2021

Lake Pontchartrain & Vicinity GRR

Appendix B – Geotechnical Engineering

US Army Corps of Engineers®
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX B – GEOTECHNICAL ENGINEERING

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LAKE PONTCHARTRAIN & VICINITY GRR APPENDIX B – GEOTECHNICAL ENGINEERING

1 INTRODUCTION

1.1 OVERVIEW

The appendix documents geotechnical analyses for levee lifts and T-wall raise for future conditions of 2073 intermediate project grades.

1.2 SCOPE

The scope of this appendix is to project lift schedules to the year 2073, based on the previously developed lift schedules to the year 2057, and to perform stability analysis for Gulf Intracoastal Waterways (GIWW), Goodhope floodwalls, and MRL-LPV-1. Settlement-induced bending moment (SIBM) caused by levee lifts on adjacent T-wall transition, and additional stability measures from the lifts were not included in the analyses. 100-year analysis only looked at RSLR, not settlement.

1.2.1 STUDY AREA

The study area is bounded by Lake Pontchartrain to the North, Lake Borgne to the East, and Mississippi River to the South.

1.3 GEOTECHNICAL TERMINOLOGY

Consolidation: settlement of soil as a result of dissipation of pore water pressure over time.

Shear strength: the internal resistance per unit area that the soil mass can offer to resist failure and sliding along any plane inside it.

Stability berm: an earthen structure built laterally and adjacent to a levee slope to help keep it stable from sliding.

2 FUTURE WITH PROJECT/ACTION CONDITION

2.1 PRIOR ANALYSIS

“Previously developed lift schedules” or “prior lift schedules” were last prepared in 2014 to estimate levee lifts needed to ensure that previously established design grades were maintained from settlement over time. Consolidation settlement of the foundation was caused by the volume change in saturated cohesive soils due to expulsion of the water

that occupies the void spaces. The volume change was induced by the levee load that compresses the soil layers.

The process of developing prior lift schedules involved creating consolidation parameters from subsurface exploration and testing, estimating stress increase from levee load, and using Settle3D computer program.

Shrinkage and consolidation of levee fill were also considered in the development of lift schedules.

Due to the non-uniform nature of soil's physical structure and substance, settlement was estimated and lift schedules were developed for planning purposes only.

2.2 LIFT SCHEDULE ANALYSIS

Survey of levee elevations was performed in November and December 2018. Survey was performed in eight reaches which consist of different levee segments. Settlement was estimated and lift schedules developed for the reaches with prior analyses.

First, lift schedules previously developed to 2057 for segments of each reach were compared to each other and the segment with representative settlement curves was selected. It should be noted that in some cases lift schedules for all levee segments of a certain reach were not previously developed.

Secondly, previously constructed lift was drawn with year and elevation, on the prior lift schedule. Thirdly, the November or December 2018 average survey values of the control segment were plotted. Since survey elevation included the 6-inch thick articulated concrete block if the levee was armored, the survey was lowered 6 inches for the actual levee crown. A settlement curve was then drawn from the actual lift elevation to the survey elevation.

If this settlement curve intersected the new design grade, another levee lift was drawn. The thickness of the lift was similar to the thickness of the prior schedule, or was modified to reduce the number of lifts to save costs. Subsequent lifts were developed as similar shaped curves.

Survey Reach 1 consisted of Bonnet Carre Lower Guide levee. Prior lift schedules was "St Charles Reach 2 Generalized Lift Schedule" and consisted of the design grade from 2007 to 2057 and three lift schedules. The three lift schedules were in red, blue and black, in 2011, 2015 and 2023, respectively. Intermediate design grade for 2073 was drawn on prior lift schedules. Previously constructed lift (+20.5 in 2003) and 2018 average survey (+20.0) were also drawn. Settlement curve was then drawn from lift elevation to survey elevation (no armor was assumed). Since settlement curve stayed above the intermediate design grade to 2073, no lifts were required.

Survey Reach 2 consisted of the following levee segments in St Charles Parish: LPV-03d.2, LPV-04.2a, PV-04.2b, LPV-05.2a and LPV-05.2b. Segment LPV-04.2a was selected as the representative segment because its settlement curves in the prior lift schedules were similar to those of most other segments in the reach. Prior lift schedules were shown as dash lines and consisted of the design grade from 2007 to 2057 and four lift schedules. The four lift schedules were in 2012, 2016, 2024 and 2038. Design grade or 100-year new in 2073 was drawn in red. Actual lift (2017 to 17) and 2018 high, average and low surveys were also drawn. Settlement curve was then drawn in red from lift elevation to survey elevation. Since the settlement curve intersected the design grade in 2024, a levee lift was required. The lift thickness was approximately 3 feet, similar to thickness of prior lift schedules between 2 feet and 3 feet. Subsequent lifts of similar shapes to the settlement curve were then drawn also in red.

Due to the pandemic telework condition, it was not possible to remove the bold grey solid lines from prior work.

Lift schedules for Survey Reaches 3 (Jefferson Lakefront), 4 (Orleans Parish Lakefront), and 5 (Orleans East) were also developed.

Since there were no prior lift schedules for Survey Reach 6 (Chalmette), and Reaches 7 and 8 (MRL Orleans and MRL Lake Borgne), no lift schedules were developed.

An MRL is typically raised to the 1973 required flowline plus freeboard. Since the levees were already previously constructed to those elevations, any lift to bring the levee back to those elevations will have minimum settlement if any at all. The foundation for those levees have had years to consolidate, over 100 years in some places. A 6-inch over-build is typically used to account for any potential settlement/shrinkage.

2.3 FLOODWALL STABILITY ANALYSIS

Stability was analyzed for raising the GIWW and Goodhope T-walls 1 ½ foot and 1 foot to elevations +27.5 and +18, respectively. GeoStudio Slope/W version 2019 with Spencer's method of analysis was used. HSDRRS criteria for minimum factors of safety apply. Non-optimized block and optimized fully-specified slip surfaces at each stratum were analyzed. The St. Charles Return floodwall was not analyzed due to lack of cross section data.

HSDRRS Slope Stability Design Factors of Safety

Analysis Condition	Required Minimum Factor of Safety	
	Spencer Method[1]	Method of Planes[2]
End of Construction[3]	1.3	1.3
Design Hurricane[4] (SWL)	1.5	1.3
Design Hurricane (SWL) w/ dry PS borrow pit[10]	1.3	1.3
Water at Project Grade (levees)[5]	1.4 (1.5)[6]	1.2
Water at Construction Grade (levees)[5]	1.2	N/A
Extreme Hurricane (water @ top of I-walls)[5]	1.4 (1.5)[6]	1.3
Extreme Hurricane (water @ top of T-walls)[5a]	1.4 (1.5)[6]	1.2
Low Water (hurricane condition)[7]	1.4	1.3
Low Water (non-hurricane condition)[8] S-case	1.4	1.3
Water at Project Grade Utility Crossing[9]	1.5 (1.4)	1.3 (1.2)

Unbalanced loads exist for all monoliths of GIWW floodwall (N1 thru N11) except for N12 and N13 sections.

For Goodhope T-wall, N1 section did not meet the minimum factor of safety and will be replaced, while N3 and N6 sections did meet the requirement. The other monoliths were not analyzed due to lack of cross section data.

2.4 LEVEE STABILITY ANALYSIS

Stability was analyzed for raising the LPV-MRL-1 to the 2073 design grades while shifting the centerline to the flood side to avoid additional right-of-way need on the protected side.

Boring data was collected and strengthlines created. Surveys were conducted in 2020 and representative cross sections selected. GeoStudio Slope/W version 2019 with Spencer's method of analysis was used, and HSDRRS criteria for minimum factors of

safety apply. Since Still Water Level (SWL) and Low Water Level (LWL) were not available, Water at Project Grade (WPG) or High Water Level (HWL) was used.

Centerline borings for LPV-MRL-1 consisted of E-84.75-UCL, EB-85.8U, CSA-2, EB-86.7U, E-85.3-UCL, E-89.3-U, E-85.5-U, and EB-86.2U drilled in 1972 to 2009 with depths of 130 feet to 150 feet. Toe borings consisted of EB-86.35UFT, EB-86.8UFT, EB-86.05UPT, EB-85.5UFT, E-85.05-UPT, CSA-3FT, CSA-1PT, and E-89.3-UT drilled in 1978 to 2009 with depths of 90 feet to 230 feet.

The required factor of safety was not met for LPV-MRL-1. Since an extensive geotechnical report was prepared in 2011, recommendations from the report was used. The report is titled Hurricane Storm Damage and Risk Reduction System & Mississippi River Levees Co-Located Areas, 65% Engineering Alternatives Report, Permanent Measures, East Bank, St. Bernard Parish, Louisiana. The followings are recommendations from the report:

Station 255+00 to station 372+00: flood side shift

Station 425+00 to station 450+00: flood side shift

Station 450+00 to station 488+00: T-wall

Station 372+00 to station 425+00: T-wall

Station 488+00 to station 611+60: flood side shift

2.5 ASSUMPTIONS AND RISK

Since most settlement curves were developed from actual settlement of levees – from latest lift to November or December 2018 survey data, and prior settlement analysis, risk should be reasonable. SIBM was not considered at this stage and risk should be reasonable.

3 LEVEE COMPOSITION

A typical levee is constructed of high plasticity clay or low plasticity clay with less than 35% sand and 9% organic material. The clay is compacted to at least 90% maximum dry density at a moisture content of within +5% to -3% optimum moisture content.

4 SETTLEMENT MONITORING / CONSTRUCTION IMPLEMENTATION

An initial construction grade is typically approximately 2-3 feet higher than the design grade at the start of the design life. The purpose for that is: to account for a settlement balance, allow for strength gain in the foundation due to consolidation, minimize the increase in required levee footprint, and maintain the constructed crown at or above the

design life for approx. 5-7 years. When the time-rate settlement curve (i.e. placed at the construction grade elevation) is scheduled to cross the assumed linearly-varying design elevation line on the lift schedule/plot, another lift is required. If authority/funding is in place, MVN or the NFS will start looking into this approximately a year or so before the time-rate settlement curve theoretically crosses the design line so that surveys can be taken to verify the theoretical calculations. After the first lift, a balance is also aimed for construction lift height, foundation conditions, and lift duration. It is usually the intent to stay within the ROW limits for additional lifts.

5 CONCLUSION

LPV levee segments can require a number of lifts to maintain the 1% of 2073 intermediate project grade. Lift schedules and estimated quantities are in Appendix A Civil.

Lift Schedule Projections

LPV-WBV GRR Future Levee Lifts
Table of Representative Levee, Latest Lift, Armor, and Prior Analysis
LPV

Survey Reach	Levee Segment	Representative Levee Segment	Latest Lift Year	Latest Lift Elevation	Armor Year	Note
1	Bonnet Carre Lower Guide (LPV-MRL-23b)		2003	20.5		No armoring assumed
2	St Charles Parish (LPV-03d.2,04.2a, 04.2b, 05.2a, 05.2b)	04.2a (Cross Bayou to I-310)	2017	17	2017	
3	Jefferson Lakefront (LPV-00.2, 01.1, 02.2, 19.2, 20.1)	00.2 Reach 1 Lakefront Levee	2017	17	2018	
4	Orleans Parish Lakefront (LPV-102, 103, 104)	103 (Orleans to London Ave canal)	2008	19.5	2015	
5	Orleans East (LPV-108, 109.02a, 111.01)	109	2011	18.5	2018	
6	Chalmette					No prior lift schedules
7	MRL Orleans Levee District					No prior lift schedules
8	MRL Lake Borgne Levee District					No prior lift schedules

Hurricane & Storm Damage Risk Reduction System (HSDRRS) Map

Structure #	Structure Name	Structure #	Structure Name
S-1	Cross Bayou Drainage Structure	S-14	Bayou Bienvenue Floodgate
S-2	St. Rose Drainage Structure	S-15	IHNC Surge Barrier
S-3	Almedia Drainage Structure	S-16	Bayou Dupre Floodgate
S-4	Walker Drainage Structure	S-17	Caernarvon Structure
S-5	17th Street Canal ICS	S-18	Western Tie-in Closure Structure
S-6	Orleans Avenue Canal ICS	S-19	Bayou Segnette Comp l ex
S-7	London Avenue Canal ICS	S-20	Harvey Lock
S-8	Seabrook Closure Complex	S-21	Harvey Sector Gate
S-9	WCS-1	S-22	GIWW Western Closure Complex
S-10	WCS-2	S-23	Algiers Lock
S-11	WCS-3	S-24	Eastern Tie-in Water Control Structure
S-12	WCS-4	S-25	Estelle Canal Water Control Structure
S-13	IHNC Lock	S-26	Western Tie-in Sluice Gate Structure

Pump Station #	Pump Station Name	Pump Station #	Pump Station Name	Pump Station #	Pump Station Name
1	Engineers Canal PS	33	OP#3 PS	65	Westminster PS
2	Bayou Trepagnier PS	34	OP#4 PS	66	Ames PS
3	New Sarpy PS	35	London Ave. Canal ICS PS	67	Mt. Kennedy PS
4	Schexnaydre PS	36	OP#17 PS (Station D)	68	Estelle #1PS (Old Estelle)
5	Destrehan II (Ormond II) PS	37	OP#19 PS	69	Estelle #2 PS
6	Destrehan I (Ormond I) PS	38	Dwyer Rd. PS	70	Cousins #1 PS
7	Bank One Portable PS	39	OP#16 PS (St. Charles)	71	Cousins #2 PS
8	4th Street PS	40	OP#10 PS (Citrus)	72	Cousins #3 PS
9	Oak Street PS	41	OP#14 PS (Jahncke)	73	Harvey PS
10	Diane PS	42	OP#15 PS	74	Hero PS
11	Turtle Pond PS	43	OP#18 PS (Maxent)	75	Whitney Barataria PS
12	Almedia Road PS	44	Grant St. PS	76	Planters PS
13	Fox Lane PS	45	Elaine St. PS	77	N.O.S.&W.B. #13 PS
14	Oakland PS	46	OP#20 PS (Amid)	78	OP#11 PS
15	Walker Canal PS	47	OP#5 PS	79	Belle Chasse #2 PS
16	Fairfield PS	48	Jean Lafie #6 PS	80	Barriere Road PS
17	Parish Line PS	49	Fortification #1 PS	81	Belle Chasse #1 PS
18	JP#4 PS (Duncan)	50	Guichard #2 PS	82	West Closure Complex PS
19	JP#3 PS (Elmwood)	51	Bayou Villere #3 PS	83	Eastern Tie-in PS #1
20	JP#2 PS (Suburban)	52	Bayou Ducros #7 PS	84	Eastern Tie-in PS #2
21	JP#1 PS (Bonnabel)	53	Meraux #4 PS	85	Cross Bayou PS
22	Prichard PS	54	E.J. Gore #5 PS	86	Almedia Drainage Structure PS
23	Montgilo PS	55	St. Mary #8 PS	87	Walker Drainage Structure PS
24	OP#6 PS	56	Ama PS	88	Motus PS
25	Canal Street PS	57	New Highway 90 PS	89	Englewood PS
26	17th Street Canal ICS PS	58	Lake Cataouatche #1 PS	90	Airline PS
27	I-10 Underpass PS	59	Lake Cataouatche #2 PS	91	LaBarre North and South PS
28	OP#12 PS	60	Bayou Segnette #1 PS	92	Oak Cove PS
29	OP#1 PS (Broad St.)	61	Bayou Segnette #2 PS	93	Harvey Sector Gate Pumps
30	OP#2 PS	62	Bayou Segnette Comp l ex PS	94	WL&F PS #1
31	OP#7 PS	63	Old Westwego PS	95	WL&F PS #2
32	Orleans Ave. Canal ICS PS	64	Westwego #2 PS	96	WL&F CTU #6 PS

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Legend

- HSDRRS Pump Station
- HSDRRS Structures
- Other Levees
- HSDRRS System
- Parishes (GDT)

H&H BASIN

- LPV Inner Harbor Navigation Canal (IHNC) Basin
- LPV Jefferson East Bank Basin
- LPV Lower 9th Ward and St. Bernard Basin
- LPV New Orleans Metro Basin
- LPV New Orleans East Basin
- LPV St. Charles Basin
- WBV Algiers Basin
- WBV Ames, Westwego Basin
- WBV Belle Chasse Basin
- WBV Catauoatche Basin
- WBV East of Harvey Basin
- WBV GIWW West Closure Complex Basin
- WBV Lower Coast Algiers Basin
- WBV Harvey Estelle, Cousins Basin

Last Modified : 3/10/2013

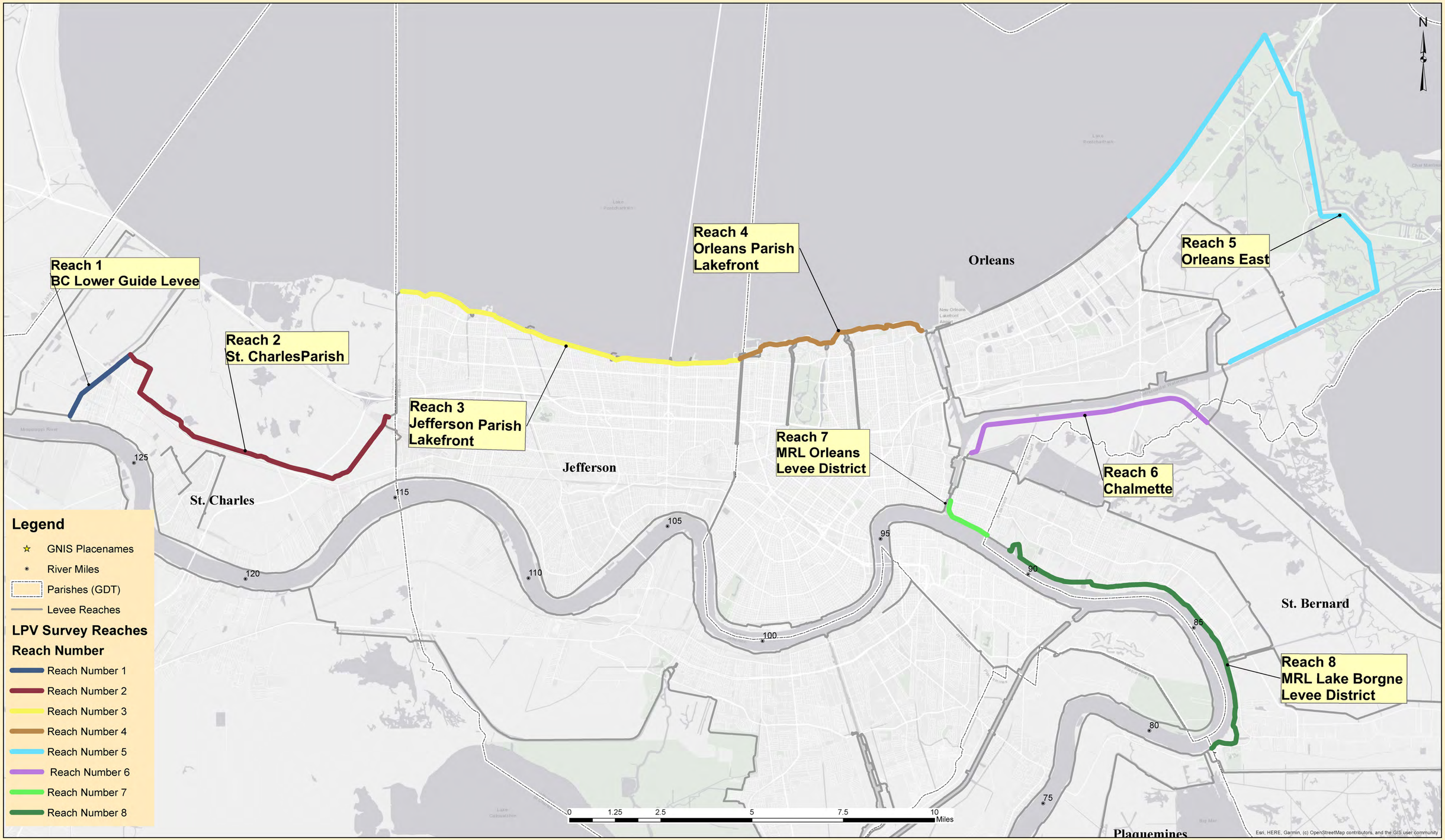
Location Map

IMAGERY
Projected coordinate system name:
NAD_1983_UTM_Zone_15N
Geographic coordinate system name:
GCS_North_American_1983
Resolution: 1.000000

Hurricane & Storm Damage Risk Reduction System (HSDRRS) Map

EGIS Map ID No. 11-004

Survey Reaches for LPV GRR Study



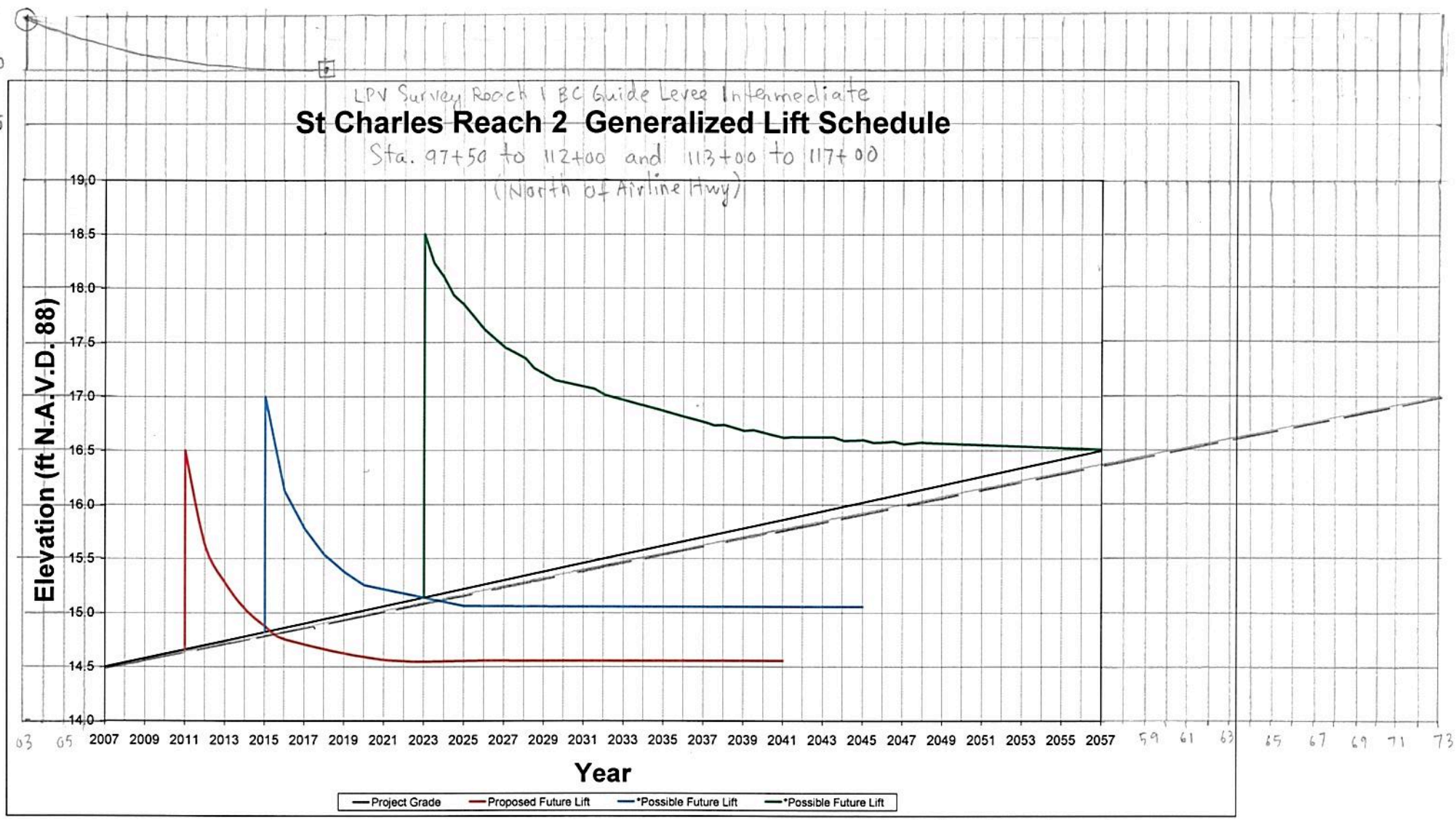
Last Modified: 2/3/2021
EGIS Map ID. 19-002-002

LPV Survey Reach 1 BC Guide Levee Intermediate

St Charles Reach 2 Generalized Lift Schedule

Sta. 97+50 to 112+00 and 113+00 to 117+00

(North of Airline Hwy)



*Note: Subsequent Lifts shall be evaluated in the future for final levee design

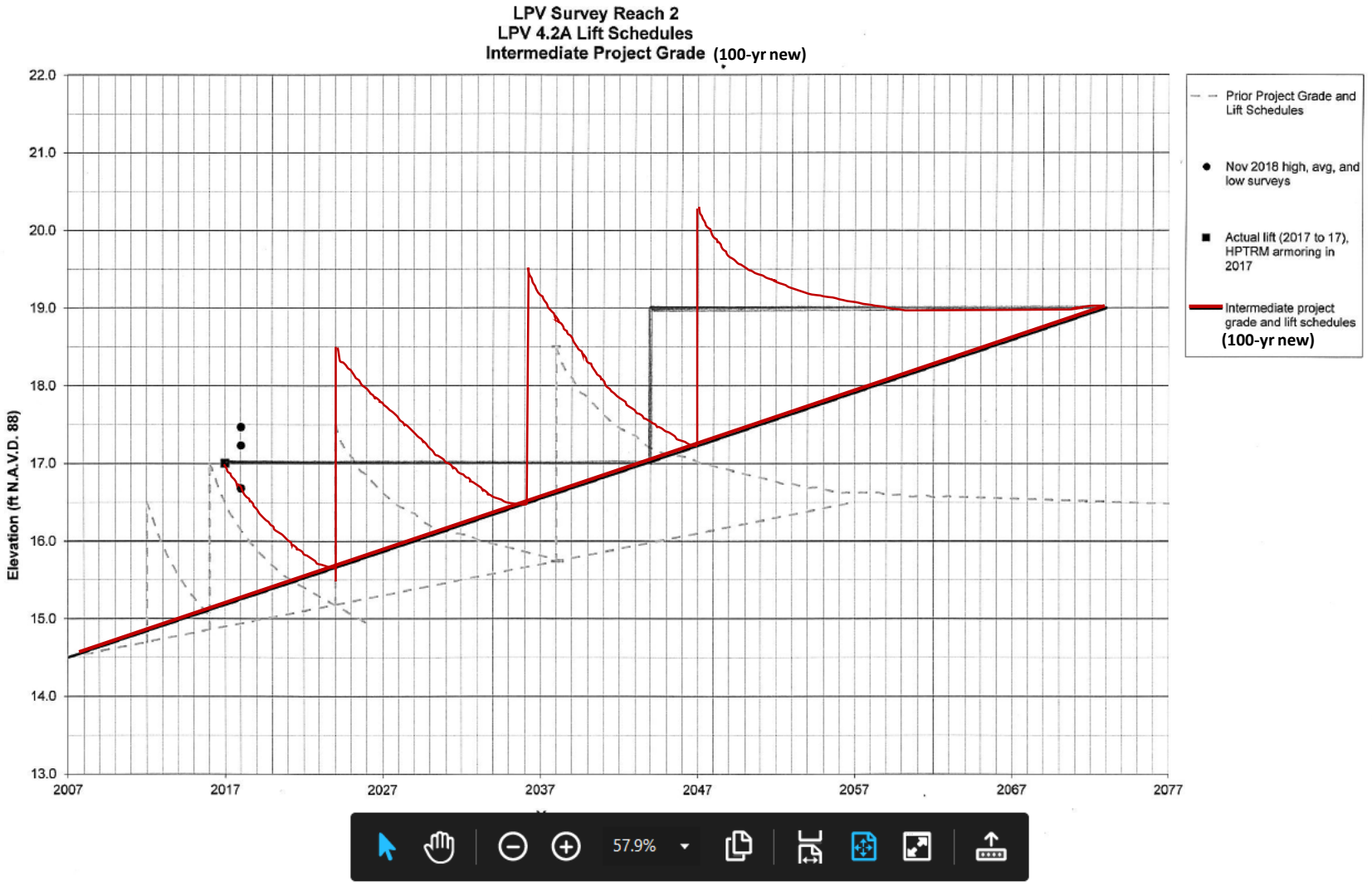
— — Project grade intermediate

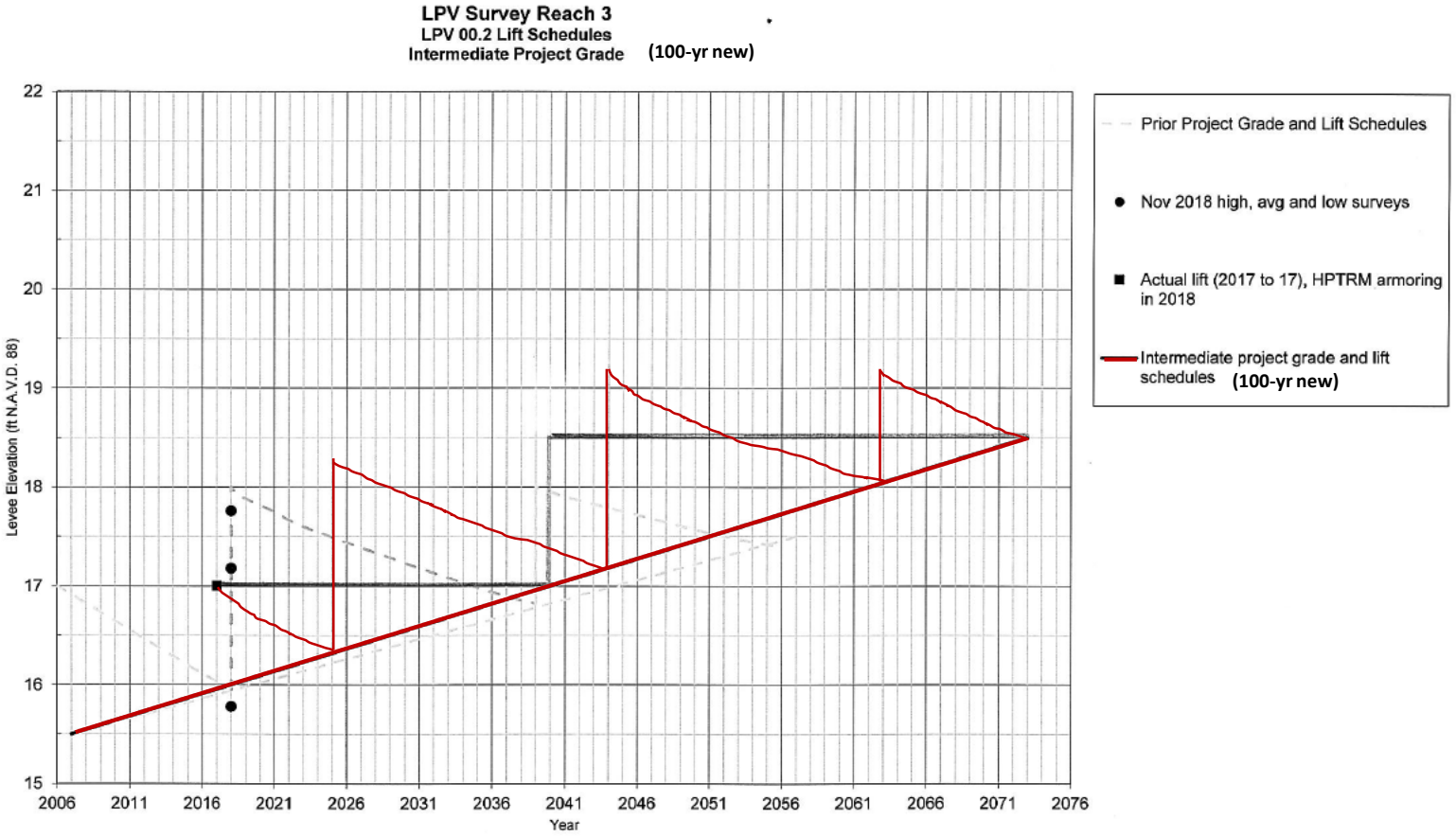
——— Settlement curve

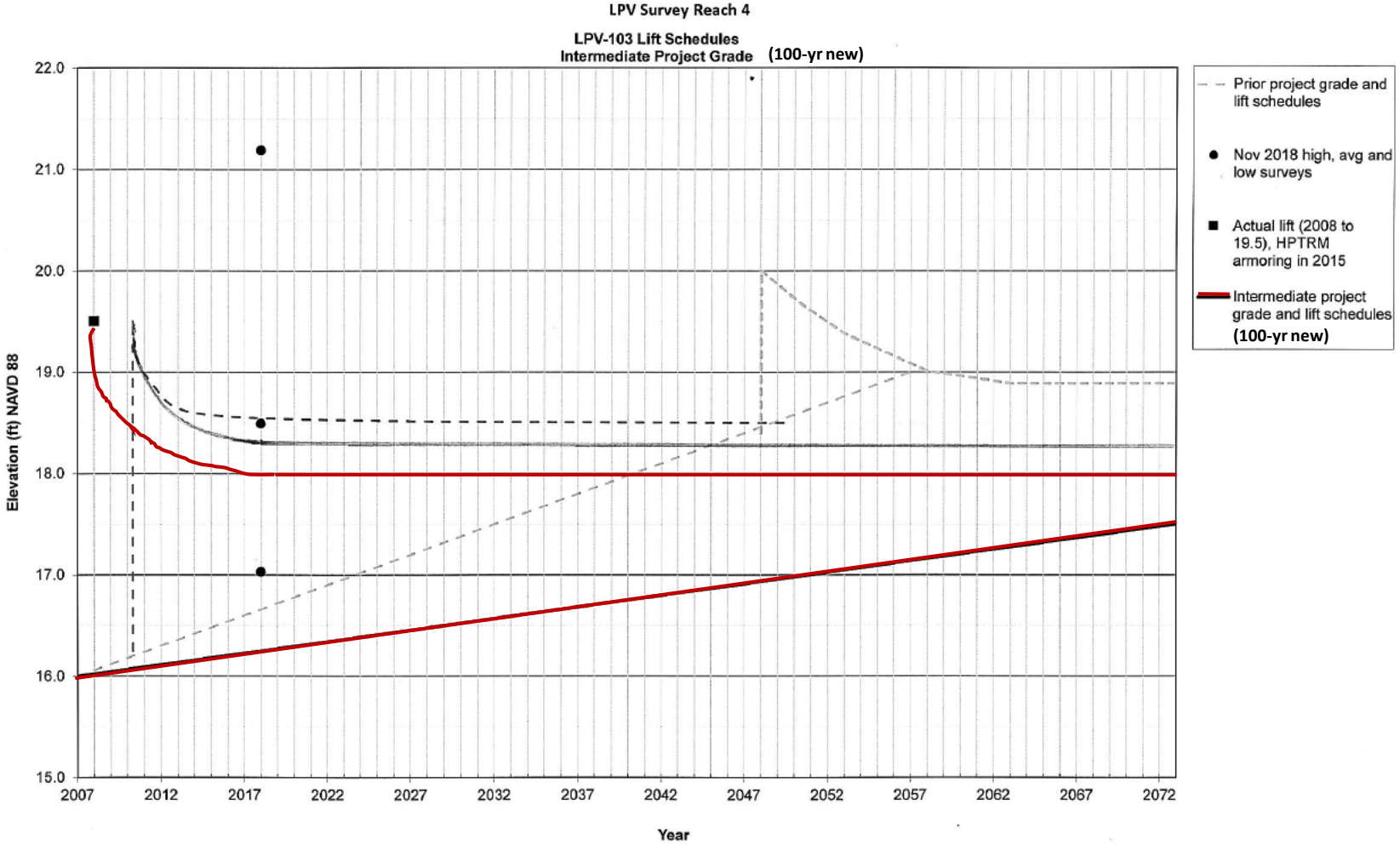
⊙ last levee lift (2003 to 20.5 NGVD)

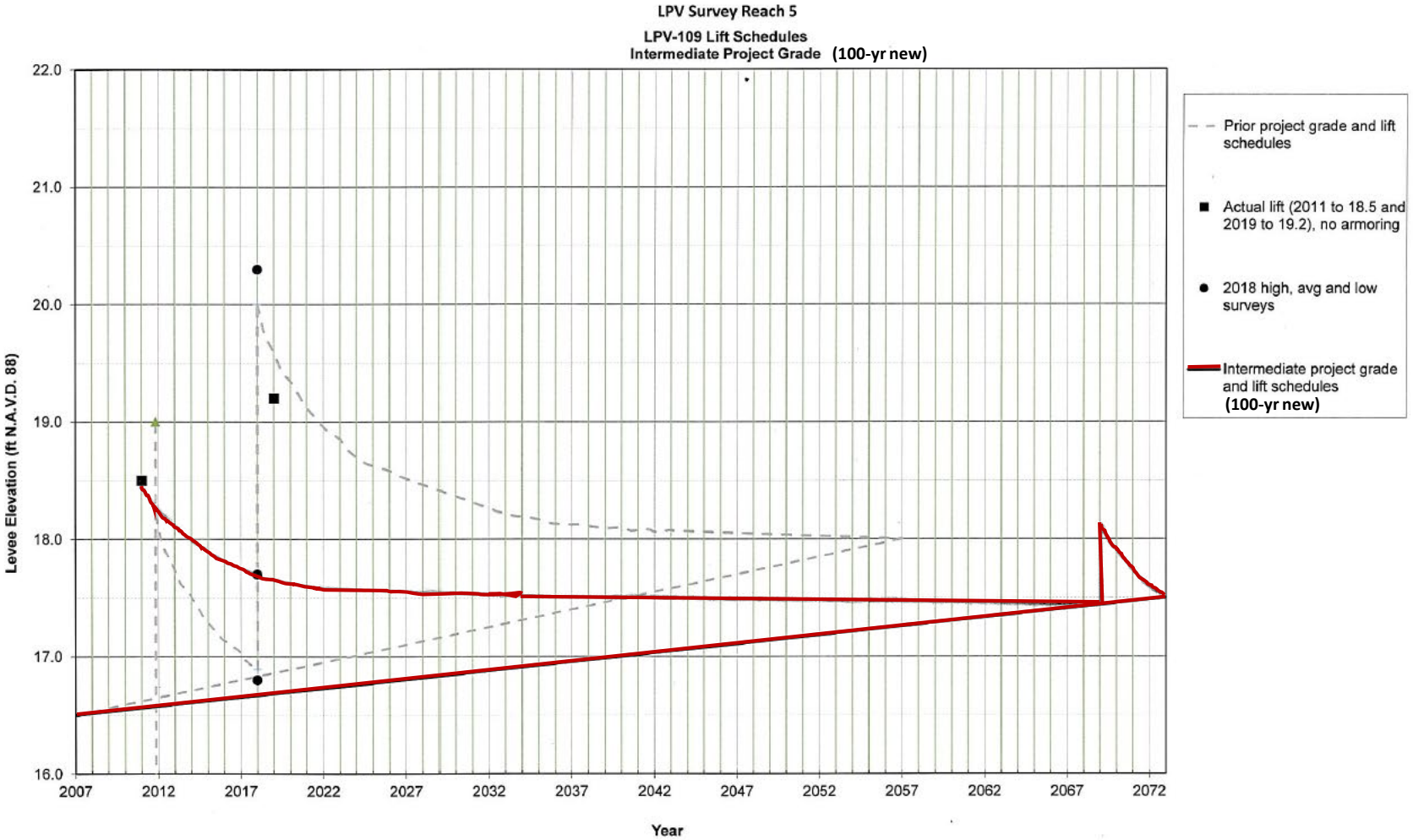
⊡ Avg survey (Nov'18) NAVD 88 (2009.55)

Assume no armoring

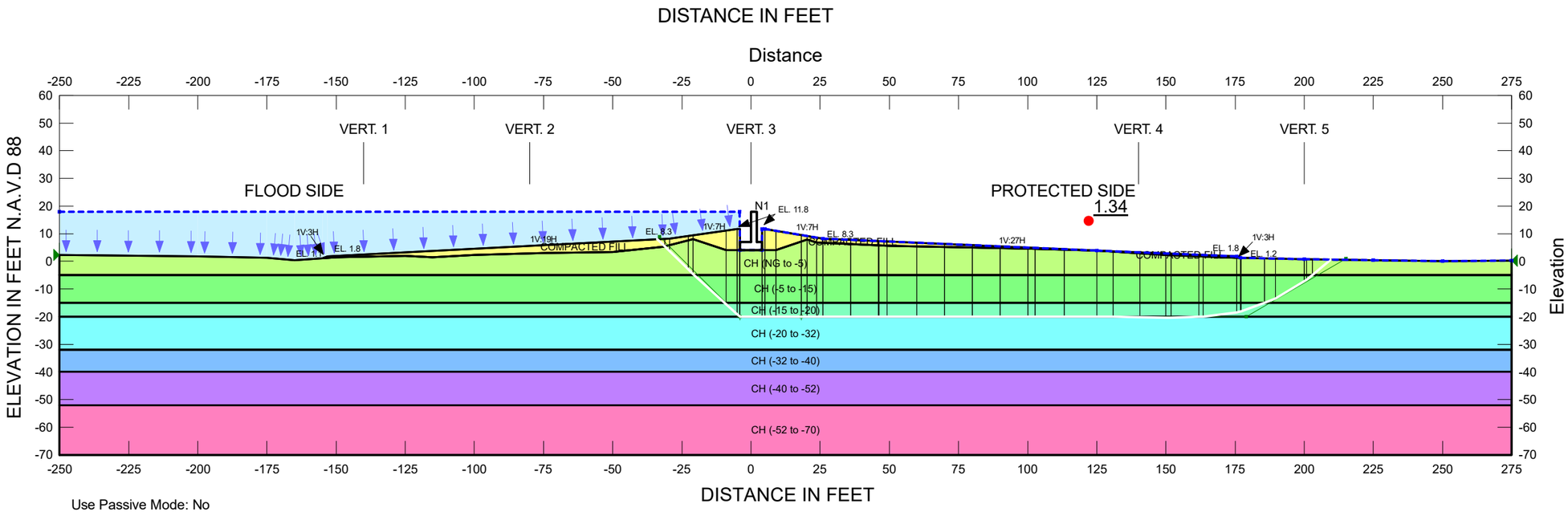

LPV Survey Reach 2
LPV 4.2A Lift Schedules
Intermediate Project Grade (100-yr new)
Elevation (ft N.A.V.D. 88)
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
2007
2017
2027
2037
2047
2057
2067
2077
Prior Project Grade and Lift Schedules
Nov 2018 high, avg, and low surveys
Actual lift (2017 to 17), HPTRM armoring in 2017
Intermediate project grade and lift schedules (100-yr new)
57.9%


LPV Survey Reach 3
LPV 00.2 Lift Schedules
Intermediate Project Grade (100-yr new)
Levee Elevation (ft N.A.V.D. 88)
Year
22
21
20
19
18
17
16
15
2006
2011
2016
2021
2026
2031
2036
2041
2046
2051
2056
2061
2066
2071
2076
Prior Project Grade and Lift Schedules
Nov 2018 high, avg and low surveys
Actual lift (2017 to 17), HPTRM armoring in 2018
Intermediate project grade and lift schedules (100-yr new)


LPV Survey Reach 4
LPV-103 Lift Schedules
Intermediate Project Grade (100-yr new)
Elevation (ft) NAVD 88
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
2007
2012
2017
2022
2027
2032
2037
2042
2047
2052
2057
2062
2067
2072
Year
Prior project grade and lift schedules
Nov 2018 high, avg and low surveys
Actual lift (2008 to 19.5), HPTRM armoring in 2015
Intermediate project grade and lift schedules (100-yr new)


LPV Survey Reach 5
LPV-109 Lift Schedules
Intermediate Project Grade (100-yr new)
Levee Elevation (ft N.A.V.D. 88)
22.0
21.0
20.0
19.0
18.0
17.0
16.0
2007
2012
2017
2022
2027
2032
2037
2042
2047
2052
2057
2062
2067
2072
Year
Prior project grade and lift schedules
Actual lift (2011 to 18.5 and 2019 to 19.2), no armoring
2018 high, avg and low surveys
Intermediate project grade and lift schedules (100-yr new)

T-Wall Stability Analyses



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE SECTION N1

TOW EL -20 FULLY-SPECIFIED

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

Name: N1_TOW_Fully-spec
File Name: Goodhope Monolith N1.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N1_TOW_Fully-spec

Report generated using GeoStudio 2019. Copyright © 1991-2018 GEOSLOPE International Ltd.

File Information

File Version: 10.00
Title: Goodhope Monolith N6
Created By: Chaisson, Kathryn MVN
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 37
Date: 05/05/2020
Time: 03:05:33 PM
Tool Version: 10.0.0.17401
File Name: Goodhope Monolith N1.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Solved Date: 05/05/2020
Last Solved Time: 03:06:22 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

N1_TOW_Fully-spec

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Fully-Specified
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 3,000
  - Convergence Tolerance: 1e-07
  - Starting Points: 8
  - Ending Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Slices: 30
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100
  - Tolerable difference in F of S: 0.01
- Solution Settings
  - Search Method: Root Finder
  - Tolerable difference between starting and converged F of S: 3

Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

COMPACTED FILL

Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	-33 ft	9 ft
	-4 ft	-20 ft
	18.2 ft	-20 ft
	179 ft	-20 ft
	215 ft	1 ft

Slip Surface Limits

Left Coordinate: (-250, 2.3) ft
Right Coordinate: (275, 0.3) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-250 ft	18 ft
Coordinate 2	-4.1 ft	18 ft
Coordinate 3	-4 ft	4 ft
Coordinate 4	4 ft	4 ft
Coordinate 5	4 ft	11.75 ft
Coordinate 6	5 ft	11.75 ft
Coordinate 7	26 ft	8.25 ft
Coordinate 8	125 ft	3.95 ft
Coordinate 9	175.5 ft	1.75 ft
Coordinate 10	177 ft	1.25 ft
Coordinate 11	200 ft	0.7 ft
Coordinate 12	225 ft	0.4 ft
Coordinate 13	250 ft	0.1 ft
Coordinate 14	275 ft	0.3 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 300)
Data Point: (0, 475)
Data Point: (140, 300)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 140)
Data Point: (0, 150)
Data Point: (140, 140)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)
Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf

Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 98)
Data Point: (0, 100)
Data Point: (140, 98)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 123)
Data Point: (-120, 123)
Data Point: (-80, 122)
Data Point: (0, 120)
Data Point: (140, 122)
Data Point: (200, 123)
Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -15, 125)
Data Point: (-120, -15, 125)
Data Point: (-80, -15, 140)
Data Point: (0, -15, 225)
Data Point: (140, -15, 140)
Data Point: (200, -15, 125)
Data Point: (275, -15, 125)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)
Data Point: (-225, -32, 200)
Data Point: (-120, -32, 200)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 200)

Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-250 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-250 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-250 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-250 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-250 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-250 ft	-15 ft
Point 12	275 ft	-15 ft
Point 13	-250 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-9 ft	4 ft
Point 16	9 ft	4 ft
Point 17	26 ft	8.25 ft

Point 18	4 ft	11.75 ft
Point 19	-5 ft	11.75 ft
Point 20	5 ft	11.75 ft
Point 21	175.5 ft	1.75 ft
Point 22	23.75 ft	6.9 ft
Point 23	49.75 ft	5.6 ft
Point 24	20.3 ft	7.8 ft
Point 25	100 ft	4.5 ft
Point 26	125 ft	3.95 ft
Point 27	150 ft	2.25 ft
Point 28	175 ft	1.3 ft
Point 29	200 ft	0.7 ft
Point 30	225 ft	0.4 ft
Point 31	250 ft	0.1 ft
Point 32	275 ft	0.3 ft
Point 33	177 ft	1.25 ft
Point 34	-29.5 ft	8.25 ft
Point 35	-153 ft	1.75 ft
Point 36	-20.9 ft	8 ft
Point 37	-31.6 ft	5.3 ft
Point 38	-50 ft	3.4 ft
Point 39	-75 ft	3 ft
Point 40	-100 ft	2.3 ft
Point 41	-115.2 ft	1.5 ft
Point 42	-125 ft	2 ft
Point 43	-165 ft	0.4 ft
Point 44	-150 ft	1.4 ft
Point 45	-175 ft	1.3 ft
Point 46	-200 ft	1.9 ft
Point 47	-250 ft	2.3 ft
Point 48	-155 ft	1.1 ft
Point 49	-4 ft	4 ft
Point 50	4 ft	4 ft
Point 51	-4 ft	11.75 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,450 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,300 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,200 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,300 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,625 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,250 ft²
Region 7	COMPACTED FILL	26,27,28,33,21	21.75 ft²
Region 8	CH (NG to -5)	13,47,46,45,43,48,44,42,41,40,39,38,37,36,15,49,50,16,24,22,23,25,26,27,28,33,29,30,31,32,14	4,107.4 ft²
Region 9	COMPACTED FILL	48,35,34,19,51,49,15,36,37,38,39,40,41,42,44	393.48 ft²

Region 10	COMPACTED FILL	50,18,20,17,26,25,23,22,24,16	191.74 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

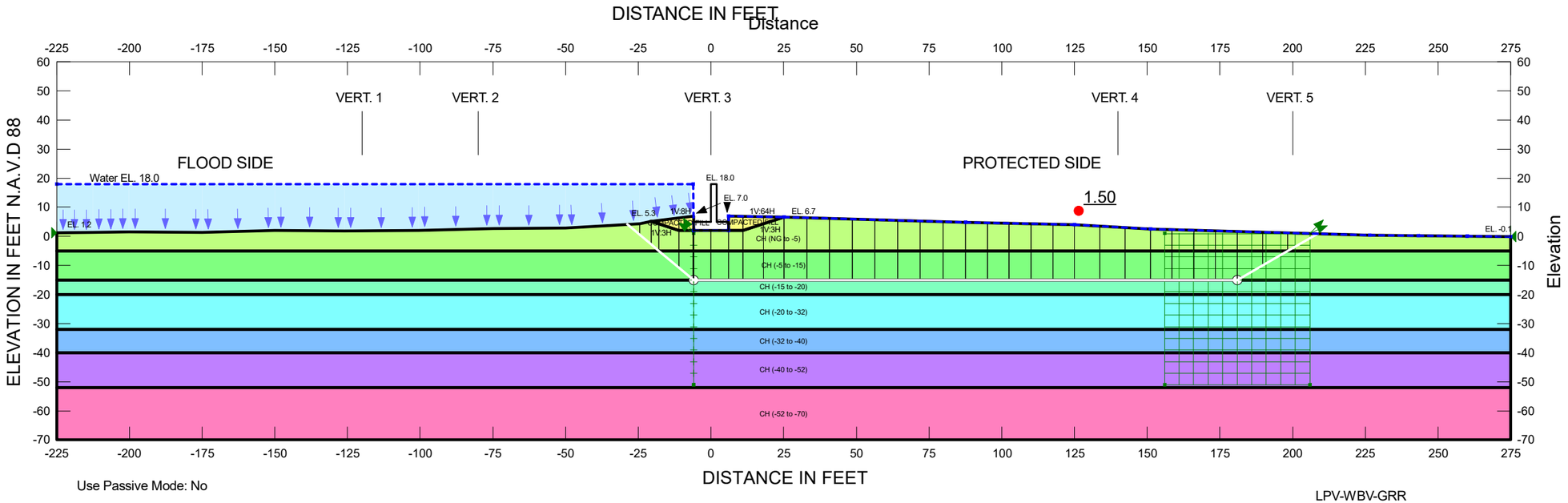
Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.34
Volume: 5,461.2929 ft³
Weight: 564,617.31 lbf
Resisting Moment: 2,433,585.1 lbf·ft
Activating Moment: 1,818,130.7 lbf·ft
Resisting Force: 47,850.162 lbf
Activating Force: 35,603.413 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (209.48505, 0.58617942) ft
Entry: (-33.889127, 8.0189933) ft
Radius: 91.206897 ft
Center: (91.215699, 10.008206) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-32.543607 ft	6.7102054 ft	704.48318 psf	346.62712 psf	0 psf	600 psf	0 psf	COMPACTED FILL
Slice 2	-30.349043 ft	4.5755525 ft	837.68552 psf	709.78548 psf	-0 psf	408.61147 psf	0 psf	CH (NG to -5)
Slice 3	-26.088665 ft	0.43148033 ft	1,096.2756 psf	1,170.92 psf	0 psf	417.93105 psf	0 psf	CH (NG to -5)
Slice 4	-21.788665 ft	-3.7009744 ft	1,354.1408 psf	1,668.34 psf	0 psf	427.3373 psf	0 psf	CH (NG to -5)
Slice 5	-14.95 ft	-9.9669632 ft	1,745.1385 psf	2,522.7343 psf	0 psf	148.13125 psf	0 psf	CH (-5 to -15)
Slice 6	-7 ft	-17.251223 ft	2,199.6763 psf	3,248.3325 psf	0 psf	219.21715 psf	0 psf	CH (-15 to -20)
Slice 7	-4.55 ft	-19.496058 ft	2,339.754 psf	3,480.6823 psf	0 psf	222.31362 psf	0 psf	CH (-15 to -20)
Slice 8	-4.0776786 ft	-19.928826 ft	2,171.7588 psf	3,335.1432 psf	0 psf	222.77777 psf	0 psf	CH (-15 to -20)
Slice 9	-4.0276786 ft	-19.974639 ft	1,737.8175 psf	3,152.4498 psf	0 psf	222.8244 psf	0 psf	CH (-15 to -20)
Slice 10	0 ft	-20 ft	1,497.6 psf	2,554.7455 psf	0 psf	225 psf	0 psf	CH (-15 to -20)
Slice 11	4.5 ft	-20 ft	1,981.2 psf	3,442.1872 psf	0 psf	223.61786 psf	0 psf	CH (-15 to -20)
Slice 12	7 ft	-20 ft	1,960.4 psf	3,401.7382 psf	0 psf	222.85 psf	0 psf	CH (-15 to -20)
Slice 13	13.6 ft	-20 ft	1,891.76 psf	3,271.5885 psf	0 psf	220.82286 psf	0 psf	CH (-15 to -20)
Slice 14	19.25 ft	-20 ft	1,833 psf	3,158.3891 psf	0 psf	219.0875 psf	0 psf	CH (-15 to -20)
Slice 15	22.025 ft	-20 ft	1,804.14 psf	3,101.6071 psf	0 psf	218.23518 psf	0 psf	CH (-15 to -20)
Slice 16	24.875 ft	-20 ft	1,774.5 psf	3,043.4429 psf	0 psf	217.35982 psf	0 psf	CH (-15 to -20)
Slice 17	30.999985 ft	-20 ft	1,749.2485 psf	2,989.7847 psf	0 psf	215.47858 psf	0 psf	CH (-15 to -20)

Slice 18	40.999955 ft	-20 ft	1,722.1456 psf	2,929.2457 psf	0 psf	212.40716 psf	0 psf	CH (-15 to -20)
Slice 19	46.140475 ft	-20 ft	1,708.2132 psf	2,898.6268 psf	0 psf	210.82828 psf	0 psf	CH (-15 to -20)
Slice 20	47.765381 ft	-20 ft	1,703.8092 psf	2,889.0174 psf	0 psf	210.3292 psf	0 psf	CH (-15 to -20)
Slice 21	54.570111 ft	-20.000002 ft	1,685.3665 psf	2,848.6272 psf	0 psf	208.2392 psf	0 psf	CH (-20 to -32)
Slice 22	64.960705 ft	-20.000005 ft	1,657.205 psf	2,787.1325 psf	0 psf	205.04783 psf	0 psf	CH (-20 to -32)
Slice 23	75.00843 ft	-20.000003 ft	1,629.9725 psf	2,728.266 psf	0 psf	201.96173 psf	0 psf	CH (-20 to -32)
Slice 24	84.98944 ft	-19.999996 ft	1,602.9205 psf	2,670.3522 psf	0 psf	198.89608 psf	0 psf	CH (-15 to -20)
Slice 25	94.99648 ft	-19.999989 ft	1,575.798 psf	2,612.8503 psf	0 psf	195.82245 psf	0 psf	CH (-15 to -20)
Slice 26	101.37008 ft	-19.999985 ft	1,558.5233 psf	2,576.522 psf	0 psf	193.86481 psf	0 psf	CH (-15 to -20)
Slice 27	107.96953 ft	-19.999835 ft	1,540.6275 psf	2,539.1463 psf	0 psf	191.83686 psf	0 psf	CH (-15 to -20)
Slice 28	119.09945 ft	-19.999028 ft	1,510.4116 psf	2,476.6228 psf	0 psf	188.41251 psf	0 psf	CH (-15 to -20)
Slice 29	127.96413 ft	-19.998039 ft	1,486.2999 psf	2,429.063 psf	0 psf	185.68167 psf	0 psf	CH (-15 to -20)
Slice 30	135.73706 ft	-20.065136 ft	1,469.3567 psf	2,394.8916 psf	0 psf	183.85412 psf	0 psf	CH (-20 to -32)
Slice 31	145.27293 ft	-20.198846 ft	1,451.7777 psf	2,347.3351 psf	0 psf	178.61136 psf	0 psf	CH (-20 to -32)
Slice 32	150.97166 ft	-20.278753 ft	1,441.2724 psf	2,312.1567 psf	0 psf	173.79367 psf	0 psf	CH (-20 to -32)
Slice 33	156.93335 ft	-20.146189 ft	1,416.794 psf	2,261.3873 psf	0 psf	167.0456 psf	0 psf	CH (-20 to -32)
Slice 34	162.6667 ft	-19.978223 ft	1,390.7274 psf	2,199.3428 psf	0 psf	160.35282 psf	0 psf	CH (-15 to -20)
Slice 35	169.45501 ft	-19.166091 ft	1,321.5969 psf	2,087.2707 psf	0 psf	150.4517 psf	0 psf	CH (-15 to -20)
Slice 36	176.25 ft	-18.277675 ft	1,234.1269 psf	1,922.1924 psf	0 psf	141.83577 psf	0 psf	CH (-15 to -20)
Slice 37	177.05956 ft	-18.171828 ft	1,211.8332 psf	1,880.4012 psf	0 psf	140.92194 psf	0 psf	CH (-15 to -20)
Slice 38	181.34409 ft	-16.58202 ft	1,106.2359 psf	1,743.3204 psf	0 psf	133.79594 psf	0 psf	CH (-15 to -20)
Slice 39	187.58387 ft	-14.245555 ft	951.12965 psf	1,470.2086 psf	0 psf	108.27742 psf	0 psf	CH (-5 to -15)
Slice 40	194.79935 ft	-10.356253 ft	697.67049 psf	1,077.7989 psf	0 psf	103.4671 psf	0 psf	CH (-5 to -15)
Slice 41	200.41751 ft	-6.9697294 ft	478.27848 psf	714.77184 psf	0 psf	100 psf	0 psf	CH (-5 to -15)
Slice 42	201.85233 ft	-5.859031 ft	407.89651 psf	628.20296 psf	0 psf	100 psf	0 psf	CH (-5 to -15)
Slice 43	206.17734 ft	-2.2069103 ft	176.76561 psf	304.67619 psf	0 psf	100 psf	0 psf	CH (NG to -5)



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE SECTION N3

TOW BLOCK

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

The profile of monolith N3 is based on cross sections taken at B/L Sta. NOs. 144+62, 144+75, and 145+00

Name: N3_TOW_Block (2)
File Name: Goodhope Monolith N3.gsz Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N3_TOW_Block (2)

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File Information

File Version: 10.00
Title: Goodhope Monolith N3
Created By: Chaisson, Kathryn MVN
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 40
Date: 05/06/2020
Time: 01:05:50 PM
Tool Version: 10.0.0.17401
File Name: Goodhope Monolith N3.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Solved Date: 05/06/2020
Last Solved Time: 01:06:36 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

N3_TOW_Block (2)

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Restrict Block Crossing: Yes
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Slices: 30
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100
  - Tolerable difference in F of S: 0.01
- Solution Settings
  - Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

COMPACTED FILL

Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)

Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (-225, 1.2) ft
Right Coordinate: (275, -0.1) ft

Slip Surface Block

Left Grid
Upper Left: (-6, 1) ft
Lower Left: (-6, -51) ft
Lower Right: (-6, -51) ft
X Increments: 1
Y Increments: 13
Starting Angle: 125 °
Ending Angle: 145 °
Angle Increments: 4
Right Grid
Starting Angle: 25 °
Ending Angle: 45 °
Upper Left: (156, 1) ft
Lower Left: (156, -51) ft
Lower Right: (206, -51) ft
X Increments: 10
Y Increments: 13
Angle Increments: 4

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-225 ft	18 ft
Coordinate 2	-6.1 ft	18 ft
Coordinate 3	-6 ft	2 ft
Coordinate 4	6 ft	2 ft
Coordinate 5	6 ft	7 ft
Coordinate 6	25.1 ft	6.7 ft
Coordinate 7	87.6 ft	4.9 ft
Coordinate 8	125 ft	4 ft
Coordinate 9	151.1 ft	2.5 ft
Coordinate 10	226.5 ft	0.4 ft
Coordinate 11	243.3 ft	0.3 ft
Coordinate 12	260 ft	0.1 ft
Coordinate 13	275 ft	-0.1 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 300)
Data Point: (0, 475)
Data Point: (140, 300)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 140)
Data Point: (0, 150)
Data Point: (140, 140)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function

Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 83 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 80)
Data Point: (0, 83)
Data Point: (140, 80)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)

Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)
Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 98)
Data Point: (0, 100)
Data Point: (140, 98)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 123)
Data Point: (-120, 123)
Data Point: (-80, 122)
Data Point: (0, 120)
Data Point: (140, 122)
Data Point: (200, 123)
Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -15, 125)
Data Point: (-120, -15, 125)
Data Point: (-80, -15, 140)
Data Point: (0, -15, 225)
Data Point: (140, -15, 140)
Data Point: (200, -15, 125)
Data Point: (275, -15, 125)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)
Data Point: (-225, -32, 200)
Data Point: (-120, -32, 200)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 200)
Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-225 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-225 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-225 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-225 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-225 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-225 ft	-15 ft
Point 12	275 ft	-15 ft

Point 13	-225 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-6 ft	7 ft
Point 16	-6 ft	5 ft
Point 17	-6 ft	2 ft
Point 18	-11 ft	2 ft
Point 19	6 ft	2 ft
Point 20	6 ft	5 ft
Point 21	6 ft	7 ft
Point 22	11 ft	2 ft
Point 23	-225 ft	1.2 ft
Point 24	-212.6 ft	1.3 ft
Point 25	-175 ft	1.3 ft
Point 26	-150 ft	2 ft
Point 27	-126 ft	1.9 ft
Point 28	-100.5 ft	2.1 ft
Point 29	-75 ft	2.7 ft
Point 30	-50 ft	2.8 ft
Point 31	-24.5 ft	4.4 ft
Point 32	25.1 ft	6.7 ft
Point 33	87.6 ft	4.9 ft
Point 34	125 ft	4 ft
Point 35	151.1 ft	2.5 ft
Point 36	226.5 ft	0.4 ft
Point 37	243.3 ft	0.3 ft
Point 38	275 ft	-0.1 ft
Point 39	-20.6 ft	5.2 ft
Point 40	-200.2 ft	1.5 ft
Point 41	260 ft	0.1 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,000 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,000 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,000 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,000 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,500 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,000 ft²
Region 7	CH (NG to -5)	13,23,24,40,25,26,27,28,29,30,31,39,18,17,19,22,32,33,34,35,36,37,41,38,14	3,819.9 ft²
Region 8	COMPACTED FILL	39,15,16,17,18	44.5 ft²

Region 9	COMPACTED FILL	19,20,21,32,22	59.5 ft²

Slip Results

Slip Surfaces Analysed: 3395 of 3850 converged

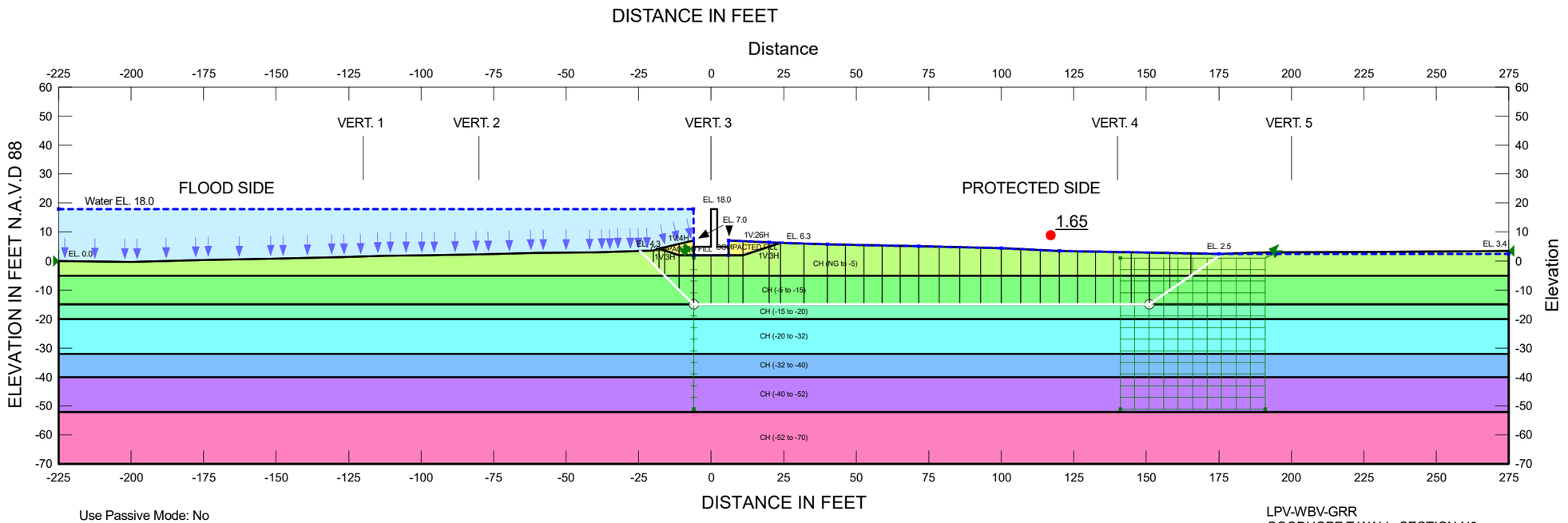
Current Slip Surface

Slip Surface: 1,292
Factor of Safety: 1.50
Volume: 4,115.4191 ft³
Weight: 385,991.36 lbf
Resisting Moment: 1,375,209.6 lbf·ft
Activating Moment: 916,074.72 lbf·ft
Resisting Force: 35,634.86 lbf
Activating Force: 23,768.855 lbf
Slip Rank: 1 of 3,850 slip surfaces
Exit: (208.53998, 0.90021286) ft
Entry: (-28.798586, 4.1302848) ft
Radius: 85.782608 ft
Center: (89.903665, 4.9378028) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-26.649293 ft	2.326814 ft	978.00681 psf	825.15737 psf	-0 psf	416.70467 psf	0 psf	CH (NG to -5)
Slice 2	-22.55 ft	-1.1129011 ft	1,192.645 psf	1,220.9874 psf	0 psf	425.67188 psf	0 psf	CH (NG to -5)
Slice 3	-19.258768 ft	-3.8745727 ft	1,364.9733 psf	1,557.4158 psf	0 psf	432.87145 psf	0 psf	CH (NG to -5)
Slice 4	-14.458768 ft	-7.9022509 ft	1,616.3005 psf	2,101.0309 psf	0 psf	148.19265 psf	0 psf	CH (-5 to -15)
Slice 5	-8.55 ft	-12.860296 ft	1,925.6825 psf	2,545.4498 psf	0 psf	148.93125 psf	0 psf	CH (-5 to -15)
Slice 6	-6.065613 ft	-14.944944 ft	1,712.4444 psf	2,401.4359 psf	0 psf	149.2418 psf	0 psf	CH (-5 to -15)
Slice 7	-6.015613 ft	-14.986899 ft	1,215.8624 psf	2,073.9363 psf	0 psf	149.24805 psf	0 psf	CH (-5 to -15)
Slice 8	-3 ft	-15 ft	1,060.8 psf	1,653.8723 psf	0 psf	149.625 psf	0 psf	CH (-5 to -15)
Slice 9	3 ft	-15 ft	1,060.8 psf	1,656.3834 psf	0 psf	149.78571 psf	0 psf	CH (-5 to -15)
Slice			1,370.3497	2,220.7294		149.39286		CH (-5 to

10	8.5 ft	-15 ft	psf	psf	0 psf	psf	0 psf	-15)
Slice 11	14.525 ft	-15 ft	1,364.4446 psf	2,204.4529 psf	0 psf	148.9625 psf	0 psf	CH (-5 to -15)
Slice 12	21.575 ft	-15 ft	1,357.5349 psf	2,183.3166 psf	0 psf	148.45893 psf	0 psf	CH (-5 to -15)
Slice 13	29.00625 ft	-15 ft	1,347.06 psf	2,151.5753 psf	0 psf	147.92812 psf	0 psf	CH (-5 to -15)
Slice 14	36.81875 ft	-15 ft	1,333.02 psf	2,112.7632 psf	0 psf	147.37009 psf	0 psf	CH (-5 to -15)
Slice 15	44.63125 ft	-15 ft	1,318.98 psf	2,074.4031 psf	0 psf	146.81205 psf	0 psf	CH (-5 to -15)
Slice 16	52.44375 ft	-15 ft	1,304.94 psf	2,036.495 psf	0 psf	146.25402 psf	0 psf	CH (-5 to -15)
Slice 17	60.25625 ft	-15 ft	1,290.9 psf	1,999.0389 psf	0 psf	145.69598 psf	0 psf	CH (-5 to -15)
Slice 18	68.06875 ft	-15 ft	1,276.86 psf	1,962.0349 psf	0 psf	145.13795 psf	0 psf	CH (-5 to -15)
Slice 19	75.88125 ft	-15 ft	1,262.82 psf	1,925.4828 psf	0 psf	144.57991 psf	0 psf	CH (-5 to -15)
Slice 20	83.69375 ft	-15 ft	1,248.78 psf	1,889.3828 psf	0 psf	144.02187 psf	0 psf	CH (-5 to -15)
Slice 21	91.34 ft	-15 ft	1,236.144 psf	1,856.3706 psf	0 psf	143.47571 psf	0 psf	CH (-5 to -15)
Slice 22	98.82 ft	-15 ft	1,224.912 psf	1,826.367 psf	0 psf	142.94143 psf	0 psf	CH (-5 to -15)
Slice 23	106.3 ft	-15 ft	1,213.68 psf	1,796.7097 psf	0 psf	142.40714 psf	0 psf	CH (-5 to -15)
Slice 24	113.78 ft	-15 ft	1,202.448 psf	1,767.3985 psf	0 psf	141.87286 psf	0 psf	CH (-5 to -15)
Slice 25	121.26 ft	-15 ft	1,191.216 psf	1,738.4336 psf	0 psf	141.33857 psf	0 psf	CH (-5 to -15)
Slice 26	129.35 ft	-15 ft	1,170 psf	1,692.7652 psf	0 psf	140.76071 psf	0 psf	CH (-5 to -15)
Slice 27	138.05 ft	-15 ft	1,138.8 psf	1,630.9726 psf	0 psf	140.13929 psf	0 psf	CH (-5 to -15)
Slice 28	146.75 ft	-15 ft	1,107.6 psf	1,560.9334 psf	0 psf	135.5 psf	0 psf	CH (-5 to -15)
Slice 29	154.8375 ft	-15 ft	1,085.5045 psf	1,506.2484 psf	0 psf	130.10833 psf	0 psf	CH (-5 to -15)
Slice 30	162.3125 ft	-15 ft	1,072.5134 psf	1,468.4257 psf	0 psf	125.125 psf	0 psf	CH (-5 to -15)
Slice 31	169.7875 ft	-15 ft	1,059.5224 psf	1,431.6405 psf	0 psf	120.14167 psf	0 psf	CH (-5 to -15)
Slice 32	177.2625 ft	-15 ft	1,046.5314 psf	1,395.8928 psf	0 psf	115.15833 psf	0 psf	CH (-5 to -15)
Slice 33	185.33013 ft	-12.5 ft	876.5104 psf	1,226.8227 psf	0 psf	109.77992 psf	0 psf	CH (-5 to -15)
Slice 34	193.99038 ft	-7.5 ft	549.45948 psf	776.10469 psf	0 psf	104.00641 psf	0 psf	CH (-5 to -15)
Slice 35	203.43024 ft	-2.0498936 ft	192.96701 psf	294.44621 psf	0 psf	100 psf	0 psf	CH (NG to -5)



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE T-WALL, SECTION N6

TOW BLOCK

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

The profile of monolith N6 is based on cross sections taken at B/L Sta. NOs. 146+75, 147+00, and 147+13

Name: N6_TOW_Block (2)
File Name: Goodhope Monolith N6.gsz Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N6_TOW_Block (2)

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File Information

File Version: 10.00
Title: Goodhope Monolith N6
Created By: Chaisson, Kathryn MVN
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 35
Date: 05/06/2020
Time: 03:30:55 PM
Tool Version: 10.0.0.17401
File Name: Goodhope Monolith N6.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Solved Date: 05/06/2020
Last Solved Time: 03:31:24 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

N6_TOW_Block (2)

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Restrict Block Crossing: Yes
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Slices: 30
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100
  - Tolerable difference in F of S: 0.01
- Solution Settings
  - Search Method: Root Finder
  - Tolerable difference between starting and converged F of S: 3
  - Maximum iterations to calculate converged lambda: 20
  - Max Absolute Lambda: 2

Materials

COMPACTED FILL

Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)

Model: Spatial Mohr-Coulomb

Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (-225, 0) ft
Right Coordinate: (275, 3.4) ft

Slip Surface Block

Left Grid
Upper Left: (-6, 1) ft
Lower Left: (-6, -51) ft
Lower Right: (-6, -51) ft
X Increments: 1
Y Increments: 13
Starting Angle: 125 °
Ending Angle: 145 °
Angle Increments: 4
Right Grid
Starting Angle: 25 °
Ending Angle: 45 °
Upper Left: (141, 1) ft
Lower Left: (141, -51) ft
Lower Right: (191, -51) ft
X Increments: 10
Y Increments: 13
Angle Increments: 4

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-225 ft	18 ft
Coordinate 2	-6.1 ft	18 ft
Coordinate 3	-6 ft	2 ft
Coordinate 4	6 ft	2 ft
Coordinate 5	6 ft	7 ft
Coordinate 6	20 ft	6.4 ft
Coordinate 7	40 ft	5.7 ft

Coordinate 8	71.5 ft	5.1 ft
Coordinate 9	100 ft	4.5 ft
Coordinate 10	120.1 ft	3.4 ft
Coordinate 11	175 ft	2.5 ft
Coordinate 12	275 ft	2.5 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 300)
Data Point: (0, 475)
Data Point: (140, 300)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 140)
Data Point: (0, 150)
Data Point: (140, 140)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 83 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 80)
Data Point: (0, 83)
Data Point: (140, 80)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)

Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 98)
Data Point: (0, 100)
Data Point: (140, 98)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 123)
Data Point: (-120, 123)
Data Point: (-80, 122)
Data Point: (0, 120)
Data Point: (140, 122)
Data Point: (200, 123)
Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -15, 125)
Data Point: (-120, -15, 125)
Data Point: (-80, -15, 140)
Data Point: (0, -15, 225)

Data Point: (140, -15, 140)
Data Point: (200, -15, 125)
Data Point: (275, -15, 125)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)
Data Point: (-225, -32, 200)
Data Point: (-120, -32, 200)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 200)
Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)

Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-225 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-225 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-225 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-225 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-225 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-225 ft	-15 ft
Point 12	275 ft	-15 ft
Point 13	-225 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-6 ft	7 ft
Point 16	-6 ft	5 ft
Point 17	-6 ft	2 ft
Point 18	-11 ft	2 ft
Point 19	6 ft	2 ft
Point 20	6 ft	5 ft
Point 21	6 ft	7 ft
Point 22	11 ft	2 ft
Point 23	-225 ft	0 ft
Point 24	-200 ft	-0.3 ft
Point 25	-175.5 ft	0.4 ft
Point 26	-149.8 ft	0.8 ft
Point 27	-128.7 ft	1.3 ft
Point 28	-112.8 ft	1.9 ft
Point 29	-97.7 ft	2 ft
Point 30	-79 ft	2.3 ft
Point 31	-60 ft	2.8 ft
Point 32	-39.9 ft	3 ft
Point 33	-30 ft	3.3 ft
Point 34	-20 ft	3.6 ft
Point 35	23.9 ft	6.3 ft
Point 36	40 ft	5.7 ft
Point 37	71.5 ft	5.1 ft
Point 38	100 ft	4.5 ft
Point 39	120.1 ft	3.4 ft
Point 40	175 ft	2.5 ft

Point 41	191.4 ft	2.9 ft
Point 42	225.6 ft	3.1 ft
Point 43	275 ft	3.4 ft
Point 44	-17.9 ft	4.3 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,000 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,000 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,000 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,000 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,500 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,000 ft²
Region 7	CH (NG to -5)	13,23,24,25,26,27,28,29,30,31,32,33,34,44,18,17,19,22,35,36,37,38,39,40,41,42,43,14	3,882.4 ft²
Region 8	COMPACTED FILL	44,15,16,17,18	35.5 ft²
Region 9	COMPACTED FILL	19,20,21,35,22	55.5 ft²

Slip Results

Slip Surfaces Analysed: 1948 of 3850 converged

Current Slip Surface

Slip Surface: 1,223
Factor of Safety: 1.65
Volume: 3,499.3845 ft³
Weight: 333,101.91 lbf
Resisting Moment: 1,222,353.4 lbf·ft
Activating Moment: 741,132.9 lbf·ft
Resisting Force: 31,783.487 lbf
Activating Force: 19,344.728 lbf
Slip Rank: 1 of 3,850 slip surfaces
Exit: (176.02841, 2.5250832) ft
Entry: (-24.466019, 3.4660194) ft
Radius: 73.067621 ft
Center: (75.784509, 3.7012535) ft

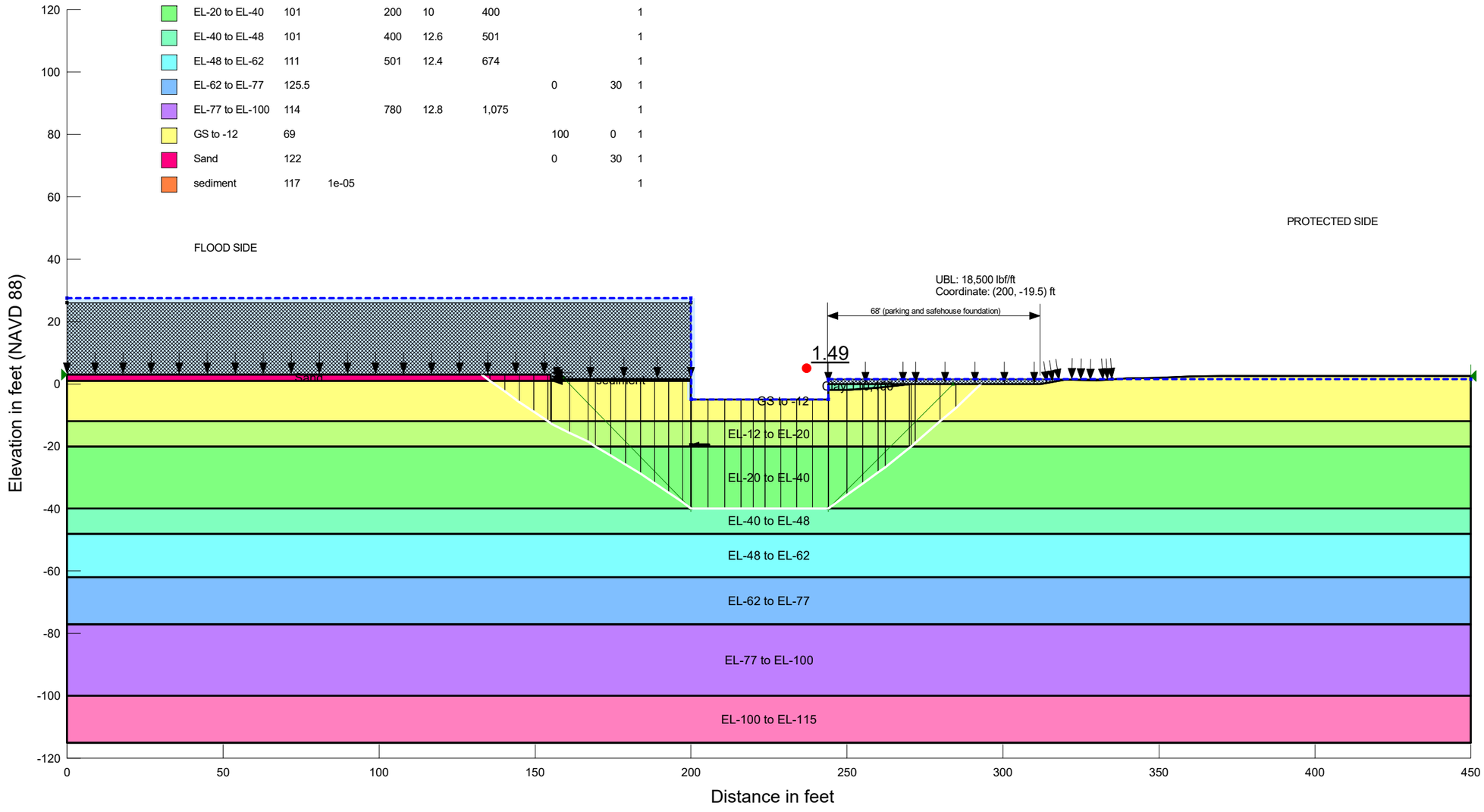
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-22.23301 ft	1.2330097 ft	1,046.2602 psf	884.93147 psf	-0 psf	426.36529 psf	0 psf	CH (NG to -5)
Slice 2	-18.95 ft	-2.05 ft	1,251.12 psf	1,257.1472 psf	0 psf	433.54688 psf	0 psf	CH (NG to -5)
Slice				1,510.5901		437.92188		CH (NG

3	-16.95 ft	-4.05 ft	1,375.92 psf	psf	0 psf	psf	0 psf	to -5)
Slice 4	-13.5 ft	-7.5 ft	1,591.2 psf	2,026.6714 psf	0 psf	148.3125 psf	0 psf	CH (-5 to -15)
Slice 5	-8.55 ft	-12.45 ft	1,900.08 psf	2,488.8701 psf	0 psf	148.93125 psf	0 psf	CH (-5 to -15)
Slice 6	-6.0656029 ft	-14.934397 ft	1,711.6855 psf	2,390.9595 psf	0 psf	149.2418 psf	0 psf	CH (-5 to -15)
Slice 7	-6.0156029 ft	-14.984397 ft	1,215.6055 psf	2,065.3149 psf	0 psf	149.24805 psf	0 psf	CH (-5 to -15)
Slice 8	-3 ft	-15 ft	1,060.8 psf	1,653.0166 psf	0 psf	149.625 psf	0 psf	CH (-5 to -15)
Slice 9	3 ft	-15 ft	1,060.8 psf	1,655.5268 psf	0 psf	149.78571 psf	0 psf	CH (-5 to -15)
Slice 10	8.5 ft	-15 ft	1,366.1143 psf	2,213.1477 psf	0 psf	149.39286 psf	0 psf	CH (-5 to -15)
Slice 11	15.5 ft	-15 ft	1,347.3943 psf	2,175.3684 psf	0 psf	148.89286 psf	0 psf	CH (-5 to -15)
Slice 12	21.95 ft	-15 ft	1,331.1012 psf	2,138.301 psf	0 psf	148.43214 psf	0 psf	CH (-5 to -15)
Slice 13	27.925 ft	-15 ft	1,318.0518 psf	2,102.5191 psf	0 psf	148.00536 psf	0 psf	CH (-5 to -15)
Slice 14	35.975 ft	-15 ft	1,300.4706 psf	2,055.2305 psf	0 psf	147.43036 psf	0 psf	CH (-5 to -15)
Slice 15	43.15 ft	-15 ft	1,287.936 psf	2,020.0591 psf	0 psf	146.91786 psf	0 psf	CH (-5 to -15)
Slice 16	49.45 ft	-15 ft	1,280.448 psf	1,996.685 psf	0 psf	146.46786 psf	0 psf	CH (-5 to -15)
Slice 17	55.75 ft	-15 ft	1,272.96 psf	1,973.5053 psf	0 psf	146.01786 psf	0 psf	CH (-5 to -15)
Slice 18	62.05 ft	-15 ft	1,265.472 psf	1,950.5201 psf	0 psf	145.56786 psf	0 psf	CH (-5 to -15)
Slice 19	68.35 ft	-15 ft	1,257.984 psf	1,927.7292 psf	0 psf	145.11786 psf	0 psf	CH (-5 to -15)
Slice 20	75.0625 ft	-15 ft	1,249.56 psf	1,902.886 psf	0 psf	144.63839 psf	0 psf	CH (-5 to -15)
Slice 21	82.1875 ft	-15 ft	1,240.2 psf	1,876.0509 psf	0 psf	144.12946 psf	0 psf	CH (-5 to -15)
Slice 22	89.3125 ft	-15 ft	1,230.84 psf	1,849.4906 psf	0 psf	143.62054 psf	0 psf	CH (-5 to -15)
Slice 23	96.4375 ft	-15 ft	1,221.48 psf	1,823.2052 psf	0 psf	143.11161 psf	0 psf	CH (-5 to -15)
Slice 24	103.35 ft	-15 ft	1,205.36 psf	1,786.154 psf	0 psf	142.61786 psf	0 psf	CH (-5 to -15)
Slice 25	110.05 ft	-15 ft	1,182.48 psf	1,738.6049 psf	0 psf	142.13929 psf	0 psf	CH (-5 to -15)
Slice 26	116.75 ft	-15 ft	1,159.6 psf	1,691.6875 psf	0 psf	141.66071 psf	0 psf	CH (-5 to -15)
Slice 27	123.19 ft	-15 ft	1,144.9991 psf	1,659.2871 psf	0 psf	141.20071 psf	0 psf	CH (-5 to -15)
Slice 28	129.37 ft	-15 ft	1,138.6772 psf	1,641.0506 psf	0 psf	140.75929 psf	0 psf	CH (-5 to -15)
Slice 29	135.55 ft	-15 ft	1,132.3554 psf	1,622.9751 psf	0 psf	140.31786 psf	0 psf	CH (-5 to -15)
Slice 30	141.73 ft	-15 ft	1,126.0336 psf	1,602.5616 psf	0 psf	138.84667 psf	0 psf	CH (-5 to -15)

Slice 31	147.91 ft	-15 ft	1,119.7117 psf	1,576.0451 psf	0 psf	134.72667 psf	0 psf	CH (-5 to -15)
Slice 32	154.57037 ft	-12.5 ft	956.89851 psf	1,434.661 psf	0 psf	130.28642 psf	0 psf	CH (-5 to -15)
Slice 33	161.71111 ft	-7.5 ft	637.59388 psf	993.30734 psf	0 psf	125.52593 psf	0 psf	CH (-5 to -15)
Slice 34	170.14074 ft	-1.5975095 ft	260.65538 psf	474.36105 psf	0 psf	199.53087 psf	0 psf	CH (NG to -5)
Slice 35	175.4963 ft	2.1524905 ft	21.684595 psf	114.48822 psf	0 psf	181.67902 psf	0 psf	CH (NG to -5)
Slice 36	176.0105 ft	2.5125416 ft	-0.78259698 psf	82.38105 psf	0 psf	179.965 psf	0 psf	CH (NG to -5)

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay 110,400	110					400	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-12 to EL-20	101		100	12.5	200			1
	EL-20 to EL-40	101		200	10	400			1
	EL-40 to EL-48	101		400	12.6	501			1
	EL-48 to EL-62	111		501	12.4	674			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					100	0	1
	Sand	122					0	30	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N1-N2)_EWL_6in sediment.gsz
SubFile: EL -40 Fully Specified w/ UBL

LPV-WBV GRR
GIWW T-WALL, N1 & N2 SECTIONS

TOW EL -40 FULLY-SPECIFIED WITH UBL

EL -40 Fully Specified w/ UBL

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File Information

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Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 06/03/2020
Last Solved Time: 01:45:22 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

EL -40 Fully Specified w/ UBL

Kind: SLOPE/W
Method: Spencer
Settings
PWP Conditions from: Piezometric Line
Apply Phreatic Correction: No
Use Staged Rapid Drawdown: No
Unit Weight of Water: 62.4 pcf
Slip Surface
Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Fully-Specified
Critical slip surfaces saved: 1
Optimize Critical Slip Surface Location: Yes
Optimizations Settings
Maximum Iterations: 10,000
Convergence Tolerance: 1e-07
Starting Points: 8
Ending Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °
Tension Crack Option: (none)
Distribution
F of S Calculation Option: Constant
Advanced

Geometry Settings
Minimum Slip Surface Depth: 0.1 ft
Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 100 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 100 psf
C-Rate of Change: 12.5 (lbf/ft²)/ft
C-Maximum: 200 psf
Pore Water Pressure
Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 200 psf
C-Rate of Change: 10 (lbf/ft²)/ft
C-Maximum: 400 psf
Pore Water Pressure
Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 400 psf
C-Rate of Change: 12.6 (lbf/ft²)/ft
C-Maximum: 501 psf
Pore Water Pressure
Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)
Unit Weight: 111 pcf
C-Top of Layer: 501 psf
C-Rate of Change: 12.4 (lbf/ft²)/ft
C-Maximum: 674 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft²)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft²)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	159 ft	2 ft
	200 ft	-40 ft
	244 ft	-40 ft
	284 ft	0 ft

Slip Surface Limits

Left Coordinate: (0, 3) ft
Right Coordinate: (450, 2.6) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	200 ft	27.5 ft
Coordinate 3	200.1 ft	-5 ft
Coordinate 4	244.01 ft	-5 ft
Coordinate 5	244.01 ft	1.5 ft
Coordinate 6	450 ft	1.5 ft

Point Loads

Point Load 1

Coordinate: (200, -19.5) ft
Magnitude: 18,500 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	0 ft	26 ft
	199.99 ft	26 ft

Surcharge Load 2

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	244.001 ft	1.5 ft
	335 ft	1.5 ft

Points

	X	Y
Point 1	0 ft	-12 ft
Point 2	0 ft	-20 ft
Point 3	0 ft	-40 ft
Point 4	0 ft	-48 ft
Point 5	0 ft	-62 ft
Point 6	0 ft	-77 ft
Point 7	0 ft	-100 ft
Point 8	0 ft	-115 ft
Point 9	450 ft	-12 ft
Point 10	450 ft	-20 ft
Point 11	450 ft	-40 ft
Point 12	450 ft	-48 ft
Point 13	450 ft	-62 ft
Point 14	450 ft	-77 ft
Point 15	450 ft	-100 ft
Point 16	450 ft	-115 ft
Point 17	200 ft	-5 ft
Point 18	244 ft	-5 ft
Point 19	244 ft	-2 ft
Point 20	0 ft	1 ft
Point 21	450 ft	2.6 ft
Point 22	200 ft	1 ft
Point 23	250 ft	-2 ft
Point 24	260 ft	-1.2 ft

Point 25	270 ft	0 ft
Point 26	320 ft	1.4 ft
Point 27	330 ft	1.1 ft
Point 28	340 ft	1.8 ft
Point 29	350 ft	2 ft
Point 30	370 ft	2.6 ft
Point 31	360 ft	2.4 ft
Point 32	155 ft	3 ft
Point 33	155 ft	1 ft
Point 34	0 ft	3 ft
Point 35	244 ft	0 ft
Point 36	312 ft	0 ft
Point 37	200 ft	1.5 ft
Point 38	155 ft	1.5 ft

Regions

	Material	Points	Area
Region 1	EL-100 to EL-115	7,15,16,8	6,750 ft²
Region 2	EL-77 to EL-100	6,14,15,7	10,350 ft²
Region 3	EL-62 to EL-77	5,13,14,6	6,750 ft²
Region 4	EL-48 to EL-62	4,12,13,5	6,300 ft²
Region 5	EL-40 to EL-48	3,11,12,4	3,600 ft²
Region 6	EL-20 to EL-40	2,10,11,3	9,000 ft²
Region 7	EL-12 to EL-20	1,9,10,2	3,600 ft²
Region 8	GS to -12	20,33,22,17,18,19,23,24,25,36,26,27,28,29,31,30,21,9,1	5,652.6 ft²
Region 9	Sand	20,34,32,38,33	310 ft²
Region 10	Clay 110,400	19,35,25,24,23	34 ft²
Region 11	sediment	33,38,37,22	22.5 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.49
Volume: 3,954.106 ft³
Weight: 352,765.43 lbf
Resisting Moment: 2,119,754.5 lbf·ft
Activating Moment: 1,426,917.1 lbf·ft
Resisting Force: 41,572.346 lbf
Activating Force: 28,005.021 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (292.92646, 0) ft
Entry: (132.89808, 3) ft

Radius: 67.956596 ft
Center: (221.7576, 1.875) ft

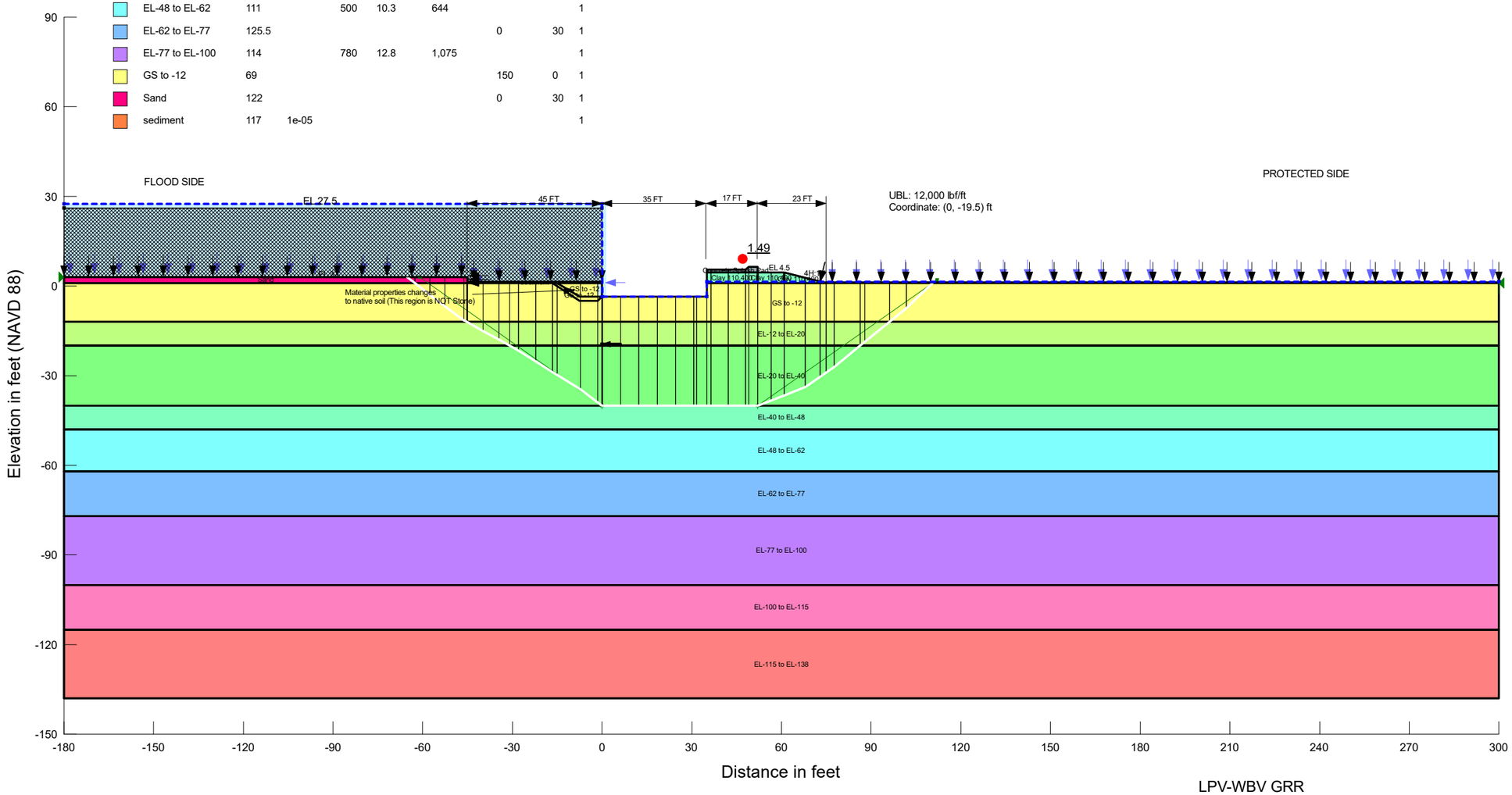
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	134.25862 ft	2 ft	1,591.2 psf	1,625.6631 psf	19.89727 psf	0 psf	0 psf	Sand
Slice 2	137.94667 ft	-0.7107125 ft	1,760.3485 psf	1,823.8729 psf	0 psf	100 psf	0 psf	GS to -12
Slice 3	142.60167 ft	-4.1321375 ft	1,973.8454 psf	2,055.7524 psf	0 psf	100 psf	0 psf	GS to -12
Slice 4	147.23616 ft	-7.3821375 ft	2,176.6454 psf	2,284.2328 psf	0 psf	100 psf	0 psf	GS to -12
Slice 5	151.85013 ft	-10.460712 ft	2,368.7485 psf	2,493.2191 psf	0 psf	100 psf	0 psf	GS to -12
Slice 6	154.57856 ft	-12.2812 ft	2,482.3469 psf	2,692.7366 psf	0 psf	103.515 psf	0 psf	EL-12 to EL-20
Slice 7	155.15972 ft	-12.66897 ft	2,506.5437 psf	2,571.1044 psf	0 psf	108.36213 psf	0 psf	EL-12 to EL-20
Slice 8	158.22612 ft	-14.20985 ft	2,602.6946 psf	2,742.2453 psf	0 psf	127.62313 psf	0 psf	EL-12 to EL-20
Slice 9	164.03949 ft	-17.07847 ft	2,781.6965 psf	3,017.3334 psf	0 psf	163.48087 psf	0 psf	EL-12 to EL-20
Slice 10	168.17594 ft	-19.25639 ft	2,917.5987 psf	3,203.4318 psf	0 psf	190.70487 psf	0 psf	EL-12 to EL-20
Slice 11	171.80609 ft	-21.451448 ft	3,054.5704 psf	3,412.7331 psf	0 psf	214.51448 psf	0 psf	EL-20 to EL-40
Slice 12	176.60685 ft	-24.354345 ft	3,235.7111 psf	3,690.4719 psf	0 psf	243.54345 psf	0 psf	EL-20 to EL-40
Slice 13	181.40761 ft	-27.257242 ft	3,416.8519 psf	3,968.2107 psf	0 psf	272.57242 psf	0 psf	EL-20 to EL-40
Slice 14	186.05859 ft	-30.230265 ft	3,602.3685 psf	4,231.0346 psf	0 psf	302.30265 psf	0 psf	EL-20 to EL-40
Slice 15	190.55981 ft	-33.273415 ft	3,792.2611 psf	4,520.2524 psf	0 psf	332.73415 psf	0 psf	EL-20 to EL-40
Slice 16	195.06101 ft	-36.316565 ft	3,982.1537 psf	4,809.4703 psf	0 psf	363.16565 psf	0 psf	EL-20 to EL-40
Slice	198.65081	-38.915049	4,144.2991	5,007.9435	0 psf	389.15049	0 psf	EL-20 to

17	ft	ft	psf	psf		psf		EL-40
Slice 18	199.995 ft	-39.995979 ft	4,211.7491 psf	78,446.901 psf	0 psf	399.95979 psf	0 psf	EL-20 to EL-40
Slice 19	200.05 ft	-40 ft	3,198 psf	4,331.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 20	202.76537 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 21	208.09609 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 22	213.42683 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 23	218.01942 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 24	221.80113 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 25	226.19868 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 26	231.28477 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 27	236.37086 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 28	241.45695 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 29	244.0005 ft	-39.999636 ft	2,183.9773 psf	4,012.4907 psf	0 psf	399.99636 psf	0 psf	EL-20 to EL-40
Slice 30	244.0055 ft	-39.995993 ft	2,183.75 psf	4,013.0138 psf	0 psf	399.95993 psf	0 psf	EL-20 to EL-40
Slice 31	247.005 ft	-37.810866 ft	2,452.998 psf	3,872.3279 psf	0 psf	378.10866 psf	0 psf	EL-20 to EL-40
Slice 32	252.5 ft	-33.807773 ft	2,203.2051 psf	3,431.6391 psf	0 psf	338.07773 psf	0 psf	EL-20 to EL-40
Slice 33	257.5 ft	-30.165287 ft	1,975.9139 psf	3,021.5464 psf	0 psf	301.65287 psf	0 psf	EL-20 to EL-40
Slice 34	261.12197 ft	-27.526692 ft	1,811.2656 psf	2,722.6041 psf	0 psf	275.26692 psf	0 psf	EL-20 to EL-40
Slice 35	266.12197 ft	-23.576013 ft	1,564.7432 psf	2,288.2658 psf	0 psf	235.76013 psf	0 psf	EL-20 to EL-40
Slice 36	270.27395 ft	-20.221343 ft	1,355.4118 psf	1,903.9372 psf	0 psf	202.21343 psf	0 psf	EL-20 to EL-40
Slice 37	271.23737 ft	-19.44293 ft	1,306.8388 psf	1,818.48 psf	0 psf	193.03662 psf	0 psf	EL-12 to EL-20

Slice 38	275.91678 ft	-15.443575 ft	1,057.2791 psf	1,385.0734 psf	0 psf	143.04469 psf	0 psf	EL-12 to EL-20
Slice 39	282.41595 ft	-9.833515 ft	707.21134 psf	850.85586 psf	0 psf	100 psf	0 psf	GS to -12
Slice 40	288.92583 ft	-3.83287 ft	332.77109 psf	435.30679 psf	0 psf	100 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay 110,400	110					400	0	1
	Concrete Splash Pad	145					20,000	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-115 to EL-138	108		1,093	10	1,323			1
	EL-12 to EL-20	101		150	10.3	212			1
	EL-20 to EL-40	101		212	10.3	418			1
	EL-40 to EL-48	101		418	10.3	500			1
	EL-48 to EL-62	111		500	10.3	644			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					150	0	1
	Sand	122					0	30	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N3 to N10)_EWL_6in sediment.gsz
SubFile: EWL-EL-40 fully specified

LPV-WBV GRR
GIWW T-WALL, N3 TO N10 SECTIONS

TOW EL -40 FULLY-SPECIFIED WITH UBL

EWL-EL-40 fully specified

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File Information

File Version: 10.00
Created By: Rebecca Scherer
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 478
Date: 06/04/2020
Time: 01:06:37 PM
Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N3 to N10)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 06/04/2020
Last Solved Time: 01:07:10 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

EWL-EL-40 fully specified

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Fully-Specified
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 4,000
  - Convergence Tolerance: 1e-07
  - Starting Points: 8
  - Ending Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced

Geometry Settings
Minimum Slip Surface Depth: 0.1 ft
Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 150 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 150 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 212 psf
Pore Water Pressure
Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 212 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 418 psf
Pore Water Pressure
Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 418 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 500 psf
Pore Water Pressure
Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)

Unit Weight: 111 pcf
C-Top of Layer: 500 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 644 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft²)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft²)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

EL-115 to EL-138

Model: S=f(depth)
Unit Weight: 108 pcf
C-Top of Layer: 1,093 psf
C-Rate of Change: 10 (lbf/ft²)/ft
C-Maximum: 1,323 psf
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	-61 ft	3 ft
	0 ft	-40 ft
	52 ft	-40 ft
	112 ft	2 ft

Slip Surface Limits

Left Coordinate: (-180, 3) ft
Right Coordinate: (300, 1) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-180 ft	27.5 ft
Coordinate 2	0 ft	27.5 ft
Coordinate 3	0.1 ft	-3.5 ft
Coordinate 4	35 ft	-3.5 ft

Coordinate 5	35 ft	1.5 ft
Coordinate 6	300 ft	1.5 ft

Point Loads

Point Load 1

Coordinate: (0, -19.5) ft
Magnitude: 12,000 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1.6 pcf
Direction: Normal

Coordinates

	X	Y
	-180 ft	26 ft
	-0.001 ft	26 ft

Surcharge Load 2

Surcharge (Unit Weight): 1.6 pcf
Direction: Normal

Coordinates

	X	Y
	73 ft	1.5 ft
	300 ft	1.5 ft

Points

	X	Y
Point 1	-180 ft	1 ft
Point 2	-180 ft	-12 ft
Point 3	-180 ft	-20 ft
Point 4	-180 ft	-40 ft
Point 5	-180 ft	-48 ft
Point 6	-180 ft	-62 ft
Point 7	-180 ft	-77 ft
Point 8	-180 ft	-100 ft
Point 9	-180 ft	-115 ft
Point 10	-180 ft	-138 ft
Point 11	300 ft	1 ft
Point 12	300 ft	-12 ft

Point 13	300 ft	-20 ft
Point 14	300 ft	-40 ft
Point 15	300 ft	-48 ft
Point 16	300 ft	-62 ft
Point 17	300 ft	-77 ft
Point 18	300 ft	-100 ft
Point 19	300 ft	-115 ft
Point 20	300 ft	-138 ft
Point 21	35 ft	-3.5 ft
Point 22	0 ft	-3.5 ft
Point 23	0 ft	1 ft
Point 24	-1.5 ft	-5 ft
Point 25	-7.5 ft	-5 ft
Point 26	-16.5 ft	1 ft
Point 27	-15 ft	1 ft
Point 28	-7.5 ft	-3.5 ft
Point 29	35 ft	1 ft
Point 30	35 ft	4.5 ft
Point 31	52 ft	4.5 ft
Point 32	61 ft	4.5 ft
Point 33	75 ft	1 ft
Point 34	52 ft	1 ft
Point 35	61 ft	1 ft
Point 36	35 ft	5.5 ft
Point 37	52 ft	6.5 ft
Point 38	49 ft	6.5 ft
Point 39	48 ft	5.5 ft
Point 40	-45 ft	1 ft
Point 41	-180 ft	3 ft
Point 42	-45 ft	3 ft
Point 43	0 ft	1.5 ft
Point 44	-45 ft	1.5 ft

Regions

	Material	Points	Area
Region 1	GS to -12	27,26,25,24,22,28	20.25 ft²
Region 2	GS to -12	27,23,22,28	50.625 ft²
Region 3	EL-115 to EL-138	10,20,19,9	11,040 ft²
Region 4	EL-100 to EL-115	8,18,19,9	7,200 ft²
Region 5	EL-77 to EL-100	7,17,18,8	11,040 ft²
Region 6	EL-62 to EL-77	6,16,17,7	7,200 ft²
Region 7	EL-48 to EL-62	5,15,16,6	6,720 ft²
Region 8	EL-40 to EL-48	4,14,15,5	3,840 ft²
Region 9	EL-20 to EL-40	3,13,14,4	9,600 ft²
Region 10	EL-12 to EL-20	2,12,13,3	3,840 ft²

Region 11	GS to -12	1,40,26,25,24,22,21,29,34,35,33,11,12,2	6,011.6 ft²
Region 12	Clay 110,400	30,31,34,29	59.5 ft²
Region 13	Clay 110,400	31,32,35,34	31.5 ft²
Region 14	Clay 110,400	32,35,33	24.5 ft²
Region 15	Concrete Splash Pad	36,39,38,37,31,30	20.5 ft²
Region 16	Sand	41,42,44,40,1	270 ft²
Region 17	sediment	40,44,43,23,27,26	22.5 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.49
Volume: 4,864.1333 ft³
Weight: 433,742.75 lbf
Resisting Moment: 2,854,236.7 lbf·ft
Activating Moment: 1,910,749.6 lbf·ft
Resisting Force: 52,156.922 lbf
Activating Force: 35,009.789 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (110.57869, 1) ft
Entry: (-65.180666, 3) ft
Radius: 73.098779 ft
Center: (24.8032, 3.5) ft

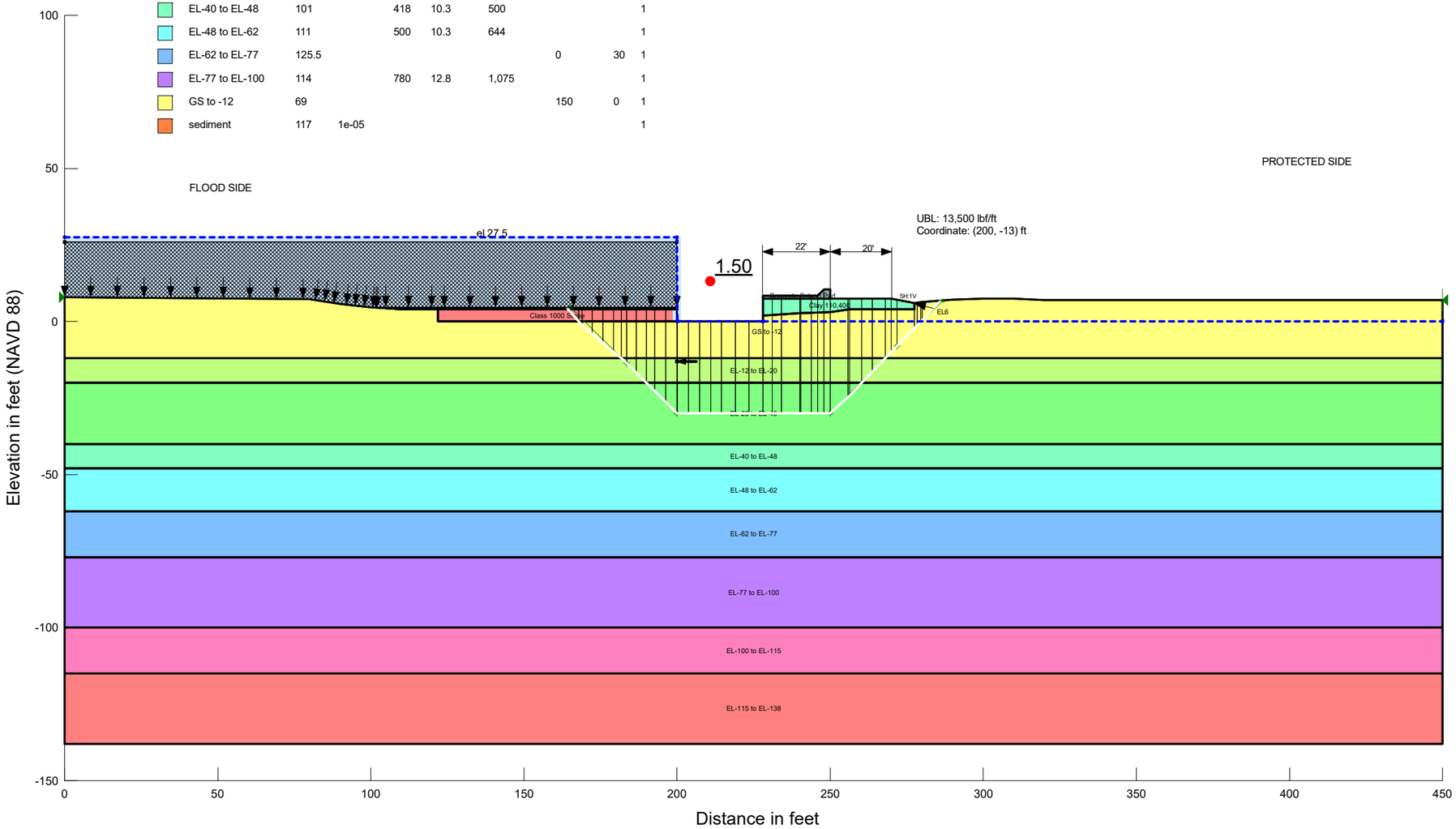
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-63.900922 ft	2 ft	1,591.2 psf	1,633.5392 psf	24.444528 psf	0 psf	0 psf	Sand
Slice 2	-60.105036 ft	-0.96613 ft	1,776.2865 psf	1,823.7505 psf	0 psf	150 psf	0 psf	GS to -12
Slice 3	-55.072752 ft	-4.89839 ft	2,021.6595 psf	2,088.2951 psf	0 psf	150 psf	0 psf	GS to -12
Slice 4	-49.34421 ft	-9.17897 ft	2,288.7677 psf	2,386.8573 psf	0 psf	150 psf	0 psf	GS to -12
Slice 5	-45.67528 ft	-11.74671 ft	2,448.9947 psf	2,589.8517 psf	0 psf	150 psf	0 psf	GS to -12
Slice 6	-45.109375 ft	-12.060683 ft	2,468.5866 psf	2,969.3106 psf	0 psf	150.62503 psf	0 psf	EL-12 to EL-20
Slice 7	-42.389072	-13.569949	2,562.7648 psf	2,669.3268 psf	0 psf	166.17048 psf	0 psf	EL-12 to EL-20

	ft	ft						
Slice 8	-37.167217 ft	-16.467116 ft	2,743.5481 psf	2,946.524 psf	0 psf	196.0113 psf	0 psf	EL-12 to EL-20
Slice 9	-32.700745 ft	-18.95785 ft	2,898.9698 psf	3,186.4867 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 10	-29.363755 ft	-20.83204 ft	3,015.9193 psf	3,369.3923 psf	0 psf	220.57001 psf	0 psf	EL-20 to EL-40
Slice 11	-25.036732 ft	-23.453622 ft	3,179.506 psf	3,601.3617 psf	0 psf	247.57231 psf	0 psf	EL-20 to EL-40
Slice 12	-19.345578 ft	-27.032706 ft	3,402.8409 psf	3,941.2072 psf	0 psf	284.43687 psf	0 psf	EL-20 to EL-40
Slice 13	-15.75 ft	-29.293912 ft	3,543.9401 psf	4,155.916 psf	0 psf	307.7273 psf	0 psf	EL-20 to EL-40
Slice 14	-11.13019 ft	-32.199243 ft	3,725.2328 psf	4,431.7866 psf	0 psf	337.6522 psf	0 psf	EL-20 to EL-40
Slice 15	-4.38019 ft	-36.762033 ft	4,009.9508 psf	4,820.2565 psf	0 psf	384.64894 psf	0 psf	EL-20 to EL-40
Slice 16	-0.7505 ft	-39.445208 ft	4,177.381 psf	5,072.15 psf	0 psf	412.28564 psf	0 psf	EL-20 to EL-40
Slice 17	-0.0005 ft	-39.99963 ft	4,211.9769 psf	674,220.47 psf	0 psf	417.99619 psf	0 psf	EL-20 to EL-40
Slice 18	0.05 ft	-40 ft	3,244.8 psf	4,390.8824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 19	3.163236 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 20	9.289708 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 21	15.41618 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 22	21.542652 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 23	27.669124 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 24	31.203625 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 25	33.337445 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 26	35.727445 ft	-40 ft	2,589.6 psf	4,264.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 27	39.341167 ft	-40 ft	2,589.6 psf	4,264.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice	45.113723			4,264.1824				EL-20 to

28	ft	-40 ft	2,589.6 psf	psf	0 psf	418 psf	0 psf	EL-40
Slice 29	48.5 ft	-40 ft	2,589.6 psf	4,336.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 30	50.5 ft	-40 ft	2,589.6 psf	4,409.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 31	54.25 ft	-39.132214 ft	2,535.4502 psf	4,189.4736 psf	0 psf	409.06181 psf	0 psf	EL-20 to EL-40
Slice 32	58.75 ft	-37.396642 ft	2,427.1505 psf	4,006.8838 psf	0 psf	391.18542 psf	0 psf	EL-20 to EL-40
Slice 33	64.46983 ft	-35.190603 ft	2,289.4936 psf	3,678.1557 psf	0 psf	368.46321 psf	0 psf	EL-20 to EL-40
Slice 34	70.46983 ft	-32.092161 ft	2,096.1508 psf	3,289.3829 psf	0 psf	336.54925 psf	0 psf	EL-20 to EL-40
Slice 35	74 ft	-29.636291 ft	1,942.9046 psf	2,940.138 psf	0 psf	311.2538 psf	0 psf	EL-20 to EL-40
Slice 36	76.29906 ft	-28.03688 ft	1,843.1013 psf	2,754.7354 psf	0 psf	294.77987 psf	0 psf	EL-20 to EL-40
Slice 37	81.98759 ft	-23.566575 ft	1,564.1543 psf	2,298.655 psf	0 psf	248.73572 psf	0 psf	EL-20 to EL-40
Slice 38	87.16193 ft	-19.36227 ft	1,301.8056 psf	1,841.1245 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 39	92.076363 ft	-15.36227 ft	1,052.2056 psf	1,410.5065 psf	0 psf	184.63138 psf	0 psf	EL-12 to EL-20
Slice 40	99.004843 ft	-9.721135 ft	700.19882 psf	879.95166 psf	0 psf	150 psf	0 psf	GS to -12
Slice 41	106.19122 ft	-3.221135 ft	294.59882 psf	436.51648 psf	0 psf	150 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Class 1000 Stone	160					0	40	1
	Clay 110,400	110					400	0	1
	Concrete Splash Pad	145					20,000	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-115 to EL-138	108		1,093	10	1,323			1
	EL-12 to EL-20	101		150	10.3	212			1
	EL-20 to EL-40	101		212	10.3	418			1
	EL-40 to EL-48	101		418	10.3	500			1
	EL-48 to EL-62	111		500	10.3	644			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					150	0	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N11)_EWL_6in sediment.gsz
SubFile: Fully Specified el-30 w/ubl

LPV-WBV-GRR
GIWW T-WALL, N11 SECTION

TOW EL -30 FULLY-SPECIFIED WITH UBL

Fully Specified el-30 w/ubl

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File Information

File Version: 10.00
Created By: Rebecca Scherer
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 577
Date: 06/05/2020
Time: 04:30:53 PM
Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N11)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 09/21/2020
Last Solved Time: 02:17:18 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Fully Specified el-30 w/ubl

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: Yes
- Slip Surface Option: Fully-Specified
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 10,000
  - Convergence Tolerance: 1e-07
  - Starting Points: 8
  - Ending Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft

Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 150 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 150 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 212 psf
Pore Water Pressure
Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 212 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 418 psf
Pore Water Pressure
Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 418 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 500 psf
Pore Water Pressure
Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)
Unit Weight: 111 pcf
C-Top of Layer: 500 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft

C-Maximum: 644 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft²)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft²)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

EL-115 to EL-138

Model: S=f(depth)
Unit Weight: 108 pcf
C-Top of Layer: 1,093 psf
C-Rate of Change: 10 (lbf/ft²)/ft
C-Maximum: 1,323 psf
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Class 1000 Stone

Model: Mohr-Coulomb
Unit Weight: 160 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	165.23417 ft	4.65046 ft
	183.47267 ft	-13.46169 ft
	200 ft	-30 ft
	250 ft	-30 ft
	271.8185 ft	-8 ft
	286.9 ft	6.9 ft

Slip Surface Limits

Left Coordinate: (0, 8) ft
Right Coordinate: (450, 7) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	200 ft	27.5 ft
Coordinate 3	200.1 ft	0 ft
Coordinate 4	228 ft	0 ft
Coordinate 5	450 ft	0 ft

Point Loads

Point Load 1

Coordinate: (200, -13) ft
Magnitude: 13,500 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	0 ft	26 ft
	199.99 ft	26 ft

Points

	X	Y
Point 1	0 ft	0 ft
Point 2	0 ft	-12 ft
Point 3	0 ft	-20 ft
Point 4	0 ft	-40 ft
Point 5	0 ft	-48 ft
Point 6	0 ft	-62 ft
Point 7	0 ft	-77 ft
Point 8	0 ft	-100 ft
Point 9	0 ft	-115 ft
Point 10	0 ft	-138 ft
Point 11	450 ft	0 ft
Point 12	450 ft	-12 ft
Point 13	450 ft	-20 ft
Point 14	450 ft	-40 ft
Point 15	450 ft	-48 ft
Point 16	450 ft	-62 ft
Point 17	450 ft	-77 ft
Point 18	450 ft	-100 ft
Point 19	450 ft	-115 ft
Point 20	450 ft	-138 ft
Point 21	80 ft	7.3 ft
Point 22	90 ft	5.7 ft
Point 23	100 ft	4.7 ft
Point 24	110 ft	4 ft

Point 25	122 ft	4 ft
Point 26	122 ft	0 ft
Point 27	200 ft	4 ft
Point 28	200 ft	0 ft
Point 29	228 ft	0 ft
Point 30	228 ft	2 ft
Point 31	228 ft	4 ft
Point 32	228 ft	7.5 ft
Point 33	228 ft	8.5 ft
Point 34	240 ft	2.8 ft
Point 35	250 ft	3 ft
Point 36	270 ft	7.5 ft
Point 37	250 ft	10.5 ft
Point 38	248 ft	10.5 ft
Point 39	0 ft	8 ft
Point 40	246 ft	8.5 ft
Point 41	250 ft	7.5 ft
Point 42	280 ft	6.4 ft
Point 43	290 ft	7.1 ft
Point 44	320 ft	7 ft
Point 45	360 ft	7 ft
Point 46	450 ft	7 ft
Point 47	256.3 ft	4 ft
Point 48	300 ft	7.5 ft
Point 49	310 ft	7.5 ft
Point 50	277.5 ft	4 ft
Point 51	270 ft	5.5 ft
Point 52	260 ft	4.6 ft
Point 53	277.5 ft	6 ft
Point 54	200 ft	4.5 ft
Point 55	122 ft	4.5 ft
Point 56	102.8 ft	4.5 ft

Regions

	Material	Points	Area
Region 1	EL-115 to EL-138	10,20,19,9	10,350 ft²
Region 2	EL-100 to EL-115	8,18,19,9	6,750 ft²
Region 3	EL-77 to EL-100	7,17,18,8	10,350 ft²
Region 4	EL-62 to EL-77	6,16,17,7	6,750 ft²
Region 5	EL-48 to EL-62	5,15,16,6	6,300 ft²
Region 6	EL-40 to EL-48	4,14,15,5	3,600 ft²

Region 7	EL-20 to EL-40	3,13,14,4	9,000 ft²
Region 8	EL-12 to EL-20	2,12,13,3	3,600 ft²
Region 9	GS to -12	1,39,21,22,23,56,24,25,26,28,29,30,34,35,47,50,53,42,43,48,49,44,45,46,11,12,2	7,598.6 ft²
Region 10	Class 1000 Stone	25,27,28,26	312 ft²
Region 11	Concrete Splash Pad	33,40,38,37,41,32	28 ft²
Region 12	Clay 110,400	30,31,32,41,36,53,50,47,35,34	200.97 ft²
Region 13	sediment	56,55,54,27,25,24	46.8 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.50
Volume: 2,999.4383 ft³
Weight: 269,851.37 lbf
Resisting Moment: 1,431,939.5 lbf·ft
Activating Moment: 957,426.78 lbf·ft
Resisting Force: 29,267.316 lbf
Activating Force: 19,568.19 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (286.02523, 6.821766) ft
Entry: (164.04279, 4.5) ft
Radius: 53.152156 ft
Center: (226.09856, 7.4771296) ft

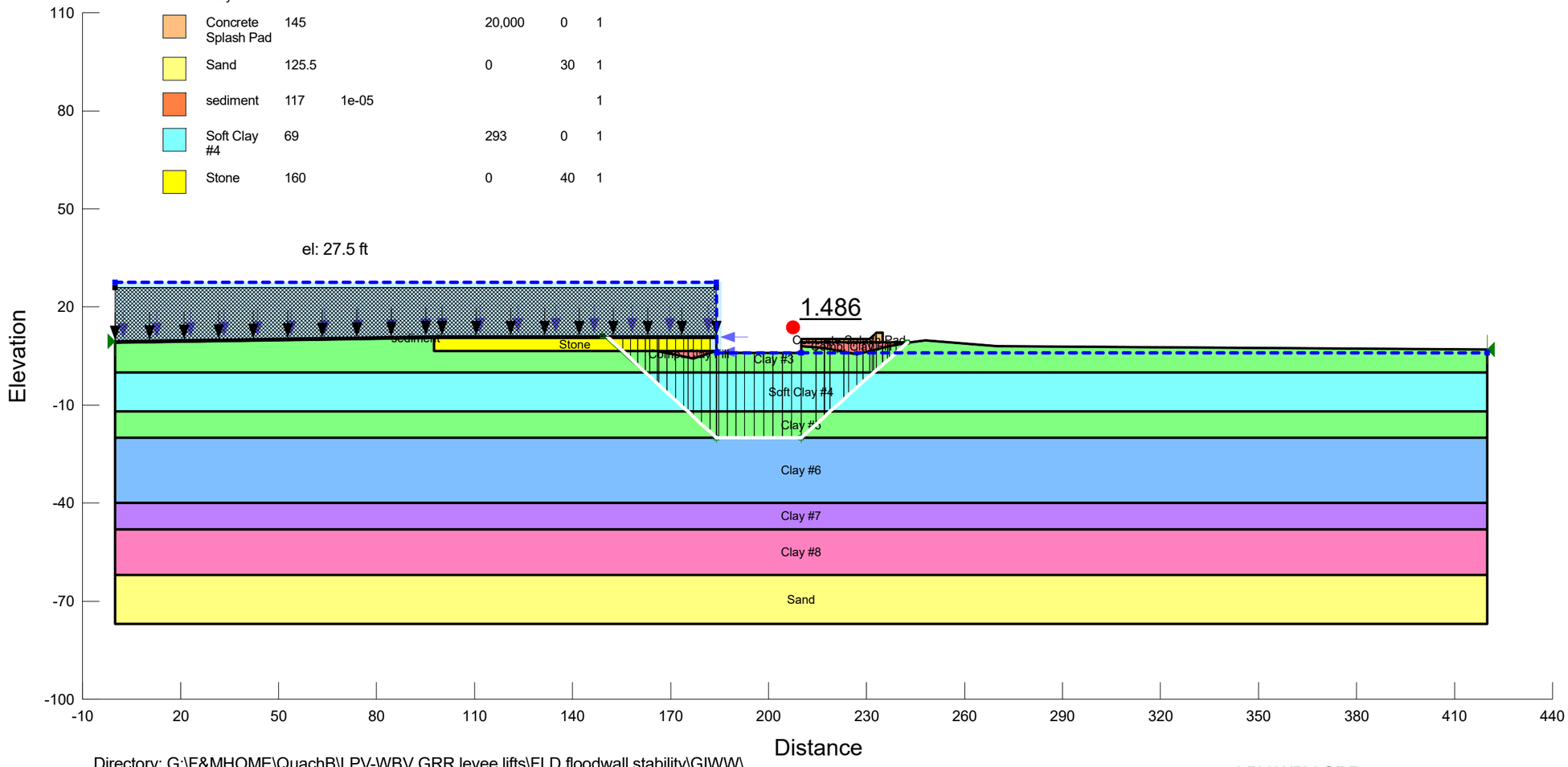
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	164.25732 ft	4.25 ft	1,450.8 psf	1,440.0567 psf	0 psf	1e-05 psf	0 psf	sediment
Slice 2	166.18807 ft	2 ft	1,591.2 psf	1,707.9505 psf	97.965273 psf	0 psf	0 psf	Class 1000 Stone
Slice 3	168.42411 ft	-0.605765 ft	1,753.7997 psf	2,022.1057 psf	0 psf	150 psf	0 psf	GS to -12
Slice 4	170.66603 ft	-2.6465633 ft	1,881.1456 psf	2,207.4959 psf	0 psf	150 psf	0 psf	GS to -12
Slice 5	174.11022 ft	-5.51663 ft	2,060.2377 psf	2,401.9299 psf	0 psf	150 psf	0 psf	GS to -12

Slice 6	177.55441 ft	-8.3866967 ft	2,239.3299 psf	2,596.3639 psf	0 psf	150 psf	0 psf	GS to -12
Slice 7	180.53207 ft	-10.910865 ft	2,396.838 psf	2,761.9665 psf	0 psf	150 psf	0 psf	GS to -12
Slice 8	182.63015 ft	-12.730845 ft	2,510.4047 psf	2,903.9672 psf	0 psf	157.5277 psf	0 psf	EL-12 to EL-20
Slice 9	185.09351 ft	-15.096267 ft	2,658.0071 psf	3,098.6862 psf	0 psf	181.89156 psf	0 psf	EL-12 to EL-20
Slice 10	188.3352 ft	-18.365423 ft	2,862.0024 psf	3,402.336 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 11	191.29047 ft	-21.345745 ft	3,047.9745 psf	3,687.8664 psf	0 psf	225.86117 psf	0 psf	EL-20 to EL-40
Slice 12	194.46618 ft	-24.51614 ft	3,245.8071 psf	3,984.5835 psf	0 psf	258.51624 psf	0 psf	EL-20 to EL-40
Slice 13	198.14873 ft	-28.16544 ft	3,473.5235 psf	4,321.5482 psf	0 psf	296.10403 psf	0 psf	EL-20 to EL-40
Slice 14	199.995 ft	-29.995045 ft	3,587.6908 psf	49,248.768 psf	0 psf	314.94896 psf	0 psf	EL-20 to EL-40
Slice 15	200.05 ft	-30 ft	2,730 psf	3,508.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 16	201.90709 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 17	205.52127 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 18	209.13545 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 19	212.74963 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 20	216.79727 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 21	221.27836 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 22	225.75945 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 23	229.53404 ft	-30 ft	1,872 psf	3,534.4735 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 24	232.60213 ft	-30 ft	1,872 psf	3,526.0874 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 25	237.06808 ft	-30 ft	1,872 psf	3,513.8804 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 26	240.15927 ft	-30 ft	1,872 psf	3,505.7359 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 27	242.07622 ft	-30 ft	1,872 psf	3,504.164 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 28	244.91696 ft	-30 ft	1,872 psf	3,501.8346 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 29	247 ft	-30 ft	1,872 psf	3,645.1265 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 30	249 ft	-30 ft	1,872 psf	3,788.4865 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 31	252.95624 ft	-27.322745 ft	1,704.9393 psf	3,302.1077 psf	0 psf	287.42427 psf	0 psf	EL-20 to EL-40

Slice 32	256.10624 ft	-24.443609 ft	1,525.2812 psf	2,998.8594 psf	0 psf	257.76917 psf	0 psf	EL-20 to EL-40
Slice 33	258.33555 ft	-22.120864 ft	1,380.3419 psf	2,740.0844 psf	0 psf	233.8449 psf	0 psf	EL-20 to EL-40
Slice 34	262.09258 ft	-18.20637 ft	1,136.0775 psf	2,319.5288 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 35	265.91335 ft	-14.20637 ft	886.47749 psf	1,878.9681 psf	0 psf	172.72561 psf	0 psf	EL-12 to EL-20
Slice 36	269.00632 ft	-10.95563 ft	683.63132 psf	1,560.4082 psf	0 psf	150 psf	0 psf	GS to -12
Slice 37	270.90925 ft	-8.9556301 ft	558.83132 psf	1,398.6261 psf	0 psf	150 psf	0 psf	GS to -12
Slice 38	274.65925 ft	-5.11414 ft	319.12234 psf	1,038.3339 psf	0 psf	150 psf	0 psf	GS to -12
Slice 39	278.01072 ft	-1.70945 ft	106.66968 psf	655.91894 psf	0 psf	150 psf	0 psf	GS to -12
Slice 40	279.07896 ft	-0.59531 ft	37.147344 psf	595.33175 psf	0 psf	150 psf	0 psf	GS to -12
Slice 41	279.81824 ft	0.19407748 ft	-12.110435 psf	547.90017 psf	0 psf	150 psf	0 psf	GS to -12
Slice 42	283.01261 ft	3.6049605 ft	-224.94953 psf	323.78887 psf	0 psf	150 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Cohesion Spatial Fn	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay #3	110			475	0	1
	Clay #5	101		Layer #5		0	1
	Clay #6	101		Layer #6		0	1
	Clay #7	101		Layer #7		0	1
	Clay #8	111		Layer #8		0	1
	Comp. Clay Fill	110			400	0	1
	Concrete Splash Pad	145			20,000	0	1
	Sand	125.5			0	30	1
	sediment	117	1e-05				1
	Soft Clay #4	69			293	0	1
	Stone	160			0	40	1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N12-N13)_EWL_6in sediment.gsz
Name: Fully Specified, el -20

LPV-WBV GRR
GIWW T-WALL, N-12 & N-13 SECTIONS

TOW EL. -20 FULLY-SPECIFIED

Fully Specified, el -20

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File Information

File Version: 10.00
Created By: William W. Caver
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 56
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Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N12-N13)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 06/05/2020
Last Solved Time: 02:47:28 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Fully Specified, el -20

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Fully-Specified
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 5,000
  - Convergence Tolerance: 1e-07
  - Starting Points: 8
  - Ending Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings

Minimum Slip Surface Depth: 0.1 ft
Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Stone

Model: Mohr-Coulomb
Unit Weight: 160 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Comp. Clay Fill

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #3

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 475 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Soft Clay #4

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 293 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #5

Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #5

Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #6

Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #6
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #7

Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #7
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #8

Model: Spatial Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion Spatial Fn: Layer #8
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf

Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	149.23055 ft	11.16033 ft
	184 ft	-20 ft
	210 ft	-20 ft
	242.43 ft	9.2 ft

Slip Surface Limits

Left Coordinate: (0, 9.5) ft
Right Coordinate: (420, 7) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	184 ft	27.5 ft
Coordinate 3	184.1 ft	6 ft
Coordinate 4	210 ft	6 ft
Coordinate 5	420 ft	6 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Vertical

Coordinates

	X	Y
	0 ft	26 ft
	184 ft	26 ft

Spatial Functions

Layer #5

Model: Linear Interpolation
Limit Range By: Data Values

Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (0, -12, 293)
Data Point: (0, -20, 351)
Data Point: (500, -12, 293)
Data Point: (500, -20, 351)

Layer #6

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (0, -20, 351)
Data Point: (0, -40, 544)
Data Point: (500, -20, 351)
Data Point: (500, -40, 544)

Layer #7

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (0, -40, 544)
Data Point: (0, -48, 621)
Data Point: (500, -40, 544)
Data Point: (500, -48, 621)

Layer #8

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (0, -48, 621)
Data Point: (0, -62, 756)
Data Point: (500, -48, 621)
Data Point: (500, -62, 756)

Points

	X	Y
Point 1	0 ft	9 ft
Point 2	97.5 ft	10.5 ft
Point 3	184 ft	10.5 ft
Point 4	184 ft	6.5 ft
Point 5	184 ft	6 ft
Point 6	210 ft	6 ft
Point 7	210 ft	8 ft
Point 8	210 ft	9.2 ft
Point 9	243.5 ft	9.2 ft
Point 10	248 ft	9.8 ft
Point 11	270 ft	8 ft
Point 12	420 ft	7 ft
Point 13	420 ft	0 ft
Point 14	420 ft	-12 ft
Point 15	420 ft	-20 ft

Point 16	420 ft	-40 ft
Point 17	420 ft	-48 ft
Point 18	420 ft	-62 ft
Point 19	420 ft	-77 ft
Point 20	237 ft	8 ft
Point 21	227 ft	5.5 ft
Point 22	217 ft	7.5 ft
Point 23	177 ft	4.2 ft
Point 24	166 ft	6.5 ft
Point 25	97.5 ft	6.5 ft
Point 26	0 ft	0 ft
Point 27	0 ft	-12 ft
Point 28	0 ft	-20 ft
Point 29	0 ft	-40 ft
Point 30	0 ft	-48 ft
Point 31	0 ft	-62 ft
Point 32	0 ft	-77 ft
Point 33	210 ft	10.2 ft
Point 34	231 ft	10.2 ft
Point 35	233 ft	12.2 ft
Point 36	235 ft	12.2 ft
Point 37	235.01 ft	9.2 ft
Point 38	184 ft	11 ft
Point 39	97.5 ft	11 ft
Point 40	0 ft	9.5 ft

Regions

	Material	Points	Area
Region 1	Stone	2,3,4,24,25	346 ft²
Region 2	Comp. Clay Fill	4,23,24	20.7 ft²
Region 3	Comp. Clay Fill	8,37,9,20,21,22,7	65.55 ft²
Region 4	Clay #3	1,2,25,24,23,4,5,6,7,22,21,20,9,10,11,12,13,26	3,254.4 ft²
Region 5	Soft Clay #4	26,13,14,27	5,040 ft²
Region 6	Clay #5	27,14,15,28	3,360 ft²
Region 7	Clay #6	28,15,16,29	8,400 ft²
Region 8	Clay #7	29,16,17,30	3,360 ft²
Region 9	Clay #8	30,17,18,31	5,880 ft²
Region 10	Sand	31,18,19,32	6,300 ft²
Region 11	Concrete Splash Pad	33,34,35,36,37,8	31.015 ft²
Region 12	sediment	40,1,2,3,38,39	92 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.486
Volume: 1,700.7863 ft³
Weight: 164,024.35 lbf
Resisting Moment: 1,244,084.1 lbf·ft
Activating Moment: 834,377.24 lbf·ft
Resisting Force: 31,200.135 lbf
Activating Force: 21,058.55 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (242.579, 9.2) ft
Entry: (150.60381, 11) ft
Radius: 41.160814 ft
Center: (195.94585, 11.45) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	150.87237 ft	10.75 ft	1,045.2 psf	1,061.859 psf	0 psf	1e-05 psf	0 psf	sediment
Slice 2	153.28941 ft	8.5 ft	1,185.6 psf	1,333.113 psf	123.77809 psf	0 psf	0 psf	Stone
Slice 3	156.56256 ft	5.45306 ft	1,375.7291 psf	1,550.0991 psf	0 psf	475 psf	0 psf	Clay #3
Slice 4	158.85093 ft	3.30459 ft	1,509.7936 psf	1,779.9883 psf	0 psf	475 psf	0 psf	Clay #3
Slice 5	161.17833 ft	1.10153 ft	1,647.2645 psf	2,020.9425 psf	0 psf	475 psf	0 psf	Clay #3
Slice 6	163.00348 ft	-0.62611 ft	1,755.0693 psf	2,298.055 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 7	164.83247 ft	-2.361741 ft	1,863.3726 psf	2,416.349 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 8	166.18014 ft	-3.642451 ft	1,943.2889 psf	2,504.212 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 9	167.64319 ft	-4.9901967 ft	2,027.3883 psf	2,603.6565 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 10	170.209 ft	-7.34331 ft	2,174.2225 psf	2,765.1239 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 11	172.77482 ft	-9.6964233 ft	2,321.0568 psf	2,926.5912 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 12	174.6761 ft	-11.43649 ft	2,429.637 psf	3,047.2301 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 13	176.14723 ft	-12.777118 ft	2,513.2922 psf	3,160.5687 psf	0 psf	298.63411 psf	0 psf	Clay #5
Slice 14	178.26462 ft	-14.70667 ft	2,633.6962 psf	3,345.971 psf	0 psf	312.62336 psf	0 psf	Clay #5
Slice 15	180.79386 ft	-17.011537 ft	2,777.5199 psf	3,567.4358 psf	0 psf	329.33364 psf	0 psf	Clay #5
Slice	183.02924	-19.081985	2,906.7159	3,776.1347		344.34439		

16	ft	ft	psf	psf	0 psf	psf	0 psf	Clay #5
Slice 17	184.05 ft	-20 ft	2,293.2 psf	2,968.2263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 18	184.39968 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 19	186.03905 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 20	188.71843 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 21	191.39781 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 22	194.17604 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 23	197.05312 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 24	199.93021 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 25	202.80729 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 26	205.68437 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 27	208.56146 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 28	212.25008 ft	-17.96151 ft	1,495.1982 psf	2,807.3892 psf	0 psf	336.22095 psf	0 psf	Clay #5
Slice 29	215.75008 ft	-14.782281 ft	1,296.8143 psf	2,471.8986 psf	0 psf	313.17154 psf	0 psf	Clay #5
Slice 30	217.07451 ft	-13.573541 ft	1,221.389 psf	2,343.7282 psf	0 psf	304.40817 psf	0 psf	Clay #5
Slice 31	217.97921 ft	-12.75277 ft	1,170.1728 psf	2,255.4323 psf	0 psf	298.45758 psf	0 psf	Clay #5
Slice 32	220.90135 ft	-10.10313 ft	1,004.8353 psf	2,044.0285 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 33	223.74666 ft	-7.5357354 ft	844.62989 psf	1,862.4264 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 34	225.75 ft	-5.7526319 ft	733.36423 psf	1,738.7249 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 35	228 ft	-3.7499899 ft	608.39937 psf	1,599.7932 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 36	230 ft	-1.9698637 ft	497.31949 psf	1,476.2982 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 37	231.33569 ft	-0.78101529 ft	423.13535 psf	1,442.7618 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 38	231.95173 ft	-0.241115 ft	389.44558 psf	1,488.9358 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 39	232.61604 ft	0.33021759 ft	353.79442 psf	1,638.3881 psf	0 psf	475 psf	0 psf	Clay #3
Slice 40	234 ft	1.5204743 ft	279.5224 psf	1,562.7392 psf	0 psf	475 psf	0 psf	Clay #3
Slice	235.005 ft	2.3848136	225.58763	1,248.524	0 psf	475 psf	0 psf	Clay #3

41		ft	psf	psf				
Slice 42	235.70753 ft	2.9890169 ft	187.88534 psf	963.07369 psf	0 psf	475 psf	0 psf	Clay #3
Slice 43	236.70253 ft	3.8592706 ft	133.58151 psf	882.6728 psf	0 psf	475 psf	0 psf	Clay #3
Slice 44	238.029 ft	5.0648106 ft	58.355817 psf	749.3289 psf	0 psf	475 psf	0 psf	Clay #3
Slice 45	240.70111 ft	7.4933125 ft	-93.1827 psf	480.71408 psf	0 psf	475 psf	0 psf	Clay #3
Slice 46	242.46161 ft	9.0933125 ft	-193.0227 psf	257.64367 psf	0 psf	400 psf	0 psf	Comp. Clay Fill

Levee Stability Analyses

WATER CONTENT (%)

WET DENSITY (PCF)

UNDRAINED SHEAR STRENGTH (PSF)

ELEVATION IN FEET (NAVD 88)

SAND

120

110

115

115

500

600

800

1200

1400

Legend

- (Q) Unconsolidated Undrained Triaxial Shear Test
- (UC) Unconfined Compression Test

- E-84.75-UCL (MVN-2009-022123
- EB-85.8U (MVN-2009-022123)
- CSA-2 (MVN-2007-022101)
- EB-86.7U (MVN-2009-022123)
- E-85.3-UCL (MVN-2009-022123)
- E-89.3-U (MVN-1978-103)
- E-85.5-U (MVN-1972-552)
- EB-86.2U (MVN-2009-022123)

Design line

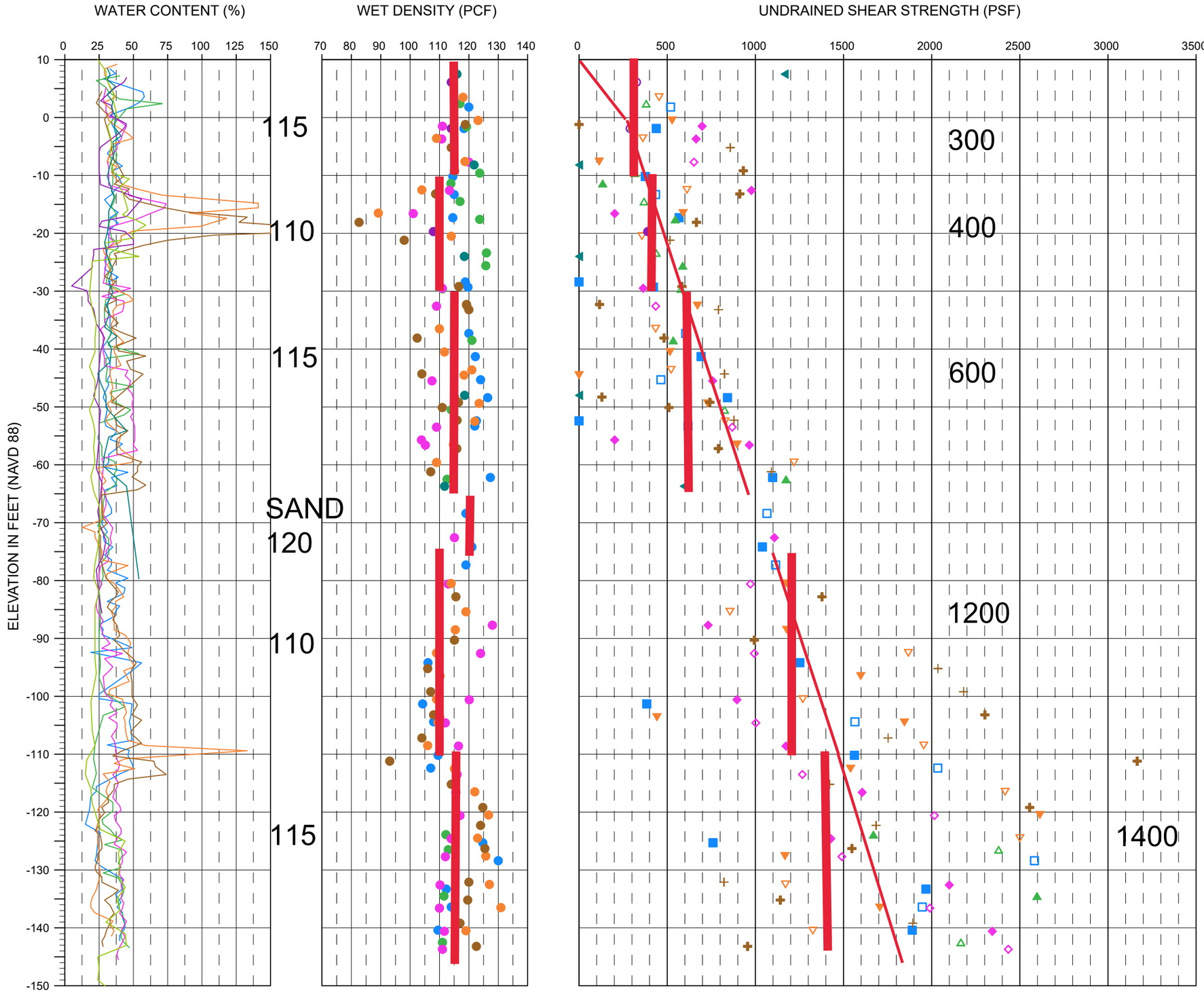
c/p = 0.22

U.S. Army Corps of Engineers
New Orleans District

LPV-MRL-1

Centerline

DRAWN.	CHECKED.	DATE.	SHEET.



Legend

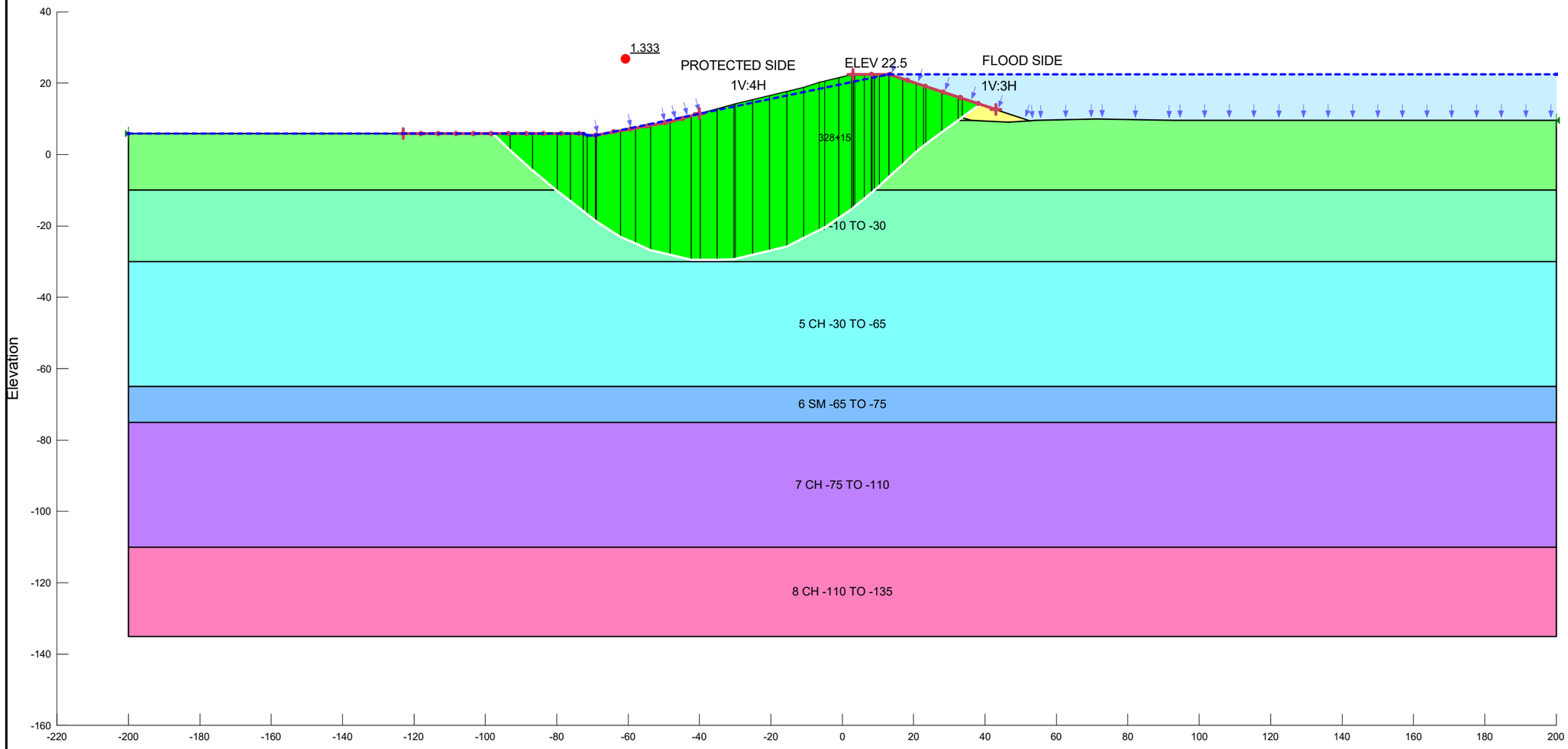
- (Q) Unconsolidated Undrained Triaxial Shear Test
- (UC) Unconfined Compression Test
- c/p = 0.22
- Design Line
- EB-86.35UFT (MVN-2009-022123
- EB-86.8UFT (MVN-2009-022123)
- EB-86.05UPT (MVN-2009-022123
- EB-85.5UFT (MVN-2009-022123)
- E-85.05-UPT (MVN-2009-022123
- CSA-3FT (MVN-2007-022101)
- CSA-1PT (MVN-2007-022101)
- E-89.3-UT (MVN-1978-103)

U.S. Army Corps of Engineers
New Orleans District

LPV-MRL-1 - Toe

Levee Toe Soil Parameters

DRAWN.	CHECKED.	DATE.	SHEET.
		22 June 2020	



Color	Name	Model	Weight Fn	Cohesion Fn	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	1 New levee	Mohr-Coulomb			115	600	0	0	1
	2 Levee	Mohr-Coulomb			115	600	0	0	1
	3 CH TO -10	Spatial Mohr-Coulomb	CH TO -10	CH TO -10			0	0	1
	4 CH -10 TO -30	Spatial Mohr-Coulomb		CH -10 TO -30	110		0	0	1
	5 CH -30 TO -65	Spatial Mohr-Coulomb		CH -30 TO -65	115		0	0	1
	6 SM -65 TO -75	Mohr-Coulomb			120	0	32	0	1
	7 CH -75 TO -110	Spatial Mohr-Coulomb	CH -75 TO -110			1,200	0	0	1
	8 CH -110 TO -135	Spatial Mohr-Coulomb			115	1,400	0	0	1

LPV-WBV GRR
LPV-MRL-1 RAISE AND FLOOD SIDE SHIFT

HWL ENTRY EXIT

HWL EE FS to PS

LPV-MRL-1 FS shift.gsz

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