approximately 10 feet thick, which is followed by silt to an undetermined depth. As seen in cross section C-C′, this sand material was not observed within the southeastern portion of the SU and is assumed to have tapered out somewhere near PDI-SU02-B-04. Soil strength properties for the materials encountered in this SU are presented in Table B1.

Table B1
Soil Parameters for SU2 – Stability Analysis

Material	Unit Weight (ɣ), pcf	Undrained Conditions		Drained Conditions	
		Cohesion (psf)/ Vertical Stress Ratio (psf/feet)	Friction Angle (ϕ′), degrees	Cohesion (c′), psf	Friction Angle (ϕ′), degrees
Landfill Cover	110	--/--	32	--	32
Waste Material[1]	100	25/--	12	--	20
Compacted Waste	105	25/--	15	--	25
Levee Fill (Silty Sand)	120	--/--	32	--	32
Levee Fill (Sand)	120	--/--	30	--	30
Silt	110	300/0.36	--	--	28
Silty Sand	120	--/--	32	--	32

Notes:
-- Indicates no applicable value.
1. Waste material refers to black mud at this SU.
2. Compacted waste material refers to excavated and placed black mud at this SU.

2.4.2 Site Unit 6

SU6 is located in the southeastern portion of the Former Reynolds Plant site, between SU8 and SU7, and covers approximately 9 acres. Surrounding the SU on three sides (north, east, and south) is existing rail spurs entering the site from Longview Switching Company Short Line, which parallels Industrial Way, and along the western edge of SU6 is an access road with an adjoined drainage ditch. SU6 is surrounded by a constructed berm consisting of sand and sandy silt, which are more than 15 feet taller than existing surrounding grade. At the base of the existing confinement berm, mostly encompassing the rail lines, a wetland and wetland buffer have been identified.

The SU itself consists of a relatively thin vegetated, silty sand landfill cover overlying waste material ranging in thickness from 1.0 to 21.3 feet thick. The waste is underlain by a sand and silty sand unit reaching down to an elevation of -10 to -20 feet NAVD88. This sand and silty sand unit is underlain by clean sands in the southern portion of the landfill and by a mixture of elastic silt and low-plasticity clay within the northern portion of the landfill (nearest to SU7). Portions of this layer at depth contain interbedded layers of organic silt. Figure B5 depicts the approximate extents of the existing SU6 deposit area, and a single geologic cross section of the SU was developed and is displayed in Figure B6. Soil strength properties for the materials encountered in this are presented in Table B2.

Table B2
Soil Parameters for SU6 – Stability Analysis

Material	Unit Weight (ɣ), pcf	Undrained Conditions		Drained Conditions	
		Cohesion (c′), psf	Friction Angle (φ′), degrees	Cohesion (c′), psf	Friction Angle (φ′), degrees
Landfill Cover	110	0	32	--	32
Waste Material[1]	100	0	20	--	20
Upper Elastic Silt/Clay	110	250	16	--	30
Lower Elastic Silt/Clay	90	250	16	--	30
Silty Sand/Sand	120	0	35	--	35
Existing Berm[2]	110	0	25	--	25

Notes:
-- Indicates no applicable value.
1. Waste material refers to black mud at this SU.
2. As noted in the paragraph preceding this table, the existing berm is composed of sand to silty sand material.

2.4.3 Site Unit 7

SU7 is located at the eastern portion of the Former Reynolds Plant, north of SU6, and covers an area of approximately 4.5 acres. An access road with an adjoining drainage ditch runs parallel to the northwestern side of SU7, an easement runs along the southwestern side, and wetland areas were identified along the eastern side. It is understood that the waste material at SU7 consists of spent lime material generated from the cryolite recovery process during past plant operations. In contrast to neighboring SU6, SU7 is elevated only slightly above the surrounding ground surface.

The landfill itself generally consists of a relatively thin layer of silty sand landfill cover material overlying waste material ranging in thickness from 1 to 6 feet. The waste material is underlain by a layer of peat that was found to be 2 to 11 feet thick. Below the peat is primarily a mixture of elastic silt and low-plasticity clay unit to significant depth. Occasional interbedded layers of sandy silt and organic silt layers are present, but these layers are generally no thicker than 6 feet. Due to the inconsistency of these layers, the subsurface is generally depicted as a silt, with engineering parameters adjusted as appropriate to reflect this variability. A geologic cross section, Figure B7, was generated for this SU, and Figure B5 depicts the approximate extents of the existing SU7 deposit area. Soil strength properties for the materials encountered in this SU are presented in Table B3.

Table B3
Parameters for SU7 – Stability Analysis

Material	Unit Weight (ɣ), pcf	Undrained Conditions		Drained Conditions	
		Cohesion (c′), psf	Friction Angle (φ′), degrees	Cohesion (c′), psf	Friction Angle (φ′), degrees
Landfill Cover	110	--	35	--	35
Waste Material[1]	90	40	0	40	0
Peat	85	50	0	50	0
Elastic Silt/Clay	100	250	16	--	30

Notes:
-- Indicates no applicable value.
1. Waste material composed of spent lime at this SU.

2.4.4 Site Unit 8

SU8 is located at the southeasternmost portion of the Former Reynolds Plant, south of SU6, and adjacent to the CDID levee. It is understood that this area contains waste material consisting of dry materials swept off the floors of potline buildings during past smelter operations. This storage area was closed in the early 1980s (Anchor QEA 2015).

Four monitoring wells and three test pits have previously been advanced in the area that encompasses SU8. The SU generally consists of a relatively thin layer of sand, 0.5 to 1.0 foot thick, overlying waste material ranging in thickness from 7 to 15.5 feet. The waste material is underlain by interbedded silt and sandy silt layers with varying amounts of organics. These interbedded layers ranged in thickness from 5 to 21.5 feet (Anchor QEA 2015). The approximate extents of the existing SU8 deposit area are shown in Figure B8, and Figure B9 provides the geologic cross section generated for this SU. Soil strength properties for the materials encountered in this SU are presented in Table B4.

Table B4
Parameters for SU8 – Stability Analysis

Material	Unit Weight (ɣ), pcf	Undrained Conditions		Drained Conditions	
		Cohesion (psf)	Friction Angle (ϕ’), degrees	Cohesion (c’), psf	Friction Angle (ϕ’), degrees
General Fill	115	--	30	--	30
Sand (Levee Fill)	120	--	30	--	30
Waste Material[1]	100	--	20	--	20
Sand	120	--	35	--	35
Silt	110	250	16	--	30
Silty Sand	120	--	32	--	32

Notes:
-- Indicates no applicable value.
1. Waste material composed of industrial solid waste at this SU.

2.4.5 Site Unit 10

SU10 is located between the Columbia River and the Former Reynolds Plant on the southwestern side of the CDID levee. The SU is bisected by a service road, which leads to the river’s edge. Both portions of SU10 cover an area of approximately 1.3 acres, and the landfill contains construction debris. The extents of the SU are displayed in Figure B8, and geologic cross sections for SU10 are presented in Figures B10 and B11.

As determined via CPT (PDI-SU10-PC-01) within SU10, the landfill itself consists of approximately 8 to 12 feet of silt fill material overlying 8 to 20 feet of loose to medium dense levee sand fill material. Beneath the levee sand fill material, below elevation 17 feet NAVD88, is approximately 6 feet of very loose to loose, poorly graded sand with silt. This layer overlies soft to medium stiff silt and organic silt to an undetermined depth. Soil strength properties for these materials are presented in Table B5.

Table B5
Parameters for SU10 – Stability Analysis

Material	Unit Weight (ɣ), pcf	Undrained Conditions		Drained Conditions	
		Cohesion (psf)	Friction Angle (ϕ′), degrees	Cohesion (c′), psf	Friction Angle (ϕ′), degrees
Waste Material[1]	110	--	40	--	40
Levee Fill (Sand)	120	--	30	--	30
Silty Sand	120	--	30	--	30
Silt	110	250	16	--	30
General Fill	115	--	30	--	30

Notes:
-- Indicates no applicable value.
1. Waste material composed of construction debris at this SU.

2.5 Site Seismicity

Anchor QEA's seismic evaluation for the site was conducted using the American Society of Civil Engineers' (ASCE's) Hazard Assessment Tool (ASCE 2017), as documented in Standard ASCE 7-16, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 2016), which incorporates the seismic analysis and mapping available online from the U.S. Geological Survey (USGS) (USGS 2018).

Additionally, earthquakes having shorter occurrence time frames were evaluated for the site using the USGS Unified Hazard Tool (USGS 2020), which incorporates the updated seismic analysis and mapping provided by the National Seismic Hazard Mapping Project, available online. The tool performs a degradation analysis in which it queries a range of earthquake magnitudes at a range of distances from the site for a specified return period. The query results in statistical estimates for earthquake magnitude. For this analysis, the most frequently occurring earthquake magnitudes for each return period were used. The seismic evaluation for both tools incorporates known seismicity and the proximity of major faults for a given site.

The ASCE Hazard Assessment Tool provides a risk-targeted maximum considered earthquake (MCE) spectrum (2,475-year return period) and the corresponding site-specific design response spectrum. Design earthquake ground motions (spectral response parameters) are defined as two-thirds of the corresponding MCE ground motions per ASCE design guidance (ASCE 2016, Section 11). The Unified Hazard Tool allows selection of a risk-targeted considered earthquake spectrum and the corresponding site-specific design response spectrum. Design earthquake ground motions were selected for return periods of 100, 475, and 975 years.

For inputs to these tools, the site soil classification was determined, based on previous and recently conducted site investigations, to be a Class E for soft subgrade soils. In addition, an Occupancy Category of I was selected, representing structures with no human occupancy (ASCE 2016).

Attachment B1 provides the output from the ASCE Hazard Assessment Tool's and USGS Unified Hazard Tool's estimated seismic response of the site. From these reports, the adjusted peak ground acceleration (PGA) for site design using the MCE was determined to be 0.572 gravity (g). Additionally, the PGA for more frequent occurrence levels, as used in the previous geotechnical evaluation by Geotechnical Resources, Inc. (GRI 2012b), are provided for the 100-, 475-, and 975-year events.

Because the PGA occurs as a transient and continually changing and reversing force, seismic analysis using limit equilibrium methods translates PGA into an equivalent horizontal earthquake force representative of the entire earthquake duration. This translation is accomplished through the application of a pseudo-static coefficient. An overview of established literature regarding the selection of a pseudo-static coefficient is provided by the California Geological Survey (2008) and others; Seed (1979) originally suggested that pseudo-static coefficients of 0.1 g to 0.15 g were appropriate values, depending on the magnitude of the seismic event. For this work, recognizing more recent research and local engineering practice, a pseudo-static factor of one-half (0.5) was applied to convert the PGA to a horizontal force for use in the limit equilibrium analyses. This results in the horizontal seismic coefficients displayed in Table B6.

Table B6
Seismic Design Parameters

Return Period in Years (Probability of Occurrence)	Site Adjusted PGA (g)	Horizontal Seismic Coefficient
100 (50% in 50 years)	0.098	NA
475 (10% in 50 years)	0.277	0.139
975 (5% in 50 years)	0.415	0.208
2,475 (2% in 50 years)	0.572	0.286

3 Landfill Design Evaluations

Sections 3.1 through 3.3 provide a summary of Anchor QEA's geotechnical engineering evaluations and recommendations. Further recommendations regarding construction methods are provided in Section 4.

3.1 Slope Stability

Slope stability modeling was performed for representative soil conditions found at each SU using Rocscience Slide 2 version 9.0 software that uses limit equilibrium methods of analysis. Documentation of the slope stability analysis is included in Attachment B2.

Slope stability was evaluated for the design under the following four conditions: 1) the existing condition; 2) the short-term condition during the construction period; 3) the long-term static condition following construction; and 4) the stability during a seismic event. The target factors of safety (FOSs) consider the intended use of the structures and the potential consequences of failure. Target FOSs of 1.3 for the short-term condition and 1.4 for the long-term are used in this analysis based on U.S. Army Corps of Engineers (USACE)-recommended slope stability guidelines for levees (USACE 2000). A target FOS of 1.05 for seismic condition was used in this analysis based on the Washington Department of Transportation (WSDOT) *Geotechnical Design Manual* (2019) for seismic analysis of cut, fill, and other non-structural slopes.

Multiple iterations were evaluated considering changes in water elevation that would occur during and following construction. Models were evaluated using both the wet and dry season groundwater levels, as presented in the remedial investigation, depicted in the geologic cross sections shown in Figures B2 to B4, B6 to B7, and B11 to B12 and discussed in Section 2.3.2. Scenarios were analyzed for conditions of retaining structure slopes immediately following construction (undrained) and then again in the long-term condition (drained). The final scenario applied a pseudo-static ground acceleration to evaluate the seismic stability of the retaining structures. The critical slip surface was identified for each scenario under the undrained and drained static condition, and the pseudo-static analysis was conducted along these planes of failure. The resulting FOSs for each condition are summarized in Table B7.

Table B7
Retaining Structure Slope Stability Analysis Results

Modeled Site Unit	Area	Short-Term Static FOS	Long-Term Static FOS	Seismic FOS
Target FOS		*1.3*	*1.4*	*1.05*
SU2	North End	2.0	2.0	0.7
SU6	North End	1.9	1.9	0.8
	South End	1.8	1.8	0.8
SU7	North End	1.6	2.4	0.5
	East End	1.5	1.9	0.6
	South End	2.0	2.0	0.8

The resulting FOSs presented in Table B7 indicate that the slopes for each landfill have been designed to be statically stable in both the short- and long-term conditions. The slopes at SU2 and SU6 can be reshaped using on-site material graded and compacted to a 4H:1V slope. At SU7, a new retaining structure will be constructed of imported granular fill. The engineered fill will be compacted and graded to a 3H:1V slope. Additionally, due to the soft subgrade, an area of soil improvement is needed below the retaining structure. Slope stability analyses indicate that a zone of improvement approximately 10 feet wide and 15 feet deep will be necessary to add additional stability for static conditions.

The designed landfill configurations do not meet the pseudo-static target FOS for the 2,475-year event. In order to evaluate the deformation due to future seismic events, a deformation analysis was performed and is described in Section 3.3.2.

3.2 Settlement

As part of the CAP (Ecology 2018a), impacted materials from former deposit areas located across the project site are to be excavated and then concentrated in existing deposit areas. Existing deposit areas SU2, SU6, and SU7 are to be reconfigured and managed to receive the excavated materials. The impacted materials will then be covered with a low permeability cap as follows:

- Approximately 50,100 cubic yards (cy) of materials will be excavated from the eastern and western portions of SU2 and concentrated into a smaller footprint of SU2.
- SU6 will receive approximately 29,000 cy of materials excavated from SU3 and SU5.
- SU7 will receive approximately 40,900 cy of materials excavated from SU8 and SU10.

As new materials are placed within the existing deposit areas (SU2, SU6, and SU7), the added weight of the new materials will result in consolidation settlement of the underlying existing waste materials and native subgrade soils. Based on the anticipated volumes, the maximum new fill heights for the managed deposit areas are approximately 5 feet for SU2, 8 feet for SU6, and 8 feet for SU7. Final surfaces of each of the managed areas will be graded accordingly to allow for positive drainage of stormwater to minimize infiltration. To maintain positive drainage of the final surface, differential settlement is an important consideration of the design. The degree of potential ground settlement is also an important consideration for potential impacts to existing infrastructure surrounding the fill areas.

3.2.1 Settlement Evaluation

Settlement was evaluated for the West and East Landfills using Settle 3 software developed by Rocscience. This software allows for modeling of three-dimensional surface loads and calculates vertical displacement in one dimension. Total settlement estimates include immediate settlement, primary consolidation settlement, and secondary compression. Documentation of the settlement analysis is included in Attachment B3.

Immediate settlement occurs as the load is applied during construction and is typical of free-draining materials such as gravels and sands. Primary consolidation is time-dependent and most applicable to finer grained soils such as silts and clays, where permeability and thickness of the deposit control the magnitude and rate of porewater expression and resulting compression. Secondary compression is the slow deformation of the soil fabric under constant loading and is typically more pronounced in organic soils, and it begins during or near the completion of primary consolidation.

The change in stress resulting from the placement of new fill material was computed using the total unit weight of fill material (assumed to be 115 pounds per cubic foot [pcf] for all areas) and the maximum anticipated thickness of the fill anticipated for each area. It was assumed that fill materials would be placed directly over the top of the existing ground surface and that no excavation or removal of existing materials would occur.

A generalized geologic profile was generated for each area analyzed, identifying the major soil units and the thicknesses of each stratum anticipated and the anticipated groundwater level. Soil properties were then assigned to each layer. The soil properties assigned for this analysis were either based on the results of relevant testing performed to date or published correlations based on soil type and expected behavior.

To evaluate the consolidation characteristics, Shelby tube samples were collected from selected depths in the materials currently underlying SU2, SU6, and SU7. Eleven of these samples (representing different depths in the subsurface) were submitted for oedometer testing, in which the samples were subjected to a series of increasing loads, and the time rate of compression was measured at each loading stage. The interpreted results of these tests are summarized in Table B8, with laboratory results provided in Attachment A4 of the DSR (Appendix A of the Final EDR).

Table B8
Oedometer Testing Summary

Boring Number PDI-	Sample Depth (feet)		Remediation Area	Soil Unit Tested	Compression Ratio ($Cc/1+e_o$)	Initial Void Ratio (e_o)	Coefficient of Consolidation (C_v) ($feet^2/day$)[1]	Estimated Secondary Compression Index (C_α)
	Top	Bottom						
SU02-B-04	5	7	SU2	Black Mud	0.10	1.14	2	0.01
SU02-B-04	30	32	SU2	Silt	0.24	1.725	0.5	0.03
SU02-B-07	10	12	SU2	Black Mud	0.11	0.945	0.1	0.01
SU02-B-07	35	37	SU2	Silt	0.11	1.225	0.3	0.01
SU06-B-01	25	27	SU6	Silt	0.342	1.122	0.1	0.04
SU06-B-04	10	12	SU6	Clay	0.16	1.346	0.14	0.02
SU06-B-05	20	22	SU6	Clay	0.10	1.087	1.9	0.01
SU06-B-06	7	9	SU6	Silty Sand	0.12	1.117	0.4	0.01
SU06-B-08	17	19	SU6	Black Mud	0.12	1.289	2.5	0.01
SU06-B-09	10	12	SU6	Black Mud	0.06	1.091	4	0.01
SU07-B-01	10	12	SU7	Peat/Silt	0.391	1.206	3	0.04
SU07-B-03	10	12	SU7	Peat	0.382	7.935	0.01	0.07
SU07-B-03	30	32	SU7	Organic Silt	0.31	3.096	0.15	0.06
SU07-B-04	10	12	SU7	Peat	0.50	5.754	0.1	0.07

Note:
1. C_v was taken as an average value for increments of loading in the normally consolidated range of the consolidation curve.

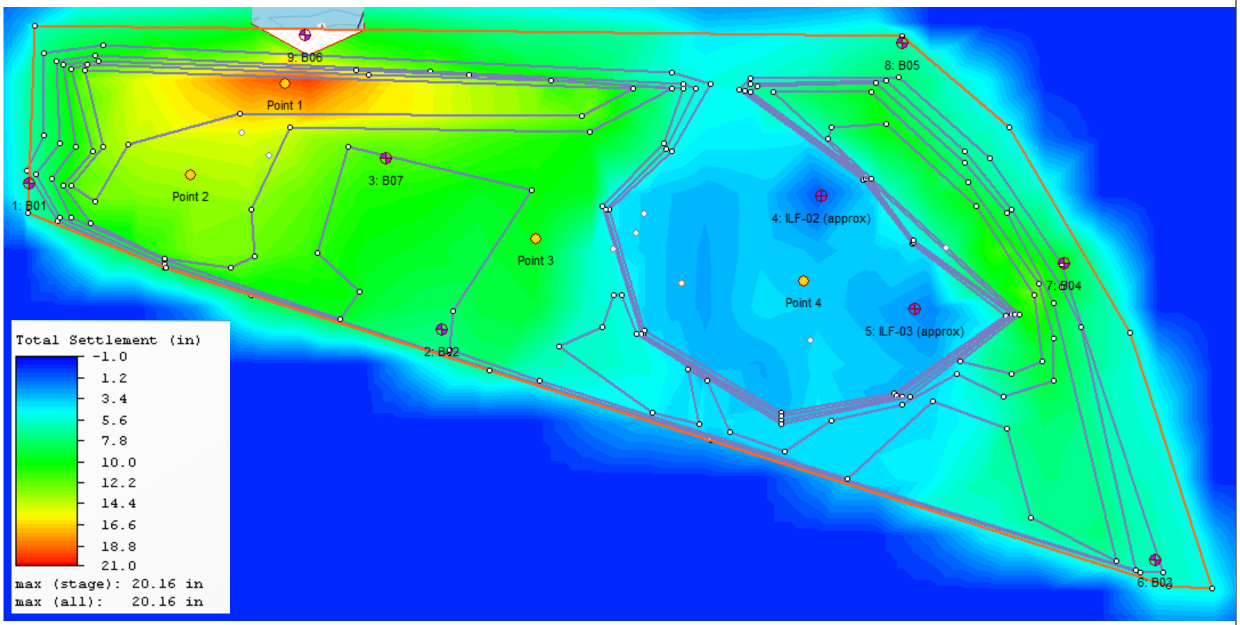
The coefficient of consolidation, Cv, values presented in Table B8, were estimated from oedometer testing results in the virgin compression range of the samples tested. The secondary compression index was estimated based on an assumed average correlation of secondary compression index to compression index ($C\alpha/Cc$) of 0.05. The interpreted oedometer results, along with correlations to the CPT data obtained, were used to predict the degree and time rate of primary settlement that would be expected after placing fill in areas SU2, SU6, and SU7.

Table B9 summarizes the resulting estimated average settlement predicted for each area analyzed. Graphics B1 through B3 include "heat maps" that indicate the range of settlement that the surface of each landfill cap may experience after a period of 30 years. The range of settlement predicted is attributable to the varying thickness of the underlying compressible soil layers observed across each of the areas analyzed, combined with the varying fill height as determined from the design grading plan. For the purposes of this assessment, deposits subject to consolidation were assumed to be normally consolidated.

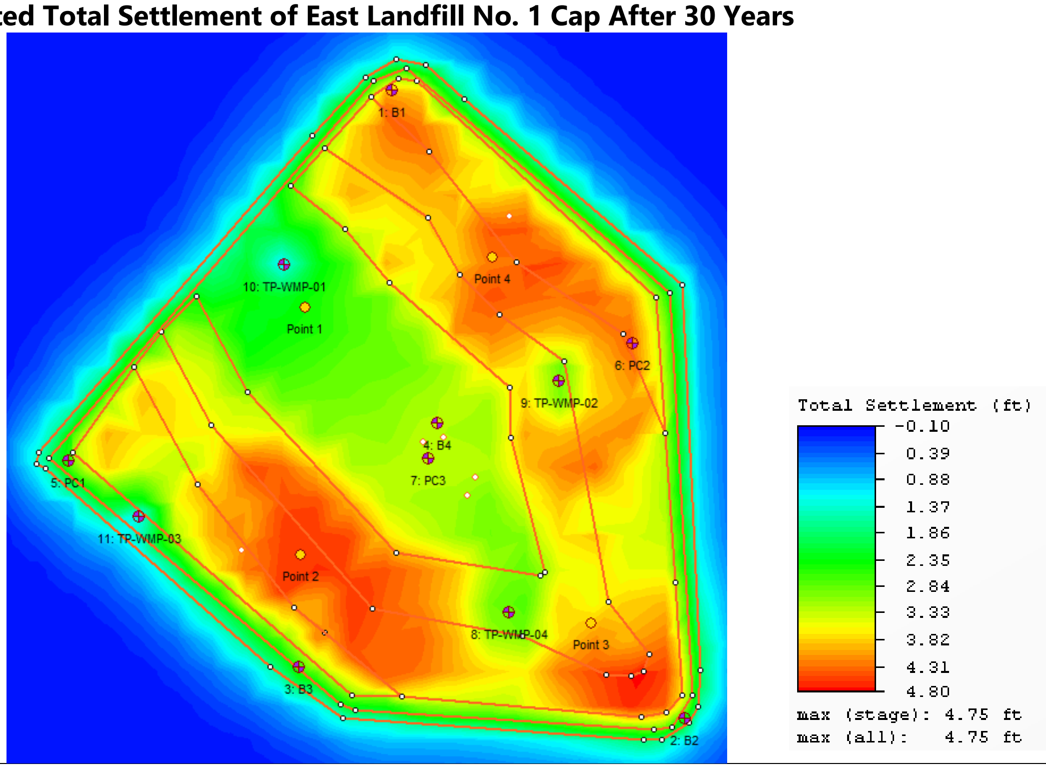
Table B9
Preliminary Settlement Summary

Remedial Area	Estimated Average Total Settlement After 30 Years (inches)	Estimated Percent Settlement After 1 Year	Estimated Settlement Below Waste Layer After 30 Years (inches)
West Landfill	8	70%	11
East Landfill No. 2	12	90%	10
East Landfill No. 1	36	65%	36

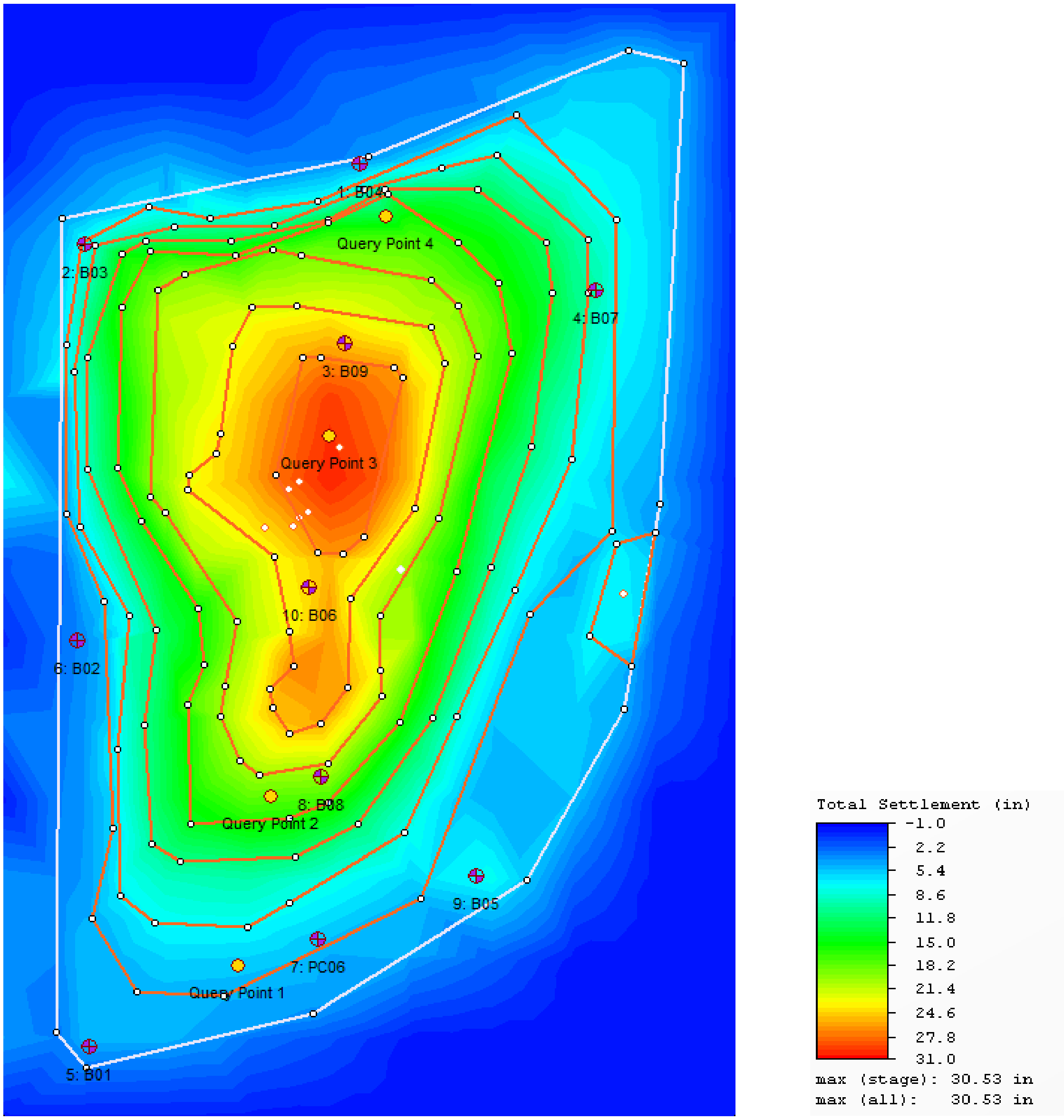
Graphic B1
Predicted Total Settlement of West Landfill Cap After 30 Years



Graphic B2
Predicted Total Settlement of East Landfill No. 1 Cap After 30 Years



Graphic B3
Predicted Total Settlement of East Landfill No. 2 Cap After 30 Years



It is important to note that settlement estimates are based on the soil characteristics observed at a limited number of subsurface explorations applied over a larger area. Subsurface conditions may vary between explorations, and depending on the subsurface conditions encountered, the actual rate and degree of settlement realized may be more or less than predicted. The settlement estimated to occur following construction of the cover system will be accounted for in the grading plan to maintain positive drainage across the landfill.

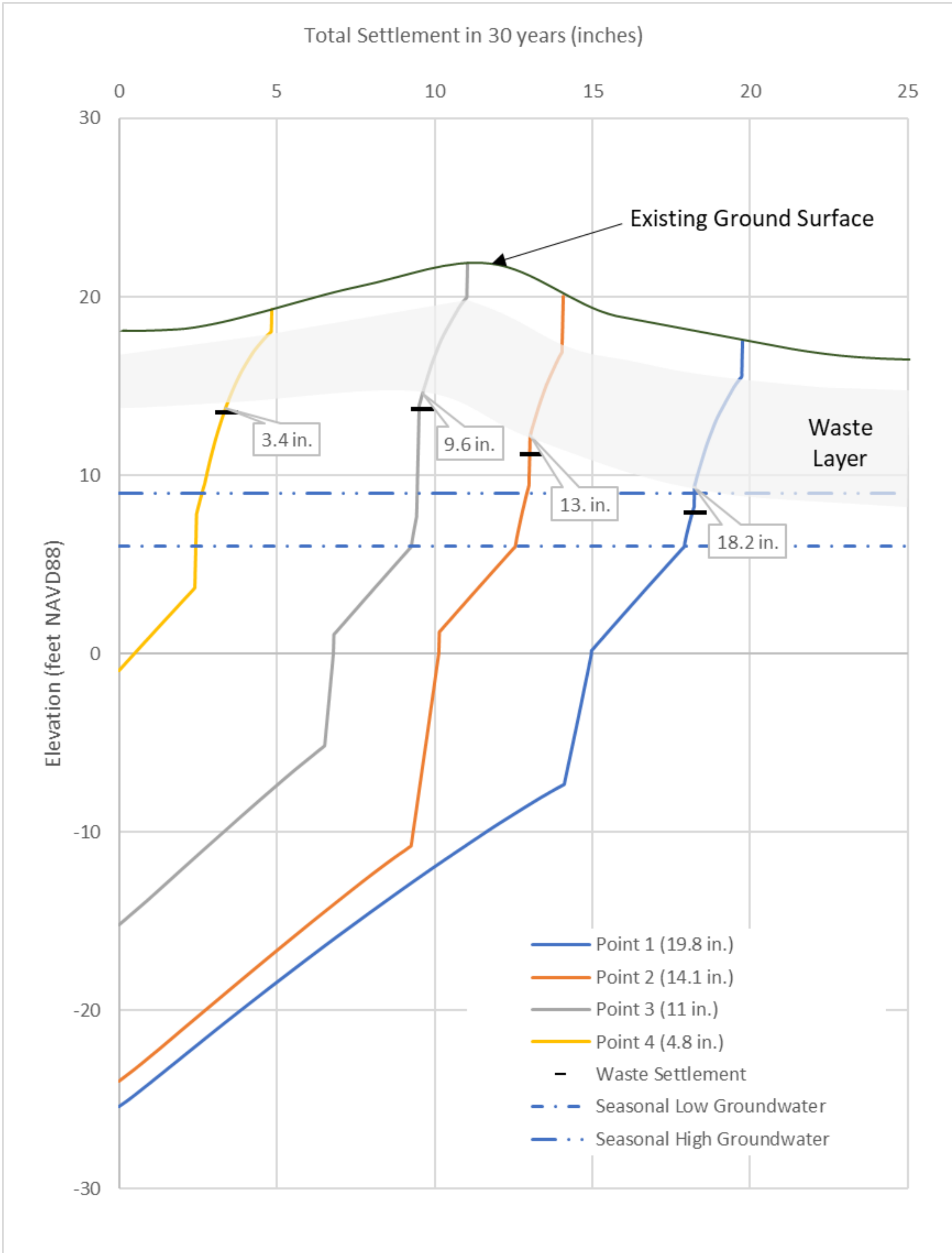
An assessment of the settlement of the bottom of the waste layer in each layer was also performed. Graphics B4 through B6 indicate the total settlement that is predicted with depth for the query locations shown on the respective heat maps shown in Graphics B1 through B3. The total settlement that will occur at the existing ground surface (i.e., the surface below the new waste fill and cap) is indicated in the legend for each query location. Model-predicted settlement of the bottom of the existing waste layer is indicated in by callouts for each query plot. The horizontal black line provides a graphic illustration of the lowering of the waste layer due to consolidation of the underlying native soil. Table B9 summarizes the estimated average settlement of the bottom of the existing waste for each landfill.

3.2.2 Potential Settlement Impacts to Surrounding Infrastructure

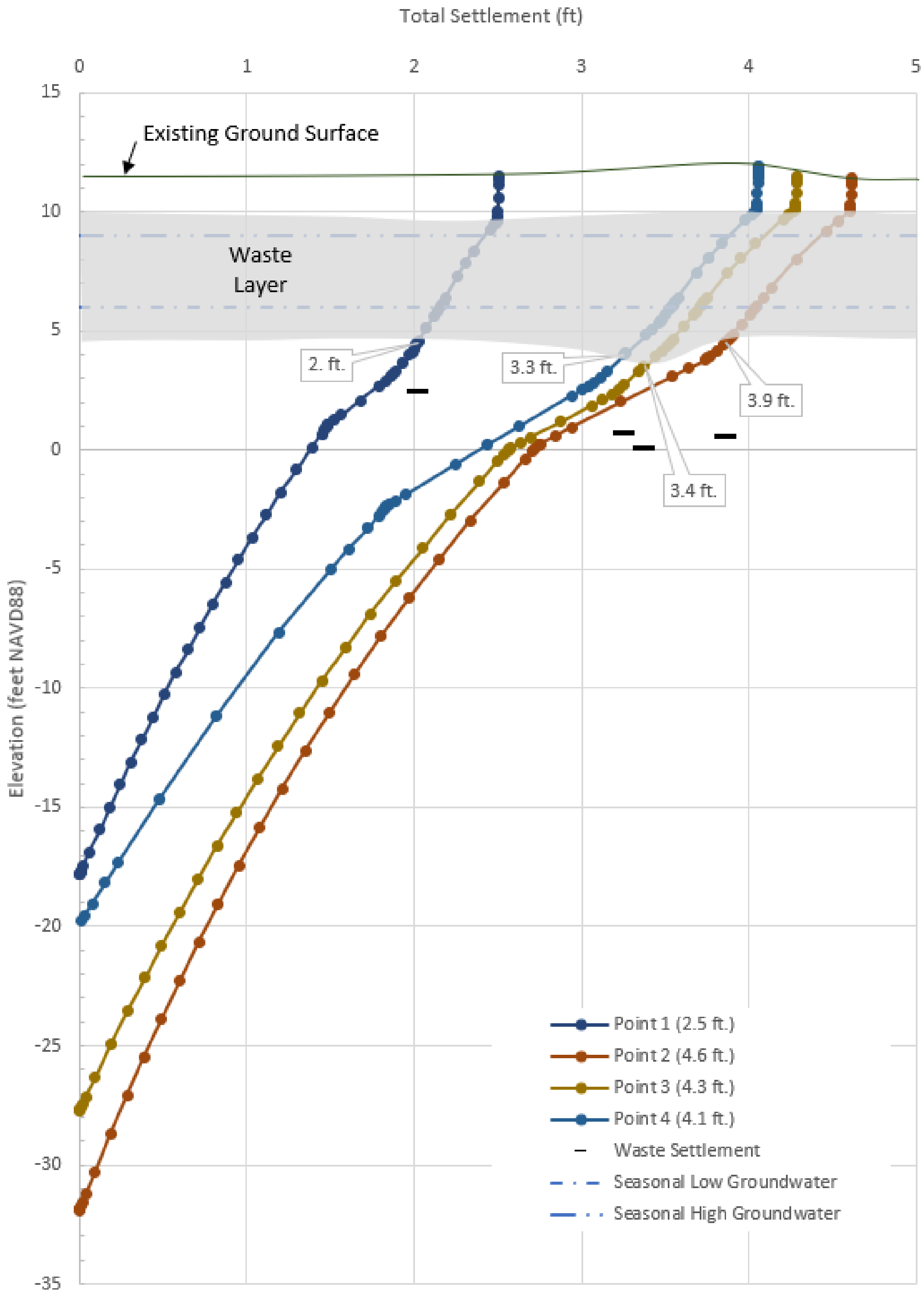
The surrounding areas immediately adjacent to the East Landfills are expected to be subject to settlement as a result of the proposed fill placement. This is an important consideration given the close proximity of existing utilities and infrastructure. Immediately surrounding the East Landfills, site records indicate an existing 66-inch-diameter buried CDID discharge line and a buried natural gas line. Additionally, two rail spurs run adjacent to the East Landfills. The proximity of these features to fill areas and the magnitude of the new load are two controlling factors impacting settlement that may be realized.

The total and potential differential settlement of existing infrastructure was determined to be negligible. Minimal settlement is expected outside the footprint of the landfills, with nearby utilities having less than 1 inch of settlement over 30 years.

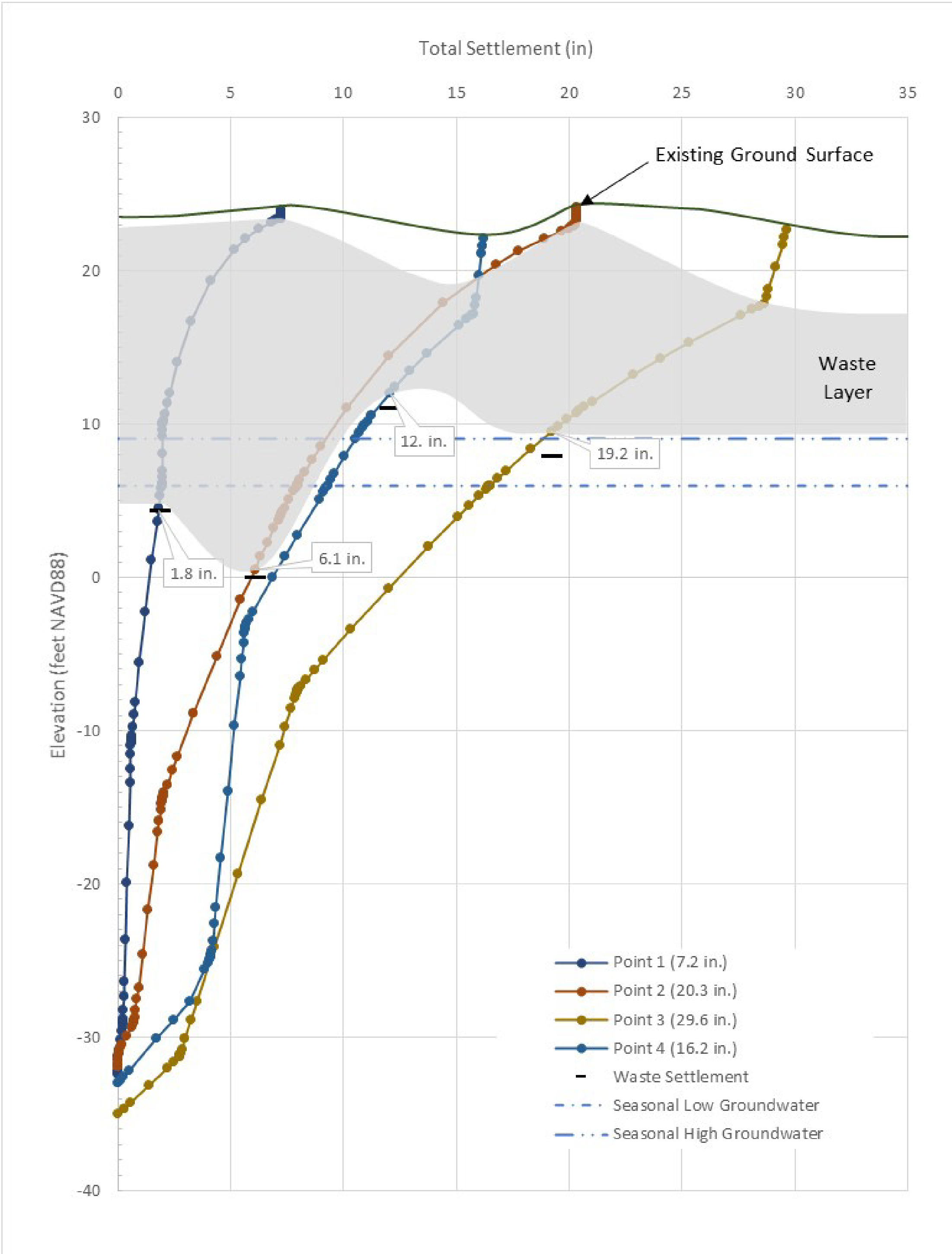
Graphic B4
Predicted Total Settlement of West Landfill Waste After 30 Years



Graphic B5
Predicted Total Settlement of East Landfill No. 1 Waste After 30 Years



Graphic B6
Predicted Total Settlement of East Landfill No. 2 Waste After 30 Years



3.3 Seismic Evaluations

3.3.1 Liquefaction

Liquefaction can occur when saturated loose soils undergo rapid strength loss due to seismic ground motion. This can result in settlement (at the ground surface or at depth), lateral spreading, sand boils, and other disruptions. At this site, there are two soil types that appear to be susceptible to liquefaction: the silty sand and sand deposits. Both material types are predicted to have FOSs against liquefaction below 1 in a design-level seismic event, using analytical methods developed by Youd et al. (2002).

Below the landfills, compressible sandy and organic silt deposits and silty sand deposits are susceptible to liquefaction-induced settlement. The settlement due to liquefaction for the 2,475-year event could be up to 30 inches, depending on the thickness of the liquefiable deposit (Tokimatsu and Seed 1987) This settlement would occur over areas including the landfills as wells as the adjacent topography.

Although there are available methods to alleviate the effect of liquefaction under the landfills, including installation of vertical "wick" drains, installation of rigid structural elements below the surface, and densification or solidification of the soft soils, each of these methods would add significant costs to the project. The need for such measures is considered unnecessary, as liquefaction of the subgrade does not pose a significant structural threat to the integrity of the retaining structures or cap system. Inspection and maintenance of the cover system will be performed as necessary following a significant seismic event as discussed in the following section.

3.3.2 Seismic Slope Deformation

Estimated slope deformation due to a seismic event was evaluated using empirical relationships and earthquake records using SLAMMER (Seismic Landslide Movement Modeled using Earthquake Records) by the USGS Techniques and Methods 12-B1. For this site, For the 475-year earthquake, slope deformation was calculated for an 8.0 magnitude earthquake with an anticipated PGA of 0.277 g and a horizontal seismic coefficient of 0.139. For the 900-year earthquake, slope deformation was calculated for a magnitude 8.7 earthquake with an anticipated PGA of 0.415 g and a horizontal seismic coefficient of 0.208. For the 2,475-year earthquake, slope deformation was conducted for a magnitude 9.0 earthquake with an anticipated PGA of 0.572 g and horizontal seismic coefficient of 0.286, as described in Section 2.5. Additionally, the site critical seismic yield acceleration was determined using Rocscience Slide 2 version 9.0 software and is presented in Table B10 for each SU. Using these inputs, the empirical formulas were used to calculate a range of anticipated deformations for each SU corresponding to events of decreasing likelihood of occurrence, with the average anticipated deformation reported in Table B10.

Table B10
Seismic Deformation Analysis Results

Remedial Area		Seismic Yield Acceleration[1]	Deformation (inches)		
			475-Year	975-Year	2,475-Year
SU2	North End	0.169	1	5	16
SU6	North End	0.194	1	4	12
	South End	0.173	1	5	15
SU7	North End	0.071/0.134	8	9	27
	East End	0.066/0.115	10	13	36
	South End	0.177	1	5	14

Note:
1. The increased yield accelerations were used in the 975- and 2,475-year evaluations.

For SU7, the areas with two seismic yield accelerations have subgrades with significant layers of underlying peat material that will experience a significant increase in strength within 12 months after fill placement due to consolidation. It is reasonable to assume that the overall strength increase could be roughly equivalent to the increase in overburden stress caused by the filling of the area, which would be approximately 700 pounds per square foot (psf) on average. However, to be conservative, the strength increase was limited to 200 psf. The increased yield accelerations were used in the 975- and 2,475-year evaluations, which may be less likely to occur within the first 12 months of waste consolidation.

The damage associated with the 475- and 975-year events is expected to be limited to loss of cover soil over the synthetic low permeability layer or subsidence to the outer engineered berm. For the 2,475-year event at SU7, there may be areas where the impermeable layer is torn and waste is exposed, but this is expected to be limited by the presence of the engineered berm. Migration of waste from the landfill is not expected to be widespread and would be repairable within a reasonable time frame. In any case, a temporary cover (e.g., visqueen) can be quickly installed to prevent contact with any exposed waste prior to completing the formal repair.

Because this site is uninhabited and does not contain any critical infrastructure, and because deformation to earthworks will be visible and repairable, the predicted 12 to 36 inches of deformation for the 2,475-year return period is considered manageable. An inspection and management program should be developed to properly respond to and repair any deformation caused by a significant seismic event.

4 Levee Stability Evaluation

This section provides a summary of Anchor QEA's geotechnical engineering evaluations and recommendations regarding stability of the CDID levees.

4.1 Approach

Slope stability modeling was performed for representative soil conditions found at each SU using Rocscience Slide 2 version 9.0 software that uses limit equilibrium methods of analysis.

Slope stability was evaluated for the design under the following four conditions: 1) the existing condition; 2) the short-term condition during the construction period; 3) the long-term static condition following construction; and 4) the stability during a seismic event. The target FOSs consider the intended use of the structures and the potential consequences of failure. Target FOSs of 1.3 for the short-term condition and 1.4 for the long-term condition are used in this analysis based on USACE-recommended slope stability guidelines for levees (USACE 2000).

4.2 Levee Slope Stability

The stability of the existing CDID levee was evaluated to determine the effect of additional material placed near or removed from the existing levee profile. An existing condition scenario was evaluated at both the wet and dry season groundwater levels, as presented in the remedial investigation, depicted in the geologic cross sections shown in the figures, and discussed in Section 3.1. A second set of scenarios representing possible conditions assumed groundwater at the dry season level during construction. The final set of scenarios represented post-construction conditions.

Additionally, the levee stability models included consideration of fluctuating river stage heights. The mean lower low water and mean higher high-water conditions, which were determined using the National Oceanic and Atmospheric Administration portal (NOAA 2020) as approximately 4.6 and 9.4 feet NAVD88 respectively, with the mean river stage determined as approximately 7.0 feet NAVD88, were used during the analyses. The critical slip surface (the surface with the lowest FOS) was identified for each scenario under the undrained and drained static conditions. The resulting FOSs for each condition are summarized in Table B11.

Table B11
Levee Slope Stability Analysis Results

Modeled Cross Section	Existing Condition FOS	Short-Term Levee FOS[1]	Long-Term Levee FOS[2]
Target FOS		1.3	1.4
SU2 A-A′	2.2	2.4	3.0
SU2 B-B′	2.2	2.2	2.5
SU2 C-C′	2.1	2.7	2.9
SU8	7.1	2.8	3.6
SU10 E-E′	3.0	3.0	3.0
SU10 F-F′	3.0	1.8	3.5

Notes:
1. Short-term FOS is calculated during construction prior to placement of backfill or cover material.
2. Long-term FOS is calculated for the as-built condition following all construction activities.

The resulting FOSs presented in Table B11 indicate that the proposed design will meet acceptable short-term and long-term FOS expectations. The proposed design for SU2 does not reduce the current slope stability of the levee. Additionally, the removal of waste adjacent to the levee at SU8 and SU10 maintains a FOS above the target values of 1.3 and 1.4 for short- and long-term scenarios.

Model outputs are documented in Attachment B4.

4.3 Levee Seismic Slope Deformation

A seismic analysis for the levee was not conducted based on the guidance provided in USACE EC 1110-2-6067 (USACE 2010), which states that no evaluation for seismic stability is needed for a levee system having a peak ground acceleration less than 0.10 g for the 100-year earthquake.
Anchor QEA's seismic evaluation for the site was conducted using the USGS Unified Hazard Tool (USGS 2020), which incorporates the updated seismic analysis and mapping provided by the National Seismic Hazard Mapping Project, available online. From this evaluation, the 100-year peak ground acceleration is less than 0.10 g.

Additionally, per USACE EM 110-2-1913, Section 6-5(a) (USACE 2000), earthquake loading does not need to be considered in analyzing the stability of the levee during a flood event due to the low probability of an earthquake coinciding with a flood. This levee has a low hazard potential classification, as outlined in USACE ER 1110-2-1806 (USACE 2016), due to no expected loss of life, no disruption of lifeline services, and minimal incremental damage to the environment.

It is assumed that should the levee undergo deformation following a significant shaking event, the levee would remain serviceable or require minor repairs, and no mitigation will be included in this design to reduce the likelihood or severity of slope deformation for the existing levee structure. The existing width of the levee, combined with additional fill placed waterway of the levee near SU10, provides additional support should deformation occur. Inspection and repair of the levee may be required after a significant seismic event.

5 Construction Considerations

5.1 Sequencing

As discussed in the Section 3.2, preliminary estimates of total settlement for the East Landfills may be on the order of 12 to 36 inches on average, depending on the location within the landfill. Approximately 60% to 90% of the total settlement is likely to occur within the first 12 months after initial placement. Because of varying subsurface conditions, some of the initial settlement will likely be variable, resulting in uneven surfaces that could cause tears in the geosynthetic clay layer. Excavation and consolidation of the fill materials is likely to consume most of the dry weather work season and will likely leave insufficient time to begin and complete the installation of the low permeability caps. Therefore, it is recommended that closure of the two East Landfills be completed using a phased approach in which all material transfer and initial grading for the SU would be completed, settlement would occur over the winter months, and final grading and capping would be completed during the following construction window.

To prevent contact with and erosion of the consolidated waste materials, a temporary cover will be installed over the waste. This cover will consist of a 6-inch layer of sand covered with a hydraulically applied layer of bonded fiber matrix (BFM) mulch. BFM is a continuous layer of elongated fiber strands held together by a water-resistant bonding agent. It eliminates direct rain drop impact on soil and allows no gaps between the product and the soil. The BFM will be supplemented with other erosion protection best management practices along the slopes, and the entire landfill perimeter will be surrounded by silt fencing. During this period, ongoing settlement will be monitored to further verify the rate of settlement predicted by the geotechnical models and that a final grading plan be prepared prior to cap placement.

5.2 Settlement Monitoring

Settlement monitoring can be accomplished using multiple methods such as, settlement plates, topographic survey techniques, and specialized geotechnical monitoring equipment such as piezometers. Monitoring settlement can be helpful for understanding subsurface strength gain in fine-grained soils and can support planning for future grading and maintenance efforts. Sections 3.2.1 and 3.2.2 discuss the recommended settlement monitoring.

5.2.1 Topographic Surveying

Surface point elevation data can be collected over time to track the magnitude and time rate of consolidation settlement. Typically, fixed targets are placed at key locations, and the elevation of the target is measured at regular intervals from a stable, fixed reference point located outside the zone of settlement influence. It is important that ample data be captured early on following construction because that is the time when settlement occurs most quickly. If these early monitoring events are not conducted, it can be very difficult to interpret the results of topographic surveying. For topographic surveying, Anchor QEA recommends the following:

- Establish several points on the ground surface for newly placed fill. Point locations should cover a range of fill thickness and should be placed at locations where the pre-construction ground surface elevation is known.
- Measure elevations frequently immediately following construction. Over time, the frequency of measurements can be reduced. An example monitoring program would collect topographic point data at baseline, 1 week, 2 weeks, 1 month, 2 months, 3 months, 6 months, 9 months, 1 year, etc. The monitoring can be stopped based on review and advice of the geotechnical engineer.

5.2.2 Settlement Plates

Settlement plates are helpful for discerning subgrade settlement from fill settlement. Typically, a settlement plate is used when construction filling durations are long such that consolidation settlement begins before filling has stopped. Settlement plates are flat steel with provision for a hollow riser pipe to be installed. The riser pipe acts as a port for accessing the plate with a survey rod, even as fill is placed above the settlement plate. Via the riser pipe, the surveyor can measure the elevation of the plate beneath the fill prism. The following guidelines should be followed with respect to settlement plates:

- The contractor should be responsible for protecting the riser pipe from damage. Settlement plates should be highly visible and clearly marked in the field to support protecting them. Settlement plates can be easily damaged by heavy equipment during earthwork.
- The riser pipe should be wide enough to accommodate the survey crew's equipment and should be tall enough to extend above the final fill surface elevation. It may be necessary to include a provision for extending the riser pipe height sequentially during filling, and as such, the top of the riser would not be considered an appropriate fixed reference point for elevation surveys.
- Survey timing considerations described in Section 5.2.1 also apply to settlement plates; however, it may be desirable to collect additional elevation data during filling.

5.2.3 Shape Accelerometer Arrays

Shape accelerometer arrays provide higher accuracy and continuous monitoring of subgrade settlement during and following fill placement. A shape accelerometer array is a chain of rigid segments connected by flexible joints. The joints are designed to resist twist but allow the segments to tilt in any direction. Each segment is instrumented with two orthogonally mounted tilt sensors and a microprocessor. The microprocessor calculates the 2-dimensional position of the segment based on length of the segment and measurements from the tilt sensors. Initial measurements serve as the baseline, and subsequent measurements are compared to the baseline to measure the direction and magnitude of soil deformation. This monitoring method can be installed below the placed fill from SU8 and SU10 so that settlement measurements of the underlying layers can be made.

5.3 Backfill of Excavated Areas

Backfill material will be needed for grading areas where waste materials were excavated. Backfill should be placed in maximum 12-inch-thick loose lifts and compacted to a minimum density equal to 95% of the standard Proctor maximum dry density as determined by the ASTM D698 test procedure. During wet weather or construction on wet subgrades, such as those anticipated near the river level or below site groundwater level, Anchor QEA recommends using a clean, well-graded sand and gravel mixture with less than 10% by weight passing the No. 200 sieve, based on the minus ¾-inch fraction. During periods of dry weather and/or construction above the water table, sand and gravel with as much as 30% fines could be used. However, this material is expected to be moisture sensitive and may require wetting or drying to achieve the required density during compaction. Moisture conditioning of high-fines-content material is expected to be difficult during wet weather construction.

5.4 Temporary Cut Slopes and Side Slopes

Temporary cut slopes will be needed to achieve waste excavation to the designated subgrade elevations during construction. The contractor will be made responsible for the stability of cut slopes and related safety of the slope. Table B12 is a representation of the WSDOT *Geotechnical Design Manual* Table 15-7, "WAC 296-155 Allowable Temporary Cut Slopes" (WSDOT 2019), and is provided for reference.

Table B12
WSDOT *Geotechnical Design Manual* Table 15-7

Soil or Rock Type	Maximum Allowable Temporary Cut Slopes (20 feet maximum height)
Stable Rock	Vertical (90°)
Type A Soil	3/4H:1V (53°)
Type B Soil	1H:1V (45°)
Type C Soil	1.5H:1V (34°)

Note:
These values do not apply to slopes greater than 20 feet, as explained in the manual (WSDOT 2019).

The soil types listed in Table B12 are described in the Washington State Department of Labor and Industries Manual – Appendix A-Soil Classification (29 Code of Federal Regulations Part 1926, Subpart P, Appendix A, Soil Classification). A soil is considered Type C if one or more of the following conditions are met:

- The soil is cohesive with an unconfined compressive strength of 0.5 tons per square foot (48 kilopascals) or less.
- The soil is granular, such as gravel, sand, or loamy sand.
- The soil is submerged, or water is freely seeping from it.
- The material is submerged rock that is not stable.
- The material is in a sloped, layered system where the layers dip into the excavation or a slope of 4H:1V or steeper.
- Soils and waste material at the site that will be excavated generally fall under Type C. Therefore, the recommended maximum estimated layback slopes for earthwork would be 1.5H:1V. In reality, several areas are likely to require flatter laybacks to maintain stable conditions. If sloughing of an excavation is observed during construction, the contractor will flatten the layback angle of the slope until sloughing no longer occurs.

6 Limitations

Anchor QEA completed this work in general accordance with Consent Decree No. 18-2-01312-08 (Ecology 2018b). This report has been prepared for the exclusive use of the design team (Anchor QEA) for specific application to the Former Reynolds Plant – Longview project. This work has been performed in accordance with generally accepted geotechnical engineering practices in the same or similar localities at the time the work was performed. The recommendations discussed in this report are appropriate for the locations shown and may vary at other locations at the site due to unforeseen variable conditions. No warranty is made, expressed, or implied.

The assumptions and analyses made here are broad and applied to a large area. The slope stability and settlement analyses are limited to the proposed design currently presented. Any modifications to the fill height, slope, or location would also affect the results of the analyses conducted. Any design changes may affect the analyses discussed in this report.

Subsurface soil conditions interpreted from Anchor QEA's observations and explorations accomplished at the site and soils properties inferred from the field and tests formed the basis for developing this design. The nature and extent of variations in subsurface conditions between the explorations and groundwater conditions with time may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate this design. Anchor QEA recommends that contingencies for unanticipated conditions be included during construction to confirm the conditions indicated by the explorations or provide corrective recommendations adapted to the conditions identified during the work.

This report is intended only as a geotechnical engineering design study. Therefore, it does not include environmental site characterization or other associated environmental studies, which are outside the scope of this report.

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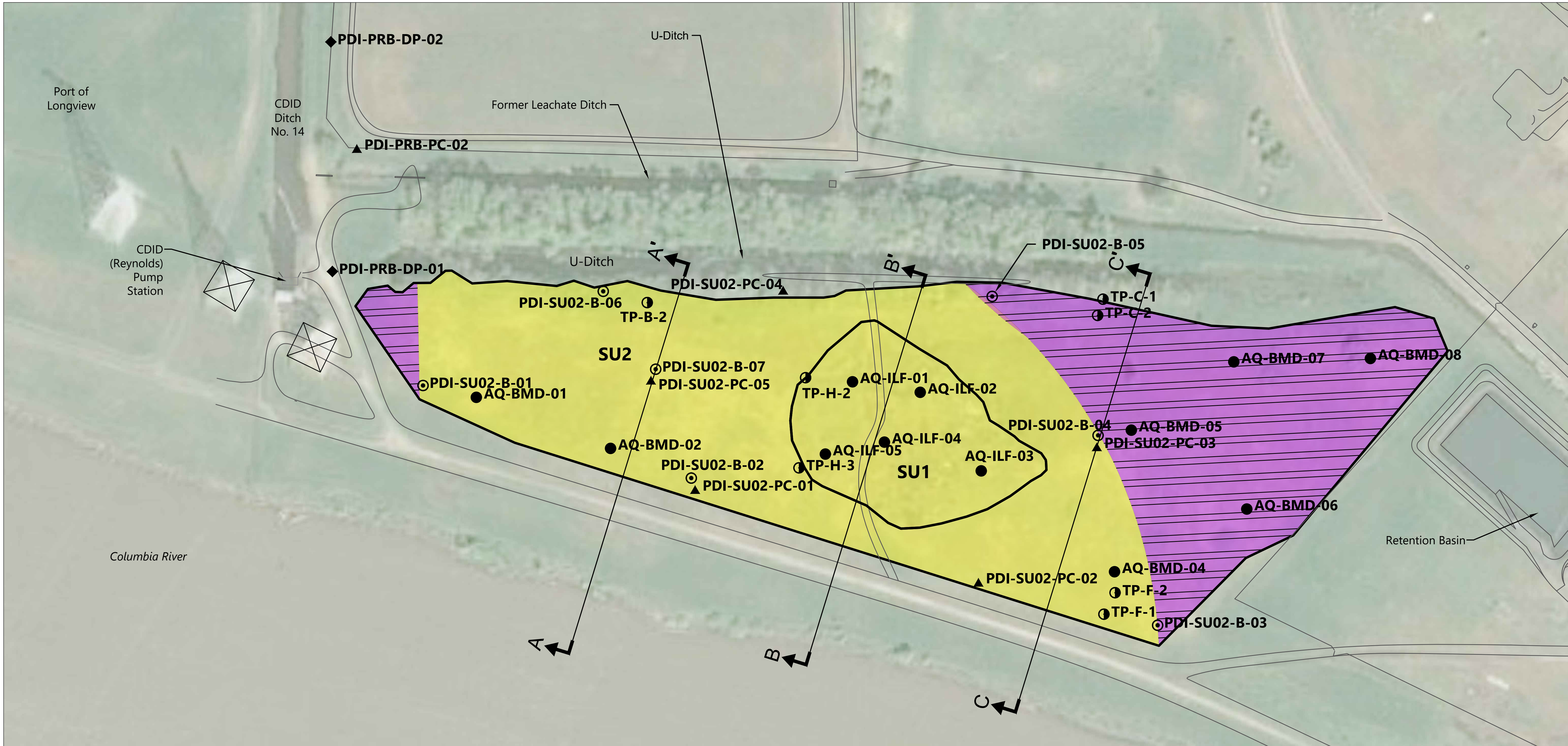
Figures



SOURCE: Drawing prepared from ALTA Survey (Minister & Glaeser Surveying, Inc.) conducted on November 11, 2010. Aerial image from Bing Maps.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- PDI Boring
- PDI Cone Penetration Test
- RI/FS Boring
- Test Pit
- PDI Direct Push Probe
- Cross Section Location and Designation

CLEANUP ACTION LEGEND:

- Low Permeability Cap
- Excavate and Consolidate on Site
- Reactive Backfill

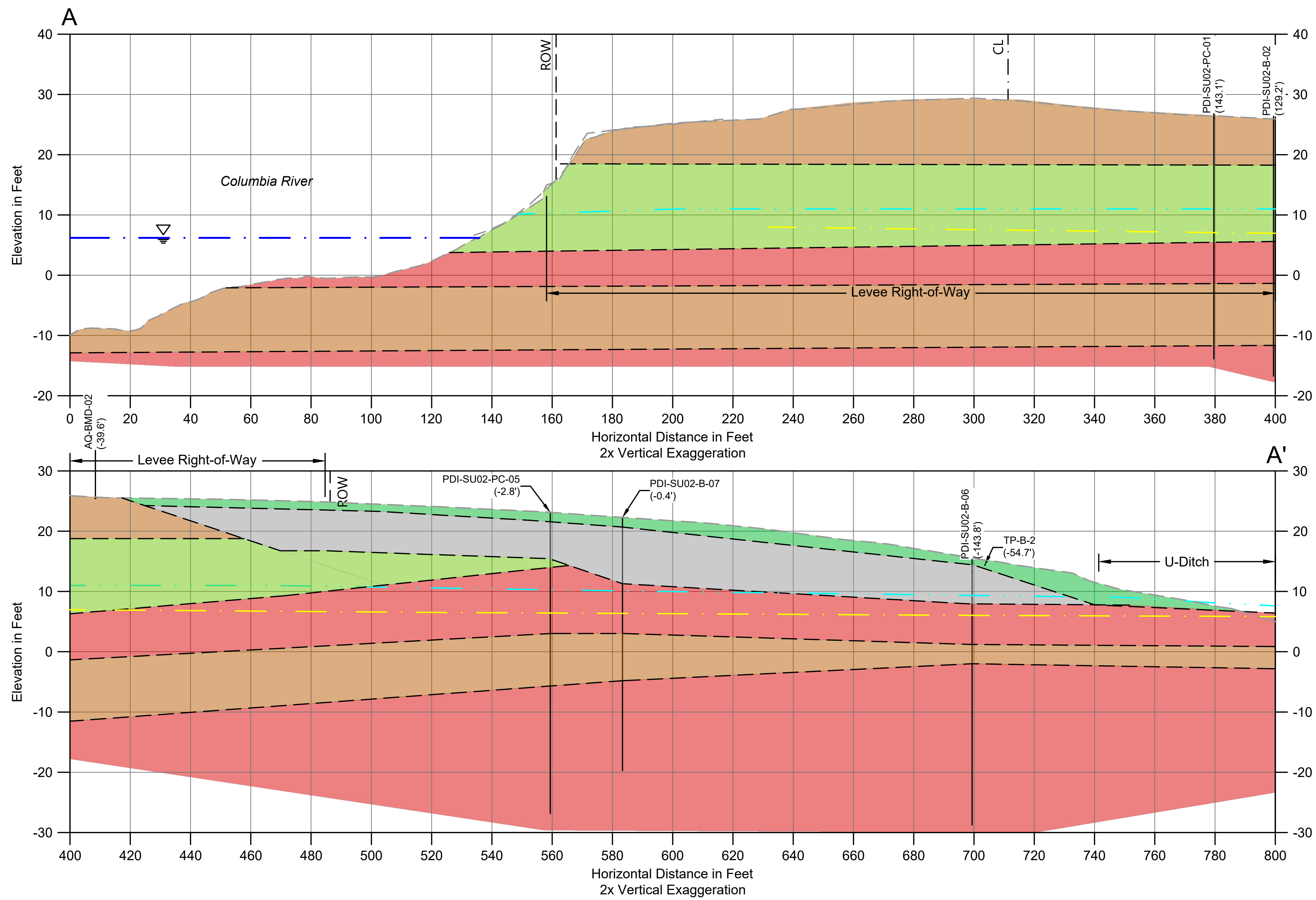
0 200
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B1

ANCHOR QEA

Figure B1
SU2 Plan View

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Approximate River Waterline (elevation 6.2 feet)
- Landfill Cover
- Silty Sand
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring

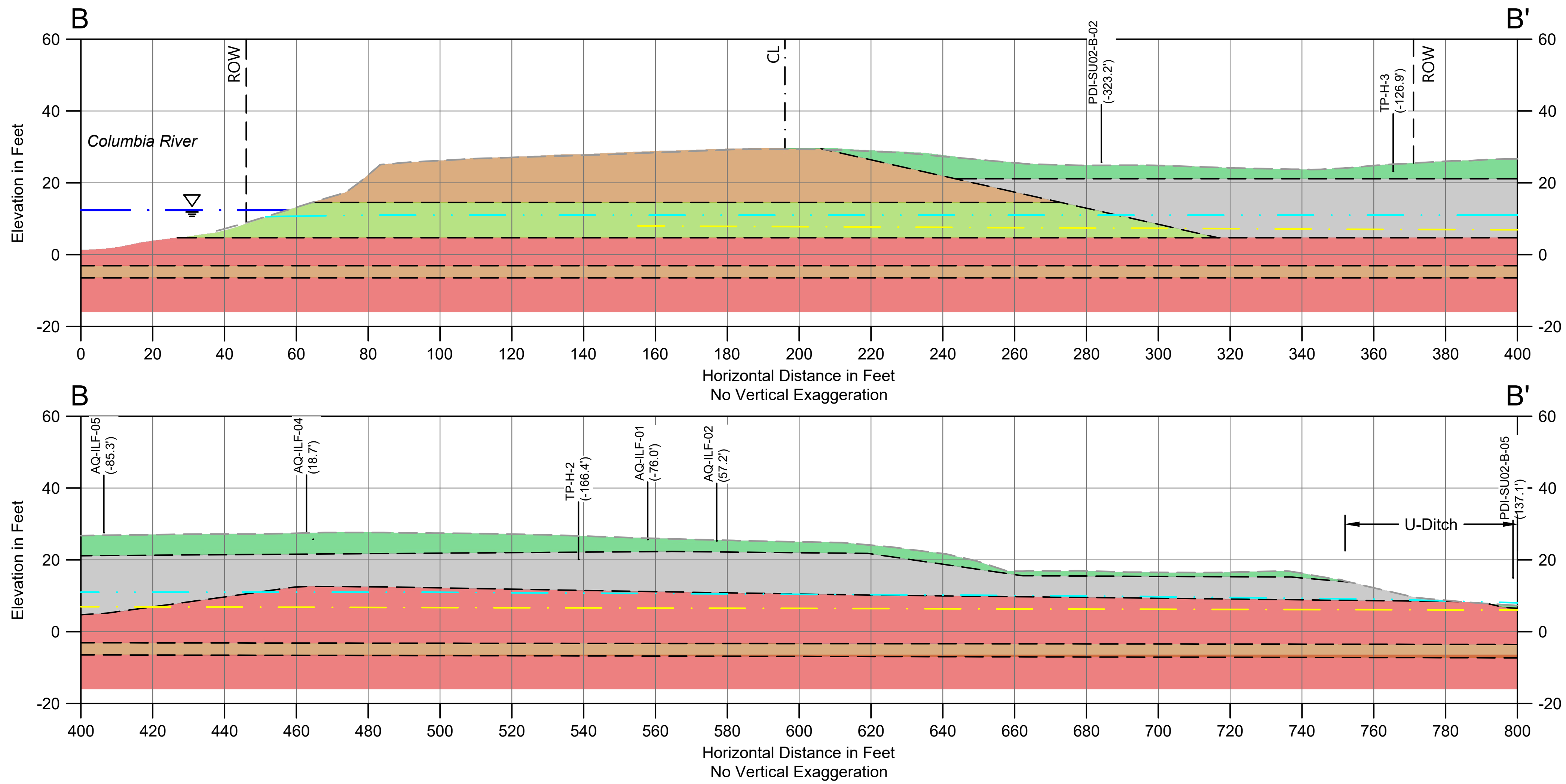
0 40
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B2

ANCHOR QEA

Figure B2
SU2 Lithology Cross Section A-A'

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Approximate River Waterline (elevation 6.2 feet)
- Landfill Cover
- Silty Sand
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring

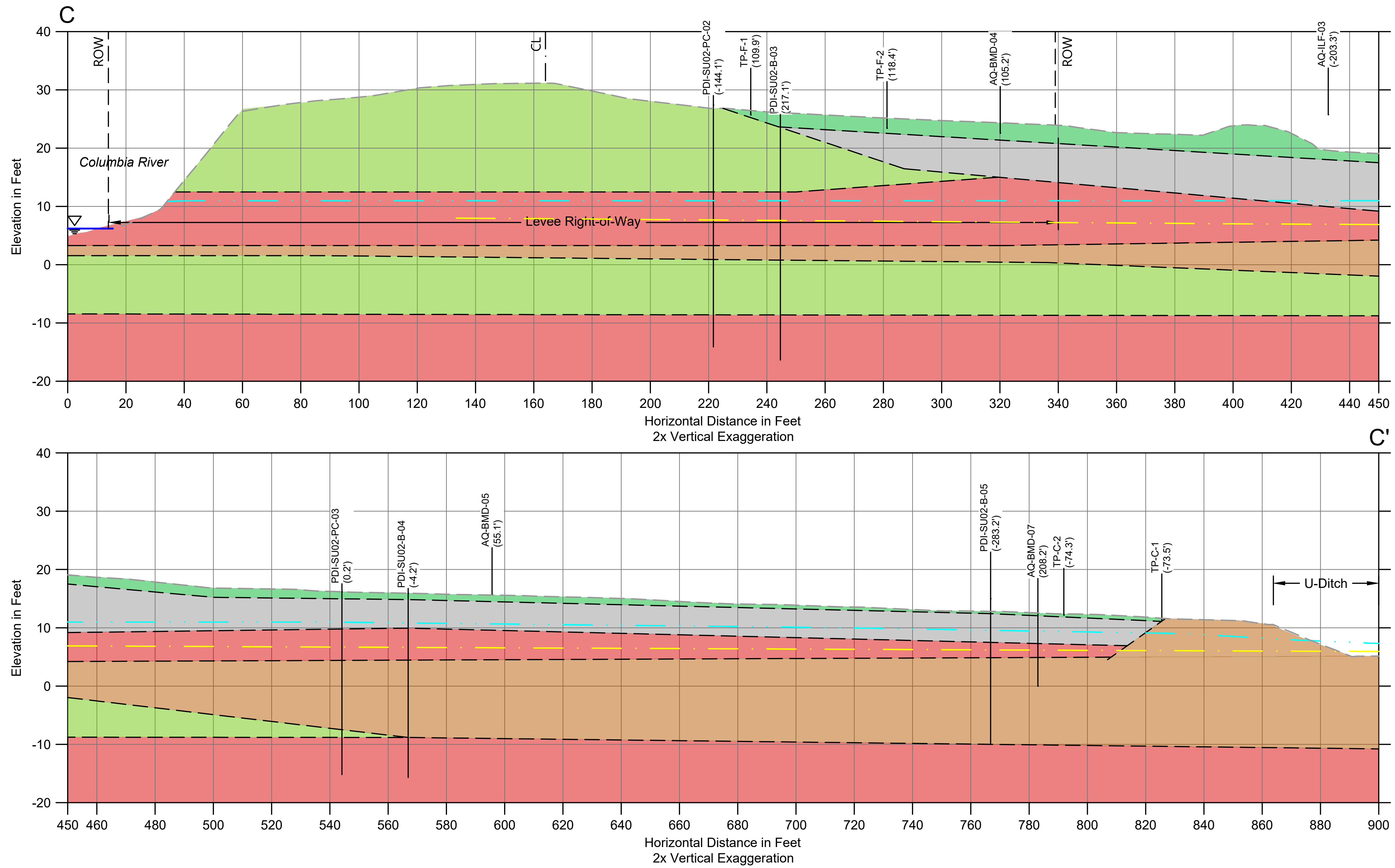
0 40
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B3

ANCHOR QEA

Figure B3
SU2 Lithology Cross Section B-B'

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Approximate River Waterline (elevation 6.2 feet)
- Landfill Cover
- Silty Sand
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring

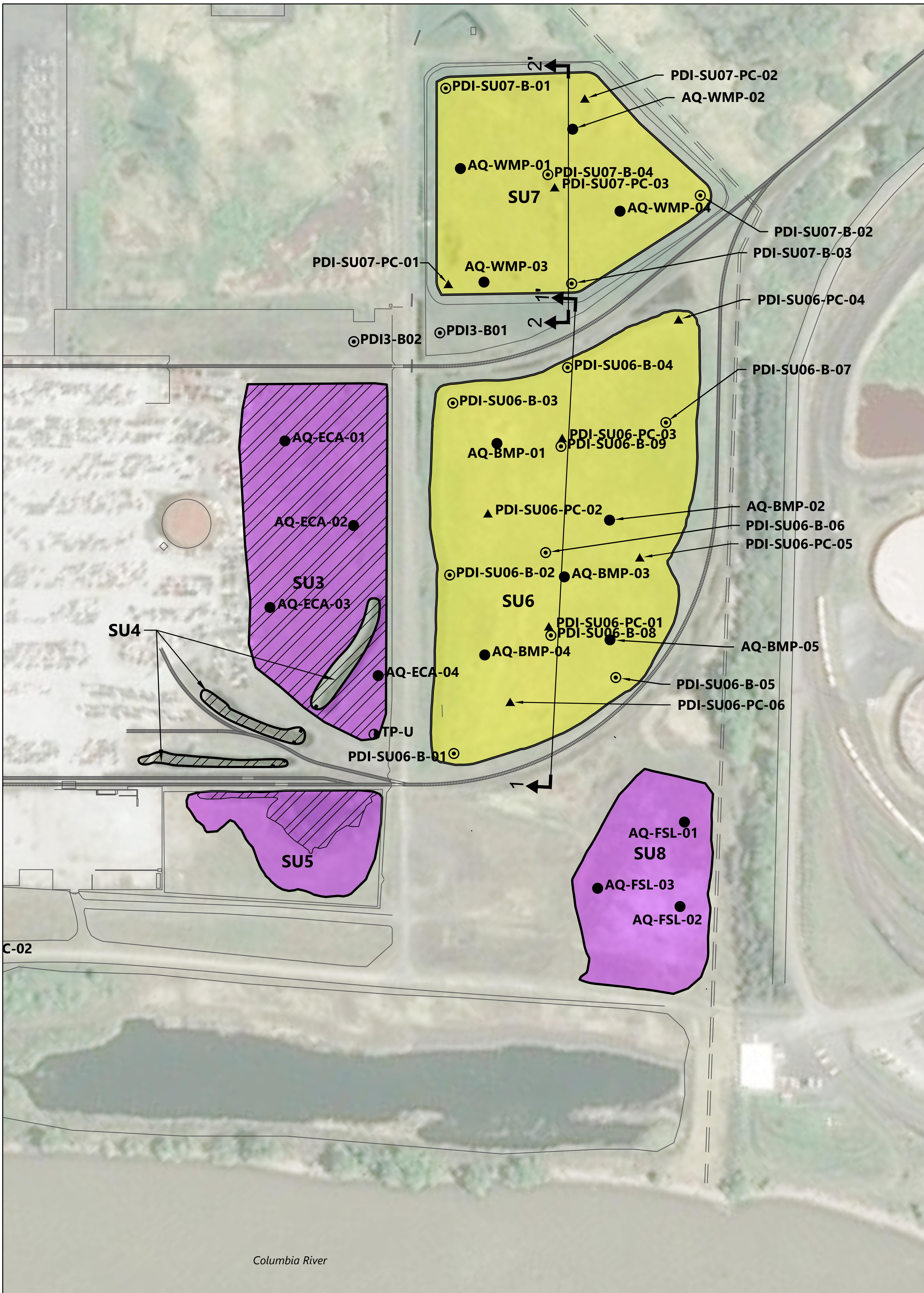
0 40
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B4

ANCHOR QEA

Figure B4
SU2 Lithology Cross Section C-C'

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Drawing prepared from ALTA Survey (Minister & Glaeser Surveying, Inc.) conducted on November 11, 2010. Aerial image from Bing Maps.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- PDI Boring
- PDI Cone Penetration Test
- RI/FS Boring
- Test Pit
- A — Cross Section Location and Designation

CLEANUP ACTION LEGEND:

- Low Permeability Cap
- Excavate and Consolidate on Site
- Reactive Backfill

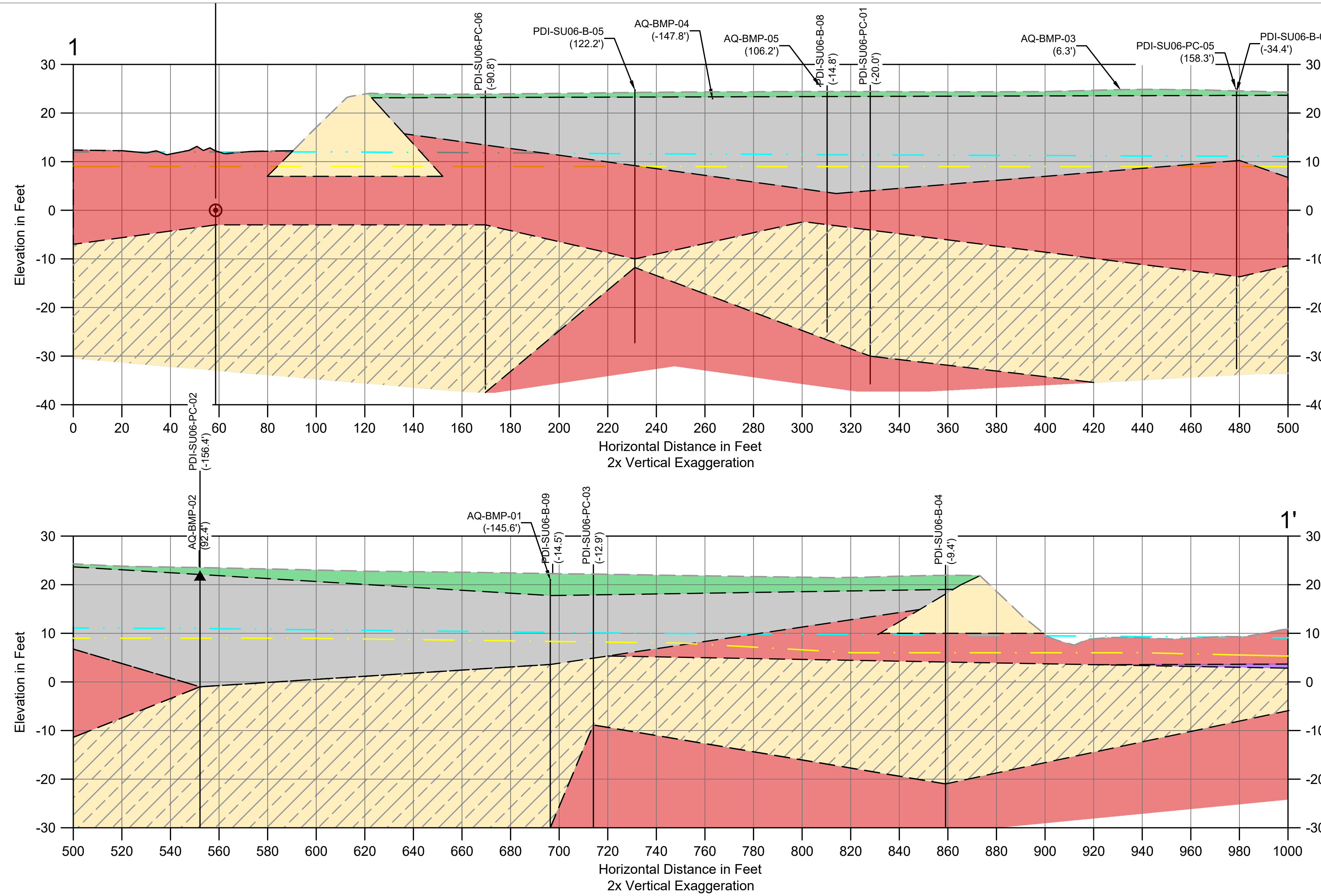
0 200
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B5

ANCHOR QEA

Figure B5
SU6 and SU7 Plan View

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

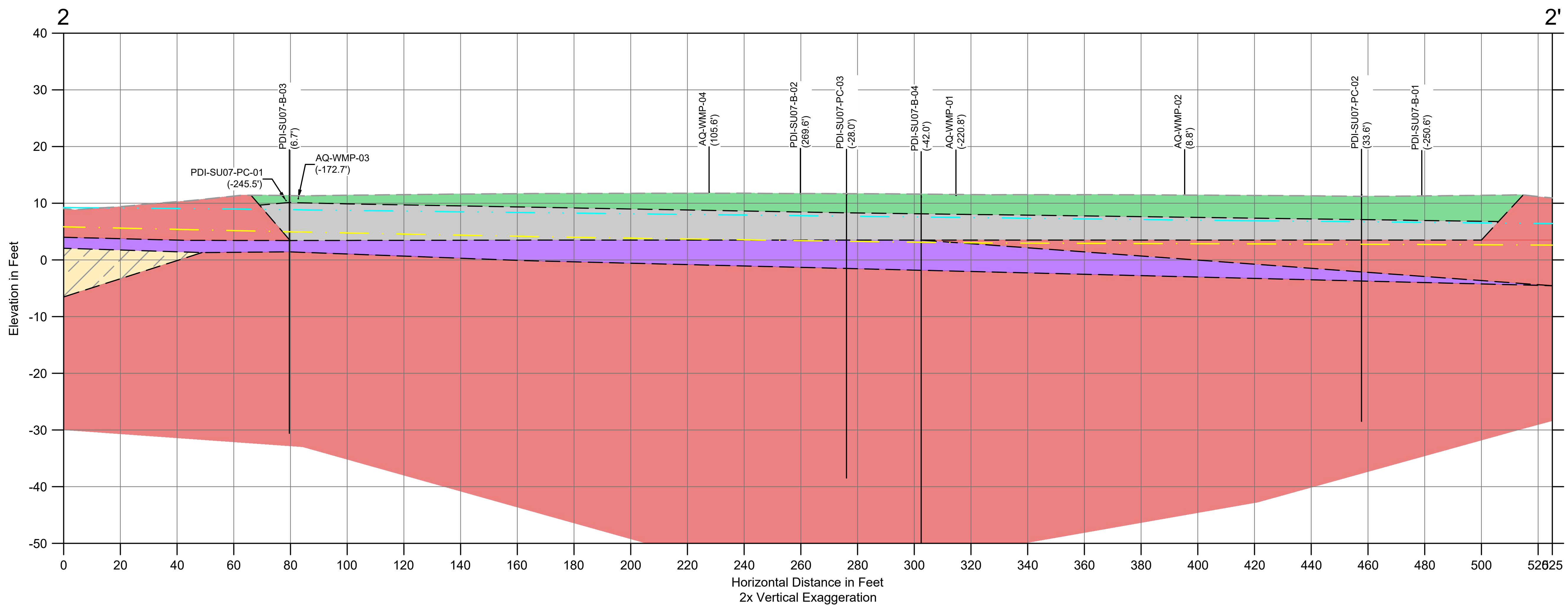
- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Landfill Cover
- Waste Material
- Silt
- Silty Sand with Interbedded Silt Lenses
- Existing Berm
- Peat
- Lithologic Contact
- Bottom of Boring

0 50
Feet

Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B6

ANCHOR QEA

Figure B6
SU6 Lithology Cross Section 1-1'
Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Landfill Cover
- Waste Material
- Silt
- Peat
- Silty Sand with Interbedded Silt Lenses
- Lithologic Contact
- Bottom of Boring

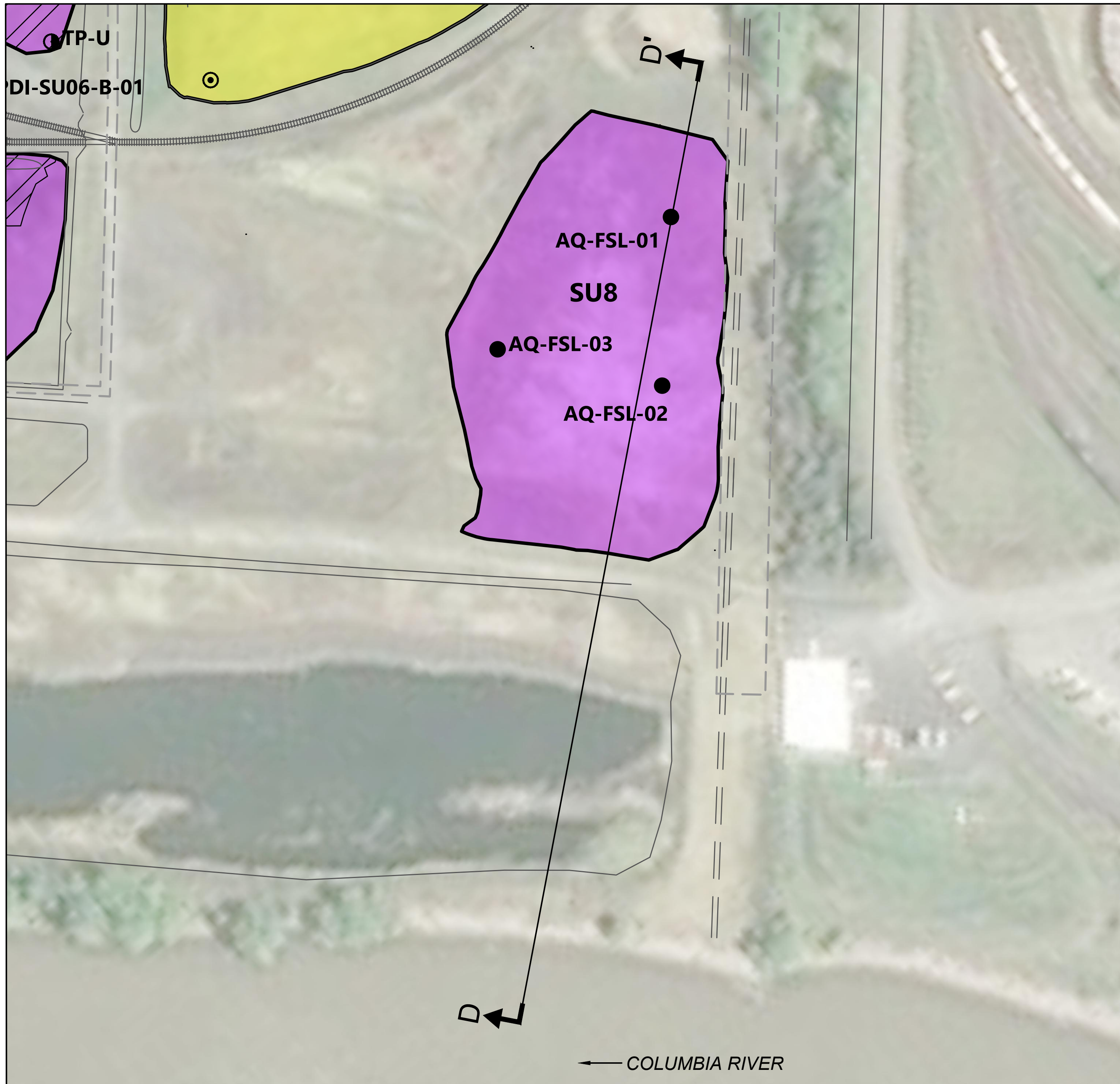
0 40
Feet

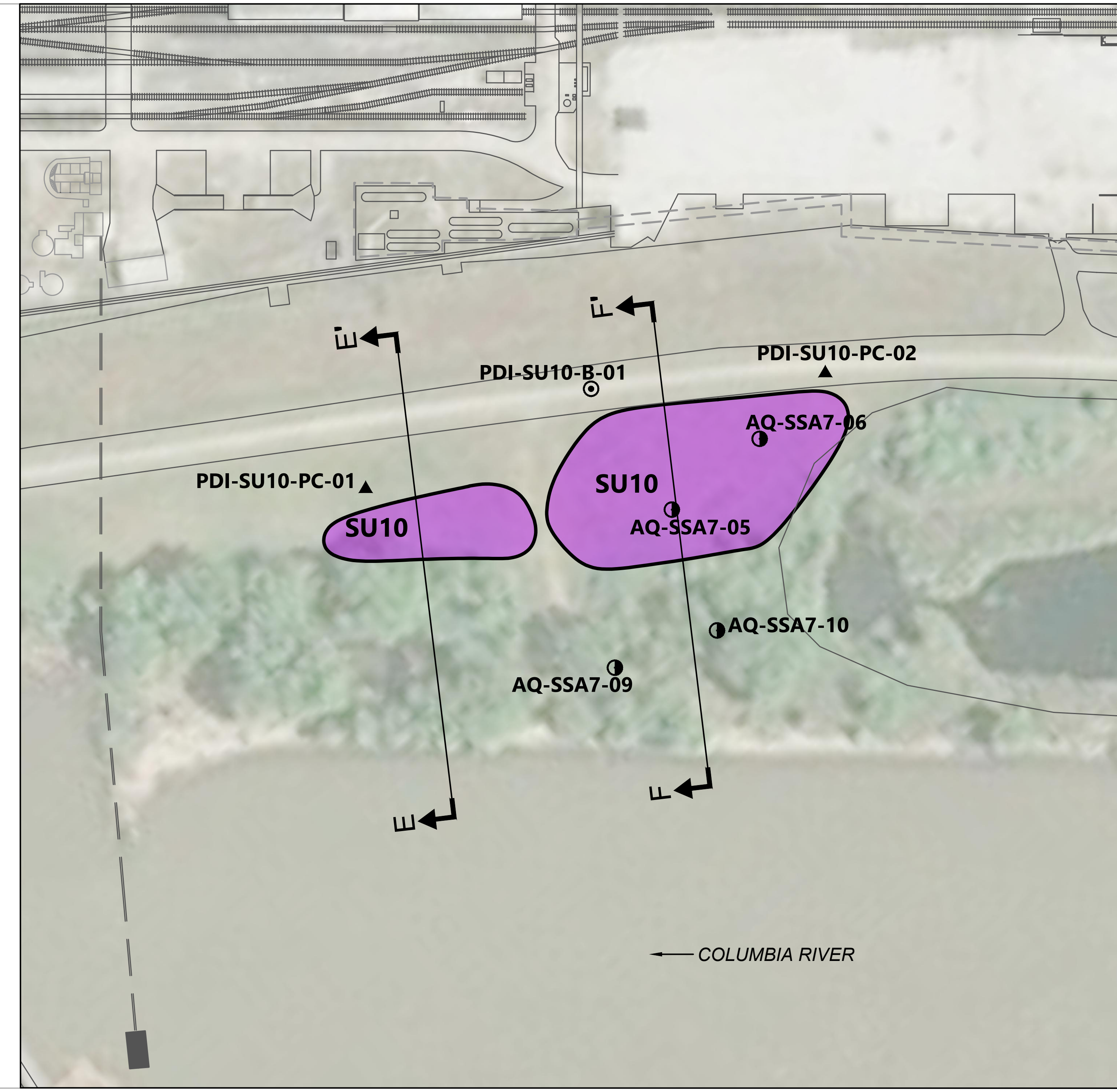
Publish Date: 2022/04/26 2:11 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B7

ANCHOR QEA

Figure B7
SU7 Lithology Cross Section 2-2'

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview





SOURCE: Drawing prepared from ALTA Survey (Minister & Glaeser Surveying, Inc.) conducted on November 11, 2010. Aerial image from Bing Maps.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: NAVD88, Feet

LEGEND:
- PDI Boring
- PDI Cone Penetration Test
- RI/FS Boring

CLEANUP ACTION LEGEND:
- Excavate and Consolidate on Site

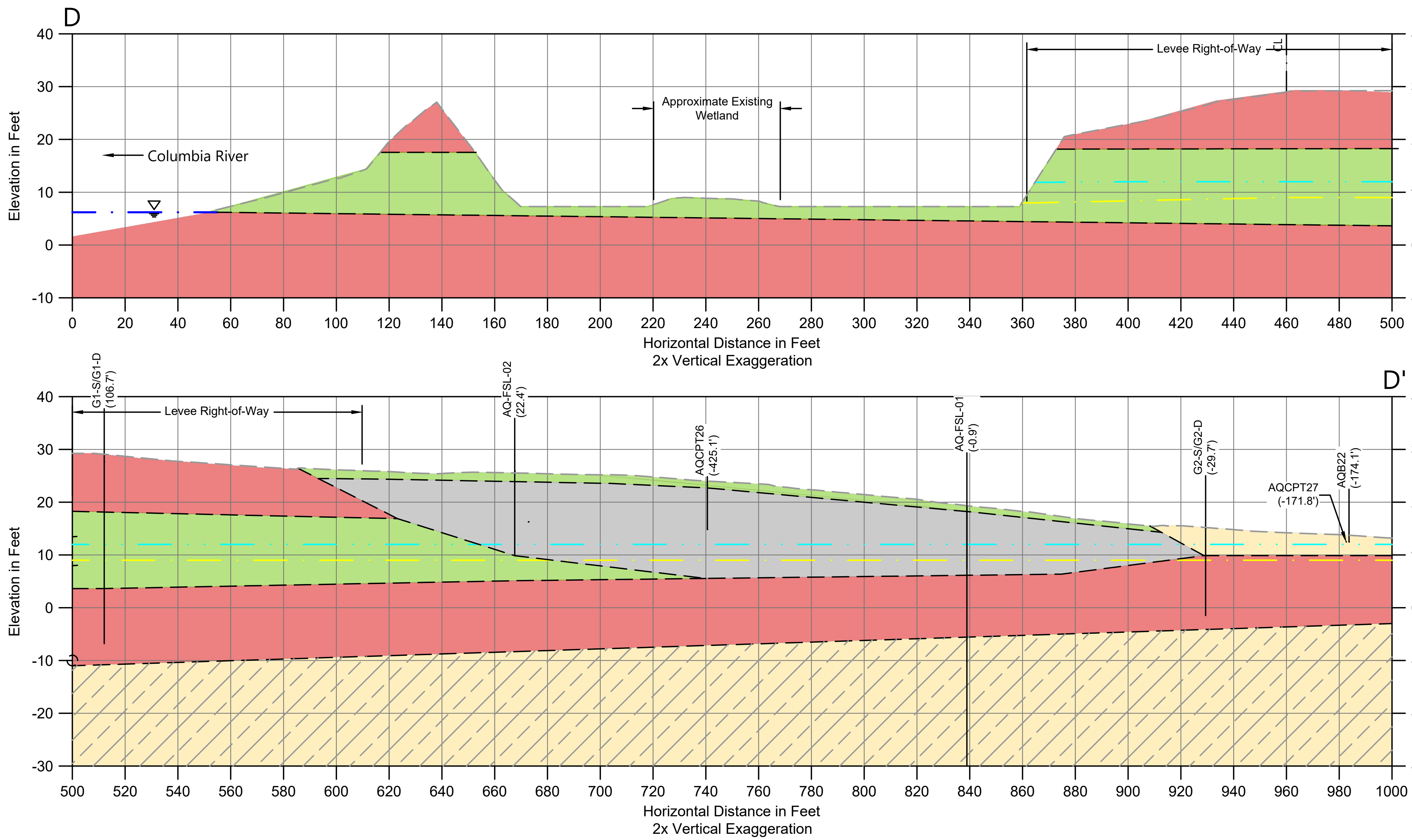
0 150
Feet

Publish Date: 2022/04/26 2:12 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B8

ANCHOR QEA

Figure B8
SU8 and SU10 Plan View

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

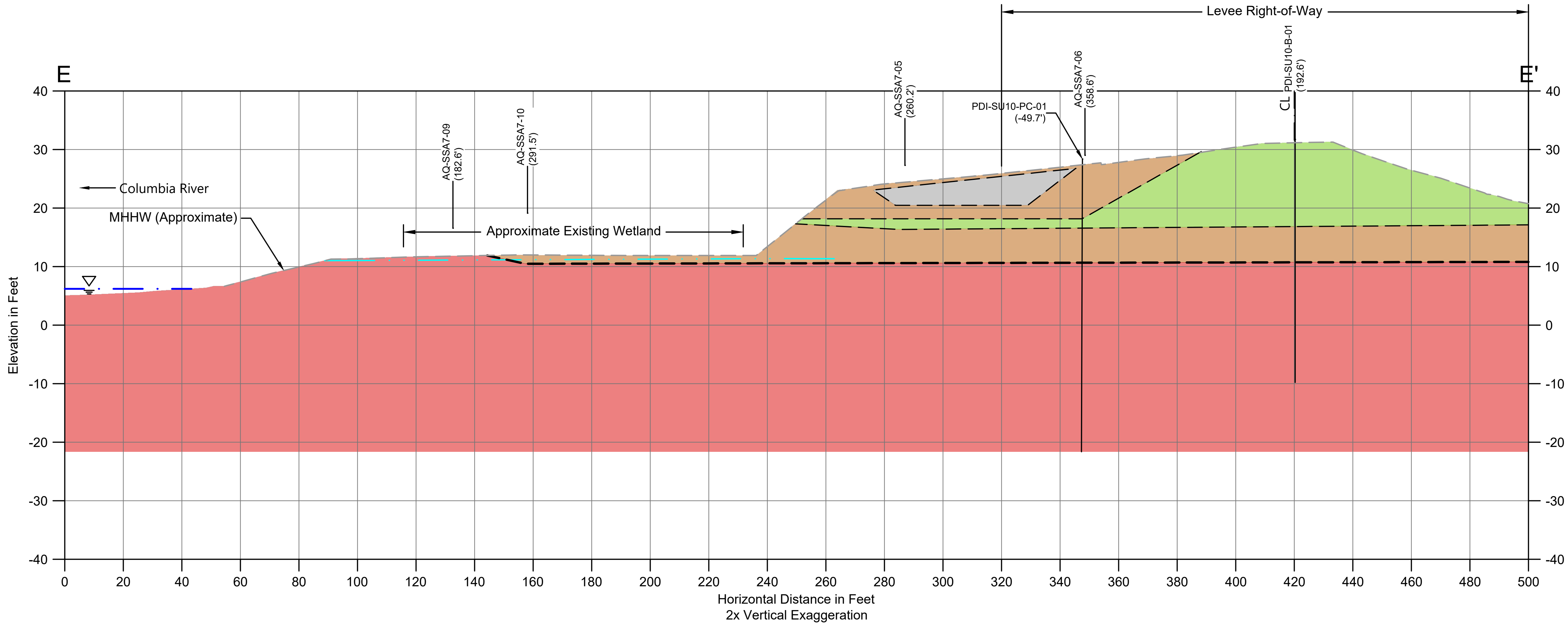
- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Approximate River Waterline (elevation 6.2 feet)
- Silty Sand with Interbedded Silt Lenses
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring

0 50
Feet

ANCHOR QEA

Figure B9
SU8 Lithology Cross Section D-D'

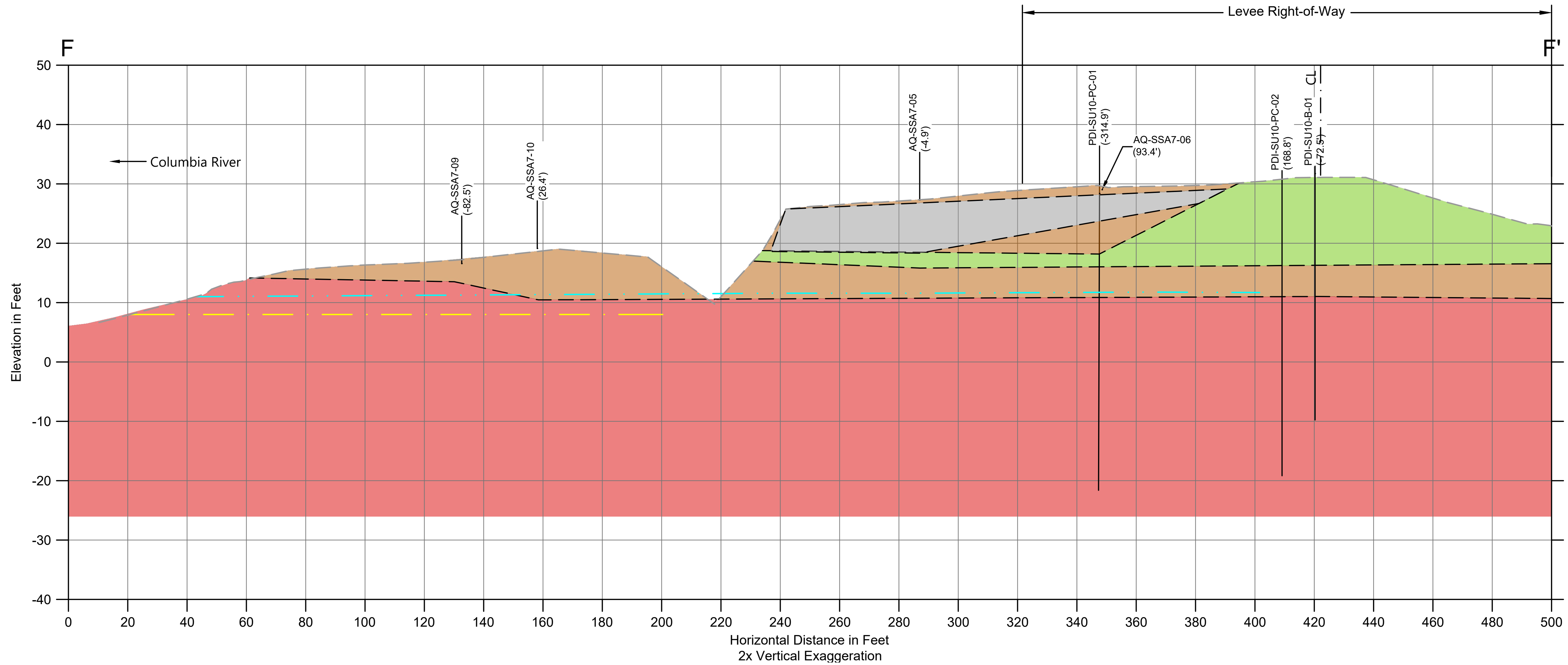
Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Approximate River Waterline (elevation 6.2 feet)
- Silty Sand
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring



SOURCE: Topography from Minister & Glaeser Surveying, Inc., dated June 14, 2010; March 4, 2013; and July 22, 2014
VERTICAL DATUM: NAVD88, Feet

LEGEND:

- Approximate Existing Grade (November 2010)
- Lithologic Contact, Dashed Where Inferred
- Historical Dry Season Groundwater Elevation
- Historical Wet Season Groundwater Elevation
- Silty Sand
- Waste Material
- Silt
- Sand
- Lithologic Contact
- Bottom of Boring

0 40
Feet

Publish Date: 2022/04/26 2:12 PM | User: chewett
Filepath: 0730-WK-003 (Geotech XS).dwg Figure B11

ANCHOR QEA

Figure B11
SU10 Lithology Cross Section F-F'

Geotechnical Summary Report
Former Reynolds Metals Reduction Plant – Longview

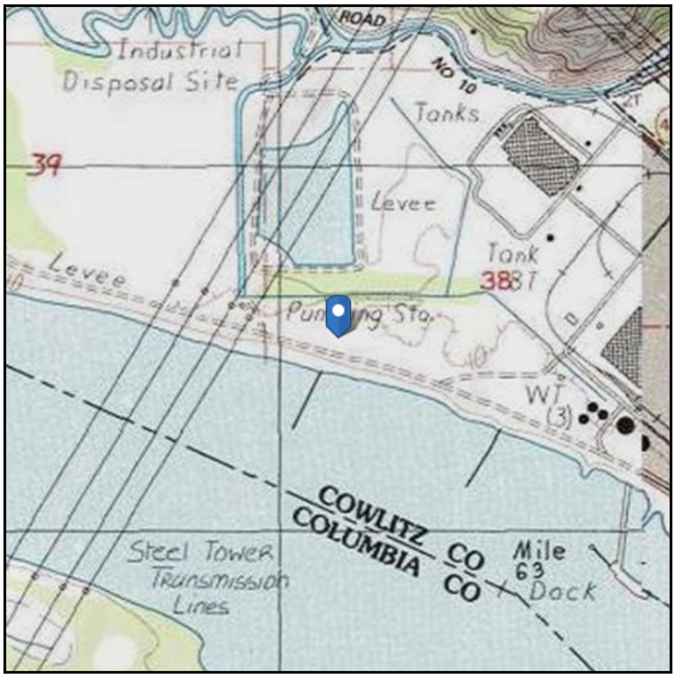
Attachment B1
ASCE 7 Hazards Report and USGS Unified Hazards Reports

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: I
Soil Class: E - Soft Clay Soil

Elevation: 25.9 ft (NAVD 88)
Latitude: 46.141
Longitude: -123.012



Seismic

Site Soil Class: E - Soft Clay Soil

Results:

S_S :	0.915	S_{D1} :	N/A
S_1 :	0.451	T_L :	16
F_a :	1.3	PGA :	0.421
F_v :	N/A	PGA_M :	0.572
S_{MS} :	1.189	F_{PGA} :	1.358
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.793	C_v :	1.257

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Thu May 07 2020

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

46.141

Longitude

Decimal degrees, negative values for western longitudes

-123.012

Site Class

180 m/s (D/E boundary)

Spectral Period

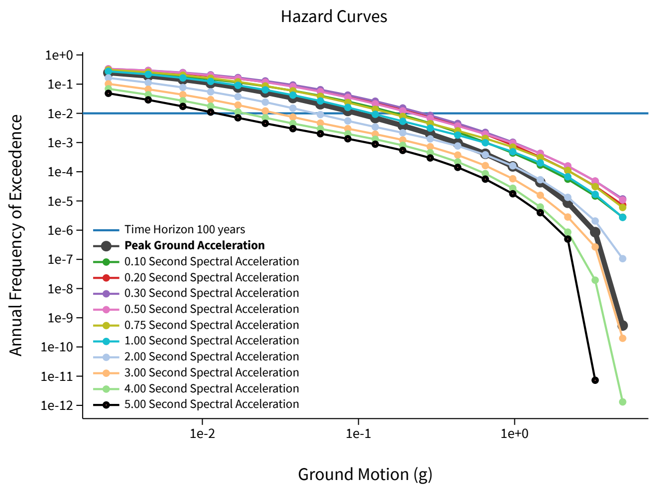
Peak Ground Acceleration

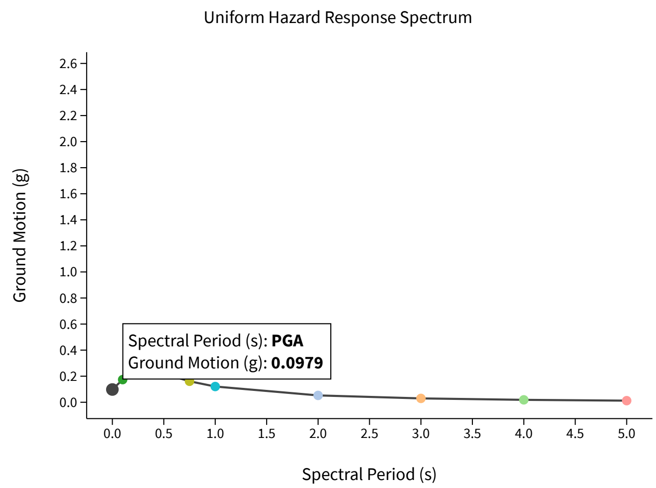
Time Horizon

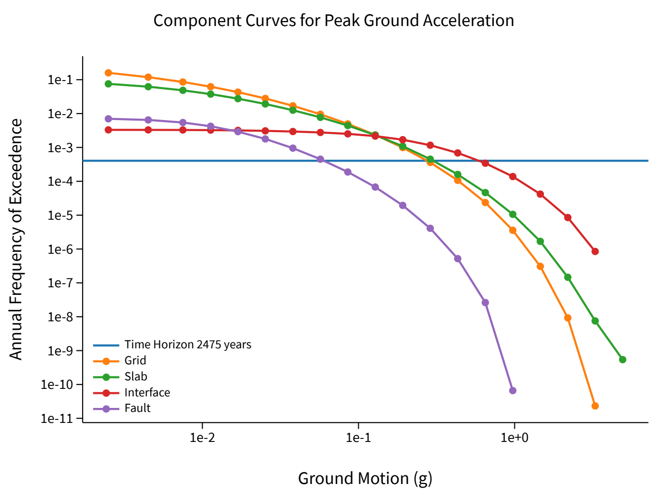
Return period in years

100

Hazard Curve







View Raw Data

Deaggregation

Please select “Edition”, “Location” “Site Class”, “Spectral Period” & “Time Horizon“ above to compute a deaggregation.

Compute Deaggregation

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Latitude

Decimal degrees

46.141

Longitude

Decimal degrees, negative values for western longitudes

-123.012

Site Class

180 m/s (D/E boundary)

Spectral Period

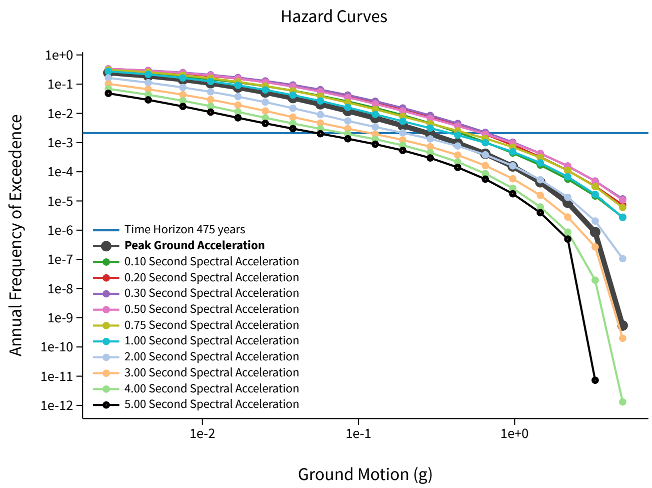
Peak Ground Acceleration

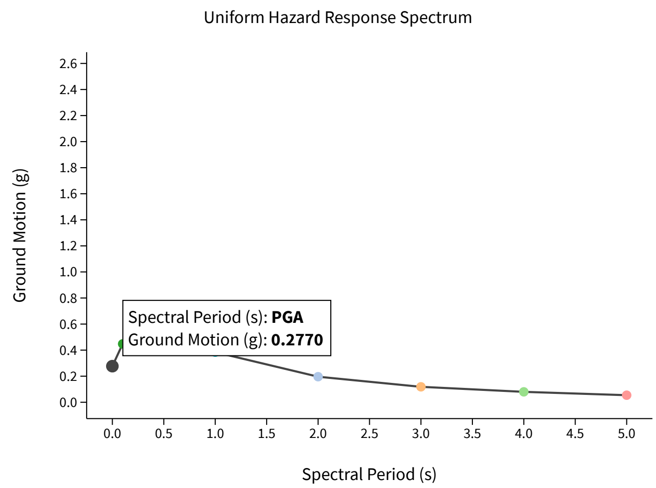
Time Horizon

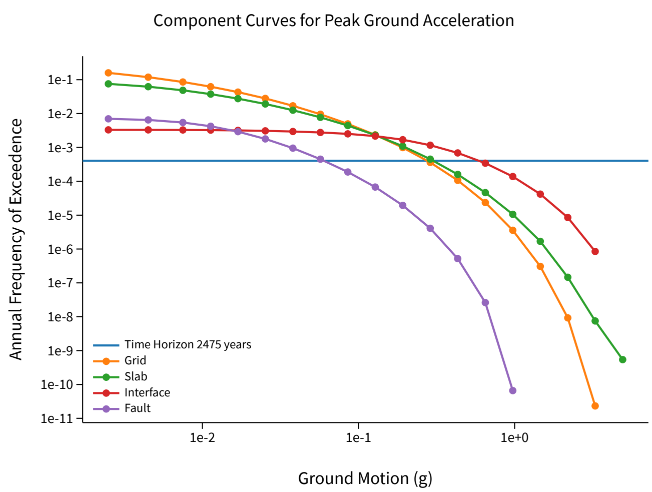
Return period in years

475

Hazard Curve





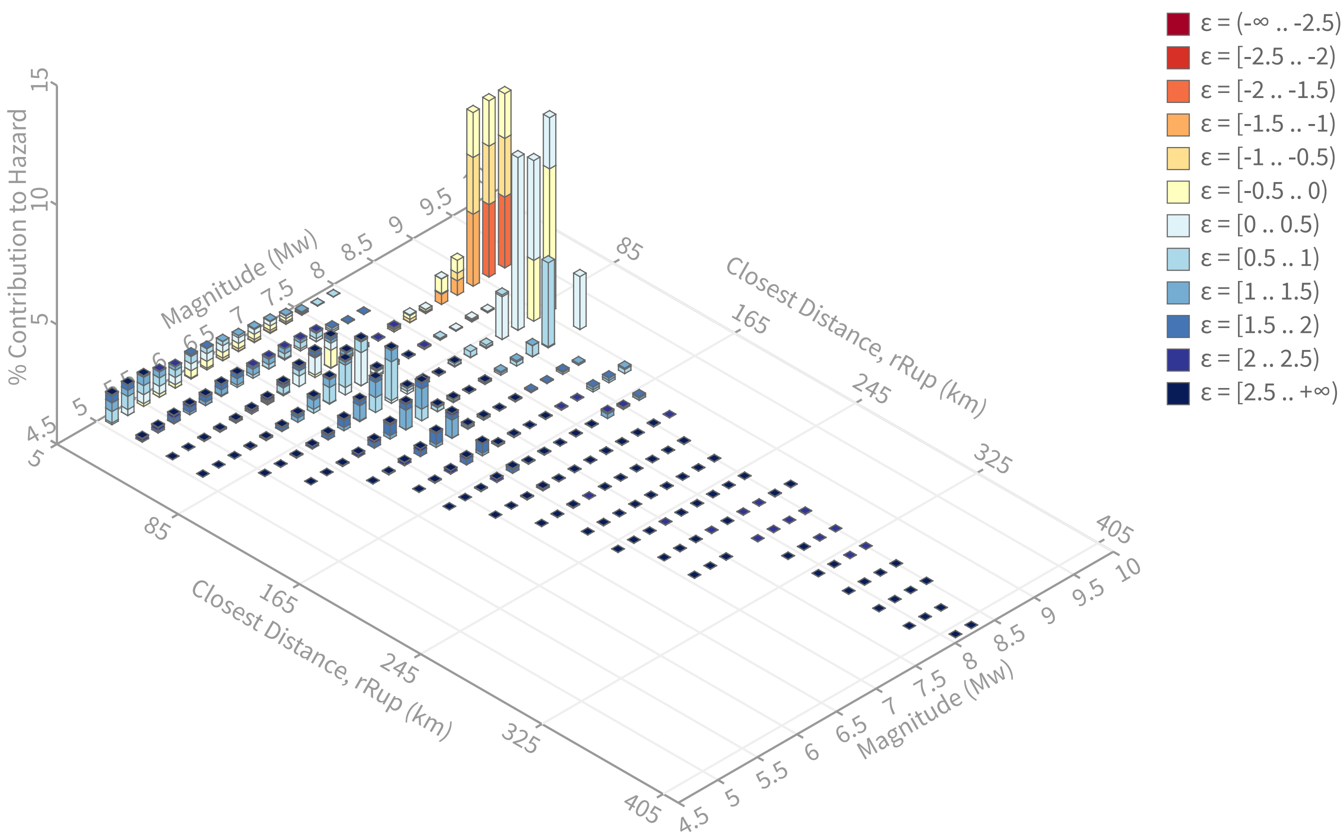


[View Raw Data](#)

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.27700968 g

Recovered targets

Return period: 480.2554 yrs
Exceedance rate: 0.0020822254 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.99 %

Mean (over all sources)

m: 7.93
r: 71.15 km
ε_0: 0.25 σ

Mode (largest m-r bin)

m: 9.12
r: 91.85 km
ε_0: -0.13 σ
Contribution: 8.13 %

Mode (largest m-r-ε_0 bin)

m: 8.7
r: 91.83 km
ε_0: 0.23 σ
Contribution: 7.22 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
sub0_ch_bot.in	Interface							21.09
Cascadia Megathrust - whole CSZ Characteristic		48.94	9.07	-1.00	123.413°W	46.300°N	299.95	21.09
sub0_ch_mid.in	Interface							20.97
Cascadia Megathrust - whole CSZ Characteristic		91.85	8.90	0.06	124.137°W	46.300°N	281.95	20.97
pacnwdeep.2014.in	Slab							10.35
sub0_ch_top.in	Interface							5.41
Cascadia Megathrust - whole CSZ Characteristic		112.95	8.81	0.51	124.439°W	46.300°N	279.66	5.41
pacnwdeep.2014.in	Slab							4.68
coastalOR_deep.in	Slab							2.36
pacnwdeep.2014.in	Slab							2.16
WUSmap_2014_fixSm.ch.in (opt)	Grid							2.04
WUSmap_2014_fixSm.gr.in (opt)	Grid							2.04
noPuget_2014_fixSm.ch.in (opt)	Grid							1.99
noPuget_2014_fixSm.gr.in (opt)	Grid							1.98
coastalOR_deep.in	Slab							1.93
puget_2014.ch.in	Grid							1.88
puget_2014.gr.in	Grid							1.88
sub4_ch_bot.in	Interface							1.28
Cascadia Megathrust - CSZ northern zone Characteristic		50.72	8.70	-0.72	123.413°W	46.300°N	299.95	1.28
sub1_ch_bot.in	Interface							1.12
Cascadia Megathrust - Goldfinger Case B Characteristic		48.27	8.84	-0.87	123.413°W	46.300°N	299.95	1.12
sub4_ch_mid.in	Interface							1.11
Cascadia Megathrust - CSZ northern zone Characteristic		91.47	8.59	0.31	124.137°W	46.300°N	281.95	1.11

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Latitude

Decimal degrees

46.141

Longitude

Decimal degrees, negative values for western longitudes

-123.012

Site Class

180 m/s (D/E boundary)

Spectral Period

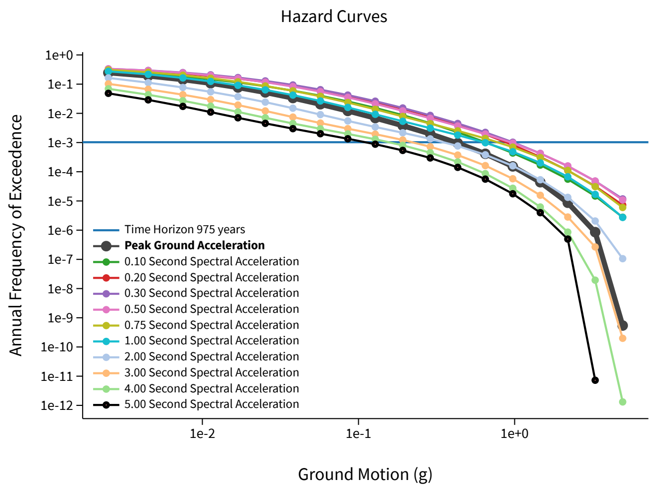
Peak Ground Acceleration

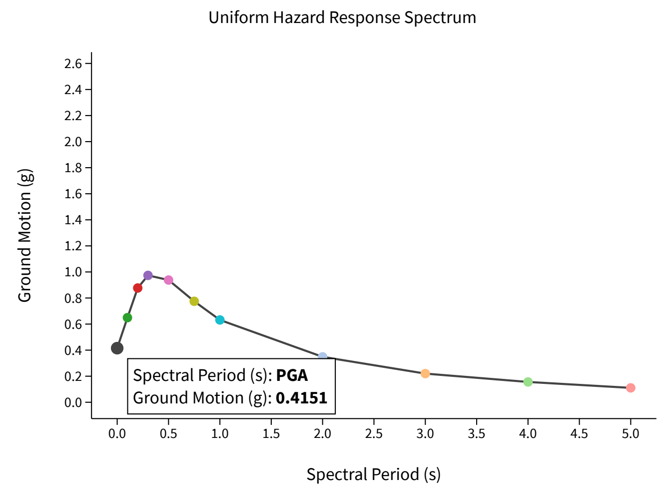
Time Horizon

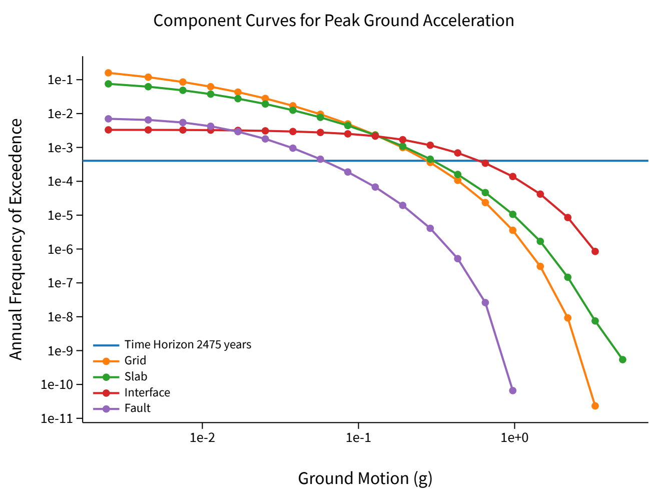
Return period in years

975

Hazard Curve





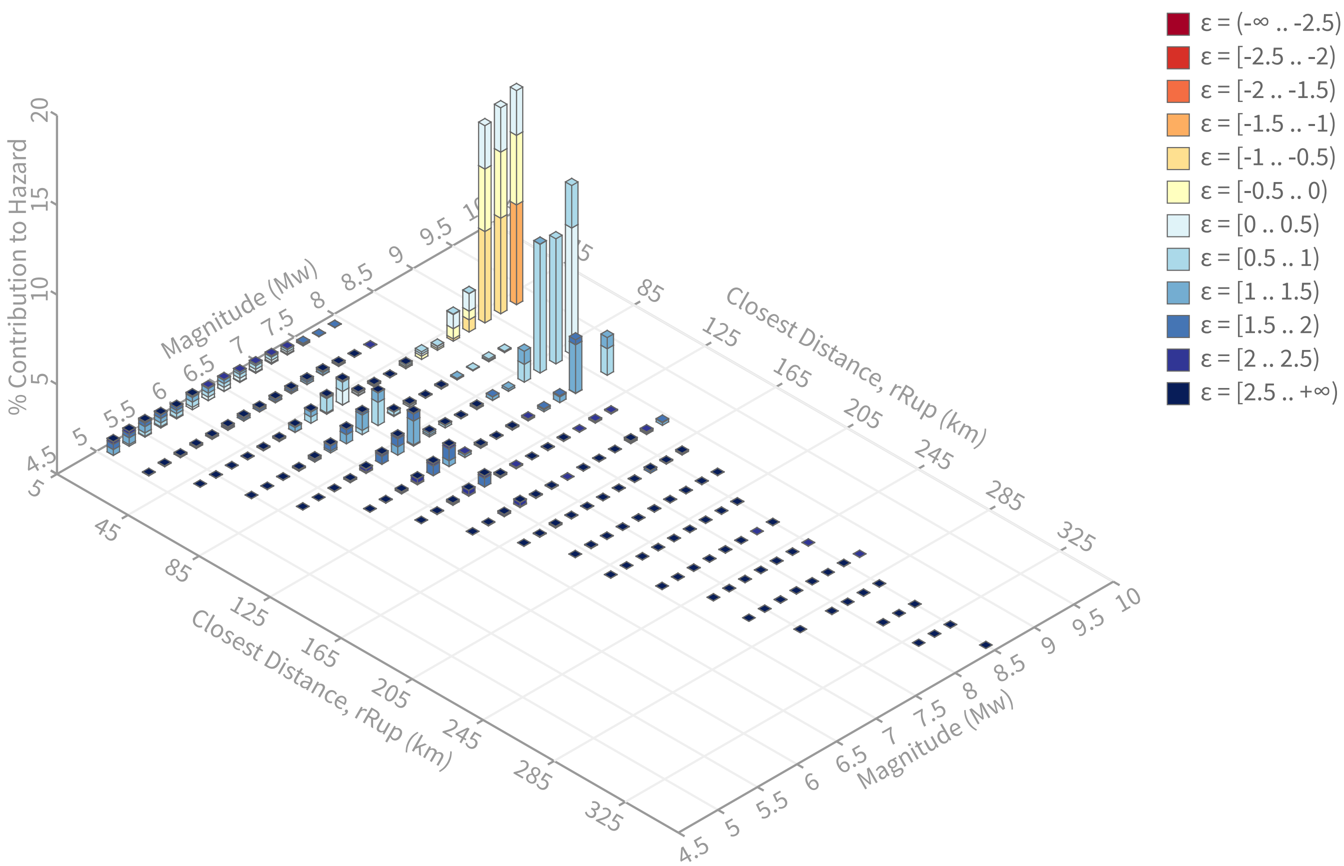


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 975 yrs
Exceedance rate: 0.001025641 yr^{-1}
PGA ground motion: 0.41512217 g

Recovered targets

Return period: 985.46057 yrs
Exceedance rate: 0.0010147539 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.72 %

Mean (over all sources)

m: 8.3
r: 67.86 km
ε_0: 0.48 σ

Mode (largest m-r bin)

m: 9.34
r: 48.94 km
ε_0: -0.63 σ
Contribution: 11.94 %

Mode (largest m-r-ε_0 bin)

m: 8.7
r: 91.81 km
ε_0: 0.85 σ
Contribution: 7.18 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
sub0_ch_bot.in	Interface							33.13
Cascadia Megathrust - whole CSZ Characteristic		48.94	9.08	-0.44	123.413°W	46.300°N	299.95	33.13
sub0_ch_mid.in	Interface							22.49
Cascadia Megathrust - whole CSZ Characteristic		91.85	8.91	0.67	124.137°W	46.300°N	281.95	22.49
pacnwdeep.2014.in	Slab							7.22
sub0_ch_top.in	Interface							4.78
Cascadia Megathrust - whole CSZ Characteristic		112.95	8.82	1.10	124.439°W	46.300°N	279.66	4.78
pacnwdeep.2014.in	Slab							3.08
coastalOR_deep.in	Slab							2.20
sub4_ch_bot.in	Interface							1.86
Cascadia Megathrust - CSZ northern zone Characteristic		50.72	8.71	-0.14	123.413°W	46.300°N	299.95	1.86
sub1_ch_bot.in	Interface							1.70
Cascadia Megathrust - Goldfinger Case B Characteristic		48.27	8.84	-0.29	123.413°W	46.300°N	299.95	1.70
coastalOR_deep.in	Slab							1.67
pacnwdeep.2014.in	Slab							1.29
WUSmap_2014_fixSm.ch.in (opt)	Grid							1.18
WUSmap_2014_fixSm.gr.in (opt)	Grid							1.18
noPuget_2014_fixSm.ch.in (opt)	Grid							1.16
noPuget_2014_fixSm.gr.in (opt)	Grid							1.16
puget_2014.ch.in	Grid							1.14
puget_2014.gr.in	Grid							1.13
sub4_ch_mid.in	Interface							1.07
Cascadia Megathrust - CSZ northern zone Characteristic		91.47	8.60	0.92	124.137°W	46.300°N	281.95	1.07

Attachment B2
Landfill Slope Stability Analysis Documentation

West Landfill_North End
Former Reynolds Metals Reduction Plant – Longview
Anchor QEA
Date Created: 5/11/2020, 3:52:26 PM
Updated: 4/21/2022, 08:46:00 AM
Software Version: 9.021

Table of Contents

Slide2 Analysis Information

West Landfill_North End_5to1 slope improvement_04-20-22

Project Summary

File Name:	West Landfill_North End_5to1 slope improvement_04-20-22.slmd
Slide2 Modeler Version:	9.021
Project Title:	Former Reynolds Metals Reduction Plant – Longview
Analysis:	West Landfill Retaining Structure
Author:	C. Janisch
Company:	Anchor QEA
Date Created:	5/11/2020, 3:52:26 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: 2.923200 Gle/morgenstern-price: 2.919110	00h:00m:14.356s
	Existing Condition - Seismic	Spencer: 0.700593 Gle/morgenstern-price: 0.676306	00h:00m:07.111s
Compacted Waste - Seismic - 5:1	Master Scenario	Spencer: 0.740525	00h:00m:00.74s
	Compacted Waste - Undrained	Spencer: 1.987110	00h:00m:00.203s
	Compacted Waste - Drained	Spencer: 2.001630	00h:00m:00.167s
	Compacted Waste - Yield Acceleration	Spencer: 0.168770	00h:00m:00.106s
Improved Toe - Seismic - 5:1	Master Scenario	Spencer: 0.759716	00h:00m:00.87s
	Improved Toe - Undrained	Spencer: 1.830520	00h:00m:09.576s
	Improved Toe - Drained	Spencer: 1.830240	00h:00m:09.594s
	Improved Toe - Yield Acceleration	Spencer: 0.176631	00h:00m:00.72s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Existing Condition

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Compacted Waste - Seismic - 5:1

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Improved Toe - Seismic - 5:1

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Existing Condition

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Compacted Waste - Seismic - 5:1

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

Improved Toe - Seismic - 5:1 - Master Scenario

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

Improved Toe - Seismic - 5:1 - Improved Toe - Undrained

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Improved Toe - Seismic - 5:1 - Improved Toe - Drained

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Improved Toe - Seismic - 5:1 - Improved Toe - Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

Seismic Loading

Existing Condition - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Existing Condition - Existing Condition - Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

Compacted Waste - Seismic - 5:1 - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

Compacted Waste - Seismic - 5:1 - Compacted Waste - Undrained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Compacted Waste - Seismic - 5:1 - Compacted Waste - Drained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Compacted Waste - Seismic - 5:1 - Compacted Waste - Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

Improved Toe - Seismic - 5:1 - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

Improved Toe - Seismic - 5:1 - Improved Toe - Undrained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Improved Toe - Seismic - 5:1 - Improved Toe - Drained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Improved Toe - Seismic - 5:1 - Improved Toe - Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

Materials

Waste Material	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	95
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (undrained)	
Color	
Strength Type	Vertical Stress Ratio
Unit Weight [lbs/ft3]	110
Tau/Sigma Ratio	0.36
Min. Strength [psf]	300
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0

Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	1
Levee Fill (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Silty Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
General Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Ru Value	0
Compacted Fill Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	1
Fill Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	28
Water Surface	Assigned per scenario

Hu Value 1

Materials In Use

Material	Existing Condition	Existing Condition - Seismic	Compacted Waste - Seismic - 5:1	Compacted Waste - Undrained	Compacted Waste - Drained	Compacted Waste - Yield Acceleration	Improved Toe - Seismic - 5:1	Improved Toe - Undrained	Improved Toe - Drained	Improved Toe - Yield Acceleration
Waste Ma	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓
Waste Ma (Drained)	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗
Compacte Waste	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓
Landfill C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Silt (undr	✗	✓	✓	✓	✗	✓	✓	✓	✗	✓
Silt (Drair	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗
Silty Sanc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Levee Fill (Sand)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Levee Fill Sand)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
General F	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓
Compacte Sand	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓
Fill Sand	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓

Global Minimums

Existing Condition - Master Scenario

Method: spencer

FS	2.923200
Axis Location:	768.806, 45.404
Left Slip Surface Endpoint:	746.522, 12.461
Right Slip Surface Endpoint:	781.790, 7.811
Left Slope Intercept:	746.522 12.461
Right Slope Intercept:	781.790 8.673
Resisting Moment:	189219 lb-ft
Driving Moment:	64730.2 lb-ft
Resisting Horizontal Force:	4366.68 lb
Driving Horizontal Force:	1493.8 lb
Total Slice Area:	125.201 ft2
Surface Horizontal Width:	35.2677 ft
Surface Average Height:	3.55001 ft

Method: gle/morgenstern-price

FS	2.919110
Axis Location:	768.581, 44.581
Left Slip Surface Endpoint:	746.786, 12.459
Right Slip Surface Endpoint:	781.202, 7.873
Left Slope Intercept:	746.786 12.459
Right Slope Intercept:	781.202 8.673
Resisting Moment:	184354 lb-ft
Driving Moment:	63154 lb-ft
Resisting Horizontal Force:	4339.08 lb
Driving Horizontal Force:	1486.44 lb
Total Slice Area:	124.002 ft2
Surface Horizontal Width:	34.4152 ft
Surface Average Height:	3.60312 ft

Existing Condition - Existing Condition - Seismic

Method: spencer

FS	0.700593
Axis Location:	709.554, 262.496
Left Slip Surface Endpoint:	566.347, 22.895
Right Slip Surface Endpoint:	815.311, 4.169
Left Slope Intercept:	566.347 22.895
Right Slope Intercept:	815.311 8.673
Resisting Moment:	4.65076e+07 lb-ft
Driving Moment:	6.63832e+07 lb-ft
Resisting Horizontal Force:	156662 lb
Driving Horizontal Force:	223614 lb
Total Slice Area:	6848.18 ft2
Surface Horizontal Width:	248.964 ft
Surface Average Height:	27.5067 ft

Method: gle/morgenstern-price

FS	0.676306
Axis Location:	712.964, 255.091
Left Slip Surface Endpoint:	573.635, 22.660
Right Slip Surface Endpoint:	815.311, 4.169
Left Slope Intercept:	573.635 22.660
Right Slope Intercept:	815.311 8.673
Resisting Moment:	4.06693e+07 lb-ft
Driving Moment:	6.01346e+07 lb-ft
Resisting Horizontal Force:	141793 lb
Driving Horizontal Force:	209659 lb
Total Slice Area:	6341.78 ft2
Surface Horizontal Width:	241.676 ft
Surface Average Height:	26.2408 ft

Compacted Waste - Seismic - 5:1 - Master Scenario

Method: spencer

FS	0.740525
Axis Location:	730.153, 67.030
Left Slip Surface Endpoint:	695.775, 22.905
Right Slip Surface Endpoint:	744.827, 13.053
Resisting Moment:	272912 lb-ft
Driving Moment:	368539 lb-ft
Resisting Horizontal Force:	4934.46 lb
Driving Horizontal Force:	6663.46 lb
Total Slice Area:	140.554 ft2
Surface Horizontal Width:	49.0514 ft
Surface Average Height:	2.86545 ft

Compacted Waste - Seismic - 5:1 - Compacted Waste - Undrained

Method: spencer

FS	1.987110
Axis Location:	726.054, 66.191
Left Slip Surface Endpoint:	693.012, 23.051
Right Slip Surface Endpoint:	740.741, 13.874
Resisting Moment:	321017 lb-ft
Driving Moment:	161550 lb-ft
Resisting Horizontal Force:	5870.28 lb
Driving Horizontal Force:	2954.19 lb
Total Slice Area:	158.829 ft2
Surface Horizontal Width:	47.7288 ft
Surface Average Height:	3.32774 ft

Compacted Waste - Seismic - 5:1 - Compacted Waste - Drained

Method: spencer

FS	2.001630
Axis Location:	724.800, 64.545
Left Slip Surface Endpoint:	693.036, 23.050
Right Slip Surface Endpoint:	738.937, 14.236
Resisting Moment:	298906 lb-ft
Driving Moment:	149331 lb-ft
Resisting Horizontal Force:	5662.86 lb
Driving Horizontal Force:	2829.13 lb
Total Slice Area:	153.239 ft2
Surface Horizontal Width:	45.9015 ft
Surface Average Height:	3.33843 ft

Compacted Waste - Seismic - 5:1 - Compacted Waste - Yield Acceleration

Method: spencer

Ky	0.168770
Axis Location:	730.153, 67.030
Left Slip Surface Endpoint:	695.775, 22.905
Right Slip Surface Endpoint:	744.827, 13.053
Resisting Moment:	279900 lb-ft
Driving Moment:	279900 lb-ft
Resisting Horizontal Force:	5033.62 lb
Driving Horizontal Force:	5033.62 lb
Total Slice Area:	140.554 ft2
Surface Horizontal Width:	49.0514 ft
Surface Average Height:	2.86545 ft

Improved Toe - Seismic - 5:1 - Master Scenario

Method: spencer

FS	0.759716
Axis Location:	726.237, 61.391
Left Slip Surface Endpoint:	696.247, 22.799
Right Slip Surface Endpoint:	739.116, 14.244
Resisting Moment:	230036 lb-ft
Driving Moment:	302791 lb-ft
Resisting Horizontal Force:	4669.49 lb
Driving Horizontal Force:	6146.37 lb
Total Slice Area:	131.779 ft2
Surface Horizontal Width:	42.8691 ft
Surface Average Height:	3.07399 ft

Improved Toe - Seismic - 5:1 - Improved Toe - Undrained

Method: spencer

FS	1.830520
Axis Location:	725.872, 60.926
Left Slip Surface Endpoint:	696.247, 22.799
Right Slip Surface Endpoint:	738.598, 14.350
Resisting Moment:	45017.3 lb-ft
Driving Moment:	24592.6 lb-ft
Resisting Horizontal Force:	996.885 lb
Driving Horizontal Force:	544.591 lb
Total Slice Area:	27.1162 ft2
Surface Horizontal Width:	42.3518 ft
Surface Average Height:	0.640262 ft

Improved Toe - Seismic - 5:1 - Improved Toe - Drained

Method: spencer

FS	1.830240
Axis Location:	725.872, 60.926
Left Slip Surface Endpoint:	696.247, 22.799
Right Slip Surface Endpoint:	738.598, 14.350
Resisting Moment:	44346.2 lb-ft
Driving Moment:	24229.7 lb-ft
Resisting Horizontal Force:	982.202 lb
Driving Horizontal Force:	536.651 lb
Total Slice Area:	26.7171 ft2
Surface Horizontal Width:	42.3518 ft
Surface Average Height:	0.630839 ft

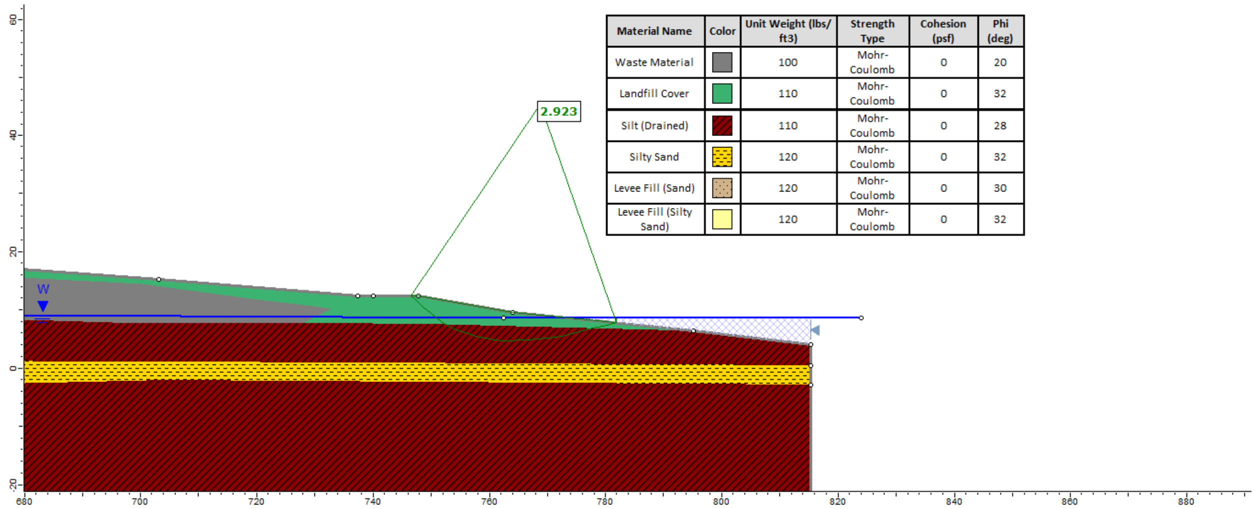
Improved Toe - Seismic - 5:1 - Improved Toe - Yield Acceleration

Method: spencer

Ky	0.176631
Axis Location:	726.237, 61.391
Left Slip Surface Endpoint:	696.247, 22.799
Right Slip Surface Endpoint:	739.116, 14.244
Resisting Moment:	234517 lb-ft
Driving Moment:	234517 lb-ft
Resisting Horizontal Force:	4741.95 lb
Driving Horizontal Force:	4741.95 lb
Total Slice Area:	131.779 ft2
Surface Horizontal Width:	42.8691 ft
Surface Average Height:	3.07399 ft

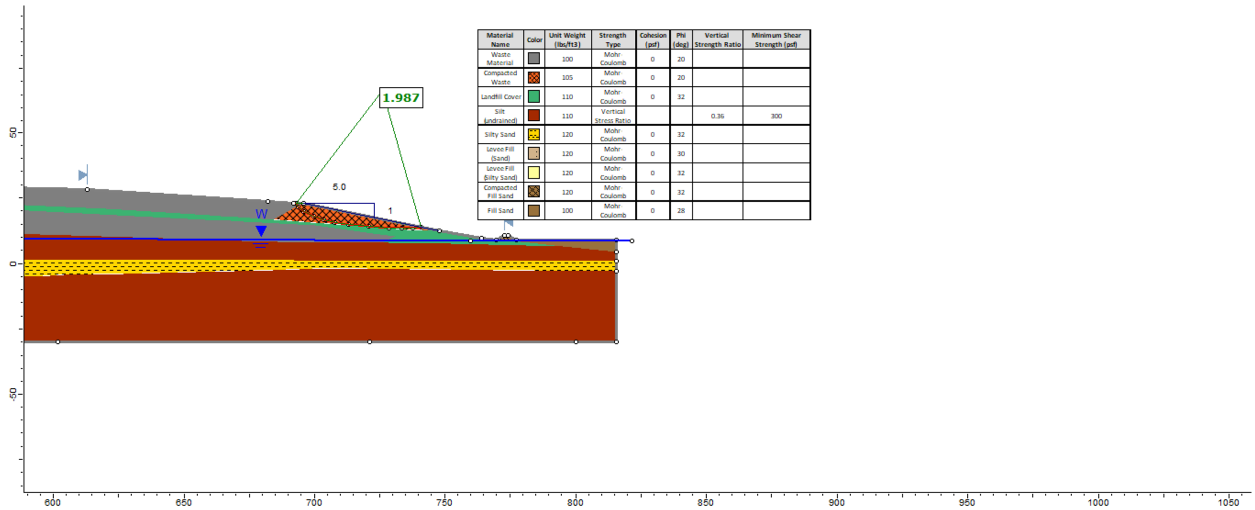
Report Views

1: North Slope of WLF - Existing Condition



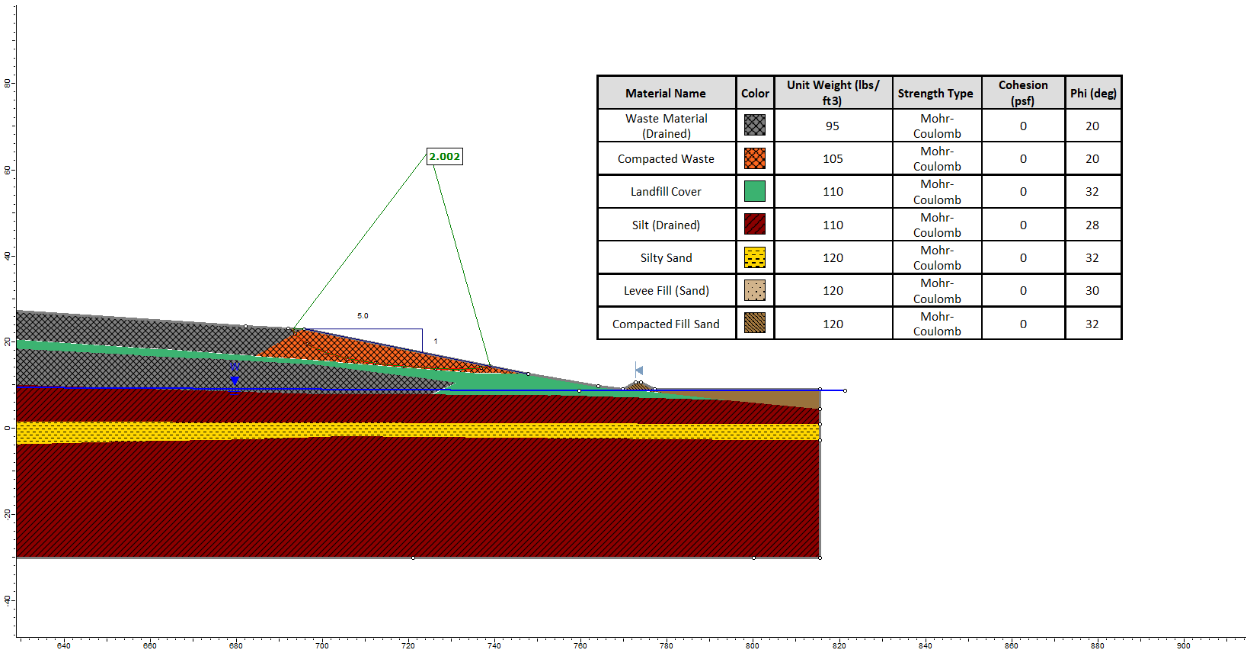
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Waste Material		100	Mohr-Coulomb	0	20
Landfill Cover		110	Mohr-Coulomb	0	32
Silt (Drained)		110	Mohr-Coulomb	0	28
Silty Sand		120	Mohr-Coulomb	0	32
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32

2: North Slope of WLF - Undrained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)
Waste Material		100	Mohr-Coulomb	0	20		
Compacted Waste		105	Mohr-Coulomb	0	20		
Landfill Cover		110	Mohr-Coulomb	0	32		
Silt (undrained)		110	Vertical Stress Ratio			0.36	300
Silty Sand		120	Mohr-Coulomb	0	32		
Levee Fill (Sand)		120	Mohr-Coulomb	0	30		
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32		
Compacted Fill Sand		120	Mohr-Coulomb	0	32		
Fill Sand		100	Mohr-Coulomb	0	28		

3: North Slope of WLF - Drained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Waste Material (Drained)		95	Mohr-Coulomb	0	20
Compacted Waste		105	Mohr-Coulomb	0	20
Landfill Cover		110	Mohr-Coulomb	0	32
Silt (Drained)		110	Mohr-Coulomb	0	28
Silty Sand		120	Mohr-Coulomb	0	32
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Compacted Fill Sand		120	Mohr-Coulomb	0	32

East Landfill No. 1
Former Reynolds Metals Reduction Plant – Longview Geotechnical Summary Report
Anchor QEA
Date Created: 4/2/2020, 8:09:01 AM
Software Version: 9.016

Table of Contents

Slide Analysis Information

East Landfill No. 1

Project Summary

File Name:	East Landfill No. 1.slmd
Slide Modeler Version:	9.016
Project Title:	Former Reynolds Metals Reduction Plant – Longview Geotechnical Summary Report
Analysis:	East Landfill No. 1 Retaining Structures
Company:	Anchor QEA
Date Created:	4/2/2020, 8:09:01 AM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: 6.146440 Gle/morgenstern-price: 6.144660	00h:00m:03.181s
North Area - undrained	Master Scenario	Spencer: 1.568610 Gle/morgenstern-price: 1.537840	00h:00m:16.289s
	North Area - drained	Spencer: 2.392410 Gle/morgenstern-price: 2.363900	00h:00m:08.230s
	North Area - seismic	Spencer: 0.538512 Gle/morgenstern-price: 0.511699	00h:00m:00.44s
	North Area - Yield Acceleration	Spencer: 0.071280 Gle/morgenstern-price: None	00h:00m:00.88s
	North Area - 1-year Yield Acceleration	Spencer: None Gle/morgenstern-price: 0.134353	00h:00m:00.91s
South Area - undrained	Master Scenario	Spencer: 1.967030 Gle/morgenstern-price: 1.967390	00h:00m:11.68s
	South Area - drained	Spencer: 2.043480 Gle/morgenstern-price: 2.086440	00h:00m:22.877s
	South Area - seismic	Spencer: 0.798821 Gle/morgenstern-price: 0.794441	00h:00m:00.51s
	South Area - Yield Acceleration	Spencer: 0.177333 Gle/morgenstern-price: 0.186060	00h:00m:00.62s
East Area - undrained	Master Scenario	Spencer: 1.456570 Gle/morgenstern-price: 1.451770	00h:00m:20.233s
	East Area - drained	Spencer: 1.907300 Gle/morgenstern-price: 1.928820	00h:00m:10.718s
	East Area - seismic	Spencer: 0.554748 Gle/morgenstern-price: 0.527378	00h:00m:00.42s
	East Area - Yield Acceleration	Spencer: 0.066019 Gle/morgenstern-price: 0.063805	00h:00m:00.55s
	East Area - 1-year Yield Acceleration	Spencer: 0.115870 Gle/morgenstern-price: 0.115368	00h:00m:00.58s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard

	Master Scenario	**Master Scenario**	**North Area - drained**	**North Area - seismic**	**North Area - Yield Acceleration**	**North Area - 1-year Yield Acceleration**	**Master Scenario**	**South Area - drained**	**South Area - seismic**	**South Area - Yield Acceleration**	**Master Scenario**	**East Area - drained**	**East Area - seismic**	**East Area - Yield Acceleration**	**East Area - 1-year Yield Acceleration**
Failure Direction:	Right to Left	Left to Right	Left to Right	Left to Right	Left to Right	Left to Right	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Existing Condition

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Area - undrained - Master Scenario

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Area - undrained - North Area - drained

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Area - undrained - North Area - seismic

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

North Area - undrained - North Area - Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

North Area - undrained - North Area - 1-year Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

South Area - undrained - Master Scenario

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

South Area - undrained - South Area - drained

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

South Area - undrained - South Area - seismic

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

South Area - undrained - South Area - Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

East Area - undrained - Master Scenario

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

East Area - undrained - East Area - drained

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

East Area - undrained - East Area - seismic

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

East Area - undrained - East Area - Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

East Area - undrained - East Area - 1-year Yield Acceleration

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

Seismic Loading

Existing Condition

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Area - undrained - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Area - undrained - North Area - drained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Area - undrained - North Area - seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

North Area - undrained - North Area - Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

North Area - undrained - North Area - 1-year Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

South Area - undrained - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

South Area - undrained - South Area - drained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

South Area - undrained - South Area - seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

South Area - undrained - South Area - Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

East Area - undrained - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

East Area - undrained - East Area - drained

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

East Area - undrained - East Area - seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

East Area - undrained - East Area - Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

East Area - undrained - East Area - 1-year Yield Acceleration

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

Materials

Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Peat	
Color	
Strength Type	Undrained
Unit Weight [lbs/ft3]	85
Cohesion [psf]	50
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Peat (drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	85
Cohesion [psf]	0
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	90

Saturated Unit Weight [lbs/ft3]	90
Cohesion [psf]	40
Friction Angle [deg]	0
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
New Waste Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Dike Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	125
Cohesion [psf]	0
Friction Angle [deg]	38
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Soil Improvement	
Color	
Strength Type	Undrained
Unit Weight [lbs/ft3]	100
Cohesion [psf]	2500
Cohesion Type	Constant
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Peat (Consol)	
Color	
Strength Type	Undrained
Unit Weight [lbs/ft3]	85
Cohesion [psf]	200
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste (Consol)	
Color	
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	90

Saturated Unit Weight [lbs/ft3]	90
Cohesion [psf]	160
Friction Angle [deg]	0
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material	Existing Condition	North Area - undrained	North Area - drained	North Area - seismic	North Area - Yield Acceleration	North Area - 1-year Yield Acceleration	South Area - undrained	South Area - drained	South Area - seismic	South Area - Yield Acceleration	East Area - undrained	East Area - drained	East Area - seismic	East Area - Yield Acceleration	East Area - 1-year Yield Acceleration
Landfil	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peat	✗	✓	✗	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✓	✓
Peat (	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗
Silt (dr	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗
Silt	✗	✓	✗	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓
Waste	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New W	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dike F	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Silty S	✓	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗
Soil Impro	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peat (	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓
Waste	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓

Global Minimums

Existing Condition

Method: spencer

FS	6.146440
Center:	35.624, 48.905
Radius:	47.639
Left Slip Surface Endpoint:	10.020, 8.731
Right Slip Surface Endpoint:	64.621, 11.108
Resisting Moment:	407590 lb-ft
Driving Moment:	66313.1 lb-ft
Resisting Horizontal Force:	8147.02 lb
Driving Horizontal Force:	1325.49 lb
Total Slice Area:	321.011 ft2
Surface Horizontal Width:	54.6014 ft
Surface Average Height:	5.87918 ft

Method: gle/morgenstern-price

FS	6.144660
Center:	35.624, 48.905
Radius:	47.639
Left Slip Surface Endpoint:	10.020, 8.731
Right Slip Surface Endpoint:	64.621, 11.108
Resisting Moment:	407472 lb-ft
Driving Moment:	66313.1 lb-ft
Resisting Horizontal Force:	8145.42 lb
Driving Horizontal Force:	1325.61 lb
Total Slice Area:	321.011 ft2
Surface Horizontal Width:	54.6014 ft
Surface Average Height:	5.87918 ft

North Area - undrained - Master Scenario

Method: spencer

FS	1.568610
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	2.77202e+06 lb-ft
Driving Moment:	1.76718e+06 lb-ft
Resisting Horizontal Force:	17957.9 lb
Driving Horizontal Force:	11448.3 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

Method: gle/morgenstern-price

FS	1.537840
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	2.76946e+06 lb-ft
Driving Moment:	1.80088e+06 lb-ft
Resisting Horizontal Force:	17936.1 lb
Driving Horizontal Force:	11663.2 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

North Area - undrained - North Area - drained

Method: spencer

FS	2.392410
Axis Location:	513.135, 29.672
Left Slip Surface Endpoint:	500.358, 16.001
Right Slip Surface Endpoint:	516.406, 11.248
Resisting Moment:	33233.2 lb-ft
Driving Moment:	13891.1 lb-ft
Resisting Horizontal Force:	1648.71 lb
Driving Horizontal Force:	689.145 lb
Total Slice Area:	20.76 ft2
Surface Horizontal Width:	16.0474 ft
Surface Average Height:	1.29366 ft

Method: gle/morgenstern-price

FS	2.363900
Axis Location:	512.750, 28.856
Left Slip Surface Endpoint:	500.428, 16.001
Right Slip Surface Endpoint:	515.641, 11.286
Resisting Moment:	31276.6 lb-ft
Driving Moment:	13230.9 lb-ft
Resisting Horizontal Force:	1626.39 lb
Driving Horizontal Force:	688.011 lb
Total Slice Area:	20.5513 ft2
Surface Horizontal Width:	15.2129 ft
Surface Average Height:	1.35091 ft

North Area - undrained - North Area - seismic

Method: spencer

FS	0.538512
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	3.39597e+06 lb-ft
Driving Moment:	6.30622e+06 lb-ft
Resisting Horizontal Force:	22849.1 lb
Driving Horizontal Force:	42430.1 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

Method: gle/morgenstern-price

FS	0.511699
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	3.32547e+06 lb-ft
Driving Moment:	6.49888e+06 lb-ft
Resisting Horizontal Force:	22441.4 lb
Driving Horizontal Force:	43856.7 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

North Area - undrained - North Area - Yield Acceleration

Method: spencer

Ky	0.071280
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	2.84518e+06 lb-ft
Driving Moment:	2.84518e+06 lb-ft
Resisting Horizontal Force:	18624.9 lb
Driving Horizontal Force:	18624.9 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

Method: gle/morgenstern-price

Resisting Moment:	0 lb-ft
Driving Moment:	0 lb-ft
Resisting Horizontal Force:	0 lb
Driving Horizontal Force:	0 lb
Total Slice Area:	0 ft2
Surface Horizontal Width:	0 ft
Surface Average Height:	0 ft

North Area - undrained - North Area - 1-year Yield Acceleration

Method: spencer

Resisting Moment:	0 lb-ft
Driving Moment:	0 lb-ft
Resisting Horizontal Force:	0 lb
Driving Horizontal Force:	0 lb
Total Slice Area:	0 ft2
Surface Horizontal Width:	0 ft
Surface Average Height:	0 ft

Method: gle/morgenstern-price

Ky	0.134353
Axis Location:	490.968, 122.561
Left Slip Surface Endpoint:	427.463, 21.020
Right Slip Surface Endpoint:	534.097, 10.832
Resisting Moment:	4.25934e+06 lb-ft
Driving Moment:	4.25934e+06 lb-ft
Resisting Horizontal Force:	29773.5 lb
Driving Horizontal Force:	29773.5 lb
Total Slice Area:	1896.12 ft2
Surface Horizontal Width:	106.635 ft
Surface Average Height:	17.7815 ft

South Area - undrained - Master Scenario

Method: spencer

FS	1.967030
Axis Location:	75.468, 101.022
Left Slip Surface Endpoint:	43.684, 10.258
Right Slip Surface Endpoint:	129.010, 21.136
Resisting Moment:	2.8783e+06 lb-ft
Driving Moment:	1.46327e+06 lb-ft
Resisting Horizontal Force:	25962.7 lb
Driving Horizontal Force:	13198.9 lb
Total Slice Area:	1085.53 ft2
Surface Horizontal Width:	85.3254 ft
Surface Average Height:	12.7222 ft

Method: gle/morgenstern-price

FS	1.967390
Axis Location:	88.137, 119.290
Left Slip Surface Endpoint:	47.082, 10.426
Right Slip Surface Endpoint:	150.595, 21.128
Resisting Moment:	3.58381e+06 lb-ft
Driving Moment:	1.82161e+06 lb-ft
Resisting Horizontal Force:	27339.8 lb
Driving Horizontal Force:	13896.5 lb
Total Slice Area:	1390.13 ft2
Surface Horizontal Width:	103.513 ft
Surface Average Height:	13.4295 ft

South Area - undrained - South Area - drained

Method: spencer

FS	2.043480
Axis Location:	66.868, 109.830
Left Slip Surface Endpoint:	31.149, 9.634
Right Slip Surface Endpoint:	125.593, 21.138
Resisting Moment:	3.41358e+06 lb-ft
Driving Moment:	1.67048e+06 lb-ft
Resisting Horizontal Force:	28598.6 lb
Driving Horizontal Force:	13995.1 lb
Total Slice Area:	1099.56 ft2
Surface Horizontal Width:	94.444 ft
Surface Average Height:	11.6425 ft

Method: gle/morgenstern-price

FS	2.086440
Axis Location:	66.868, 109.830
Left Slip Surface Endpoint:	31.149, 9.634
Right Slip Surface Endpoint:	125.593, 21.138
Resisting Moment:	3.43756e+06 lb-ft
Driving Moment:	1.64758e+06 lb-ft
Resisting Horizontal Force:	28791.4 lb
Driving Horizontal Force:	13799.3 lb
Total Slice Area:	1099.56 ft2
Surface Horizontal Width:	94.444 ft
Surface Average Height:	11.6425 ft

South Area - undrained - South Area - seismic

Method: spencer

FS	0.798821
Axis Location:	75.468, 101.022
Left Slip Surface Endpoint:	43.684, 10.258
Right Slip Surface Endpoint:	129.010, 21.136
Resisting Moment:	3.03691e+06 lb-ft
Driving Moment:	3.80174e+06 lb-ft
Resisting Horizontal Force:	27534.4 lb
Driving Horizontal Force:	34468.8 lb
Total Slice Area:	1085.53 ft2
Surface Horizontal Width:	85.3254 ft
Surface Average Height:	12.7222 ft

Method: gle/morgenstern-price

FS	0.794441
Axis Location:	75.468, 101.022
Left Slip Surface Endpoint:	43.684, 10.258
Right Slip Surface Endpoint:	129.010, 21.136
Resisting Moment:	3.02495e+06 lb-ft
Driving Moment:	3.80764e+06 lb-ft
Resisting Horizontal Force:	27691.3 lb
Driving Horizontal Force:	34856.4 lb
Total Slice Area:	1085.53 ft2
Surface Horizontal Width:	85.3254 ft
Surface Average Height:	12.7222 ft

South Area - undrained - South Area - Yield Acceleration

Method: spencer

Ky	0.177333
Axis Location:	75.468, 101.022
Left Slip Surface Endpoint:	43.684, 10.258
Right Slip Surface Endpoint:	129.010, 21.136
Resisting Moment:	2.92857e+06 lb-ft
Driving Moment:	2.92857e+06 lb-ft
Resisting Horizontal Force:	26682.8 lb
Driving Horizontal Force:	26682.8 lb
Total Slice Area:	1085.53 ft2
Surface Horizontal Width:	85.3254 ft
Surface Average Height:	12.7222 ft

Method: gle/morgenstern-price

Ky	0.186060
Axis Location:	75.468, 101.022
Left Slip Surface Endpoint:	43.684, 10.258
Right Slip Surface Endpoint:	129.010, 21.136
Resisting Moment:	2.97344e+06 lb-ft
Driving Moment:	2.97344e+06 lb-ft
Resisting Horizontal Force:	27039.2 lb
Driving Horizontal Force:	27039.2 lb
Total Slice Area:	1085.53 ft2
Surface Horizontal Width:	85.3254 ft
Surface Average Height:	12.7222 ft

East Area - undrained - Master Scenario

Method: spencer

FS	1.456570
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	2.92938e+06 lb-ft
Driving Moment:	2.01116e+06 lb-ft
Resisting Horizontal Force:	20751.5 lb
Driving Horizontal Force:	14246.9 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

Method: gle/morgenstern-price

FS	1.451770
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	2.93683e+06 lb-ft
Driving Moment:	2.02292e+06 lb-ft
Resisting Horizontal Force:	20789.2 lb
Driving Horizontal Force:	14319.9 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

East Area - undrained - East Area - drained

Method: spencer

FS	1.907300
Axis Location:	63.182, 112.739
Left Slip Surface Endpoint:	26.195, 9.388
Right Slip Surface Endpoint:	123.670, 21.138
Resisting Moment:	3.44524e+06 lb-ft
Driving Moment:	1.80634e+06 lb-ft
Resisting Horizontal Force:	27795.6 lb
Driving Horizontal Force:	14573.2 lb
Total Slice Area:	1165.6 ft2
Surface Horizontal Width:	97.4756 ft
Surface Average Height:	11.9578 ft

Method: gle/morgenstern-price

FS	1.928820
Axis Location:	62.244, 119.405
Left Slip Surface Endpoint:	22.076, 9.184
Right Slip Surface Endpoint:	126.320, 21.137
Resisting Moment:	3.84275e+06 lb-ft
Driving Moment:	1.99228e+06 lb-ft
Resisting Horizontal Force:	29391.6 lb
Driving Horizontal Force:	15238.1 lb
Total Slice Area:	1253.24 ft2
Surface Horizontal Width:	104.244 ft
Surface Average Height:	12.0222 ft

East Area - undrained - East Area - seismic

Method: spencer

FS	0.554748
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	3.32887e+06 lb-ft
Driving Moment:	6.00068e+06 lb-ft
Resisting Horizontal Force:	23589.4 lb
Driving Horizontal Force:	42522.7 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

Method: gle/morgenstern-price

FS	0.527378
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	3.22223e+06 lb-ft
Driving Moment:	6.10991e+06 lb-ft
Resisting Horizontal Force:	23041.4 lb
Driving Horizontal Force:	43690.5 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

East Area - undrained - East Area - Yield Acceleration

Method: spencer

Ky	0.066019
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	2.94986e+06 lb-ft
Driving Moment:	2.94986e+06 lb-ft
Resisting Horizontal Force:	21029 lb
Driving Horizontal Force:	21029 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

Method: gle/morgenstern-price

Ky	0.063805
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	2.93966e+06 lb-ft
Driving Moment:	2.93966e+06 lb-ft
Resisting Horizontal Force:	20979.9 lb
Driving Horizontal Force:	20979.9 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

East Area - undrained - East Area - 1-year Yield Acceleration

Method: spencer

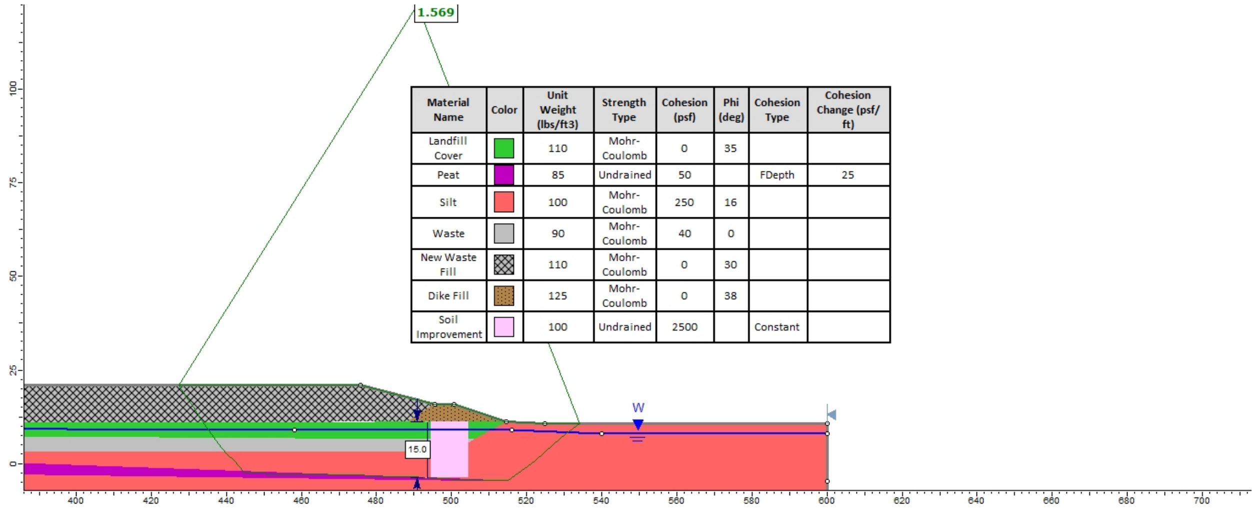
Ky	0.115870
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	3.74925e+06 lb-ft
Driving Moment:	3.74925e+06 lb-ft
Resisting Horizontal Force:	27134.8 lb
Driving Horizontal Force:	27134.8 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

Method: gle/morgenstern-price

Ky	0.115368
Axis Location:	70.913, 126.606
Left Slip Surface Endpoint:	26.956, 9.426
Right Slip Surface Endpoint:	138.283, 21.133
Resisting Moment:	3.7643e+06 lb-ft
Driving Moment:	3.7643e+06 lb-ft
Resisting Horizontal Force:	27127.3 lb
Driving Horizontal Force:	27127.3 lb
Total Slice Area:	1429.74 ft2
Surface Horizontal Width:	111.327 ft
Surface Average Height:	12.8428 ft

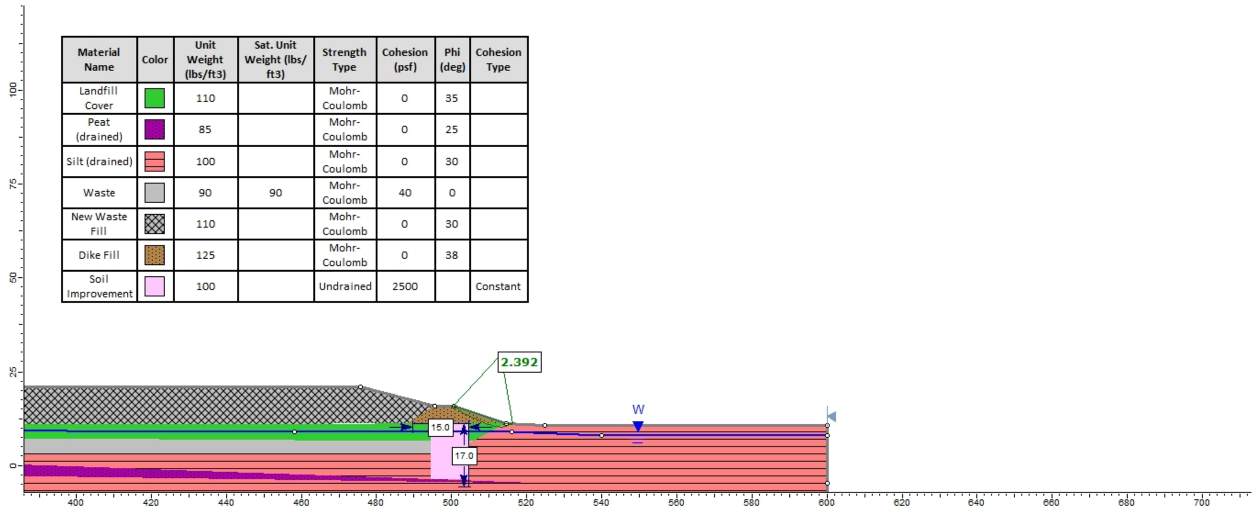
Report Views

1: North slope of ELF1 - Undrained



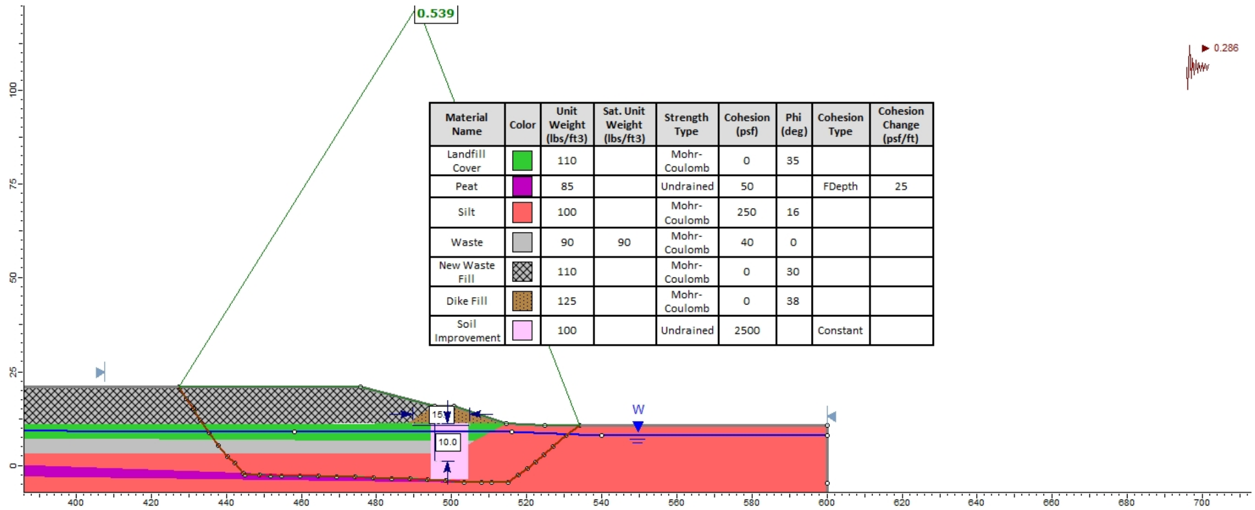
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110	Mohr-Coulomb	0	35		
Peat		85	Undrained	50		FDepth	25
Silt		100	Mohr-Coulomb	250	16		
Waste		90	Mohr-Coulomb	40	0		
New Waste Fill		110	Mohr-Coulomb	0	30		
Dike Fill		125	Mohr-Coulomb	0	38		
Soil Improvement		100	Undrained	2500		Constant	

2: North slope of ELF1 - Drained



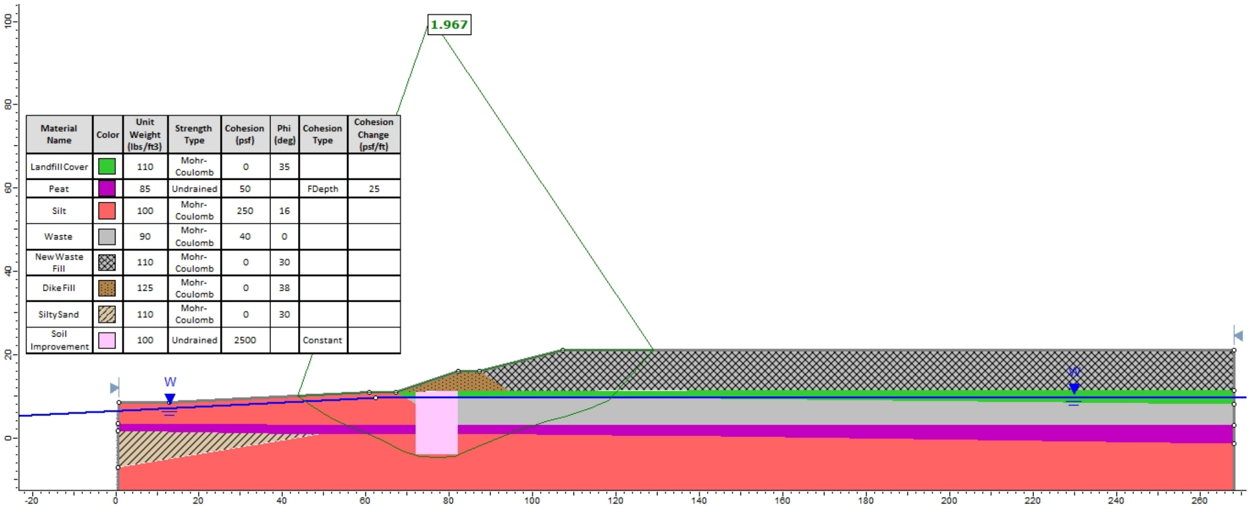
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type
Landfill Cover		110		Mohr-Coulomb	0	35	
Peat (drained)		85		Mohr-Coulomb	0	25	
Silt (drained)		100		Mohr-Coulomb	0	30	
Waste		90	90	Mohr-Coulomb	40	0	
New Waste Fill		110		Mohr-Coulomb	0	30	
Dike Fill		125		Mohr-Coulomb	0	38	
Soil Improvement		100		Undrained	2500		Constant

3: North slope of ELF1 - Seismic



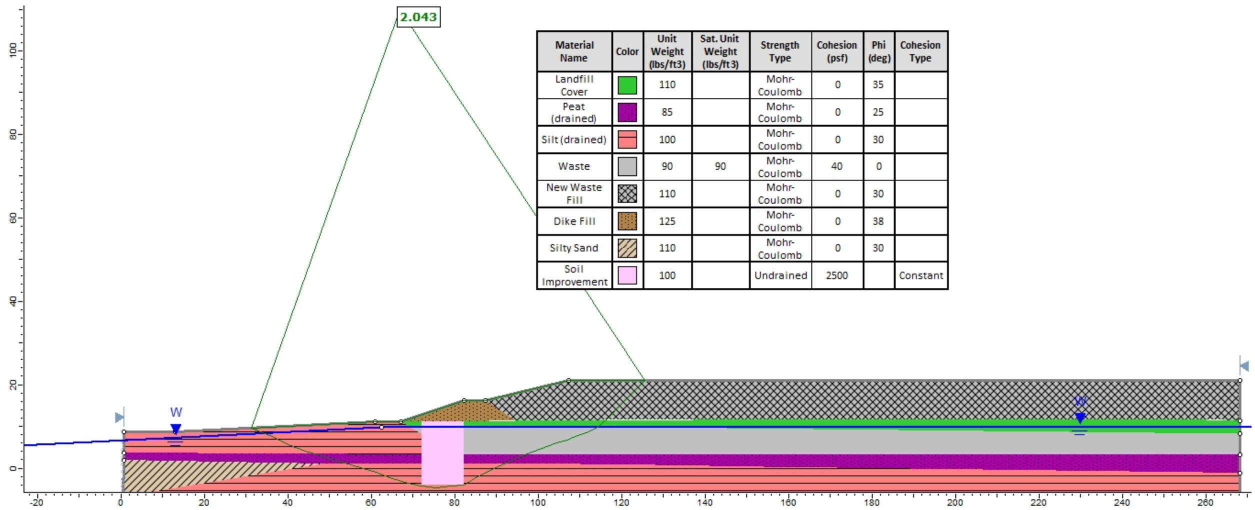
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110		Mohr-Coulomb	0	35		
Peat		85		Undrained	50		FDepth	25
Silt		100		Mohr-Coulomb	250	16		
Waste		90	90	Mohr-Coulomb	40	0		
New Waste Fill		110		Mohr-Coulomb	0	30		
Dike Fill		125		Mohr-Coulomb	0	38		
Soil Improvement		100		Undrained	2500		Constant	

4: South slope of ELF1 - Undrained



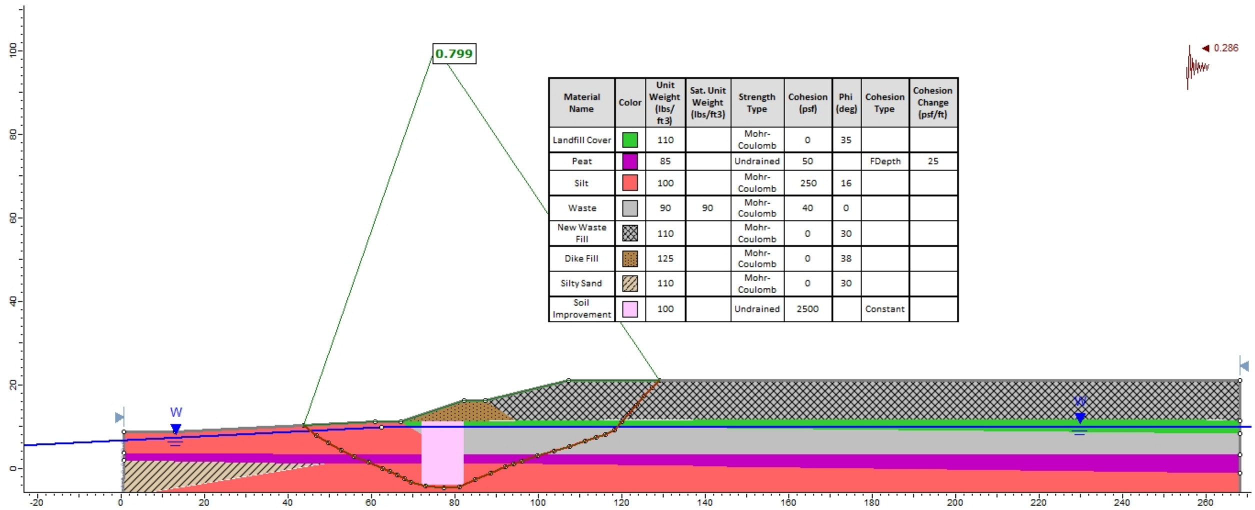
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110	Mohr-Coulomb	0	35		
Peat		85	Undrained	50		FDepth	25
Silt		100	Mohr-Coulomb	250	16		
Waste		90	Mohr-Coulomb	40	0		
New Waste Fill		110	Mohr-Coulomb	0	30		
Dike Fill		125	Mohr-Coulomb	0	38		
Silty Sand		110	Mohr-Coulomb	0	30		
Soil Improvement		100	Undrained	2500		Constant	

5: South slope of ELF1 - Drained



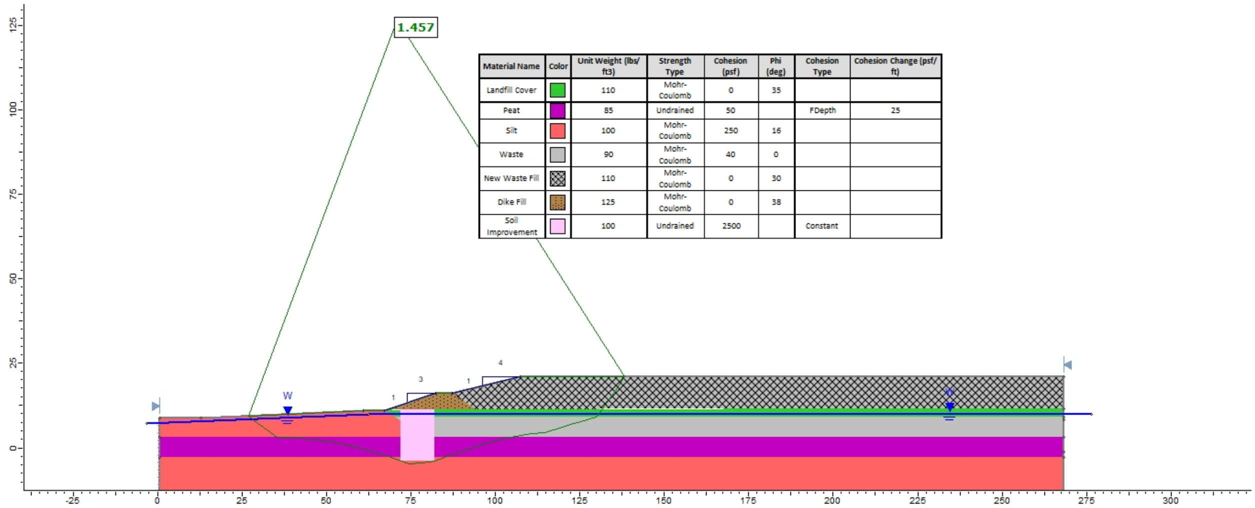
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type
Landfill Cover		110		Mohr-Coulomb	0	35	
Peat (drained)		85		Mohr-Coulomb	0	25	
Silt (drained)		100		Mohr-Coulomb	0	30	
Waste		90	90	Mohr-Coulomb	40	0	
New Waste Fill		110		Mohr-Coulomb	0	30	
Dike Fill		125		Mohr-Coulomb	0	38	
Silty Sand		110		Mohr-Coulomb	0	30	
Soil Improvement		100		Undrained	2500		Constant

6: South slope of ELF1 - Seismic



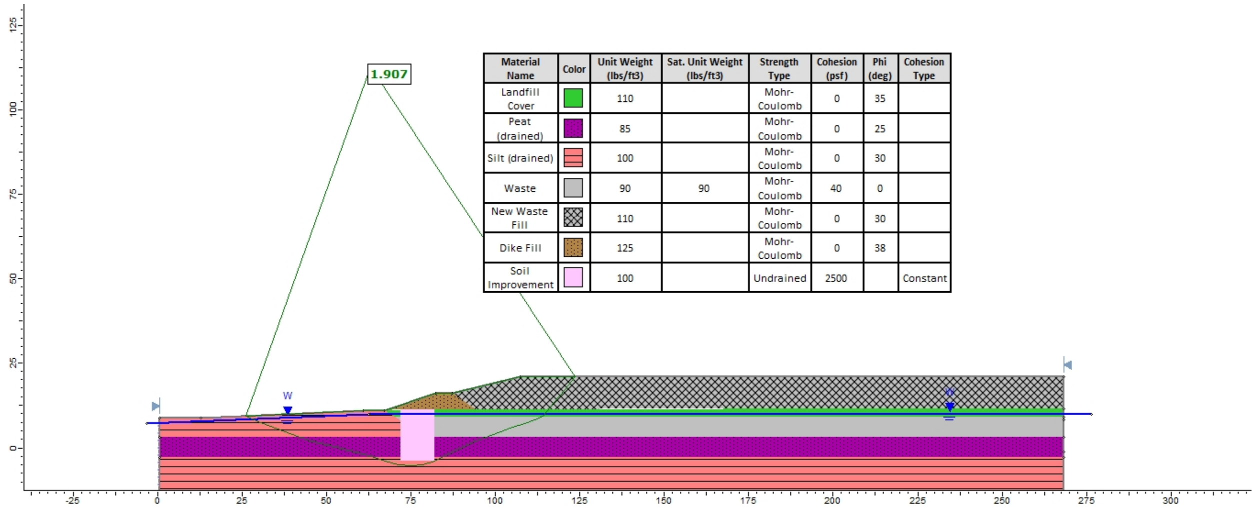
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110		Mohr-Coulomb	0	35		
Peat		85		Undrained	50		FDepth	25
Silt		100		Mohr-Coulomb	250	16		
Waste		90	90	Mohr-Coulomb	40	0		
New Waste Fill		110		Mohr-Coulomb	0	30		
Dike Fill		125		Mohr-Coulomb	0	38		
Silty Sand		110		Mohr-Coulomb	0	30		
Soil Improvement		100		Undrained	2500		Constant	

7: East slope of ELF1 - Undrained



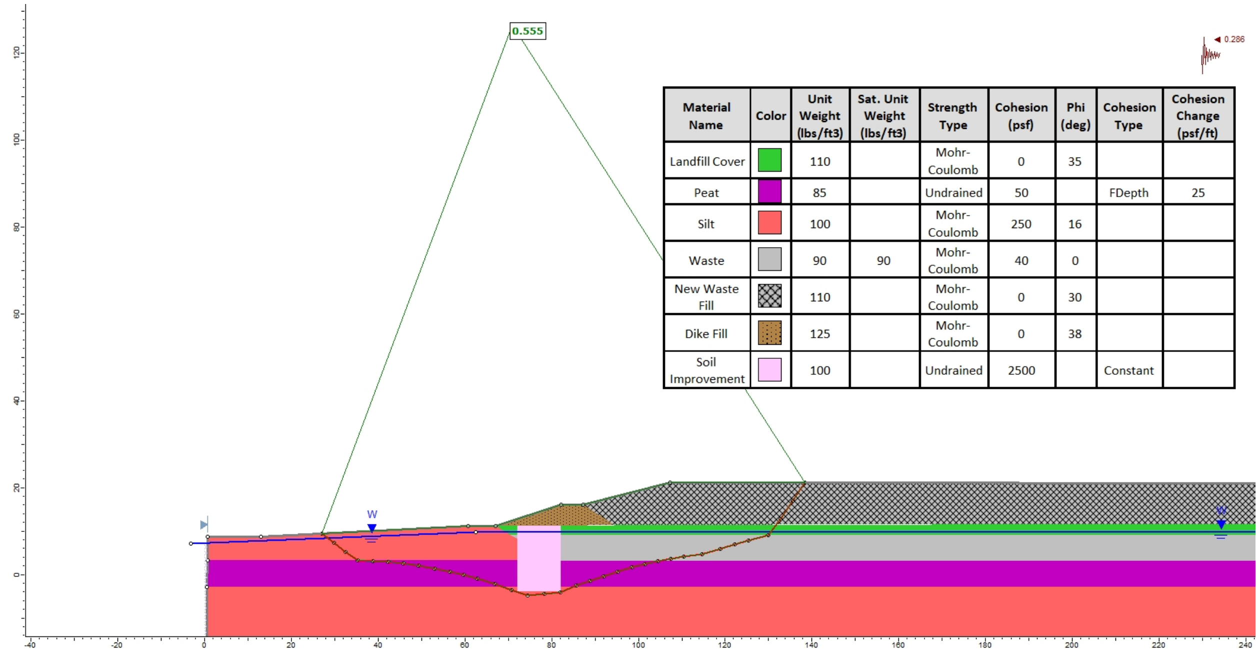
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110	Mohr-Coulomb	0	35		
Peat		85	Undrained	50		FDepth	25
Silt		100	Mohr-Coulomb	250	16		
Waste		90	Mohr-Coulomb	40	0		
New Waste Fill		110	Mohr-Coulomb	0	30		
Dike Fill		125	Mohr-Coulomb	0	38		
Soil Improvement		100	Undrained	2500		Constant	

8: East slope of ELF1 - Drained



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type
Landfill Cover		110		Mohr-Coulomb	0	35	
Peat (drained)		85		Mohr-Coulomb	0	25	
Silt (drained)		100		Mohr-Coulomb	0	30	
Waste		90	90	Mohr-Coulomb	40	0	
New Waste Fill		110		Mohr-Coulomb	0	30	
Dike Fill		125		Mohr-Coulomb	0	38	
Soil Improvement		100		Undrained	2500		Constant

9: East slope of ELF1 - Seismic



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
Landfill Cover		110		Mohr-Coulomb	0	35		
Peat		85		Undrained	50		FDepth	25
Silt		100		Mohr-Coulomb	250	16		
Waste		90	90	Mohr-Coulomb	40	0		
New Waste Fill		110		Mohr-Coulomb	0	30		
Dike Fill		125		Mohr-Coulomb	0	38		
Soil Improvement		100		Undrained	2500		Constant	

East Landfill No. 2
Former Reynolds Metals Reduction Plant - Longview Geotechnical Summary Report
Anchor QEA
Date Created: 11/3/2020, 6:27:59 PM
Software Version: 9.02

Table of Contents

Slide Analysis Information

East Landfill No. 2

Project Summary

File Name:	East Landfill No. 2.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	11/3/2020, 6:27:59 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: 1.600800 Gle/morgenstern-price: 1.601420	00h:00m:02.220s
North Retaining Structure	Master Scenario	Spencer: 1.868630 Gle/morgenstern-price: 1.868630	00h:00m:02.72s
	3:1 Cut (undrained)	Spencer: 1.893750 Gle/morgenstern-price: 1.893750	00h:00m:02.604s
	New 4:1 Structure (undrained)	Spencer: 1.870340 Gle/morgenstern-price: 1.870280	00h:00m:08.688s
	New 4:1 Structure (drained)	Spencer: 1.870090 Gle/morgenstern-price: 1.869880	00h:00m:08.474s
	New 4:1 Structure (seismic)	Spencer: 0.809835 Gle/morgenstern-price: 0.809688	00h:00m:00.89s
	New 4:1 Structure (yeild acceleration)	Spencer: 0.194470 Gle/morgenstern-price: 0.194657	00h:00m:00.73s
South Retaining Structure	Master Scenario	Spencer: 1.601130 Gle/morgenstern-price: 1.601770	00h:00m:02.591s
	New 4:1 Structure (undrained)	Spencer: 1.760850 Gle/morgenstern-price: 1.761920	00h:00m:17.26s
	New 4:1 Structure (drained)	Spencer: 1.760850 Gle/morgenstern-price: 1.761920	00h:00m:11.903s
	New 4:1 Structure (seismic)	Spencer: 0.768905 Gle/morgenstern-price: 0.772961	00h:00m:00.54s
	New 4:1 Structure (yeild acceleration)	Spencer: 0.173275 Gle/morgenstern-price: 0.172581	00h:00m:00.109s

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard

	Master Scenario	Master Scenario	3:1 Cut (undrained)	New 4:1 Structure (undrained)	New 4:1 Structure (drained)	New 4:1 Structure (seismic)	New 4:1 Structure (yeild acceleration)	Master Scenario	New 4:1 Structure (undrained)	New 4:1 Structure (drained)	New 4:1 Structure (seismic)	New 4:1 Structure (yeild acceleration)
Failure Direction:	Right to Left	Left to Right	Left to Right	Left to Right	Left to Right	Left to Right	Left to Right	Right to Left	Right to Left	Right to Left	Right to Left	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Existing Condition

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Retaining Structure - Master Scenario

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Retaining Structure - 3:1 Cut (undrained)

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Retaining Structure - New 4:1 Structure (undrained)

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Retaining Structure - New 4:1 Structure (drained)

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

North Retaining Structure - New 4:1 Structure (seismic)

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

North Retaining Structure - New 4:1 Structure (yeild acceleration)

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

South Retaining Structure - Master Scenario

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

South Retaining Structure - New 4:1 Structure (undrained)

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

South Retaining Structure - New 4:1 Structure (drained)

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

South Retaining Structure - New 4:1 Structure (seismic)

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

South Retaining Structure - New 4:1 Structure (yeild acceleration)

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

Seismic Loading

Existing Condition

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Retaining Structure - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Retaining Structure - 3:1 Cut (undrained)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Retaining Structure - New 4:1 Structure (undrained)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Retaining Structure - New 4:1 Structure (drained)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

North Retaining Structure - New 4:1 Structure (seismic)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

North Retaining Structure - New 4:1 Structure (yeild acceleration)

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

South Retaining Structure - Master Scenario

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

South Retaining Structure - New 4:1 Structure (undrained)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

South Retaining Structure - New 4:1 Structure (drained)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

South Retaining Structure - New 4:1 Structure (seismic)

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.286

South Retaining Structure - New 4:1 Structure (yeild acceleration)

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	Yes
Target factor of safety:	1
Using Newmark analysis:	No
Staged pseudostatic analysis:	No

Materials

Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
New Waste	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Existing Berm	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt or Clay (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt or Clay (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0

Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sands	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Retaining Structure Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
No Material	
Color	
Strength Type	No strength
Unit Weight [lbs/ft3]	1e-05
Water Surface	Assigned per scenario
Hu Value	0
Lower Silt/Clay	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	90
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Lower Silt/Clay (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	90
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material	Existing Condition	North Retaining Structure	3:1 Cut (undrained)	New 4:1 Structure (undrained)	New 4:1 Structure (drained)	New 4:1 Structure (seismic)	New 4:1 Structure (yeild acceleration)	South Retaining Structure	New 4:1 Structure (undrained)	New 4:1 Structure (drained)	New 4:1 Structure (seismic)	New 4:1 Structure (yeild acceleration)
Landfill	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
New Wa	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓
Waste	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Silt or C (Undrai	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✓	✓
Silt or C (Drainec	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗
Silty Sar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Retainin Structur	✗	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓
No Mate	✓	✓	✓	✗	✗	✗	✗	✓	✓	✓	✓	✓
Lower S	✗	✗	✗	✓	✗	✓	✓	✓	✓	✗	✓	✓
Lower S (Drainec	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗

Global Minimums

Existing Condition

Method: spencer

FS	1.600800
Center:	128.347, 33.425
Radius:	12.354
Left Slip Surface Endpoint:	126.375, 21.229
Right Slip Surface Endpoint:	135.711, 23.506
Resisting Moment:	2818.53 lb-ft
Driving Moment:	1760.69 lb-ft
Resisting Horizontal Force:	218.685 lb
Driving Horizontal Force:	136.61 lb
Total Slice Area:	6.27995 ft2
Surface Horizontal Width:	9.33636 ft
Surface Average Height:	0.672634 ft

Method: gle/morgenstern-price

FS	1.601420
Center:	128.347, 33.425
Radius:	12.354
Left Slip Surface Endpoint:	126.375, 21.229
Right Slip Surface Endpoint:	135.711, 23.506
Resisting Moment:	2819.62 lb-ft
Driving Moment:	1760.69 lb-ft
Resisting Horizontal Force:	218.728 lb
Driving Horizontal Force:	136.583 lb
Total Slice Area:	6.27995 ft2
Surface Horizontal Width:	9.33636 ft
Surface Average Height:	0.672634 ft

North Retaining Structure - Master Scenario

Method: spencer

FS	1.868630
Center:	938.788, 214.578
Radius:	206.227
Left Slip Surface Endpoint:	869.606, 20.301
Right Slip Surface Endpoint:	908.389, 10.604
Resisting Moment:	265349 lb-ft
Driving Moment:	142002 lb-ft
Resisting Horizontal Force:	1249.58 lb
Driving Horizontal Force:	668.715 lb
Total Slice Area:	25.8783 ft2
Surface Horizontal Width:	38.7823 ft
Surface Average Height:	0.66727 ft

Method: gle/morgenstern-price

FS	1.868630
Center:	938.788, 214.578
Radius:	206.227
Left Slip Surface Endpoint:	869.606, 20.301
Right Slip Surface Endpoint:	908.389, 10.604
Resisting Moment:	265349 lb-ft
Driving Moment:	142002 lb-ft
Resisting Horizontal Force:	1249.58 lb
Driving Horizontal Force:	668.715 lb
Total Slice Area:	25.8783 ft2
Surface Horizontal Width:	38.7823 ft
Surface Average Height:	0.66727 ft

North Retaining Structure - 3:1 Cut (undrained)

Method: spencer

FS	1.893750
Center:	941.619, 234.872
Radius:	226.698
Left Slip Surface Endpoint:	864.232, 21.792
Right Slip Surface Endpoint:	908.024, 10.677
Left Slope Intercept:	864.232 21.808
Right Slope Intercept:	908.024 10.695
Resisting Moment:	314024 lb-ft
Driving Moment:	165821 lb-ft
Resisting Horizontal Force:	1345.82 lb
Driving Horizontal Force:	710.666 lb
Total Slice Area:	31.5084 ft2
Surface Horizontal Width:	43.7913 ft
Surface Average Height:	0.719513 ft

Method: gle/morgenstern-price

FS	1.893750
Center:	941.619, 234.872
Radius:	226.698
Left Slip Surface Endpoint:	864.232, 21.792
Right Slip Surface Endpoint:	908.024, 10.677
Left Slope Intercept:	864.232 21.808
Right Slope Intercept:	908.024 10.695
Resisting Moment:	314024 lb-ft
Driving Moment:	165821 lb-ft
Resisting Horizontal Force:	1345.82 lb
Driving Horizontal Force:	710.666 lb
Total Slice Area:	31.5084 ft2
Surface Horizontal Width:	43.7913 ft
Surface Average Height:	0.719513 ft

North Retaining Structure - New 4:1 Structure (undrained)

Method: spencer

FS	1.870340
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	66537.4 lb-ft
Driving Moment:	35575.1 lb-ft
Resisting Horizontal Force:	1365.16 lb
Driving Horizontal Force:	729.9 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

Method: gle/morgenstern-price

FS	1.870280
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	66537.6 lb-ft
Driving Moment:	35576.2 lb-ft
Resisting Horizontal Force:	1365.15 lb
Driving Horizontal Force:	729.918 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

North Retaining Structure - New 4:1 Structure (drained)

Method: spencer

FS	1.870090
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	68116.6 lb-ft
Driving Moment:	36424.2 lb-ft
Resisting Horizontal Force:	1397.37 lb
Driving Horizontal Force:	747.221 lb
Total Slice Area:	28.9363 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.645536 ft

Method: gle/morgenstern-price

FS	1.869880
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	71465.7 lb-ft
Driving Moment:	38219.3 lb-ft
Resisting Horizontal Force:	1465.4 lb
Driving Horizontal Force:	783.685 lb
Total Slice Area:	30.3454 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.676972 ft

North Retaining Structure - New 4:1 Structure (seismic)

Method: spencer

FS	0.809835
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	61571 lb-ft
Driving Moment:	76029.1 lb-ft
Resisting Horizontal Force:	1268.17 lb
Driving Horizontal Force:	1565.96 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

Method: gle/morgenstern-price

FS	0.809688
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	61520.3 lb-ft
Driving Moment:	75980.3 lb-ft
Resisting Horizontal Force:	1268.11 lb
Driving Horizontal Force:	1566.17 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

North Retaining Structure - New 4:1 Structure (yeild acceleration)

Method: spencer

Ky	0.194470
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	63005.2 lb-ft
Driving Moment:	63005.2 lb-ft
Resisting Horizontal Force:	1298.66 lb
Driving Horizontal Force:	1298.66 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

Method: gle/morgenstern-price

Ky	0.194657
Axis Location:	902.023, 59.823
Left Slip Surface Endpoint:	868.403, 20.602
Right Slip Surface Endpoint:	913.228, 9.394
Resisting Moment:	63077.9 lb-ft
Driving Moment:	63077.9 lb-ft
Resisting Horizontal Force:	1299.04 lb
Driving Horizontal Force:	1299.04 lb
Total Slice Area:	28.2688 ft2
Surface Horizontal Width:	44.8252 ft
Surface Average Height:	0.630645 ft

South Retaining Structure - Master Scenario

Method: spencer

FS	1.601130
Center:	128.358, 33.510
Radius:	12.440
Left Slip Surface Endpoint:	126.372, 21.229
Right Slip Surface Endpoint:	135.774, 23.521
Resisting Moment:	2880.22 lb-ft
Driving Moment:	1798.87 lb-ft
Resisting Horizontal Force:	221.896 lb
Driving Horizontal Force:	138.587 lb
Total Slice Area:	6.36856 ft2
Surface Horizontal Width:	9.40195 ft
Surface Average Height:	0.677366 ft

Method: gle/morgenstern-price

FS	1.601770
Center:	128.358, 33.510
Radius:	12.440
Left Slip Surface Endpoint:	126.372, 21.229
Right Slip Surface Endpoint:	135.774, 23.521
Resisting Moment:	2881.37 lb-ft
Driving Moment:	1798.87 lb-ft
Resisting Horizontal Force:	221.941 lb
Driving Horizontal Force:	138.56 lb
Total Slice Area:	6.36856 ft2
Surface Horizontal Width:	9.40195 ft
Surface Average Height:	0.677366 ft

South Retaining Structure - New 4:1 Structure (undrained)

Method: spencer

FS	1.760850
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	128005 lb-ft
Driving Moment:	72695 lb-ft
Resisting Horizontal Force:	3169.74 lb
Driving Horizontal Force:	1800.12 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

Method: gle/morgenstern-price

FS	1.761920
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	128215 lb-ft
Driving Moment:	72770 lb-ft
Resisting Horizontal Force:	3173.98 lb
Driving Horizontal Force:	1801.43 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

South Retaining Structure - New 4:1 Structure (drained)

Method: spencer

FS	1.760850
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	128005 lb-ft
Driving Moment:	72695 lb-ft
Resisting Horizontal Force:	3169.74 lb
Driving Horizontal Force:	1800.12 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

Method: gle/morgenstern-price

FS	1.761920
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	128215 lb-ft
Driving Moment:	72770 lb-ft
Resisting Horizontal Force:	3173.98 lb
Driving Horizontal Force:	1801.43 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

South Retaining Structure - New 4:1 Structure (seismic)

Method: spencer

FS	0.768905
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	120399 lb-ft
Driving Moment:	156585 lb-ft
Resisting Horizontal Force:	3004.29 lb
Driving Horizontal Force:	3907.23 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

Method: gle/morgenstern-price

FS	0.772961
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	121175 lb-ft
Driving Moment:	156767 lb-ft
Resisting Horizontal Force:	3016.19 lb
Driving Horizontal Force:	3902.12 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

South Retaining Structure - New 4:1 Structure (yeild acceleration)

Method: spencer

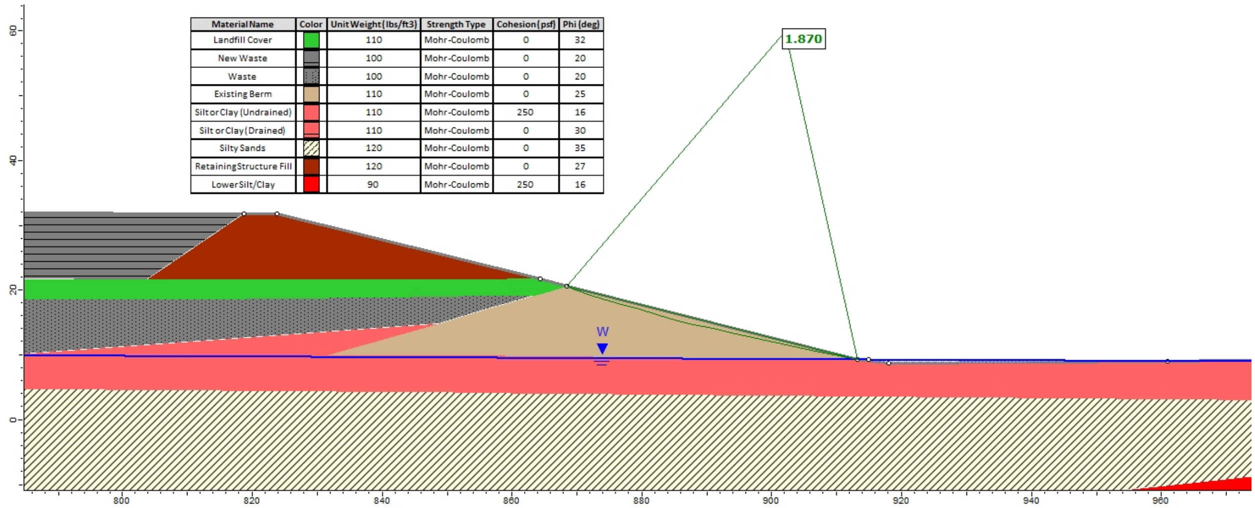
Ky	0.173275
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	123605 lb-ft
Driving Moment:	123605 lb-ft
Resisting Horizontal Force:	3068.69 lb
Driving Horizontal Force:	3068.69 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

Method: gle/morgenstern-price

Ky	0.172581
Axis Location:	123.602, 57.380
Left Slip Surface Endpoint:	114.698, 18.382
Right Slip Surface Endpoint:	149.458, 26.858
Resisting Moment:	123359 lb-ft
Driving Moment:	123359 lb-ft
Resisting Horizontal Force:	3071.43 lb
Driving Horizontal Force:	3071.43 lb
Total Slice Area:	69.3211 ft2
Surface Horizontal Width:	34.7604 ft
Surface Average Height:	1.99425 ft

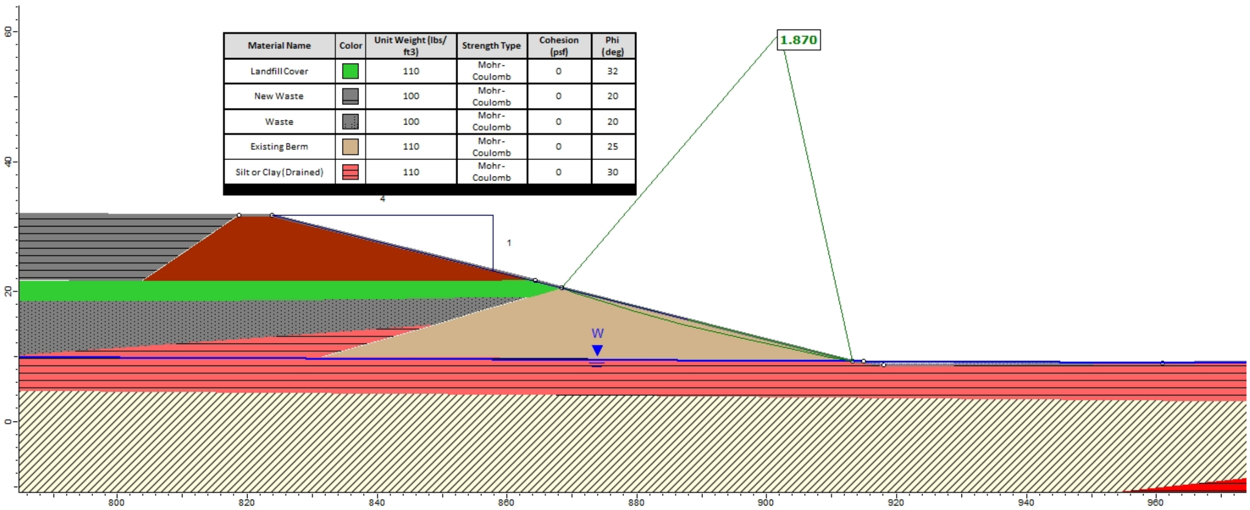
Report Views

1: North Slope of ELF2 - Undrained



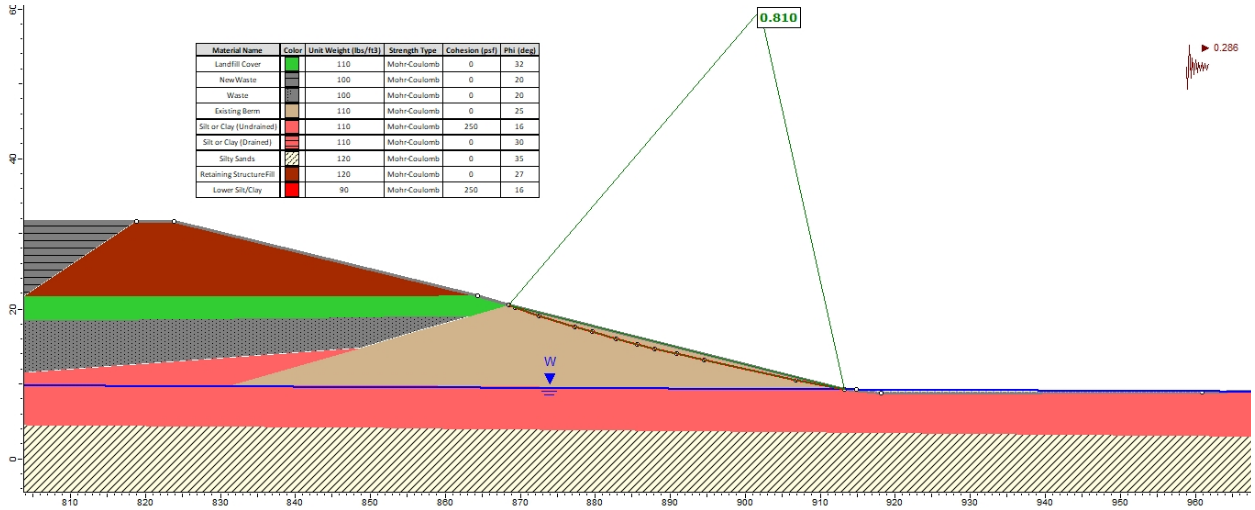
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
New Waste		100	Mohr-Coulomb	0	20
Waste		100	Mohr-Coulomb	0	20
Existing Berm		110	Mohr-Coulomb	0	25
Silt or Clay (Undrained)		110	Mohr-Coulomb	250	16
Silt or Clay (Drained)		110	Mohr-Coulomb	0	30
Silty Sands		120	Mohr-Coulomb	0	35
Retaining Structure Fill		120	Mohr-Coulomb	0	27
Lower Silt/Clay		90	Mohr-Coulomb	250	16

2: North Slope of ELF2 - Drained

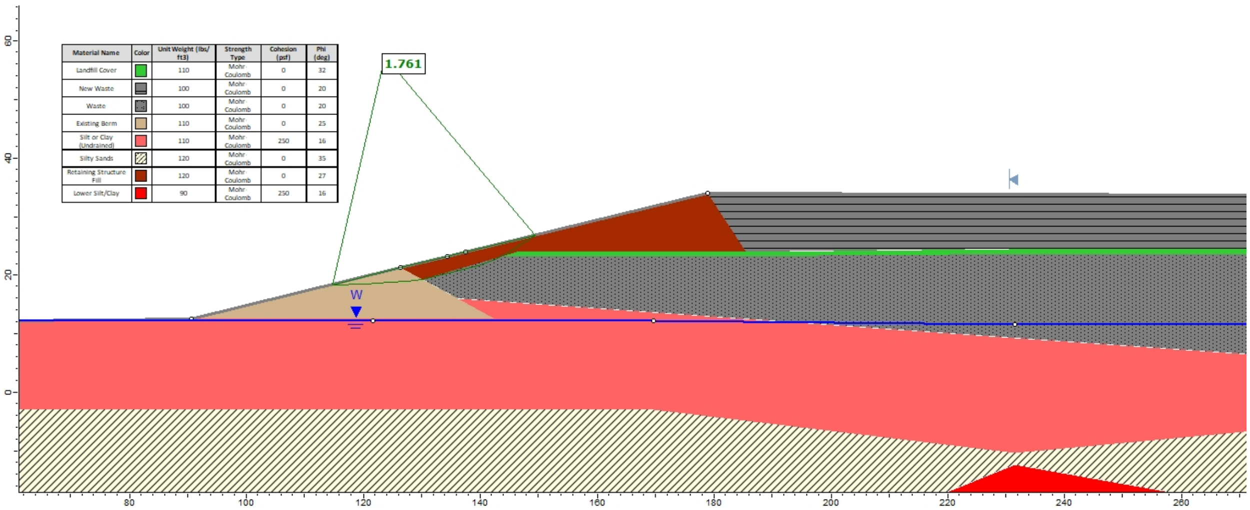


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
New Waste		100	Mohr-Coulomb	0	20
Waste		100	Mohr-Coulomb	0	20
Existing Berm		110	Mohr-Coulomb	0	25
Silt or Clay (Drained)		110	Mohr-Coulomb	0	30

3: North Slope ELF2 - Seismic

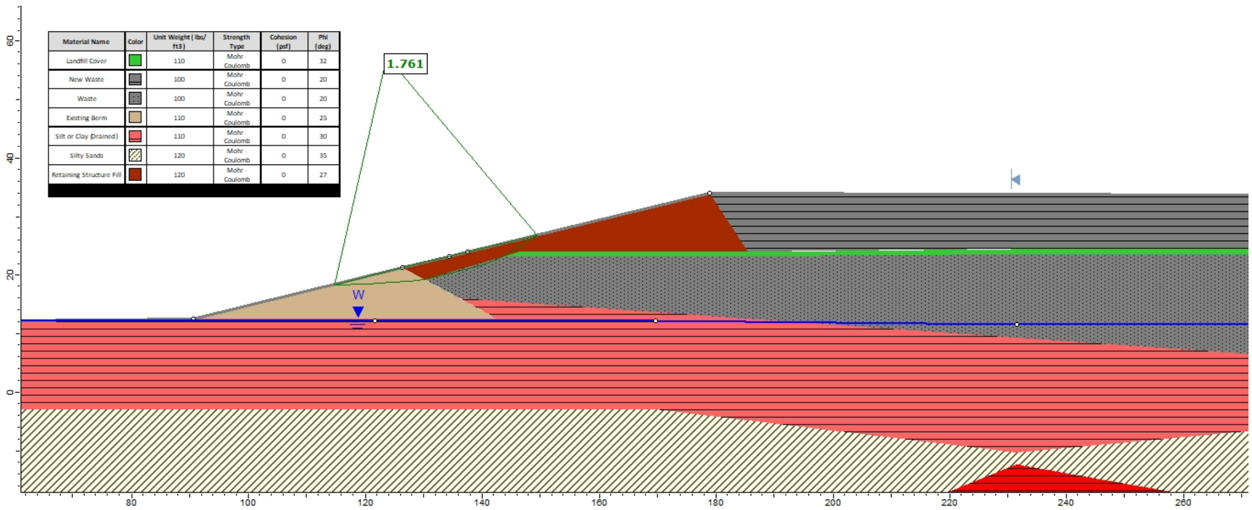


4: South Slope of ELF2 - Undrained

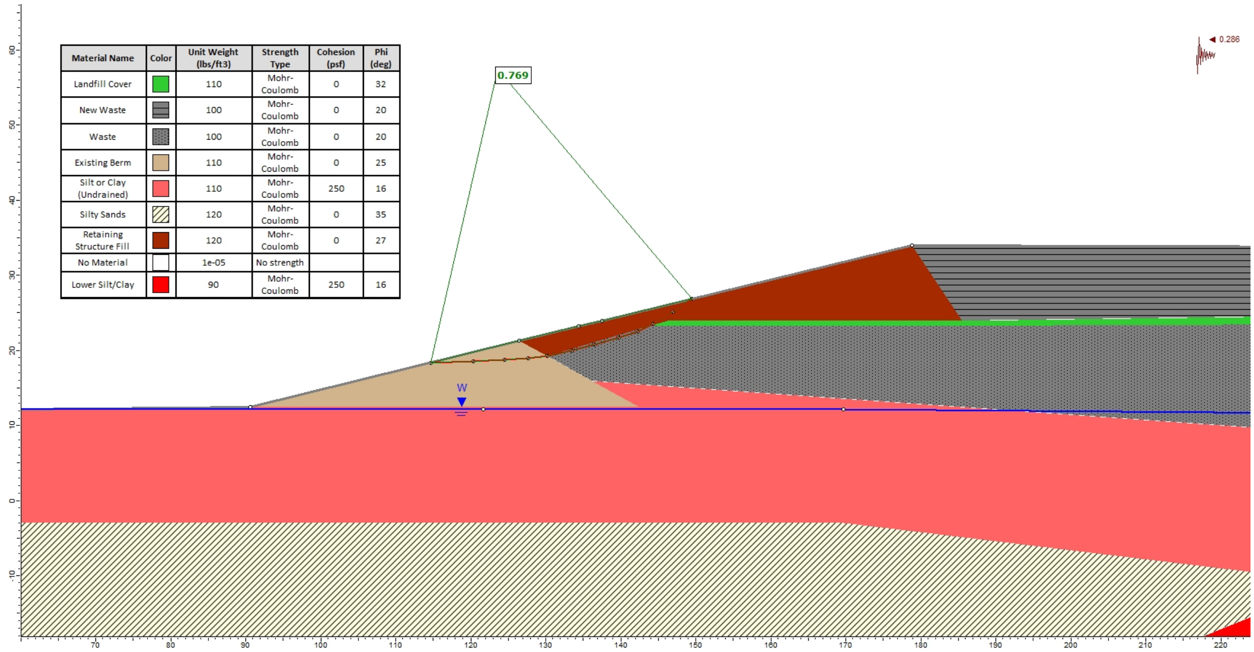


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
New Waste		100	Mohr-Coulomb	0	20
Waste		100	Mohr-Coulomb	0	20
Existing Berm		110	Mohr-Coulomb	0	25
Silt or Clay (Undrained)		110	Mohr-Coulomb	250	16
Silty Sands		120	Mohr-Coulomb	0	35
Retaining Structure Fill		120	Mohr-Coulomb	0	27
Lower Silt/Clay		90	Mohr-Coulomb	250	16

5: South Slope of ELF2 - Drained



6: South Slope of ELF2 - Seismic



Attachment B3

Settlement Analysis Documentation

rocscience

West Landfill
Anchor QEA, LLC
Report Creation Date: 2022/05/24, 19:39:52

Table of Contents

Settle3 Analysis Information

West Landfill

Project Settings

Document Name	WLF_2021-06-03(feet).s3z
Project Title	West Landfill
Company	Anchor QEA, LLC
Stress Computation Method	Boussinesq
Time-dependent Consolidation Analysis	
Time Units	days
Permeability Units	feet/day
Minimum settlement ratio for subgrade modulus	0.9
Calculate settlement with mean stress	
Include buoyancy effect when material settles below water table	
Include vertical stress reduction due to settlement above a point	
Use average properties to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name	Time [days]
1	Construction	0
2	1 mo	30
3	2 mo	60
4	6 mo	180
5	12 mo	365
6	24 mo	730
7	10 years	3650
8	30 years	10950

Results

Time taken to compute: 0 seconds

Stage: Construction = 0 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.639245	2.85781
Total Consolidation Settlement [in]	-0.641774	2.09496
Virgin Consolidation Settlement [in]	0	2.09496
Recompression Consolidation Settlement [in]	-0.641774	0
Immediate Settlement [in]	-0.0256887	1.38158
Secondary Settlement [in]	0	0
Loading Stress ZZ [ksf]	0	1.73319
Loading Stress XX [ksf]	-0.453494	2.23968
Loading Stress YY [ksf]	-0.72007	1.80552
Effective Stress ZZ [ksf]	-0.534812	3.54771
Effective Stress XX [ksf]	-1.49067	3.0968
Effective Stress YY [ksf]	-1.45216	2.72247
Mean Stress [ksf]	0	2.5456
Total Stress ZZ [ksf]	0	6.52158
Total Stress XX [ksf]	0	5.60104
Total Stress YY [ksf]	0	5.76092
Modulus of Subgrade Reaction (Total) [ksf/ft]	-12021.8	6581.94
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-140.844	3958.14
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-12021.8	6581.94
Total Strain	-0.0524601	0.00997838
Pore Water Pressure [ksf]	0	3.55653
Excess Pore Water Pressure [ksf]	0	3.182
Degree of Consolidation [%]	0	34.5391
Pre-consolidation Stress [ksf]	2.83395e-05	3.54725
Over-consolidation Ratio	1	4.50264
Void Ratio	0	1.31541
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-0.000372816	0.0151954

Stage: 1 mo = 30 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.287107	7.98238
Total Consolidation Settlement [in]	-0.301352	7.20915
Virgin Consolidation Settlement [in]	0	7.25876
Recompression Consolidation Settlement [in]	-0.325582	0.0927809
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	0
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.59706
Effective Stress XX [ksf]	-7.27424	4.83284
Effective Stress YY [ksf]	-7.36241	4.43783
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.70234
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-247.431	4.75755
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-32.2112	7.6624
Total Strain	-0.0119494	0.113613
Pore Water Pressure [ksf]	0	2.56249
Excess Pore Water Pressure [ksf]	-0.00170632	1.10843
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.59472
Over-consolidation Ratio	1	1.30461
Void Ratio	0	1.22072
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-0.0193962	0.053966

Stage: 2 mo = 60 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.048585	10.0111
Total Consolidation Settlement [in]	-0.0425403	9.23786
Virgin Consolidation Settlement [in]	0	9.23982
Recompression Consolidation Settlement [in]	-0.121061	0.0927771
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	0.0518379
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.75158
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62834
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.68957
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-8.93875	69.5022
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-497.421	328.707
Total Strain	-0.0119494	0.116421
Pore Water Pressure [ksf]	0	2.23861
Excess Pore Water Pressure [ksf]	-0.013566	0.739084
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.03122
Void Ratio	0	1.2024
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-0.00086086	0.0583239

Stage: 6 mo = 180 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00707087	12.5272
Total Consolidation Settlement [in]	-0.000804726	10.824
Virgin Consolidation Settlement [in]	0	10.8486
Recompression Consolidation Settlement [in]	-0.025854	0.0884254
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	1.62956
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.7352
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62875
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.67319
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-16.3557	123.057
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-8.57872	5.26492
Total Strain	-0.0119494	0.126986
Pore Water Pressure [ksf]	0	2.11526
Excess Pore Water Pressure [ksf]	-0.0221209	0.11885
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.01767
Void Ratio	0	1.20001
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-2.82055e-05	0.0583239

Stage: 12 mo = 365 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00707087	13.9495
Total Consolidation Settlement [in]	0	11.0577
Virgin Consolidation Settlement [in]	0	11.0998
Recompression Consolidation Settlement [in]	-0.042152	0.0842943
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	2.51113
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.72614
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62875
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.66414
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-16.4848	115.548
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	18.1569
Total Strain	-0.0119494	0.132317
Pore Water Pressure [ksf]	0	2.11526
Excess Pore Water Pressure [ksf]	-0.0276361	0.0259247
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.0234
Void Ratio	0	1.2
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-2.82055e-05	0.0583239

Stage: 24 mo = 730 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00707087	15.2724
Total Consolidation Settlement [in]	0	11.0324
Virgin Consolidation Settlement [in]	0	11.1022
Recompression Consolidation Settlement [in]	-0.0925178	0.0805013
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	3.49335
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.71786
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62875
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.65586
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-16.4848	115.548
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	18.1559
Total Strain	-0.0119494	0.137206
Pore Water Pressure [ksf]	0	2.11526
Excess Pore Water Pressure [ksf]	-0.02559	0.0272723
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.02901
Void Ratio	0	1.2
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-2.82055e-05	0.0583239

Stage: 10 years = 3650 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00707087	18.1966
Total Consolidation Settlement [in]	0	10.9511
Virgin Consolidation Settlement [in]	0	11.1022
Recompression Consolidation Settlement [in]	-0.266252	0.0720298
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	6.60292
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.6994
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62875
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.63739
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-16.4848	115.548
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	18.1559
Total Strain	-0.0119494	0.148105
Pore Water Pressure [ksf]	0	2.11526
Excess Pore Water Pressure [ksf]	-0.0270649	0.0252679
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.04235
Void Ratio	0	1.20014
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-2.82055e-05	0.0583239

Stage: 30 years = 10950 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00707087	20.1603
Total Consolidation Settlement [in]	0	10.8956
Virgin Consolidation Settlement [in]	0	11.1022
Recompression Consolidation Settlement [in]	-0.385276	0.0663268
Immediate Settlement [in]	-0.0248884	1.69061
Secondary Settlement [in]	0	8.93127
Loading Stress ZZ [ksf]	0	1.95148
Loading Stress XX [ksf]	-0.370209	2.35972
Loading Stress YY [ksf]	-0.581196	1.95162
Effective Stress ZZ [ksf]	0	4.68699
Effective Stress XX [ksf]	-7.27424	5.03197
Effective Stress YY [ksf]	-7.36241	4.62875
Mean Stress [ksf]	-0.00135844	6.1156
Total Stress ZZ [ksf]	0	6.62499
Total Stress XX [ksf]	-7.27424	5.89035
Total Stress YY [ksf]	-7.36241	6.08921
Modulus of Subgrade Reaction (Total) [ksf/ft]	-16.4848	115.548
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-13.7175	32269
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	18.1559
Total Strain	-0.0119494	0.155428
Pore Water Pressure [ksf]	0	2.11526
Excess Pore Water Pressure [ksf]	-0.0270282	0.0252207
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	2.83395e-05	4.75817
Over-consolidation Ratio	1	1.05512
Void Ratio	0	1.20025
Permeability [ft/d]	0	0.0856365
Coefficient of Consolidation [ft^2/d]	0	2
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	-2.82055e-05	0.0583239

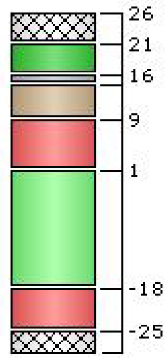
Soil Layers

Ground Surface Drained: Yes

B01

XY Location: B01: (127.111, 517.474)

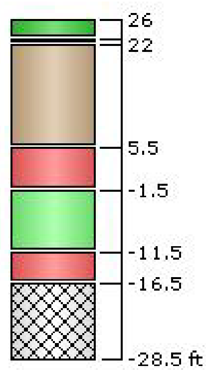
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Landfill Cover	5	21	No
2	Waste	1.5	16	Yes
3	Silty Sand	5.5	14.5	No
4	Silt	8	9	Yes
5	Sand	19	1	No
6	Silt	7	-18	Yes



B02

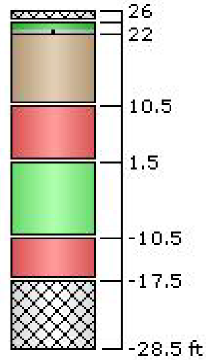
XY Location: B02: (655.484, 330.278)

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Landfill Cover	3	26	No
2	Waste	1	23	Yes
3	Silty Sand	16.5	22	No
4	Silt	7	5.5	Yes
5	Sand	10	-1.5	No
6	Silt	5	-11.5	Yes



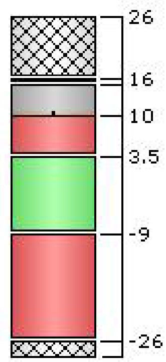
B03

XY Location:		B03: (1570.9, 34.28)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	2	24	No
2	Waste	0	22	Yes
3	Silty Sand	11.5	22	No
4	Silt	9	10.5	Yes
5	Sand	12	1.5	No
6	Silt	7	-10.5	Yes



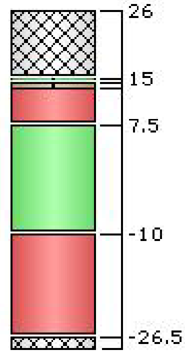
B04

XY Location:		B04: (1453.41, 414.897)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	1	16	No
2	Waste	5	15	Yes
3	Silty Sand	0	10	No
4	Silt	6.5	10	Yes
5	Sand	12.5	3.5	No
6	Silt	17	-9	Yes



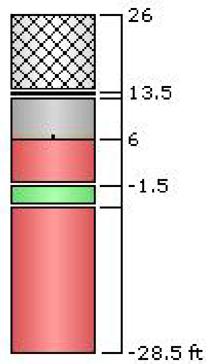
B05

XY Location:		B05: (1246.55, 696.8)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	0.5	15	No
2	Waste	1	14.5	Yes
3	Silty Sand	0	13.5	No
4	Silt	6	13.5	Yes
5	Sand	17.5	7.5	No
6	Silt	16.5	-10	Yes



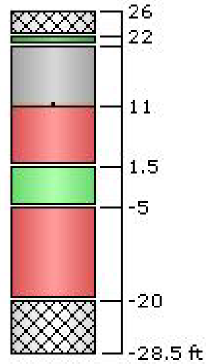
B06

XY Location:		B06: (480.691, 706.716)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	1	13.5	No
2	Waste	6.5	12.5	Yes
3	Silty Sand	0	6	No
4	Silt	7.5	6	Yes
5	Sand	3.5	-1.5	No
6	Silt	23.5	-5	Yes



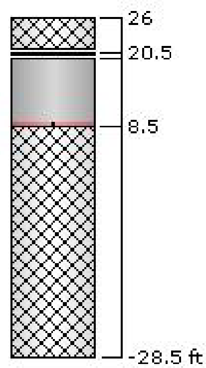
B07

XY Location:		B07: (584.772, 549.47)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	1.5	22	No
2	Waste	9.5	20.5	Yes
3	Silty Sand	0	11	No
4	Silt	9.5	11	Yes
5	Sand	6.5	1.5	No
6	Silt	15	-5	Yes



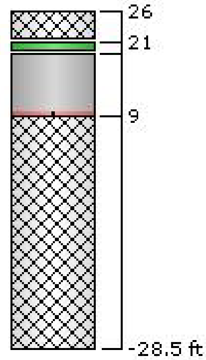
ILF-02 (approx)

XY Location:		ILF-02 (approx): (1142.54, 501.373)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	1	20.5	No
2	Waste	11	19.5	Yes
3	Silty Sand	0	8.5	No
4	Silt	0	8.5	Yes
5	Sand	0	8.5	No
6	Silt	0	8.5	Yes



ILF-03 (approx)

XY Location:		ILF-03 (approx): (1262.18, 356.736)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Landfill Cover	2	21	No
2	Waste	10	19	Yes
3	Silty Sand	0	9	No
4	Silt	0	9	Yes
5	Sand	0	9	No
6	Silt	0	9	Yes



Soil Properties

Property	Landfill Cover	Silt	Silty Sand	Waste
Color				
Unit Weight [kips/ft3]	0.11	0.11	0.12	0.1
Saturated Unit Weight [kips/ft3]	0.11	0.11	0.12	0.1
Poisson's Ratio	0.2	0.2	0.2	0.2
K0	0.5	0.5	0.5	0.5
Immediate Settlement	Enabled	Disabled	Enabled	Disabled
E [ksf]	146.198	-	146.198	-
Eur [ksf]	104.4	-	104.4	-
Primary Consolidation	Disabled	Enabled	Disabled	Enabled
Material Type		Non-Linear		Non-Linear
Cc	-	0.374	-	0.25
Cr	-	0.18	-	0.026
e0	-	1.2	-	1
OCR	-	1	-	1
Cv [ft2/d]	-	0.5	-	2
Cvr [ft2/d]	-	0.1	-	0.1
B-bar	-	1	-	1
Secondary Consolidation	Disabled	Standard	Disabled	Standard
Ca	-	0.03	-	0.02
Car	-	0.03	-	0.03
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	Sand
Color	
Unit Weight [kips/ft3]	0.12
Saturated Unit Weight [kips/ft3]	0.12
Poisson's Ratio	0.2
K0	0.5
Immediate Settlement	Enabled
E [ksf]	150
Eur [ksf]	94
B-bar	-
Undrained Su A [kips/ft2]	0
Undrained Su S	0.2
Undrained Su m	0.8
Piezo Line ID	1

Groundwater

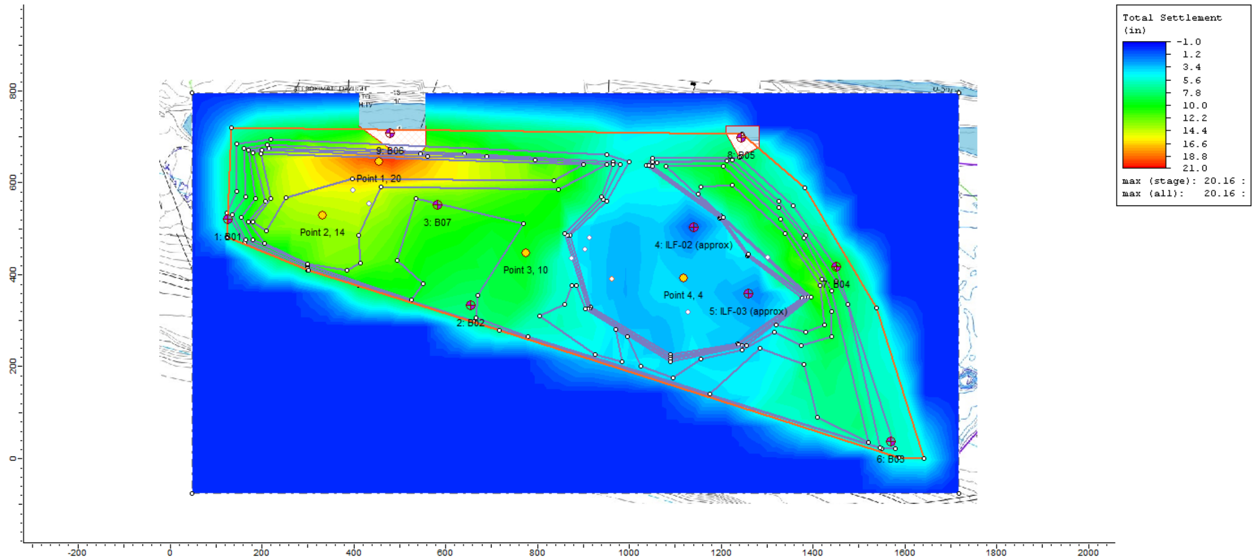
Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
1	6 ft

Report Views

Total Settlement - 30 Years 1



rocscience

East Landfill No. 1
Anchor QEA, LLC
Report Creation Date: 2021/06/09, 13:04:46

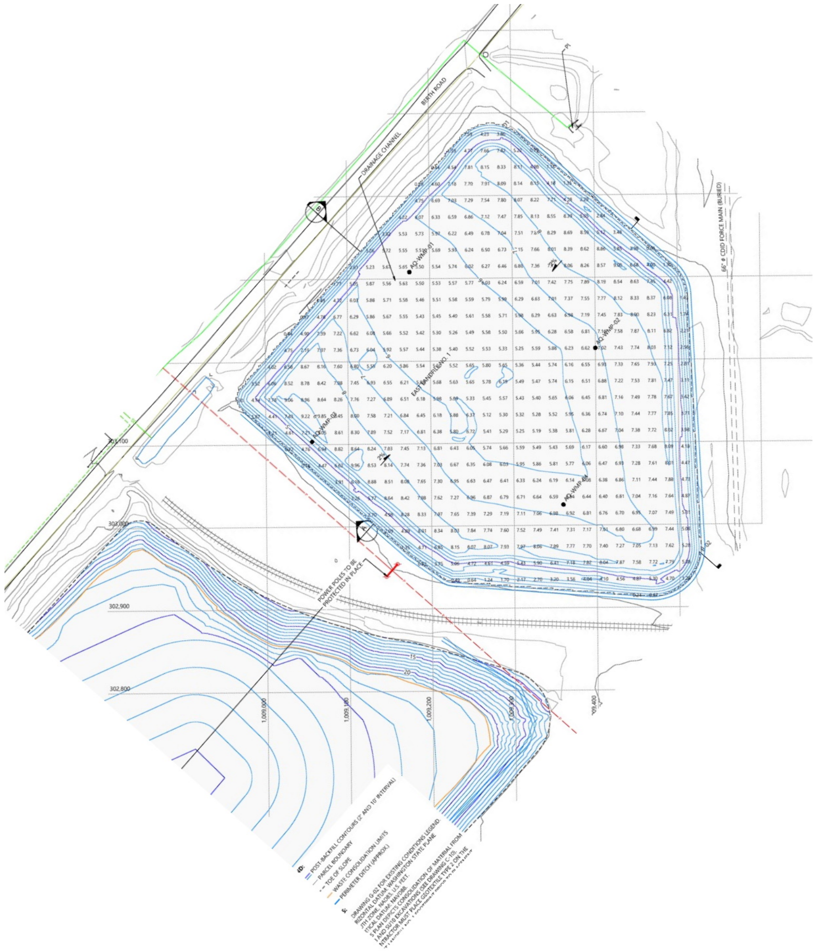
Table of Contents

Settle3 Analysis Information

East Landfill No. 1

Project Settings

Document Name	ELF1_2021-06-03.s3z
Project Title	East Landfill No. 1
Company	Anchor QEA, LLC
Stress Computation Method	Boussinesq
Time-dependent Consolidation Analysis	
Time Units	days
Permeability Units	feet/day
Minimum settlement ratio for subgrade modulus	0.9
Poisson ratio for Boussinesq stress computation	0.2
Calculate settlement with mean stress	
Include buoyancy effect when material settles below water table	
Include vertical stress reduction due to settlement above a point	
Use average properties to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	


BURN ROAD
DRAINAGE CHANNEL
302,900
302,800
POWER POLES TO BE PROTECTED IN PLACE

Stage Settings

Stage #	Name	Time [days]
1	1 mo	30
2	3 mo	90
3	1 yr	365
4	2 yr	730
5	5yr	1825
6	10 yr	3650
7	30 yr	10950

Results

Time taken to compute: 43.813 seconds

Stage: 1 mo = 30 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.0525638	0.763328
Total Consolidation Settlement [ft]	-0.0525638	0.758572
Virgin Consolidation Settlement [ft]	0	0.758572
Recompression Consolidation Settlement [ft]	-0.0525638	0
Immediate Settlement [ft]	-0.00075817	0.0143508
Secondary Settlement [ft]	0	0
Loading Stress ZZ [ksf]	0	0.632914
Loading Stress XX [ksf]	-0.487013	0.587594
Loading Stress YY [ksf]	-0.243981	0.752185
Effective Stress ZZ [ksf]	0	2.90541
Effective Stress XX [ksf]	-0.466231	1.59128
Effective Stress YY [ksf]	-0.245156	1.58931
Mean Stress [ksf]	0	0.506035
Total Stress ZZ [ksf]	0	6.16881
Total Stress XX [ksf]	-0.466231	5.30918
Total Stress YY [ksf]	-0.245156	5.30721
Modulus of Subgrade Reaction (Total) [ksf/ft]	-112.193	23.8189
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-268.226	4965.38
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-112.193	23.8189
Total Strain	-0.00443971	0.125204
Pore Water Pressure [ksf]	0	3.7179
Excess Pore Water Pressure [ksf]	0	0.618373
Degree of Consolidation [%]	0	49.3717
Pre-consolidation Stress [ksf]	8.38593e-05	2.925
Over-consolidation Ratio	1	1.21189
Void Ratio	0	6.82042
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	2
Undrained Shear Strength	-0.00344186	0.0190484

Stage: 3 mo = 90 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.0715623	1.93934
Total Consolidation Settlement [ft]	-0.0715623	1.9305
Virgin Consolidation Settlement [ft]	0	1.9305
Recompression Consolidation Settlement [ft]	-0.117891	0
Immediate Settlement [ft]	-0.00131388	0.0264694
Secondary Settlement [ft]	0	0
Loading Stress ZZ [ksf]	0	1.76651
Loading Stress XX [ksf]	-0.861562	1.72809
Loading Stress YY [ksf]	-0.527097	2.08873
Effective Stress ZZ [ksf]	0	2.89213
Effective Stress XX [ksf]	-0.847839	2.07157
Effective Stress YY [ksf]	-0.507002	2.10246
Mean Stress [ksf]	-0.00130587	1.28535
Total Stress ZZ [ksf]	0	6.20821
Total Stress XX [ksf]	-0.847839	5.59349
Total Stress YY [ksf]	-0.507002	5.59182
Modulus of Subgrade Reaction (Total) [ksf/ft]	-27.6857	4.32083
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-3946.33	2677.16
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-27.6857	4.32083
Total Strain	-0.00396903	0.186528
Pore Water Pressure [ksf]	-8.15517e-06	3.92007
Excess Pore Water Pressure [ksf]	0	1.23148
Degree of Consolidation [%]	0	99.2322
Pre-consolidation Stress [ksf]	8.38593e-05	2.925
Over-consolidation Ratio	1	1.18945
Void Ratio	0	6.80762
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	96.3437
Undrained Shear Strength	-0.00374083	0.0363195

Stage: 1 yr = 365 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.0520805	3.17895
Total Consolidation Settlement [ft]	-0.0520805	3.16699
Virgin Consolidation Settlement [ft]	0	3.16774
Recompression Consolidation Settlement [ft]	-0.0561263	0
Immediate Settlement [ft]	-0.00152402	0.030257
Secondary Settlement [ft]	0	0.410674
Loading Stress ZZ [ksf]	0	1.98651
Loading Stress XX [ksf]	-0.767243	1.9307
Loading Stress YY [ksf]	-0.527097	2.29415
Effective Stress ZZ [ksf]	0	2.89969
Effective Stress XX [ksf]	-0.750075	3.08701
Effective Stress YY [ksf]	-0.509545	3.10567
Mean Stress [ksf]	-0.00413986	1.46056
Total Stress ZZ [ksf]	0	6.40901
Total Stress XX [ksf]	-0.750075	5.9038
Total Stress YY [ksf]	-0.509545	5.90133
Modulus of Subgrade Reaction (Total) [ksf/ft]	-64.9093	3.17048
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-653.734	3333.5
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-870.131	1.47685
Total Strain	-0.00300462	0.271909
Pore Water Pressure [ksf]	-1.04313e-05	4.08556
Excess Pore Water Pressure [ksf]	0	1.28693
Degree of Consolidation [%]	0	94.4096
Pre-consolidation Stress [ksf]	8.38593e-05	2.925
Over-consolidation Ratio	1	1.12222
Void Ratio	0	6.80196
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	92.4449
Undrained Shear Strength	-0.00105289	0.0399306

Stage: 2 yr = 730 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.0278896	3.74037
Total Consolidation Settlement [ft]	-0.0278896	3.72841
Virgin Consolidation Settlement [ft]	0	3.72931
Recompression Consolidation Settlement [ft]	-0.040731	0
Immediate Settlement [ft]	-0.00152402	0.030257
Secondary Settlement [ft]	0	0.410674
Loading Stress ZZ [ksf]	0	1.98651
Loading Stress XX [ksf]	-0.767243	1.9307
Loading Stress YY [ksf]	-0.527097	2.29415
Effective Stress ZZ [ksf]	0	2.91516
Effective Stress XX [ksf]	-0.750075	3.28823
Effective Stress YY [ksf]	-0.509545	3.31185
Mean Stress [ksf]	-0.00413986	1.46056
Total Stress ZZ [ksf]	0	6.36103
Total Stress XX [ksf]	-0.750075	5.9038
Total Stress YY [ksf]	-0.509545	5.90133
Modulus of Subgrade Reaction (Total) [ksf/ft]	-56.8007	2.32484
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-653.734	3333.5
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-757.153	2.93637
Total Strain	-0.00197471	0.291385
Pore Water Pressure [ksf]	0	4.08939
Excess Pore Water Pressure [ksf]	-0.0293699	1.16665
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	8.38593e-05	2.925
Over-consolidation Ratio	1	1.10223
Void Ratio	0	6.80066
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-0.00105289	0.0431024

Stage: 5yr = 1825 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.00387094	4.12798
Total Consolidation Settlement [ft]	-0.00387094	4.00541
Virgin Consolidation Settlement [ft]	0	4.00886
Recompression Consolidation Settlement [ft]	-0.0107935	0
Immediate Settlement [ft]	-0.00152402	0.030257
Secondary Settlement [ft]	0	0.458257
Loading Stress ZZ [ksf]	0	1.98651
Loading Stress XX [ksf]	-0.767243	1.9307
Loading Stress YY [ksf]	-0.527097	2.29415
Effective Stress ZZ [ksf]	0	2.92814
Effective Stress XX [ksf]	-0.750075	3.28823
Effective Stress YY [ksf]	-0.509545	3.31185
Mean Stress [ksf]	-0.00413986	1.46056
Total Stress ZZ [ksf]	0	6.3316
Total Stress XX [ksf]	-0.750075	5.9038
Total Stress YY [ksf]	-0.509545	5.90133
Modulus of Subgrade Reaction (Total) [ksf/ft]	-48.5894	2495.67
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-653.734	3333.5
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-2426.29	9.82394
Total Strain	-0.000529182	0.297183
Pore Water Pressure [ksf]	0	3.8736
Excess Pore Water Pressure [ksf]	-0.0484881	0.770102
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	8.38593e-05	2.92762
Over-consolidation Ratio	1	1.0726
Void Ratio	0	6.80171
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-0.00105289	0.0459921

Stage: 10 yr = 3650 d

Data Type	Minimum	Maximum
Total Settlement [ft]	-0.000953695	4.34502
Total Consolidation Settlement [ft]	-0.000953695	4.14341
Virgin Consolidation Settlement [ft]	0	4.14839
Recompression Consolidation Settlement [ft]	-0.0104408	0
Immediate Settlement [ft]	-0.00152402	0.030257
Secondary Settlement [ft]	0	0.613711
Loading Stress ZZ [ksf]	0	1.98651
Loading Stress XX [ksf]	-0.767243	1.9307
Loading Stress YY [ksf]	-0.527097	2.29415
Effective Stress ZZ [ksf]	0	2.92955
Effective Stress XX [ksf]	-0.750075	3.28823
Effective Stress YY [ksf]	-0.509545	3.31185
Mean Stress [ksf]	-0.00413986	1.46056
Total Stress ZZ [ksf]	0	6.29918
Total Stress XX [ksf]	-0.750075	5.9038
Total Stress YY [ksf]	-0.509545	5.90133
Modulus of Subgrade Reaction (Total) [ksf/ft]	-79.9628	53.3543
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-653.734	3333.5
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-79.9628	36.6852
Total Strain	-0.000917478	0.298961
Pore Water Pressure [ksf]	0	3.66168
Excess Pore Water Pressure [ksf]	-0.0608809	0.432505
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	8.38593e-05	2.92903
Over-consolidation Ratio	1	1.08898
Void Ratio	0	6.80329
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-0.00105289	0.0472757

Stage: 30 yr = 10950 d

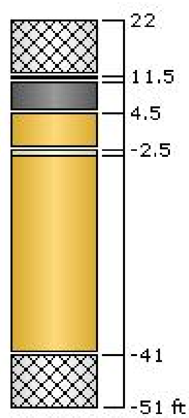
Data Type	Minimum	Maximum
Total Settlement [ft]	-0.000135963	4.75322
Total Consolidation Settlement [ft]	0	4.30229
Virgin Consolidation Settlement [ft]	0	4.30903
Recompression Consolidation Settlement [ft]	-0.0194286	0
Immediate Settlement [ft]	-0.00152402	0.030257
Secondary Settlement [ft]	0	0.824035
Loading Stress ZZ [ksf]	0	1.98651
Loading Stress XX [ksf]	-0.767243	1.9307
Loading Stress YY [ksf]	-0.527097	2.29415
Effective Stress ZZ [ksf]	0	3.14325
Effective Stress XX [ksf]	-0.750075	3.28823
Effective Stress YY [ksf]	-0.509545	3.31185
Mean Stress [ksf]	-0.00413986	1.46056
Total Stress ZZ [ksf]	0	6.25493
Total Stress XX [ksf]	-0.750075	5.9038
Total Stress YY [ksf]	-0.509545	5.90133
Modulus of Subgrade Reaction (Total) [ksf/ft]	-4.9442	243.886
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-653.734	3333.5
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	4.6372
Total Strain	-0.00190702	0.301482
Pore Water Pressure [ksf]	0	3.3017
Excess Pore Water Pressure [ksf]	-0.0440261	0.072524
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	8.38593e-05	3.1427
Over-consolidation Ratio	1	1.12775
Void Ratio	0	6.80691
Permeability [ft/d]	0	0.00292134
Coefficient of Consolidation [ft^2/d]	0	0.15
Hydroconsolidation Settlement [ft]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-0.00105289	0.0494732

Soil Layers

Ground Surface Drained: Yes

B1

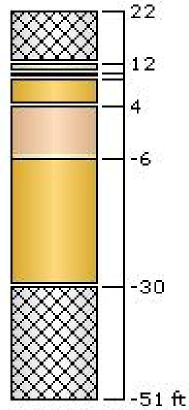
XY Location:		B1: (1.00926e+06, 303450)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	1	11.5	No
2	Waste	6	10.5	No
3	Elastic Silt (interbedded OH)	7	4.5	No
4	Peat	1	-2.5	Yes
5	Sand Cover (SP/SM)	0	-3.5	No
6	Elastic Silt (interbedded OH)	37.5	-3.5	No



B2

XY Location: B2: (1.0095e+06, 302939)

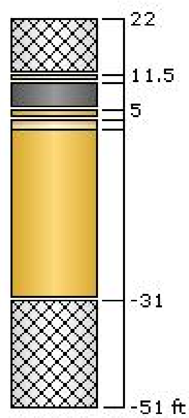
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Sand Cover (SP/SM)	2	12	No
2	Waste	1	10	No
3	Elastic Silt (interbedded OH)	5	9	No
4	Peat	10	4	Yes
5	Sand Cover (SP/SM)	0	-6	No
6	Elastic Silt (interbedded OH)	24	-6	No



B3

XY Location: B3: (1.00919e+06, 302981)

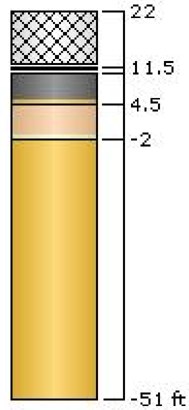
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Sand Cover (SP/SM)	1.5	11.5	No
2	Waste	5	10	No
3	Elastic Silt (interbedded OH)	2	5	No
4	Peat	2	3	Yes
5	Sand Cover (SP/SM)	0	1	No
6	Elastic Silt (interbedded OH)	32	1	No



B4

XY Location: B4: (1.0093e+06, 303179)

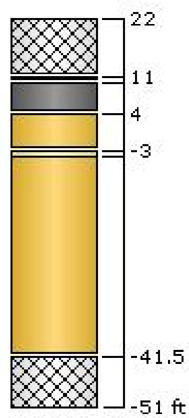
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Sand Cover (SP/SM)	1	11.5	No
2	Waste	6	10.5	No
3	Elastic Silt (interbedded OH)	0	4.5	No
4	Peat	6.5	4.5	Yes
5	Sand Cover (SP/SM)	0	-2	No
6	Elastic Silt (interbedded OH)	49	-2	No



PC1

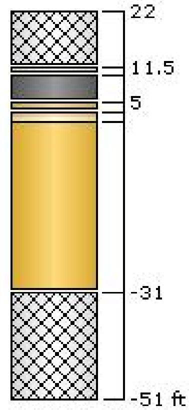
XY Location: PC1: (1.009e+06, 303149)

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Sand Cover (SP/SM)	1	11	No
2	Waste	6	10	No
3	Elastic Silt (interbedded OH)	7	4	No
4	Peat	1	-3	Yes
5	Sand Cover (SP/SM)	0	-4	No
6	Elastic Silt (interbedded OH)	37.5	-4	No



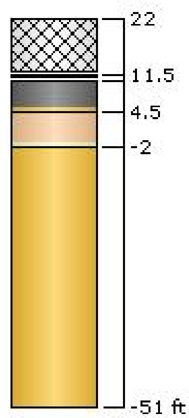
PC2

XY Location:		PC2: (1.00946e+06, 303244)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	1.5	11.5	No
2	Waste	5	10	No
3	Elastic Silt (interbedded OH)	2	5	No
4	Peat	2	3	Yes
5	Sand Cover (SP/SM)	0	1	No
6	Elastic Silt (interbedded OH)	32	1	No



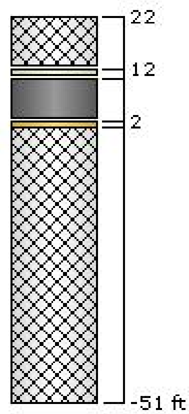
PC3

XY Location:		PC3: (1.00929e+06, 303150)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	1	11.5	No
2	Waste	6	10.5	No
3	Elastic Silt (interbedded OH)	0	4.5	No
4	Peat	6.5	4.5	Yes
5	Sand Cover (SP/SM)	0	-2	No
6	Elastic Silt (interbedded OH)	49	-2	No



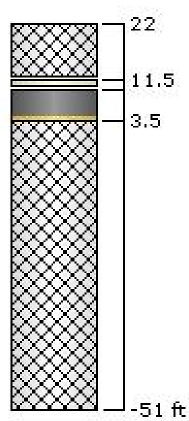
TP-WMP-04

XY Location:		TP-WMP-04: (1.00936e+06, 303025)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	2	12	No
2	Waste	8	10	No
3	Elastic Silt (interbedded OH)	1	2	No
4	Peat	0	1	Yes
5	Sand Cover (SP/SM)	0	1	No
6	Elastic Silt (interbedded OH)	0	1	No



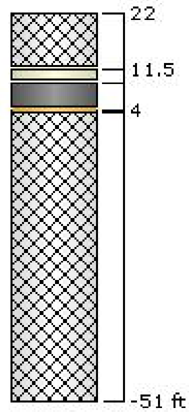
TP-WMP-02

XY Location:		TP-WMP-02: (1.0094e+06, 303214)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	2	11.5	No
2	Waste	6	9.5	No
3	Elastic Silt (interbedded OH)	0	3.5	No
4	Peat	0	3.5	Yes
5	Sand Cover (SP/SM)	0	3.5	No
6	Elastic Silt (interbedded OH)	0	3.5	No



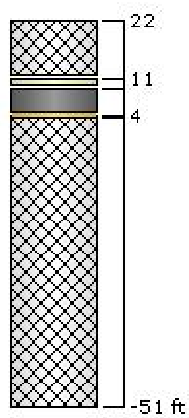
TP-WMP-01

XY Location:		TP-WMP-01: (1.00918e+06, 303308)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	2.5	11.5	No
2	Waste	5	9	No
3	Elastic Silt (interbedded OH)	0.5	4	No
4	Peat	0	3.5	Yes
5	Sand Cover (SP/SM)	0	3.5	No
6	Elastic Silt (interbedded OH)	0	3.5	No



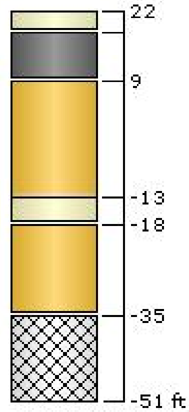
TP-WMP-03

XY Location:		TP-WMP-03: (1.00906e+06, 303103)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	2	11	No
2	Waste	5	9	No
3	Elastic Silt (interbedded OH)	0.5	4	No
4	Peat	0	3.5	Yes
5	Sand Cover (SP/SM)	0	3.5	No
6	Elastic Silt (interbedded OH)	0	3.5	No



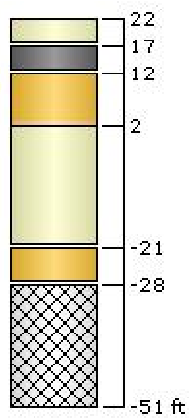
SU6-B03

XY Location:		SU6-B03: (1.00884e+06, 302962)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	4	22	No
2	Waste	9	18	No
3	Elastic Silt (interbedded OH)	22	9	No
4	Peat	0	-13	Yes
5	Sand Cover (SP/SM)	5	-13	No
6	Elastic Silt (interbedded OH)	17	-18	No



SU6-B04

XY Location:		SU6-B04: (1.00907e+06, 302859)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Sand Cover (SP/SM)	5	22	No
2	Waste	5	17	No
3	Elastic Silt (interbedded OH)	10	12	No
4	Peat	0	2	Yes
5	Sand Cover (SP/SM)	23	2	No
6	Elastic Silt (interbedded OH)	7	-21	No



Soil Properties

Property	Sand Cover (SP/SM)	Waste	Peat	Elastic Silt (interbedded OH)
Color				
Unit Weight [kips/ft3]	0.11	0.09	0.085	0.1
Saturated Unit Weight [kips/ft3]	0.11	0.09	0.085	0.1
Poisson's Ratio	0.2	0.2	0.2	0.2
K0	0.5	0.5	0.5	0.5
Immediate Settlement	Enabled	Disabled	Disabled	Disabled
E [ksf]	146.2	-	-	-
Eur [ksf]	208.9	-	-	-
Primary Consolidation	Disabled	Enabled	Enabled	Enabled
Material Type		Non-Linear	Non-Linear	Non-Linear
Cc	-	0.534	4.056	0.563
Cr	-	0.05	0.3	0.135
e0	-	2	6.8	1.25
OCR	-	1	1	1
Cv [ft2/d]	-	0.093	0.1	0.15
Cvr [ft2/d]	-	0.1	0.1	0.1
B-bar	-	1	1	1
Secondary Consolidation	Disabled	Standard	Standard	Standard
Ca	-	0.04	0.07	0.07
Car	-	0.03	0.03	0.03
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	Staged	2	2	2

Groundwater

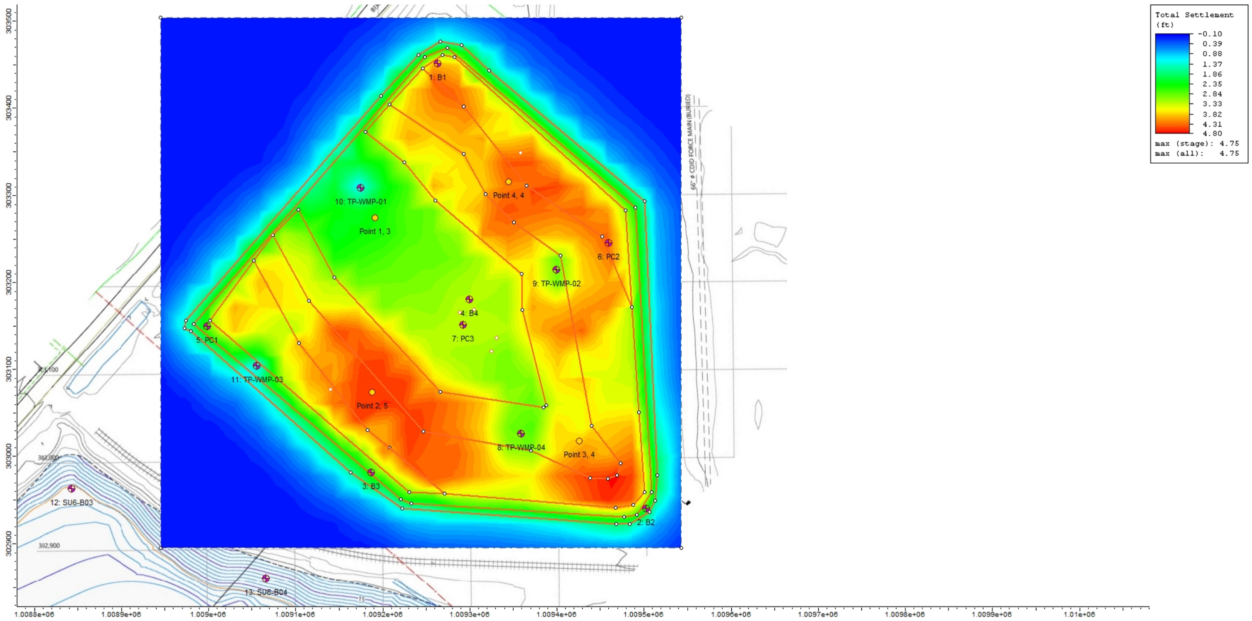
Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
1	6 ft
2	6 ft

Report Views

30 Years 1



rocscience

East Landfill No. 2
Anchor QEA, LLC
Report Creation Date: 2021/06/09, 13:07:16

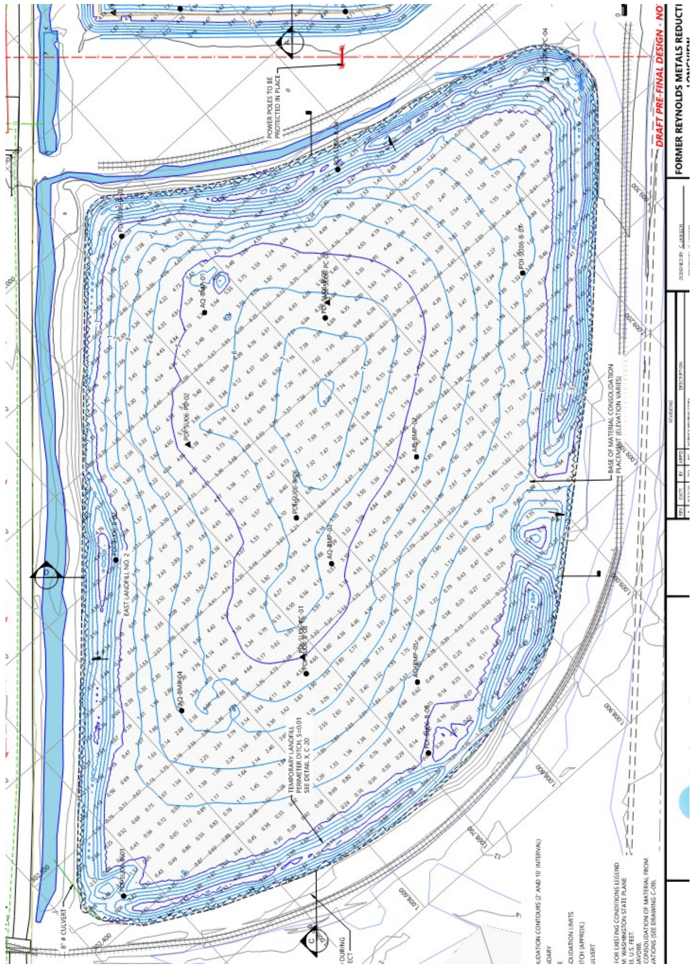
Table of Contents

Settle3 Analysis Information

East Landfill No. 2

Project Settings

Document Name	ELF2_2021-06-03.s3z
Project Title	East Landfill No. 2
Company	Anchor QEA, LLC
Stress Computation Method	Boussinesq
Time-dependent Consolidation Analysis	
Time Units	days
Permeability Units	feet/day
Minimum settlement ratio for subgrade modulus	0.9
Poisson ratio for Boussinesq stress computation	0.2
Calculate settlement with mean stress	
Include buoyancy effect when material settles below water table	
Include vertical stress reduction due to settlement above a point	
Use average properties to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	


DRAFT PRE-FINAL DESIGN - NO
FORMER REYNOLDS METALS REDUCTI
POWER POLES TO BE PROTECTED IN PLACE
BASE OF MATERIAL CONSOLIDATION PLACEMENT (ELEVATION VARIES)
EAST LANDFILL NO. 2

Stage Settings

Stage #	Name	Time [days]
1	1 mo	30
2	10 mo	300
3	1 yr	365
4	2 yr	730
5	5 yr	1825
6	10 yr	3650
7	30 yr	10950

Results

Time taken to compute: 13.1011 seconds

Stage: 1 mo = 30 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.166196	21.5364
Total Consolidation Settlement [in]	-0.155109	16.8771
Virgin Consolidation Settlement [in]	0	16.8771
Recompression Consolidation Settlement [in]	-0.155109	0
Immediate Settlement [in]	-0.0451248	5.88109
Secondary Settlement [in]	0	0
Loading Stress ZZ [ksf]	0	3.2775
Loading Stress XX [ksf]	-0.30861	2.9335
Loading Stress YY [ksf]	-0.322322	2.46774
Effective Stress ZZ [ksf]	0	4.87439
Effective Stress XX [ksf]	-0.324266	5.07668
Effective Stress YY [ksf]	-0.338176	4.94739
Mean Stress [ksf]	0	2.61438
Total Stress ZZ [ksf]	0	9.04467
Total Stress XX [ksf]	-0.324266	8.67866
Total Stress YY [ksf]	-0.338176	8.54937
Modulus of Subgrade Reaction (Total) [ksf/ft]	-173.198	464.476
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-122.637	429.3
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-158.836	16.038
Total Strain	-0.000979431	0.16695
Pore Water Pressure [ksf]	0	4.29232
Excess Pore Water Pressure [ksf]	0	2.70706
Degree of Consolidation [%]	0	83.9741
Pre-consolidation Stress [ksf]	0.000103662	4.81314
Over-consolidation Ratio	1	1.11936
Void Ratio	0	3.10239
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	24.2131
Undrained Shear Strength	-0.0212899	0.0817923

Stage: 10 mo = 300 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0334338	29.1809
Total Consolidation Settlement [in]	-0.0061347	24.2688
Virgin Consolidation Settlement [in]	0	24.2698
Recompression Consolidation Settlement [in]	-0.00615744	0
Immediate Settlement [in]	-0.0451248	5.88109
Secondary Settlement [in]	0	0
Loading Stress ZZ [ksf]	0	3.2775
Loading Stress XX [ksf]	-0.30861	2.9335
Loading Stress YY [ksf]	-0.322322	2.46774
Effective Stress ZZ [ksf]	0	6.41634
Effective Stress XX [ksf]	-0.324266	6.34067
Effective Stress YY [ksf]	-0.338176	6.21138
Mean Stress [ksf]	-0.00291764	2.61438
Total Stress ZZ [ksf]	0	8.98717
Total Stress XX [ksf]	-0.324266	8.67866
Total Stress YY [ksf]	-0.338176	8.54937
Modulus of Subgrade Reaction (Total) [ksf/ft]	-3463.93	70.2489
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-122.637	429.3
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-639.741	3.21737
Total Strain	-0.000266856	0.16695
Pore Water Pressure [ksf]	-1.43735e-05	3.16354
Excess Pore Water Pressure [ksf]	-0.0099707	0.541832
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.000103662	6.45401
Over-consolidation Ratio	1	1.014
Void Ratio	0	3.10029
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-0.0159121	0.0891366

Stage: 1 yr = 365 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0489752	30.0731
Total Consolidation Settlement [in]	-0.0158767	24.7748
Virgin Consolidation Settlement [in]	0	24.7749
Recompression Consolidation Settlement [in]	-0.0259432	0
Immediate Settlement [in]	-0.0539696	6.23781
Secondary Settlement [in]	0	0.181598
Loading Stress ZZ [ksf]	0	3.4975
Loading Stress XX [ksf]	-0.286252	3.10188
Loading Stress YY [ksf]	-0.312121	2.60696
Effective Stress ZZ [ksf]	0	6.45386
Effective Stress XX [ksf]	-0.282684	6.49267
Effective Stress YY [ksf]	-0.346204	6.34818
Mean Stress [ksf]	-0.000782424	2.78978
Total Stress ZZ [ksf]	0	9.19649
Total Stress XX [ksf]	-0.282684	9.00725
Total Stress YY [ksf]	-0.346204	8.86276
Modulus of Subgrade Reaction (Total) [ksf/ft]	-776.459	92.1505
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-500.811	192.942
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	-81.4258	472.138
Total Strain	-0.000242265	0.177072
Pore Water Pressure [ksf]	-1.43735e-05	3.19601
Excess Pore Water Pressure [ksf]	0	0.574366
Degree of Consolidation [%]	0	98.4385
Pre-consolidation Stress [ksf]	0.000103662	6.45401
Over-consolidation Ratio	1	1.01916
Void Ratio	0	3.10045
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	95.894
Undrained Shear Strength	-0.0170805	0.0897291

Stage: 2 yr = 730 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0299175	30.5323
Total Consolidation Settlement [in]	-0.00124642	25.2341
Virgin Consolidation Settlement [in]	0	25.2341
Recompression Consolidation Settlement [in]	-0.00303147	0
Immediate Settlement [in]	-0.0539696	6.23781
Secondary Settlement [in]	0	2.45064
Loading Stress ZZ [ksf]	0	3.4975
Loading Stress XX [ksf]	-0.286252	3.10188
Loading Stress YY [ksf]	-0.312121	2.60696
Effective Stress ZZ [ksf]	0	6.62325
Effective Stress XX [ksf]	-0.282684	6.76037
Effective Stress YY [ksf]	-0.346204	6.65007
Mean Stress [ksf]	-0.00208585	2.78978
Total Stress ZZ [ksf]	0	9.19224
Total Stress XX [ksf]	-0.282684	9.00725
Total Stress YY [ksf]	-0.346204	8.86276
Modulus of Subgrade Reaction (Total) [ksf/ft]	-7.22202	32.0681
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-500.811	192.942
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	1.87913
Total Strain	-0.000242265	0.177072
Pore Water Pressure [ksf]	-1.43735e-05	2.94518
Excess Pore Water Pressure [ksf]	-1.14627e-09	0.281814
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.000103662	6.62071
Over-consolidation Ratio	1	1.00527
Void Ratio	0	3.10007
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	-4.46883e-05	0.0943827

Stage: 5 yr = 1825 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0299175	30.5323
Total Consolidation Settlement [in]	0	25.2341
Virgin Consolidation Settlement [in]	0	25.2341
Recompression Consolidation Settlement [in]	-0.00904355	0
Immediate Settlement [in]	-0.0539696	6.23781
Secondary Settlement [in]	0	2.84341
Loading Stress ZZ [ksf]	0	3.4975
Loading Stress XX [ksf]	-0.286252	3.10188
Loading Stress YY [ksf]	-0.312121	2.60696
Effective Stress ZZ [ksf]	0	6.62327
Effective Stress XX [ksf]	-0.282684	6.88458
Effective Stress YY [ksf]	-0.346204	6.7327
Mean Stress [ksf]	-0.00208585	2.78978
Total Stress ZZ [ksf]	0	9.19224
Total Stress XX [ksf]	-0.282684	9.1825
Total Stress YY [ksf]	-0.346204	9.03062
Modulus of Subgrade Reaction (Total) [ksf/ft]	-8.35711	32.0649
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-500.811	192.942
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	1.87913
Total Strain	-0.000242265	0.177072
Pore Water Pressure [ksf]	-1.43735e-05	2.73894
Excess Pore Water Pressure [ksf]	-3.92121e-10	0.3744
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.000103662	6.62072
Over-consolidation Ratio	1	1.00624
Void Ratio	0	3.09993
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	0	0.0943827

Stage: 10 yr = 3650 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0299175	30.5323
Total Consolidation Settlement [in]	0	25.2341
Virgin Consolidation Settlement [in]	0	25.2341
Recompression Consolidation Settlement [in]	-0.0160185	0
Immediate Settlement [in]	-0.0539696	6.23781
Secondary Settlement [in]	0	3.07316
Loading Stress ZZ [ksf]	0	3.4975
Loading Stress XX [ksf]	-0.286252	3.10188
Loading Stress YY [ksf]	-0.312121	2.60696
Effective Stress ZZ [ksf]	0	6.62327
Effective Stress XX [ksf]	-0.282684	7.25898
Effective Stress YY [ksf]	-0.346204	7.1071
Mean Stress [ksf]	-0.00208585	2.78978
Total Stress ZZ [ksf]	0	9.19224
Total Stress XX [ksf]	-0.282684	9.1825
Total Stress YY [ksf]	-0.346204	9.03062
Modulus of Subgrade Reaction (Total) [ksf/ft]	-19.399	30.0245
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-500.811	192.942
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	2.08671
Total Strain	-0.000242265	0.177072
Pore Water Pressure [ksf]	-1.43735e-05	2.67169
Excess Pore Water Pressure [ksf]	-3.91796e-10	0.00832972
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.000103662	6.62072
Over-consolidation Ratio	1	1.00866
Void Ratio	0	3.09993
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	0	0.0943827

Stage: 30 yr = 10950 d

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0299175	30.5323
Total Consolidation Settlement [in]	0	25.2341
Virgin Consolidation Settlement [in]	0	25.2341
Recompression Consolidation Settlement [in]	-0.0278808	0
Immediate Settlement [in]	-0.0539696	6.23781
Secondary Settlement [in]	0	3.89767
Loading Stress ZZ [ksf]	0	3.4975
Loading Stress XX [ksf]	-0.286252	3.10188
Loading Stress YY [ksf]	-0.312121	2.60696
Effective Stress ZZ [ksf]	0	6.62327
Effective Stress XX [ksf]	-0.282684	7.25898
Effective Stress YY [ksf]	-0.346204	7.1071
Mean Stress [ksf]	-0.00208585	2.78978
Total Stress ZZ [ksf]	0	9.19224
Total Stress XX [ksf]	-0.282684	9.1825
Total Stress YY [ksf]	-0.346204	9.03062
Modulus of Subgrade Reaction (Total) [ksf/ft]	-19.4878	30.0224
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	-500.811	192.942
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	2.08587
Total Strain	-0.000242265	0.177072
Pore Water Pressure [ksf]	-1.43735e-05	2.67168
Excess Pore Water Pressure [ksf]	-1.13784e-09	1.20792e-06
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.000103662	6.62072
Over-consolidation Ratio	1	1.01284
Void Ratio	0	3.09993
Permeability [ft/d]	0	0.0275494
Coefficient of Consolidation [ft^2/d]	0	1.9
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	100
Undrained Shear Strength	0	0.0943827

Liquefaction

Insitu Type	Shear Wave Velocity (VST)
General Settings	
Max. Earthquake Acceleration [g]	0.572
Earthquake Magnitude	9
Slope Angle [°]	0
Find FS using Probability of Liquefaction of	15%
Calculate Settlement for FS <	1
Advanced Settings	
Magnitude Scaling Factor (MSF)	None
Strength Reduction Factor (RD)	NCEER (1997)
Overburden Correction Factor(K Sigma)	None

Input Data for Liquefaction

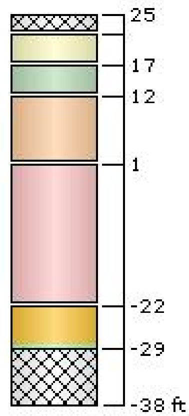
Depth [ft]	Vs [ft/s]
12.795	304.74
19.357	328.82
25.919	351.42
32.48	383.04
39.042	456.03
45.604	491.3
52.165	519.62
58.727	464.16
65.289	501.74
71.85	583.12
78.412	624.85
84.974	602.67
91.535	632.48
98.097	553.32

Soil Layers

Ground Surface Drained: Yes

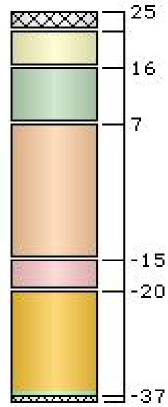
B04

XY Location:		B04: (1.00882e+06, 302903)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	5	22	No
2	Waste Material	5	17	No
3	Silt (upper)	11	12	Yes
4	Sand/Silty Sand	23	1	No
5	Silt (lower)	7	-22	No
6	Sand	0	-29	No



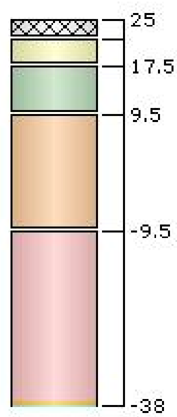
B03

XY Location:		B03: (1.00862e+06, 302840)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	6	22	No
2	Waste Material	9	16	No
3	Silt (upper)	22	7	Yes
4	Sand/Silty Sand	5	-15	No
5	Silt (lower)	17	-20	No
6	Sand	0	-37	No



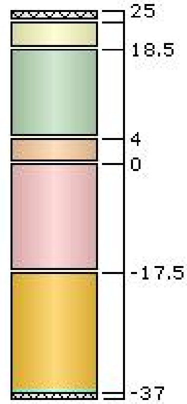
B09

XY Location:		B09: (1.00881e+06, 302762)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	4.5	22	No
2	Waste Material	8	17.5	No
3	Silt (upper)	19	9.5	Yes
4	Sand/Silty Sand	28.5	-9.5	No
5	Silt (lower)	0	-38	No
6	Sand	0	-38	No



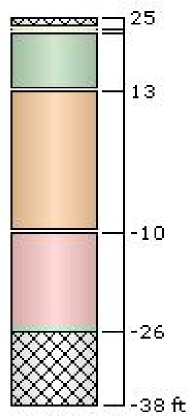
B07

XY Location:		B07: (1.009e+06, 302805)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	4.5	23	No
2	Waste Material	14.5	18.5	No
3	Silt (upper)	4	4	Yes
4	Sand/Silty Sand	17.5	-0	No
5	Silt (lower)	19.5	-17.5	No
6	Sand	0	-37	No



B01

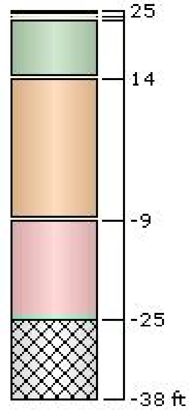
XY Location:		B01: (1.00862e+06, 302213)		
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	0.5	23	No
2	Waste Material	9.5	22.5	No
3	Silt (upper)	23	13	Yes
4	Sand/Silty Sand	16	-10	No
5	Silt (lower)	0	-26	No
6	Sand	0	-26	No



B02

XY Location: B02: (1.00861e+06, 302531)

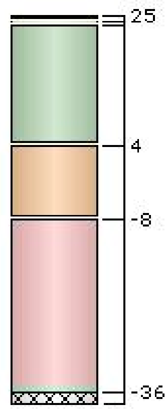
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Existing Cover Material - SM/SP	0.5	24	No
2	Waste Material	9.5	23.5	No
3	Silt (upper)	23	14	Yes
4	Sand/Silty Sand	16	-9	No
5	Silt (lower)	0	-25	No
6	Sand	0	-25	No



PC06

XY Location: PC06: (1.00879e+06, 302297)

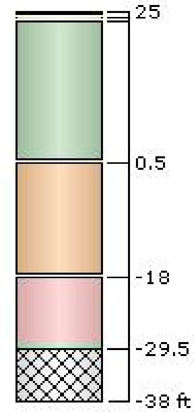
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Existing Cover Material - SM/SP	0.5	24	No
2	Waste Material	19.5	23.5	No
3	Silt (upper)	12	4	Yes
4	Sand/Silty Sand	28	-8	No
5	Silt (lower)	0	-36	No
6	Sand	0	-36	No



B08

XY Location: B08: (1.00879e+06, 302424)

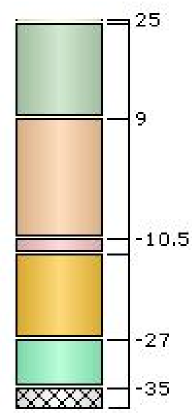
Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Existing Cover Material - SM/SP	0.5	24	No
2	Waste Material	23	23.5	No
3	Silt (upper)	18.5	0.5	Yes
4	Sand/Silty Sand	11.5	-18	No
5	Silt (lower)	0	-29.5	No
6	Sand	0	-29.5	No



B05

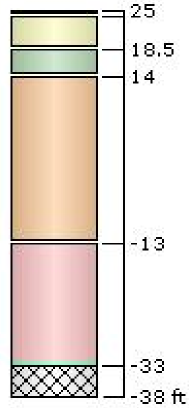
XY Location: B05: (1.00891e+06, 302347)

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	Existing Cover Material - SM/SP	0.5	25	No
2	Waste Material	15.5	24.5	No
3	Silt (upper)	19.5	9	Yes
4	Sand/Silty Sand	2.5	-10.5	No
5	Silt (lower)	14	-13	No
6	Sand	8	-27	No



B06

XY Location:	B06: (1.00878e+06, 302572)			
Layer #	**Type**	**Thickness [ft]**	**Elevation [ft]**	**Drained at Bottom**
1	Existing Cover Material - SM/SP	5.5	24	No
2	Waste Material	4.5	18.5	No
3	Silt (upper)	27	14	Yes
4	Sand/Silty Sand	20	-13	No
5	Silt (lower)	0	-33	No
6	Sand	0	-33	No



Soil Properties

Property	Existing Cover Material - SM/SP	Waste Material	Silt (upper)	Silt (lower)
Color				
Unit Weight [kips/ft3]	0.11	0.1	0.11	0.09
Saturated Unit Weight [kips/ft3]	0.11	0.1	0.11	0.09
Poisson's Ratio	0.2	0.2	0.2	0.2
K0	0.5	0.5	0.5	0.5
Immediate Settlement	Enabled	Disabled	Disabled	Disabled
E [ksf]	146.2	-	-	-
Eur [ksf]	292.4	-	-	-
Primary Consolidation	Disabled	Enabled	Enabled	Enabled
Material Type		Non-Linear	Non-Linear	Non-Linear
Cc	-	0.308	0.28	1.025
Cr	-	0.027	0.043	0.135
e0	-	1.2	1.15	3.1
OCR	-	1	1	1
Cv [ft2/d]	-	0.4	1.9	0.15
Cvr [ft2/d]	-	0.1	0.1	0.1
B-bar	-	1	1	1
Secondary Consolidation	Disabled	Standard	Standard	Standard
Ca	-	0.02	0.01	0.07
Car	-	0.03	0.03	0.07
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	0	2	2	2
Fines Content [%]	15	50	50	50
Liquefaction Prone	Yes	No	No	No

Property	Sand/Silty Sand	Sand
Color		
Unit Weight [kips/ft3]	0.12	0.12
Saturated Unit Weight [kips/ft3]	0.12	0.12
Poisson's Ratio	0.2	0.2
K0	0.5	1
Immediate Settlement	Enabled	Enabled
E [ksf]	150	210
Eur [ksf]	292.4	208.9
B-bar	-	-

Undrained Su A [kips/ft2]	0	0
Undrained Su S	0.2	0.2
Undrained Su m	0.8	0.8
Piezo Line ID	2	2
Fines Content [%]	15	15
Liquefaction Prone	Yes	Yes

Groundwater

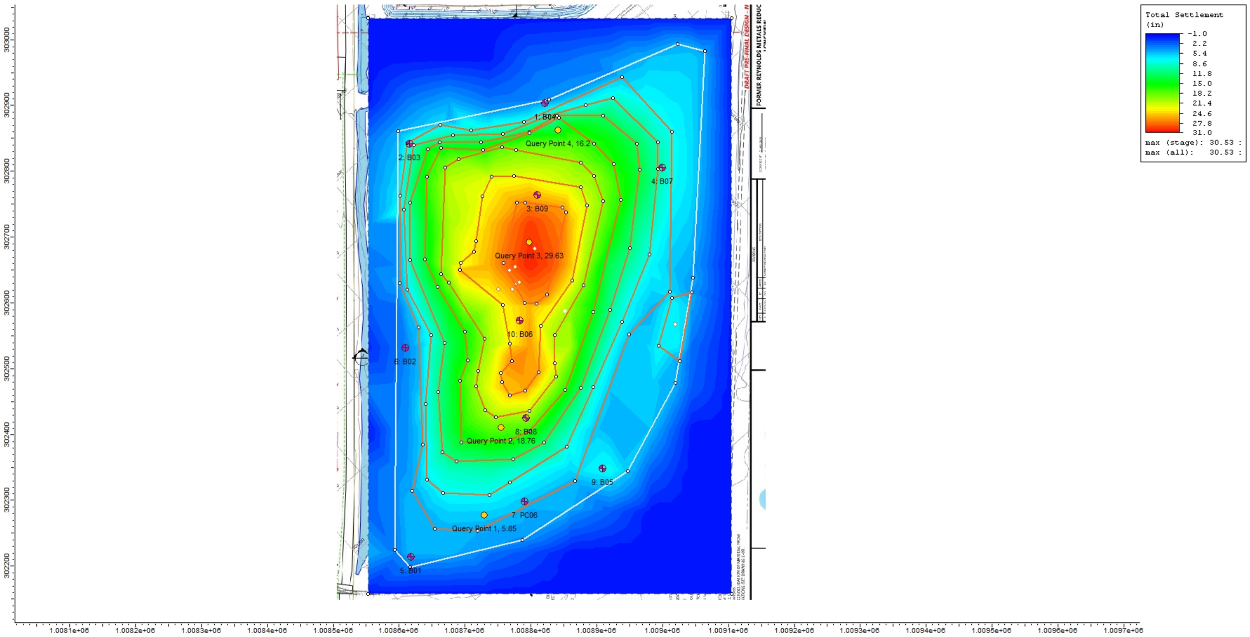
Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
2	6 ft

Report Views

30 Years 1



Attachment B4
Levee Slope Stability Analysis Documentation

SU2 Cross Section A-A'
Former Reynolds Metals Reduction Plant - Longview
Anchor QEA
Date Created: 5/11/2020, 3:52:26 PM
Software Version: 9.02

Table of Contents

Slide Analysis Information

West Landfill_SU2_AtoA'_112021

Project Summary

File Name:	West Landfill_SU2_AtoA'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	Former Reynolds Metals Reduction Plant – Longview
Analysis:	West Landfill Retaining Structure
Author:	C. Janisch
Company:	Anchor QEA
Date Created:	5/11/2020, 3:52:26 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: 2.242630 Gle/morgenstern-price: 2.246880	00h:00m:08.348s
11.2021 Fill Update-RtoL	Master Scenario	Spencer: 4.531730	00h:00m:00.106s
	Undrained-GWT 7ft	Spencer: 2.414730	00h:00m:05.184s
	Drained-GWT 11ft	Spencer: 3.004460	00h:00m:04.389s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Existing Condition

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

11.2021 Fill Update-RtoL

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Existing Condition

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

11.2021 Fill Update-RtoL - Master Scenario

Surface Type:	Non-Circular Path Search
Number of Surfaces:	1
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Segment Length:	Auto Defined
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined
Upper Angle [deg]:	Auto Defined
Lower Angle [deg]:	Auto Defined

11.2021 Fill Update-RtoL - Undrained-GWT 7ft

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

11.2021 Fill Update-RtoL - Drained-GWT 11ft

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	1
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	25
Friction Angle [deg]	12
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	25
Friction Angle [deg]	15
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	0
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Silty Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0

Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Vertical Stress Ratio
Unit Weight [lbs/ft3]	110
Tau/Sigma Ratio	0.36
Min. Strength [psf]	300
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Retraining Structure Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	27
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material	Existing Condition	11.2021 Fill Update-RtoL	Undrained-GWT 7ft	Drained-GWT 11ft
Landfill Cover	✓	✓	✓	✓
Waste Material (Undrained)	✗	✓	✓	✗
Waste Material (Drained)	✓	✗	✗	✓
Compacted Waste (Undrained)	✗	✓	✓	✗
Compacted Waste (Drained)	✗	✗	✗	✓
Levee Fill (Silty Sand)	✓	✓	✓	✓
Levee Fill (Sand)	✓	✓	✓	✓
Silt (Undrained)	✗	✓	✓	✗
Silt (Drained)	✓	✗	✗	✓
Silty Sand	✓	✓	✓	✓
Retraining Structure Fill	✗	✓	✓	✓

Global Minimums

Existing Condition

Method: spencer

FS	2.242630
Axis Location:	168.882, 260.302
Left Slip Surface Endpoint:	75.237, -0.517
Right Slip Surface Endpoint:	321.350, 28.894
Left Slope Intercept:	75.237 7.000
Right Slope Intercept:	321.350 28.894
Resisting Moment:	4.95283e+07 lb-ft
Driving Moment:	2.20849e+07 lb-ft
Resisting Horizontal Force:	178076 lb
Driving Horizontal Force:	79404.8 lb
Total Slice Area:	4716.3 ft2
Surface Horizontal Width:	246.113 ft
Surface Average Height:	19.1631 ft

Method: gle/morgenstern-price

FS	2.246880
Axis Location:	168.882, 260.302
Left Slip Surface Endpoint:	75.237, -0.517
Right Slip Surface Endpoint:	321.350, 28.894
Left Slope Intercept:	75.237 7.000
Right Slope Intercept:	321.350 28.894
Resisting Moment:	4.95241e+07 lb-ft
Driving Moment:	2.20413e+07 lb-ft
Resisting Horizontal Force:	178067 lb
Driving Horizontal Force:	79250.9 lb
Total Slice Area:	4716.3 ft2
Surface Horizontal Width:	246.113 ft
Surface Average Height:	19.1631 ft

11.2021 Fill Update-RtoL - Master Scenario

Method: spencer

FS	4.531730
Axis Location:	203.400, 285.977
Left Slip Surface Endpoint:	99.964, -0.517
Right Slip Surface Endpoint:	370.533, 31.332
Left Slope Intercept:	99.964 7.000
Right Slope Intercept:	370.533 31.332
Resisting Moment:	1.17572e+08 lb-ft
Driving Moment:	2.59442e+07 lb-ft
Resisting Horizontal Force:	369036 lb
Driving Horizontal Force:	81433.8 lb
Total Slice Area:	8693.37 ft2
Surface Horizontal Width:	270.569 ft
Surface Average Height:	32.13 ft

11.2021 Fill Update-RtoL - Undrained-GWT 7ft

Method: spencer

FS	2.414730
Axis Location:	152.893, 347.148
Left Slip Surface Endpoint:	20.093, -9.007
Right Slip Surface Endpoint:	358.137, 27.215
Left Slope Intercept:	20.093 7.000
Right Slope Intercept:	358.137 27.215
Resisting Moment:	1.14299e+08 lb-ft
Driving Moment:	4.73341e+07 lb-ft
Resisting Horizontal Force:	294389 lb
Driving Horizontal Force:	121914 lb
Total Slice Area:	11252.9 ft2
Surface Horizontal Width:	338.044 ft
Surface Average Height:	33.2883 ft

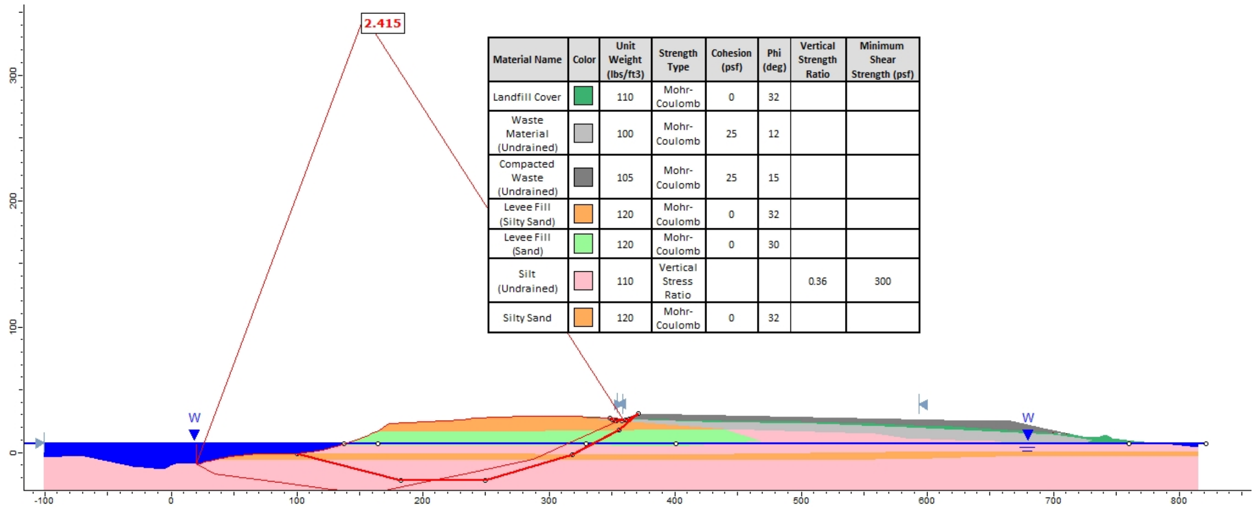
11.2021 Fill Update-RtoL - Drained-GWT 11ft

Method: spencer

FS	3.004460
Axis Location:	149.680, 353.574
Left Slip Surface Endpoint:	13.667, -9.007
Right Slip Surface Endpoint:	358.137, 27.215
Left Slope Intercept:	13.667 7.000
Right Slope Intercept:	358.137 27.215
Resisting Moment:	1.41396e+08 lb-ft
Driving Moment:	4.7062e+07 lb-ft
Resisting Horizontal Force:	361143 lb
Driving Horizontal Force:	120202 lb
Total Slice Area:	10710.4 ft2
Surface Horizontal Width:	344.47 ft
Surface Average Height:	31.0923 ft

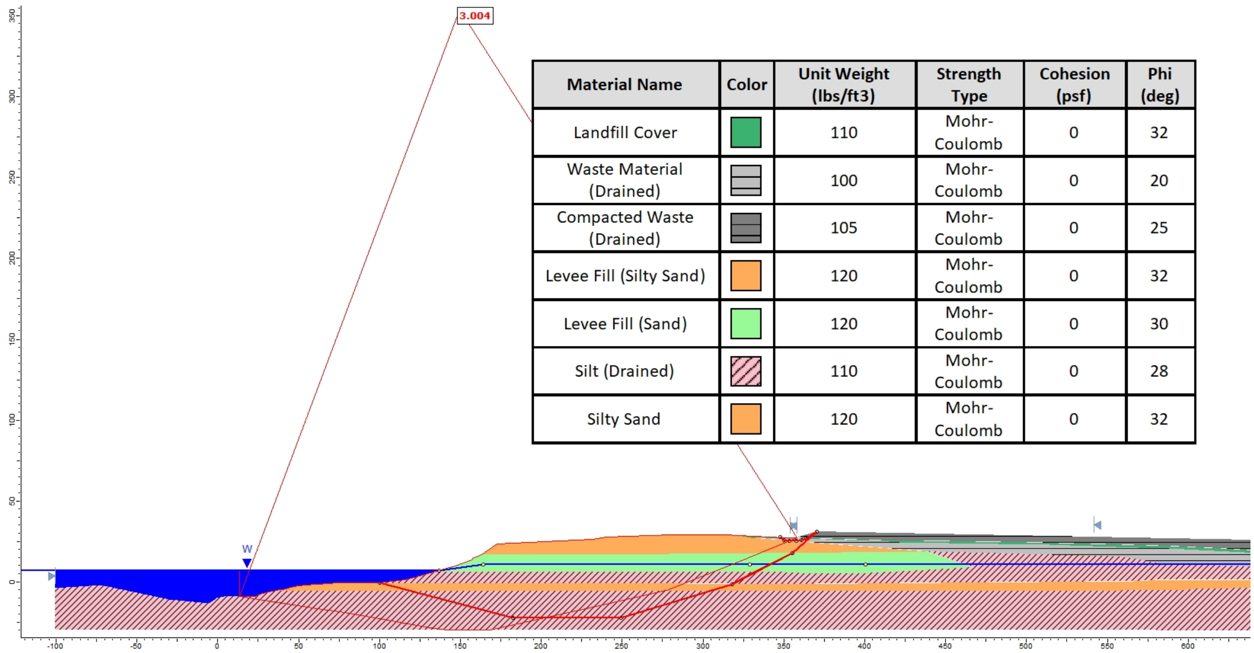
Report Views

1: Cross Section A-A' Undrained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)
Landfill Cover		110	Mohr-Coulomb	0	32		
Waste Material (Undrained)		100	Mohr-Coulomb	25	12		
Compacted Waste (Undrained)		105	Mohr-Coulomb	25	15		
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32		
Levee Fill (Sand)		120	Mohr-Coulomb	0	30		
Silt (Undrained)		110	Vertical Stress Ratio			0.36	300
Silty Sand		120	Mohr-Coulomb	0	32		

2: Cross Section A-A' Drained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
Waste Material (Drained)		100	Mohr-Coulomb	0	20
Compacted Waste (Drained)		105	Mohr-Coulomb	0	25
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Silt (Drained)		110	Mohr-Coulomb	0	28
Silty Sand		120	Mohr-Coulomb	0	32

SU02 Cross Section B-B'
Former Reynolds Metals Reduction Plant - Longview Geotechnical Summary Report
Anchor QEA
Date Created: 5/26/2020, 1:27:31 PM
Software Version: 9.02

Table of Contents

Slide Analysis Information

SU02_B_B'_112021

Project Summary

File Name:	SU02_B_B'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	5/26/2020, 1:27:31 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: 2.180060 Gle/morgenstern-price: 2.181370	00h:00m:05.906s
Undrained + Fill, GWT 7ft	Master Scenario	Spencer: 2.246580 Gle/morgenstern-price: 2.245200	00h:00m:17.787s
Drained + Fill, GWT 11ft	Master Scenario	Spencer: 2.535930 Gle/morgenstern-price: 2.536960	00h:00m:10.350s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

All Open Scenarios

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
SU1	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	25
Friction Angle [deg]	12
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	25
Friction Angle [deg]	15
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	0

Friction Angle [deg]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Silty Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Vertical Stress Ratio
Unit Weight [lbs/ft3]	110
Tau/Sigma Ratio	0.36
Min. Strength [psf]	300
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material	Existing Condition	Undrained + Fill, GWT 7ft	Drained + Fill, GWT 11ft
Landfill Cover	✓	✓	✓
SU1	✗	✓	✓
Waste Material (Undrained)	✗	✓	✗
Waste Material (Drained)	✓	✗	✓
Compacted Waste (Undrained)	✗	✓	✗
Compacted Waste (Drained)	✗	✗	✓
Levee Fill (Silty Sand)	✓	✓	✓
Levee Fill (Sand)	✓	✓	✓
Silt (Undrained)	✗	✓	✗
Silt (Drained)	✓	✗	✓
Silty Sand	✓	✓	✓

Global Minimums

Existing Condition

Method: spencer

FS	2.180060
Axis Location:	74.423, 221.399
Left Slip Surface Endpoint:	-0.782, 2.365
Right Slip Surface Endpoint:	204.527, 29.815
Left Slope Intercept:	-0.782 7.000
Right Slope Intercept:	204.527 29.815
Resisting Moment:	3.21031e+07 lb-ft
Driving Moment:	1.47258e+07 lb-ft
Resisting Horizontal Force:	138064 lb
Driving Horizontal Force:	63330.4 lb
Total Slice Area:	3220.26 ft2
Surface Horizontal Width:	205.309 ft
Surface Average Height:	15.685 ft

Method: gle/morgenstern-price

FS	2.181370
Axis Location:	74.423, 221.399
Left Slip Surface Endpoint:	-0.782, 2.365
Right Slip Surface Endpoint:	204.527, 29.815
Left Slope Intercept:	-0.782 7.000
Right Slope Intercept:	204.527 29.815
Resisting Moment:	3.20947e+07 lb-ft
Driving Moment:	1.47131e+07 lb-ft
Resisting Horizontal Force:	138033 lb
Driving Horizontal Force:	63278 lb
Total Slice Area:	3220.26 ft2
Surface Horizontal Width:	205.309 ft
Surface Average Height:	15.685 ft

Undrained + Fill, GWT 7ft

Method: spencer

FS	2.246580
Axis Location:	88.087, 267.019
Left Slip Surface Endpoint:	-12.526, 2.100
Right Slip Surface Endpoint:	239.655, 27.577
Left Slope Intercept:	-12.526 7.000
Right Slope Intercept:	239.655 27.577
Resisting Moment:	4.9544e+07 lb-ft
Driving Moment:	2.20531e+07 lb-ft
Resisting Horizontal Force:	177470 lb
Driving Horizontal Force:	78995.4 lb
Total Slice Area:	4756.15 ft2
Surface Horizontal Width:	252.181 ft
Surface Average Height:	18.8601 ft

Method: gle/morgenstern-price

FS	2.245200
Axis Location:	88.087, 267.019
Left Slip Surface Endpoint:	-12.526, 2.100
Right Slip Surface Endpoint:	239.655, 27.577
Left Slope Intercept:	-12.526 7.000
Right Slope Intercept:	239.655 27.577
Resisting Moment:	4.95072e+07 lb-ft
Driving Moment:	2.20502e+07 lb-ft
Resisting Horizontal Force:	177345 lb
Driving Horizontal Force:	78988.5 lb
Total Slice Area:	4756.15 ft2
Surface Horizontal Width:	252.181 ft
Surface Average Height:	18.8601 ft

Drained + Fill, GWT 11ft

Method: spencer

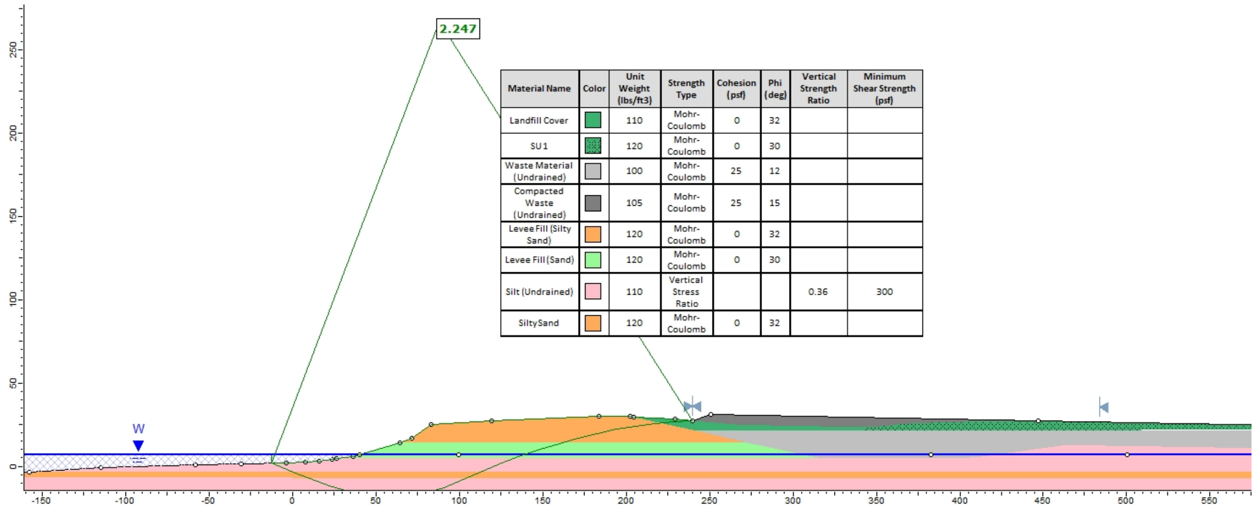
FS	2.535930
Axis Location:	83.826, 275.174
Left Slip Surface Endpoint:	-20.755, 1.954
Right Slip Surface Endpoint:	239.655, 27.577
Left Slope Intercept:	-20.755 7.000
Right Slope Intercept:	239.655 27.577
Resisting Moment:	5.62703e+07 lb-ft
Driving Moment:	2.21892e+07 lb-ft
Resisting Horizontal Force:	195740 lb
Driving Horizontal Force:	77186.7 lb
Total Slice Area:	4650.01 ft2
Surface Horizontal Width:	260.409 ft
Surface Average Height:	17.8566 ft

Method: gle/morgenstern-price

FS	2.536960
Axis Location:	83.826, 275.174
Left Slip Surface Endpoint:	-20.755, 1.954
Right Slip Surface Endpoint:	239.655, 27.577
Left Slope Intercept:	-20.755 7.000
Right Slope Intercept:	239.655 27.577
Resisting Moment:	5.62616e+07 lb-ft
Driving Moment:	2.21768e+07 lb-ft
Resisting Horizontal Force:	195718 lb
Driving Horizontal Force:	77146.8 lb
Total Slice Area:	4650.01 ft2
Surface Horizontal Width:	260.409 ft
Surface Average Height:	17.8566 ft

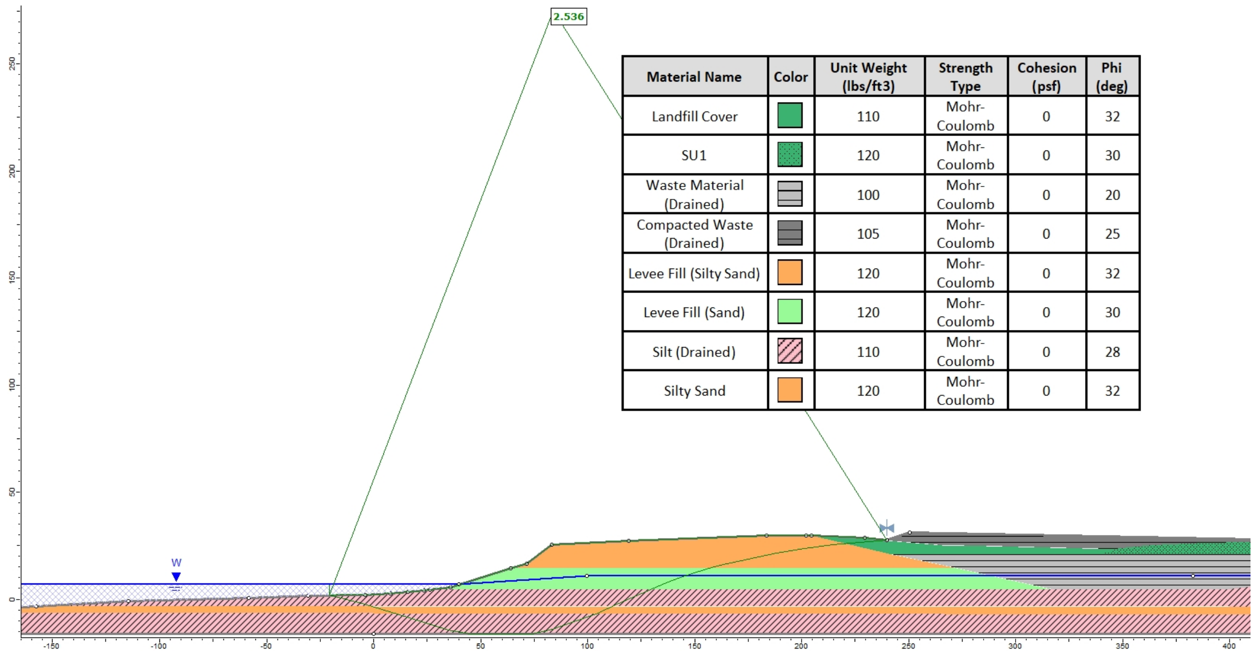
Report Views

1: Cross Section B-B' Undrained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)
Landfill Cover		110	Mohr-Coulomb	0	32		
SU1		120	Mohr-Coulomb	0	30		
Waste Material (Undrained)		100	Mohr-Coulomb	25	12		
Compacted Waste (Undrained)		105	Mohr-Coulomb	25	15		
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32		
Levee Fill (Sand)		120	Mohr-Coulomb	0	30		
Silt (Undrained)		110	Vertical Stress Ratio			0.36	300
Silty Sand		120	Mohr-Coulomb	0	32		

2: Cross Section B-B' Drained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
SU1		120	Mohr-Coulomb	0	30
Waste Material (Drained)		100	Mohr-Coulomb	0	20
Compacted Waste (Drained)		105	Mohr-Coulomb	0	25
Levee Fill (Silty Sand)		120	Mohr-Coulomb	0	32
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Silt (Drained)		110	Mohr-Coulomb	0	28
Silty Sand		120	Mohr-Coulomb	0	32

SU02 Cross Section C-C'
Former Reynolds Metals Reduction Plant - Longview
Anchor QEA
Date Created: 5/6/2020, 2:58:07 PM
Software Version: 9.02

Table of Contents

Slide Analysis Information

SU02_C-C'_112021

Project Summary

File Name:	SU02_C-C'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	5/6/2020, 2:58:07 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Condition	Master Scenario	Spencer: None Gle/morgenstern-price: None	00h:00m:00.186s
Undrained RtoL, GWT 7ft	Master Scenario	Spencer: 2.654480 Gle/morgenstern-price: 2.647950	00h:00m:01.92s
Drained RtoL, GWT 11ft	Master Scenario	Spencer: 2.828930 Gle/morgenstern-price: 2.819020	00h:00m:00.146s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Discard data for surfaces with FS below:	0.1
Discard data for surfaces with FS above:	3
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

All Open Scenarios

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Landfill Cover	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	25
Friction Angle [deg]	12
Water Surface	Assigned per scenario
Hu Value	0
Waste Material (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	25
Friction Angle [deg]	15
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Compacted Waste (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	105
Cohesion [psf]	0
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0

Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Vertical Stress Ratio
Unit Weight [lbs/ft3]	110
Tau/Sigma Ratio	0.36
Min. Strength [psf]	300
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material		Existing Condition	Undrained RtoL, GWT 7ft	Drained RtoL, GWT 11ft
Landfill Cover		✓	✓	✓
Waste Material (Undrained)		✗	✓	✗
Waste Material (Drained)		✓	✗	✓
Compacted Waste (Undrained)		✗	✓	✗
Compacted Waste (Drained)		✗	✗	✓
Levee Fill (Sand)		✓	✓	✓
Silt (Undrained)		✗	✓	✗
Silt (Drained)		✓	✗	✓
Silty Sand		✓	✓	✓

Global Minimums

Existing Condition

Method: spencer

Resisting Moment:	-0 lb-ft
Driving Moment:	0 lb-ft
Resisting Horizontal Force:	-0 lb
Driving Horizontal Force:	0 lb
Total Slice Area:	0 ft2
Surface Horizontal Width:	0 ft
Surface Average Height:	0 ft

Method: gle/morgenstern-price

Resisting Moment:	-0 lb-ft
Driving Moment:	0 lb-ft
Resisting Horizontal Force:	-0 lb
Driving Horizontal Force:	0 lb
Total Slice Area:	0 ft2
Surface Horizontal Width:	0 ft
Surface Average Height:	0 ft

Undrained RtoL, GWT 7ft

Method: spencer

FS	2.654480
Axis Location:	35.844, 316.531
Left Slip Surface Endpoint:	-80.682, 2.312
Right Slip Surface Endpoint:	206.350, 28.019
Left Slope Intercept:	-80.682 7.000
Right Slope Intercept:	206.350 28.019
Resisting Moment:	8.62476e+07 lb-ft
Driving Moment:	3.24913e+07 lb-ft
Resisting Horizontal Force:	248641 lb
Driving Horizontal Force:	93668.4 lb
Total Slice Area:	7589.19 ft2
Surface Horizontal Width:	287.032 ft
Surface Average Height:	26.4402 ft

Method: gle/morgenstern-price

FS	2.647950
Axis Location:	35.844, 316.531
Left Slip Surface Endpoint:	-80.682, 2.312
Right Slip Surface Endpoint:	206.350, 28.019
Left Slope Intercept:	-80.682 7.000
Right Slope Intercept:	206.350 28.019
Resisting Moment:	8.60357e+07 lb-ft
Driving Moment:	3.24914e+07 lb-ft
Resisting Horizontal Force:	248018 lb
Driving Horizontal Force:	93664.1 lb
Total Slice Area:	7589.19 ft2
Surface Horizontal Width:	287.032 ft
Surface Average Height:	26.4402 ft

Drained RtoL, GWT 11ft

Method: spencer

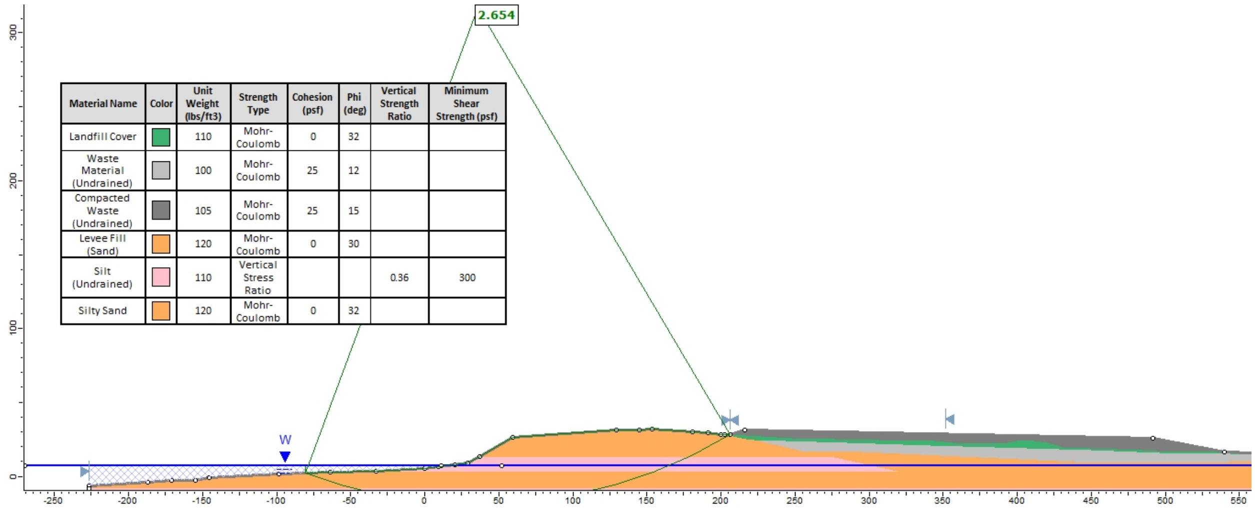
FS	2.828930
Axis Location:	208.832, 48.384
Left Slip Surface Endpoint:	202.576, 28.205
Right Slip Surface Endpoint:	221.221, 31.272
Resisting Moment:	42913.5 lb-ft
Driving Moment:	15169.5 lb-ft
Resisting Horizontal Force:	1939.49 lb
Driving Horizontal Force:	685.592 lb
Total Slice Area:	33.827 ft2
Surface Horizontal Width:	18.645 ft
Surface Average Height:	1.81427 ft

Method: gle/morgenstern-price

FS	2.819020
Axis Location:	208.832, 48.384
Left Slip Surface Endpoint:	202.576, 28.205
Right Slip Surface Endpoint:	221.221, 31.272
Resisting Moment:	42994.1 lb-ft
Driving Moment:	15251.4 lb-ft
Resisting Horizontal Force:	1940.82 lb
Driving Horizontal Force:	688.472 lb
Total Slice Area:	33.827 ft2
Surface Horizontal Width:	18.645 ft
Surface Average Height:	1.81427 ft

Report Views

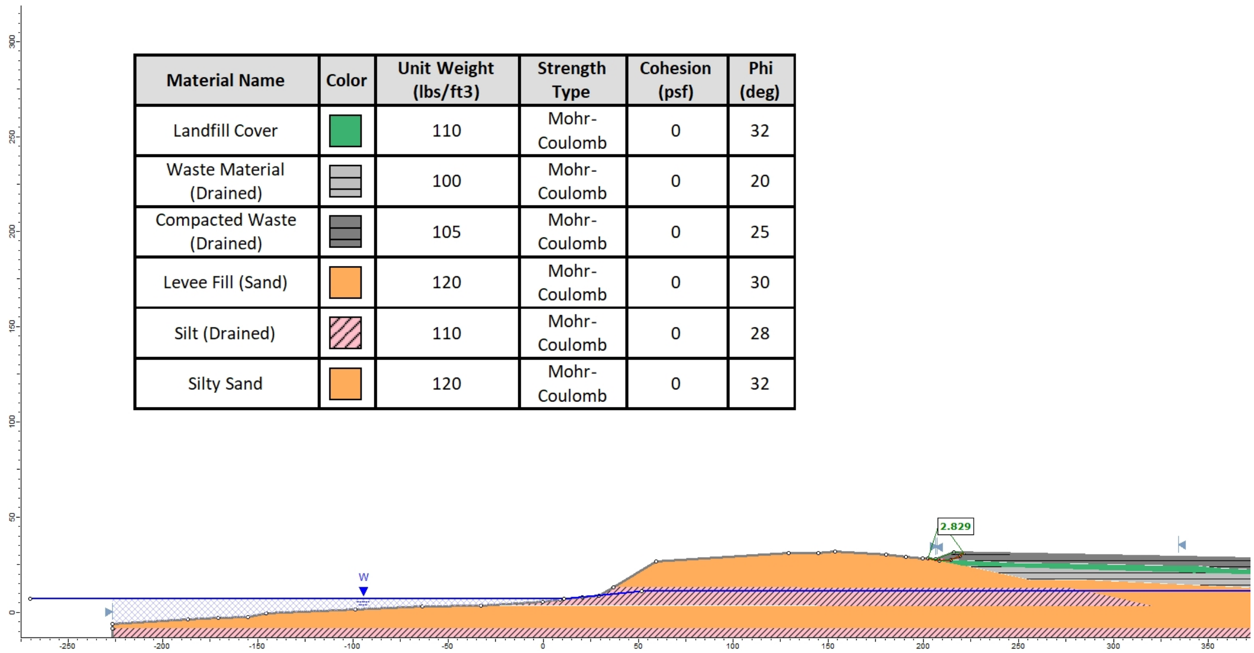
1: Cross Section C-C' Undrained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)
Landfill Cover		110	Mohr-Coulomb	0	32		
Waste Material (Undrained)		100	Mohr-Coulomb	25	12		
Compacted Waste (Undrained)		105	Mohr-Coulomb	25	15		
Levee Fill (Sand)		120	Mohr-Coulomb	0	30		
Silt (Undrained)		110	Vertical Stress Ratio			0.36	300
Silty Sand		120	Mohr-Coulomb	0	32		

2: Cross Section B-B' Drained

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Landfill Cover		110	Mohr-Coulomb	0	32
Waste Material (Drained)		100	Mohr-Coulomb	0	20
Compacted Waste (Drained)		105	Mohr-Coulomb	0	25
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Silt (Drained)		110	Mohr-Coulomb	0	28
Silty Sand		120	Mohr-Coulomb	0	32



SU08
Former Reynolds Metals Reduction Plant - Longview
Anchor QEA
Date Created: 6/15/2020, 11:09:10 AM
Software Version: 9.02

Table of Contents

Slide Analysis Information

SU08_DtoD'_112021

Project Summary

File Name:	SU08_DtoD'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	6/15/2020, 11:09:10 AM

Currently Open Scenarios

Group Name	Scenario Name	Description	Global Minimum	Compute Time
Exisitng Condition	Master Scenario		Spencer: 7.077370 Gle/morgenstern-price: 7.071870	00h:00m:11.996s
LT HighCut HW (Drained)	Master Scenario	LT=long term; HW: GWT at 11ft; LW: GWT at7 ft	Spencer: 3.553000 Gle/morgenstern-price: 3.553210	00h:00m:07.280s
ST LowCut LW (Undrained)	Master Scenario		Spencer: 2.808290 Gle/morgenstern-price: 2.779990	00h:00m:10.651s
ST LowCut LW (Drained)	Master Scenario		Spencer: 3.506560 Gle/morgenstern-price: 3.486680	00h:00m:10.699s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

All Open Scenarios

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

General fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Sand (Levee Fill)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Waste Material	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	100
Cohesion [psf]	0
Friction Angle [deg]	20
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0

Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	1

Materials In Use

Material	Exisitng Condition	LT HighCut HW (Drained)	ST LowCut LW (Undrained)	ST LowCut LW (Drained)
General fill	✗	✓	✗	✗
Sand (Levee Fill)	✓	✓	✓	✓
Waste Material	✓	✓	✓	✓
Sand	✓	✓	✓	✓
Silt (Undrained)	✗	✗	✓	✗
Silt (Drained)	✓	✓	✗	✓
Silty Sand	✓	✓	✓	✓

Global Minimums

Exisitng Condition

Method: spencer

FS	7.077370
Axis Location:	758.291, 345.322
Left Slip Surface Endpoint:	585.267, 26.521
Right Slip Surface Endpoint:	909.517, 15.622
Resisting Moment:	2.40941e+07 lb-ft
Driving Moment:	3.40438e+06 lb-ft
Resisting Horizontal Force:	71566.8 lb
Driving Horizontal Force:	10112.1 lb
Total Slice Area:	2219.14 ft2
Surface Horizontal Width:	324.25 ft
Surface Average Height:	6.8439 ft

Method: gle/morgenstern-price

FS	7.071870
Axis Location:	758.291, 345.322
Left Slip Surface Endpoint:	585.267, 26.521
Right Slip Surface Endpoint:	909.517, 15.622
Resisting Moment:	2.4093e+07 lb-ft
Driving Moment:	3.40688e+06 lb-ft
Resisting Horizontal Force:	71566.2 lb
Driving Horizontal Force:	10119.8 lb
Total Slice Area:	2219.14 ft2
Surface Horizontal Width:	324.25 ft
Surface Average Height:	6.8439 ft

LT HighCut HW (Drained)

Method: spencer

FS	3.553000
Axis Location:	541.800, 104.551
Left Slip Surface Endpoint:	487.215, 29.116
Right Slip Surface Endpoint:	569.397, 15.622
Resisting Moment:	670032 lb-ft
Driving Moment:	188582 lb-ft
Resisting Horizontal Force:	7683.67 lb
Driving Horizontal Force:	2162.59 lb
Total Slice Area:	113.666 ft2
Surface Horizontal Width:	82.1819 ft
Surface Average Height:	1.3831 ft

Method: gle/morgenstern-price

FS	3.553210
Axis Location:	541.800, 104.551
Left Slip Surface Endpoint:	487.215, 29.116
Right Slip Surface Endpoint:	569.397, 15.622
Resisting Moment:	670039 lb-ft
Driving Moment:	188573 lb-ft
Resisting Horizontal Force:	7683.66 lb
Driving Horizontal Force:	2162.45 lb
Total Slice Area:	113.666 ft2
Surface Horizontal Width:	82.1819 ft
Surface Average Height:	1.3831 ft

ST LowCut LW (Undrained)

Method: spencer

FS	2.808290
Axis Location:	566.313, 158.629
Left Slip Surface Endpoint:	477.814, 29.170
Right Slip Surface Endpoint:	616.781, 10.155
Resisting Moment:	1.87515e+07 lb-ft
Driving Moment:	6.67721e+06 lb-ft
Resisting Horizontal Force:	104378 lb
Driving Horizontal Force:	37167.9 lb
Total Slice Area:	2651.46 ft2
Surface Horizontal Width:	138.967 ft
Surface Average Height:	19.0798 ft

Method: gle/morgenstern-price

FS	2.779990
Axis Location:	565.397, 154.702
Left Slip Surface Endpoint:	478.863, 29.170
Right Slip Surface Endpoint:	613.902, 10.155
Resisting Moment:	1.83937e+07 lb-ft
Driving Moment:	6.61647e+06 lb-ft
Resisting Horizontal Force:	104212 lb
Driving Horizontal Force:	37486.5 lb
Total Slice Area:	2690.3 ft2
Surface Horizontal Width:	135.039 ft
Surface Average Height:	19.9224 ft

ST LowCut LW (Drained)

Method: spencer

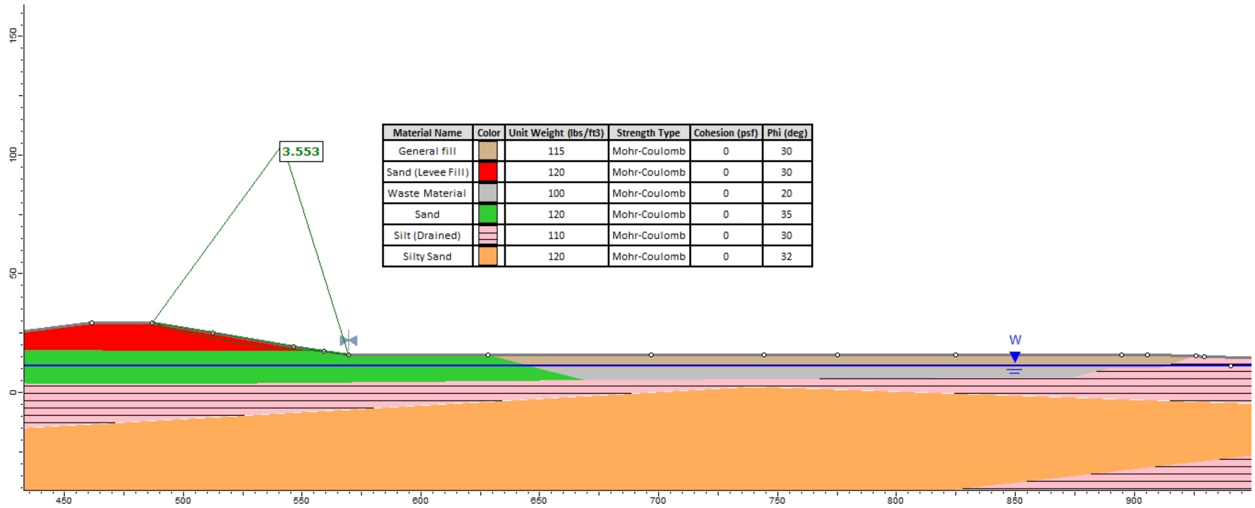
FS	3.506560
Axis Location:	570.498, 159.124
Left Slip Surface Endpoint:	481.752, 29.170
Right Slip Surface Endpoint:	621.214, 10.155
Resisting Moment:	2.15769e+07 lb-ft
Driving Moment:	6.15331e+06 lb-ft
Resisting Horizontal Force:	122815 lb
Driving Horizontal Force:	35024.4 lb
Total Slice Area:	2368.52 ft2
Surface Horizontal Width:	139.462 ft
Surface Average Height:	16.9833 ft

Method: gle/morgenstern-price

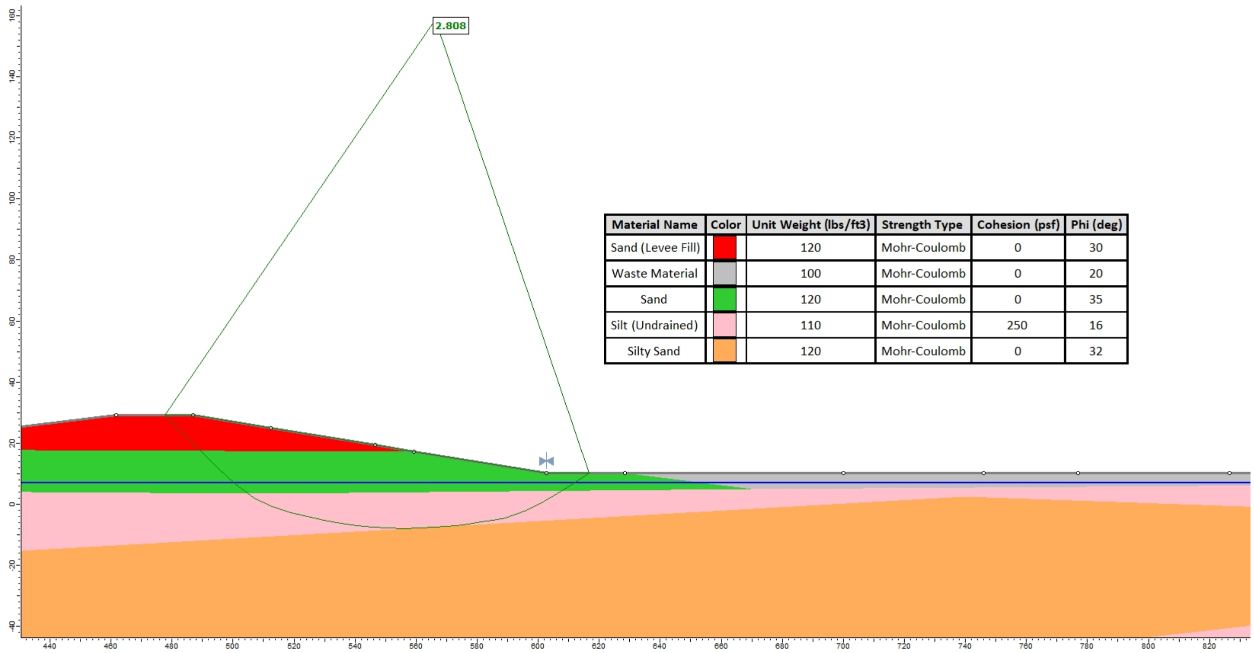
FS	3.486680
Axis Location:	567.834, 154.054
Left Slip Surface Endpoint:	481.623, 29.170
Right Slip Surface Endpoint:	616.014, 10.155
Resisting Moment:	2.10282e+07 lb-ft
Driving Moment:	6.031e+06 lb-ft
Resisting Horizontal Force:	123371 lb
Driving Horizontal Force:	35383.7 lb
Total Slice Area:	2372.96 ft2
Surface Horizontal Width:	134.391 ft
Surface Average Height:	17.6571 ft

Report Views

1: Cross Section D-D' Drained



2: Cross Section D-D' Undrained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Sand (Levee Fill)		120	Mohr-Coulomb	0	30
Waste Material		100	Mohr-Coulomb	0	20
Sand		120	Mohr-Coulomb	0	35
Silt (Undrained)		110	Mohr-Coulomb	250	16
Silty Sand		120	Mohr-Coulomb	0	32

SU10 Cross Section E-E'
Former Reynolds Metals Reduction Plant - Longview
Anchor QEA
Date Created: 6/12/2020, 1:02:45 PM
Software Version: 9.02

Table of Contents

Slide Analysis Information

SU10_E-E'_notG-G'_112021

Project Summary

File Name:	SU10_E-E'_notG-G'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	6/12/2020, 1:02:45 PM

Currently Open Scenarios

Group Name	Scenario Name	Description	Global Minimum	Compute Time
Existing Condition	Master Scenario	"RS=River Stage. HGWT=high groundwater table. SAND AND SILTY/CLAYEY SAND [Fill]: CPT (PC1) indicates unit weight of 99.5-122 pcf at 41.4 & 42.6 degrees. LEVEE SAND: CPT (PC2) provided unit weight of 113.7 & 117.7 pcf, phi of 40 & 38.9. SPT interp in general agreement. Silt and Clay: CPTs PC1&2 indicate unit weight of 108 & 107 & PC2 indicates min Su of .8tsf (600psf) & ratio of .9. CU data of unit indicates Su min of 511psf and ratio of .26	Spencer: 2.989860 Gle/morgenstern-price: 2.975920	00h:00m:09.658s
ST Undrained, GWT 7ft, RtoL	Master Scenario		Spencer: 3.046970 Gle/morgenstern-price: 3.022030	00h:00m:09.41s
LT Drained, GWT 11ft	Master Scenario		Spencer: 2.985090 Gle/morgenstern-price: 2.985620	00h:00m:15.212s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

All Open Scenarios

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Waste Material	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	40
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Fill (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
General Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated

Materials In Use

Material		Existing Condition	ST Undrained, GWT 7ft, RtoL	LT Drained, GWT 11ft
Waste Material		✓	✗	✗
Levee Fill (Sand)		✓	✓	✓
Silty Sand		✓	✓	✓
Silt (Undrained)		✗	✓	✗
Silt (Drained)		✓	✗	✓
General Fill		✗	✗	✓

Global Minimums

Existing Condition

Method: spencer

FS	2.989860
Axis Location:	277.305, 207.528
Left Slip Surface Endpoint:	201.509, 11.830
Right Slip Surface Endpoint:	388.386, 29.472
Resisting Moment:	2.18745e+07 lb-ft
Driving Moment:	7.31621e+06 lb-ft
Resisting Horizontal Force:	102850 lb
Driving Horizontal Force:	34399.5 lb
Total Slice Area:	2318.72 ft2
Surface Horizontal Width:	186.877 ft
Surface Average Height:	12.4078 ft

Method: gle/morgenstern-price

FS	2.975920
Axis Location:	277.305, 207.528
Left Slip Surface Endpoint:	201.509, 11.830
Right Slip Surface Endpoint:	388.386, 29.472
Resisting Moment:	2.18623e+07 lb-ft
Driving Moment:	7.34641e+06 lb-ft
Resisting Horizontal Force:	102816 lb
Driving Horizontal Force:	34549.1 lb
Total Slice Area:	2318.72 ft2
Surface Horizontal Width:	186.877 ft
Surface Average Height:	12.4078 ft

ST Undrained, GWT 7ft, RtoL

Method: spencer

FS	3.046970
Axis Location:	280.114, 240.156
Left Slip Surface Endpoint:	190.100, 11.844
Right Slip Surface Endpoint:	408.755, 31.158
Resisting Moment:	5.65654e+07 lb-ft
Driving Moment:	1.85645e+07 lb-ft
Resisting Horizontal Force:	201555 lb
Driving Horizontal Force:	66149.4 lb
Total Slice Area:	6882.9 ft2
Surface Horizontal Width:	218.655 ft
Surface Average Height:	31.4784 ft

Method: gle/morgenstern-price

FS	3.022030
Axis Location:	284.329, 227.071
Left Slip Surface Endpoint:	200.780, 11.831
Right Slip Surface Endpoint:	406.392, 31.088
Resisting Moment:	4.90234e+07 lb-ft
Driving Moment:	1.6222e+07 lb-ft
Resisting Horizontal Force:	186179 lb
Driving Horizontal Force:	61607.4 lb
Total Slice Area:	6159.52 ft2
Surface Horizontal Width:	205.612 ft
Surface Average Height:	29.957 ft

LT Drained, GWT 11ft

Method: spencer

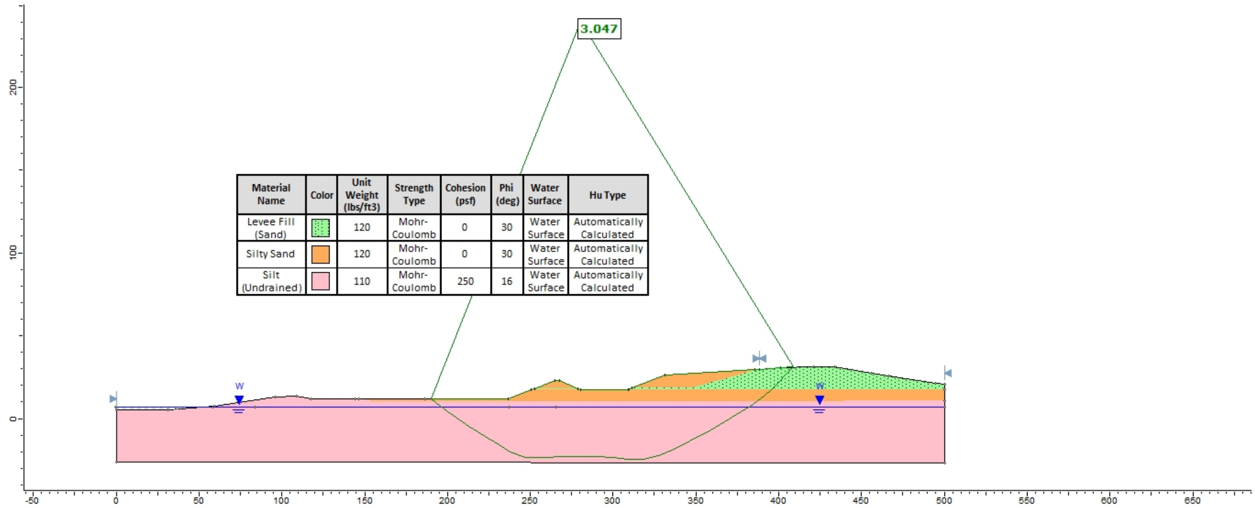
FS	2.985090
Axis Location:	272.910, 216.347
Left Slip Surface Endpoint:	192.695, 11.841
Right Slip Surface Endpoint:	388.386, 29.472
Resisting Moment:	2.25975e+07 lb-ft
Driving Moment:	7.57012e+06 lb-ft
Resisting Horizontal Force:	102049 lb
Driving Horizontal Force:	34186.2 lb
Total Slice Area:	2297.73 ft2
Surface Horizontal Width:	195.691 ft
Surface Average Height:	11.7416 ft

Method: gle/morgenstern-price

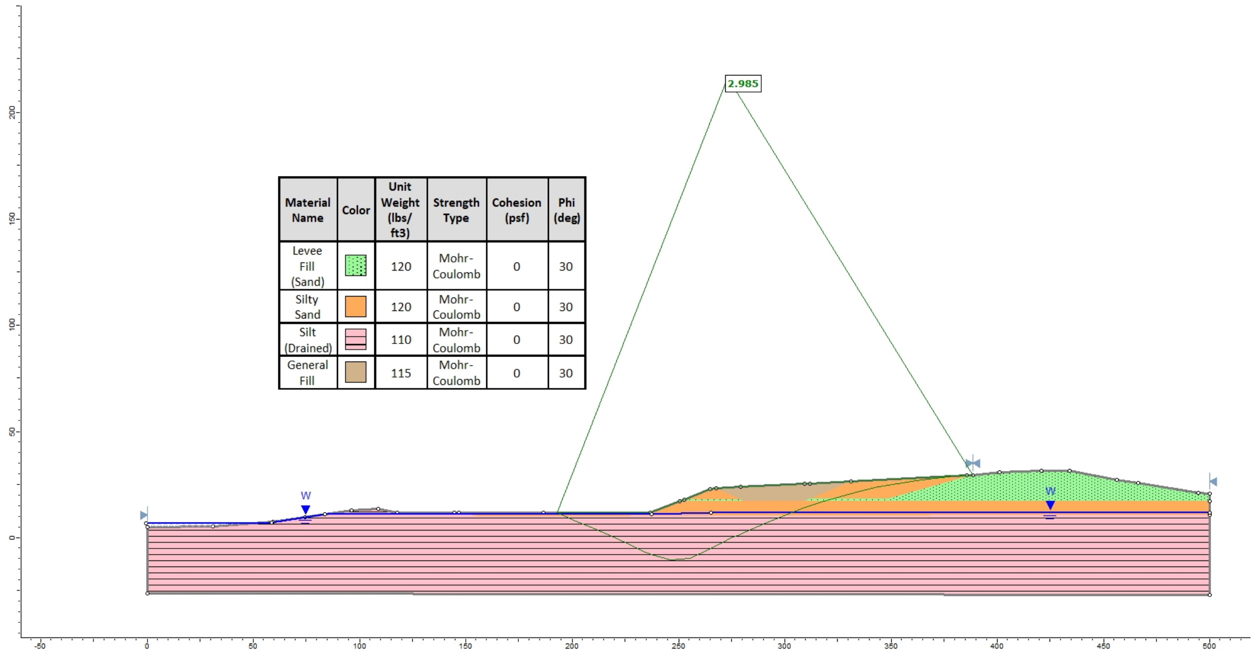
FS	2.985620
Axis Location:	272.910, 216.347
Left Slip Surface Endpoint:	192.695, 11.841
Right Slip Surface Endpoint:	388.386, 29.472
Resisting Moment:	2.25977e+07 lb-ft
Driving Moment:	7.56886e+06 lb-ft
Resisting Horizontal Force:	102050 lb
Driving Horizontal Force:	34180.5 lb
Total Slice Area:	2297.73 ft2
Surface Horizontal Width:	195.691 ft
Surface Average Height:	11.7416 ft

Report Views

1: Cross Section E-E' Undrained



2: Cross Section E-E' Drained



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Levee Fill (Sand)		120	Mohr-Coulomb	0	30
Silty Sand		120	Mohr-Coulomb	0	30
Silt (Drained)		110	Mohr-Coulomb	0	30
General Fill		115	Mohr-Coulomb	0	30

SU10 Cross Section F-F'
Former Reynolds Metals Reduction Plant - Longview
Anchor QEA
Date Created: 6/15/2020, 8:52:58 AM
Software Version: 9.02

Table of Contents

Slide Analysis Information

SU10_F-F'_notH-H'_112021

Project Summary

File Name:	SU10_F-F'_notH-H'_112021.slmd
Slide Modeler Version:	9.02
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	6/15/2020, 8:52:58 AM

Currently Open Scenarios

Group Name	Scenario Name	Description	Global Minimum	Compute Time
Existing Condition	Master Scenario	"RS: River Stage. SAND AND SILTY/CLAYEY SAND [Fill]: CPT (PC1) indicates unit weight of 99.5-122 pcf at 41.4 & 42.6 degrees. LEVEE SAND: CPT (PC2) provided unit weight of 113.7 & 117.7 pcf, phi of 40 & 38.9. SPT interp in general agreement. Silt and Clay: CPTs PC1&2 indicate unit weight of 108 & 107 & PC2 indicates min Su of .8tsf (600psf) & ratio of .9. CU data of unit indicates Su min of 511psf and ratio of .26. MLLW: 4.6ft, MHHW: 9.3. Stage Av. assumed 7 ft.	Spencer: 2.979330 Gle/morgenstern-price: 2.941270	00h:00m:51.289s
ST undrained, GWT 7ft, RtoL	Master Scenario		Spencer: 1.764320 Gle/morgenstern-price: 1.764060	00h:00m:03.921s
LT drained, GWT 11ft, RtoL	Master Scenario		Spencer: 3.491350 Gle/morgenstern-price: 3.489080	00h:00m:07.753s

General Settings

Units of Measurement:	Imperial Units
Time Units:	minutes
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	GLE/Morgenstern-Price with interslice force function (Half Sine)
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

All Open Scenarios

Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	2
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Waste Material	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	40
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Levee Sand (Sand)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silty Sand	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Undrained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	250
Friction Angle [deg]	16
Water Surface	Assigned per scenario
Hu Value	Automatically Calculated
Silt (Drained)	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	1
General Fill	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	0
Friction Angle [deg]	30
Water Surface	Assigned per scenario
Hu Value	1

Materials In Use

Material		Existing Condition	ST undrained, GWT 7ft, RtoL	LT drained, GWT 11ft, RtoL
Waste Material		✓	✗	✗
Levee Sand (Sand)		✓	✓	✓
Silty Sand		✓	✓	✓
Silt (Undrained)		✗	✓	✗
Silt (Drained)		✓	✗	✓
General Fill		✗	✗	✓

Global Minimums

Existing Condition

Method: spencer

FS	2.979330
Axis Location:	285.126, 205.436
Left Slip Surface Endpoint:	211.364, 12.135
Right Slip Surface Endpoint:	395.509, 30.446
Resisting Moment:	2.60906e+07 lb-ft
Driving Moment:	8.75719e+06 lb-ft
Resisting Horizontal Force:	131059 lb
Driving Horizontal Force:	43989.3 lb
Total Slice Area:	2477.47 ft2
Surface Horizontal Width:	184.145 ft
Surface Average Height:	13.4539 ft

Method: gle/morgenstern-price

FS	2.941270
Axis Location:	285.126, 205.436
Left Slip Surface Endpoint:	211.364, 12.135
Right Slip Surface Endpoint:	395.509, 30.446
Resisting Moment:	2.60492e+07 lb-ft
Driving Moment:	8.85643e+06 lb-ft
Resisting Horizontal Force:	130925 lb
Driving Horizontal Force:	44512.9 lb
Total Slice Area:	2477.47 ft2
Surface Horizontal Width:	184.145 ft
Surface Average Height:	13.4539 ft

ST undrained, GWT 7ft, RtoL

Method: spencer

FS	1.764320
Axis Location:	385.284, 50.193
Left Slip Surface Endpoint:	381.389, 22.970
Right Slip Surface Endpoint:	404.726, 30.743
Resisting Moment:	50097.9 lb-ft
Driving Moment:	28395 lb-ft
Resisting Horizontal Force:	1785.7 lb
Driving Horizontal Force:	1012.11 lb
Total Slice Area:	28.5343 ft2
Surface Horizontal Width:	23.3367 ft
Surface Average Height:	1.22272 ft

Method: gle/morgenstern-price

FS	1.764060
Axis Location:	385.284, 50.193
Left Slip Surface Endpoint:	381.389, 22.970
Right Slip Surface Endpoint:	404.726, 30.743
Resisting Moment:	50101 lb-ft
Driving Moment:	28401 lb-ft
Resisting Horizontal Force:	1785.64 lb
Driving Horizontal Force:	1012.24 lb
Total Slice Area:	28.5343 ft2
Surface Horizontal Width:	23.3367 ft
Surface Average Height:	1.22272 ft

LT drained, GWT 11ft, RtoL

Method: spencer

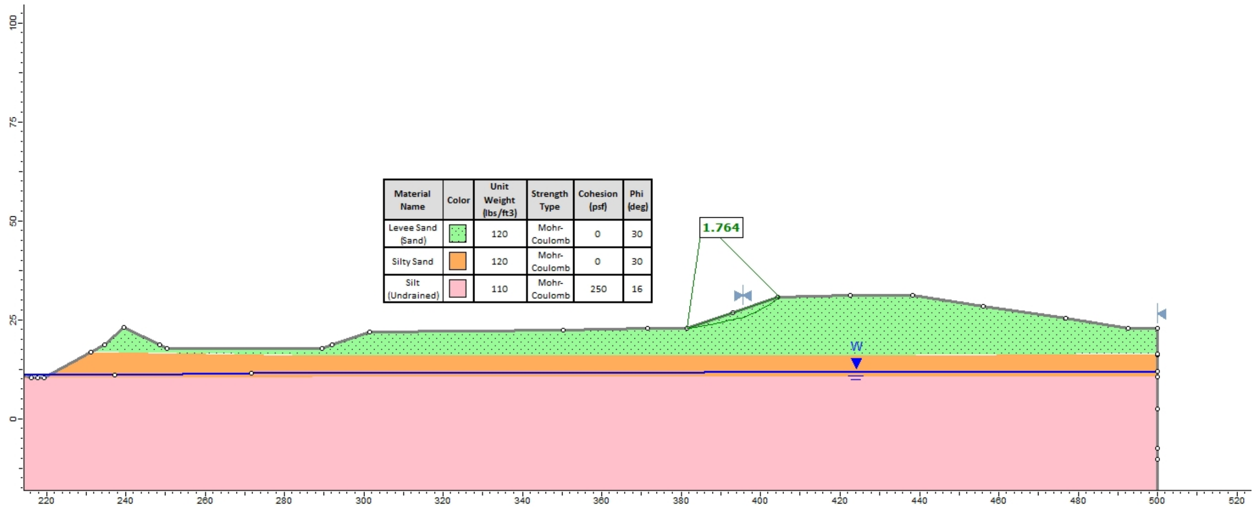
FS	3.491350
Axis Location:	385.681, 51.395
Left Slip Surface Endpoint:	378.174, 26.777
Right Slip Surface Endpoint:	400.871, 30.619
Resisting Moment:	49016.1 lb-ft
Driving Moment:	14039.3 lb-ft
Resisting Horizontal Force:	1915.63 lb
Driving Horizontal Force:	548.679 lb
Total Slice Area:	29.6408 ft2
Surface Horizontal Width:	22.6965 ft
Surface Average Height:	1.30597 ft

Method: gle/morgenstern-price

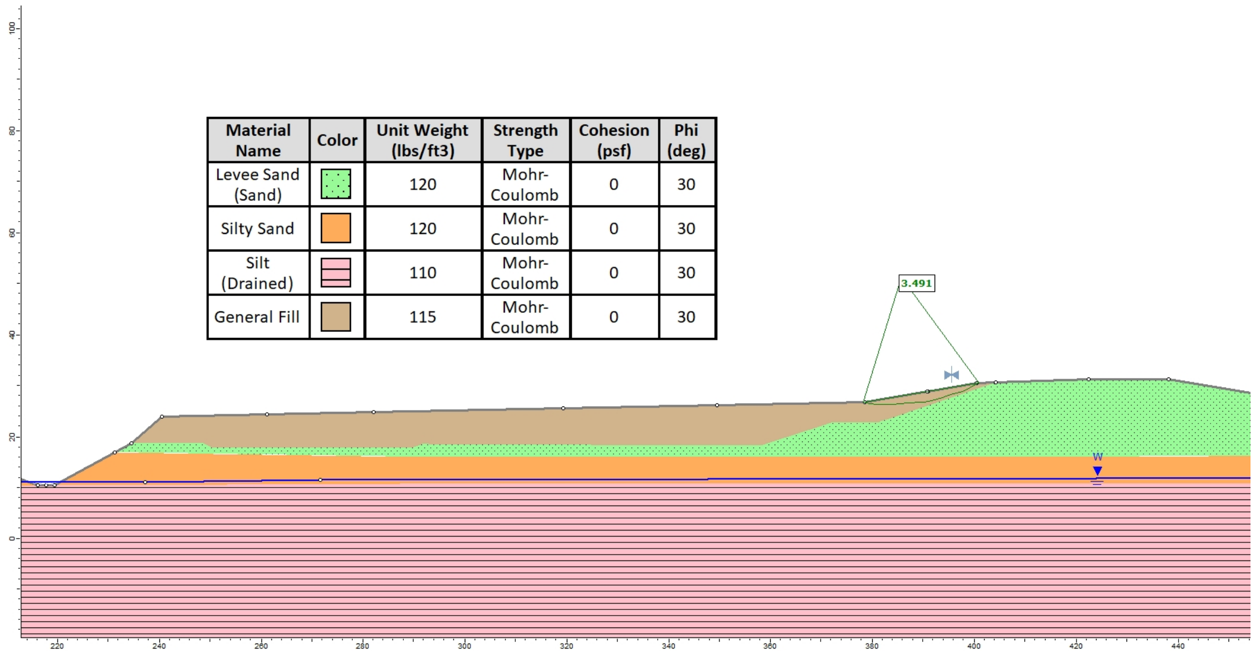
FS	3.489080
Axis Location:	385.681, 51.395
Left Slip Surface Endpoint:	378.174, 26.777
Right Slip Surface Endpoint:	400.871, 30.619
Resisting Moment:	49014.6 lb-ft
Driving Moment:	14048 lb-ft
Resisting Horizontal Force:	1915.56 lb
Driving Horizontal Force:	549.017 lb
Total Slice Area:	29.6408 ft2
Surface Horizontal Width:	22.6965 ft
Surface Average Height:	1.30597 ft

Report Views

1: Cross Section F-F' Undrained



2: Cross Section F-F' Drained



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Levee Sand (Sand)		120	Mohr-Coulomb	0	30
Silty Sand		120	Mohr-Coulomb	0	30
Silt (Drained)		110	Mohr-Coulomb	0	30
General Fill		115	Mohr-Coulomb	0	30