INSIGHT ENGINEERING CO.

PRELIMINARY STORMWATER SITE PLAN

For
Pioneer Point

Prepared for
City of Arlington
238 N. Olympic Ave
Arlington, WA 98223
360.403.3500

Project Site Location:
8500 Block of 207th Pl NE
Arlington, WA 98223

Applicant:
Lavoy Inc.
1602 4th St
Marysville, WA 98270
425-770-0888

Contact:
IECO
P.O. Box 1478
Everett, WA 98206
425-303-9363

Tax Id's: 31051200301000, 31051200301400, 31051200301500
IECO Project: 17-0828

Certified Erosion and Sedimentation Control Lead:
To be named by contractor

Stormwater Site Plan Prepared By:

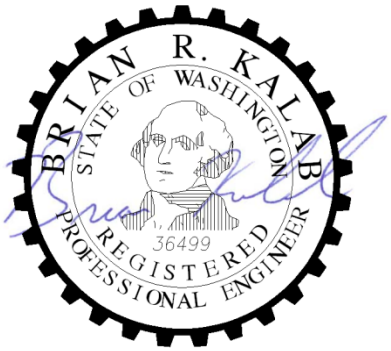
Sithara George, BSCE.

Stormwater Site Plan Preparation Date:

October 1, 2024

Approximate Construction Date:

May 1, 2025



11/08/2024

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Acronyms and Abbreviations

BMP	Best Management Practices
DOE	Department of Ecology
EDDS	Engineering Design and Development Standards
ESC	Erosion and Sediment Control
IECO	Insight Engineering Company
MR	Minimum Requirement
SWPPP	Stormwater Pollution Prevention Plan
SWMMWW	Stormwater Management Manual for Western Washington
TESC	Temporary Erosion and Sediment Control
WWHM	Western Washington Hydrology Model

1.0 Executive Summary

The proposed project ***Pioneer Point*** is located at 8500 Block of 207th ST NE Arlington, Washington. More generally, the site is located in Section 12, Township 31 North, and Range 5 East of the Willamette Meridian in Snohomish County, Washington. Please refer to the Vicinity Map attached later in the section. This report follows the requirements defined in the SWMMWW 2014 and the City of Arlington Requirements.

The project site contains approximately 16 Acres. The development area includes 3 parcels (APN# 31051200301000, APN# 31051200301400, APN#31051200301500) The property to the west of the site has been approved for construction. The existing drainage basin includes the development area and two upstream parcels located south of the property. The existing site is currently undeveloped and exists as low growing foliage with few trees and a man-made pond located on the northern portion of the site. There are two wetlands located on the northern portion of the site which will remain undisturbed. The existing site contains two drainage basins. Basin-1 that slopes to the northwest into the existing pond includes the development area. Basin-2 slopes northeast towards the Type-F stream. Basin-2 is a part of the property and will remain undisturbed. Based on the topographic survey of the site, there are upstream flows entering the site. Please refer to the upstream and downstream analysis for more details. Per SCC survey of Snohomish County, the project site contains Norma and Pastik type soils that have a hydrologic classification of Type “C”. Please refer to the soils map and descriptions attached later in this report for more details.

The site is zoned RHD. The clearing area for the proposed development contains 3.92 Acres. The proposal is to construct 49 townhome units with access road and associated utilities. The access to the new units will be from new public local access street. The driveway entrances will be constructed per the city of Arlington standards.

Per Figure 2.2, (flow chart for new development requirements) Volume I Snohomish County Drainage Manual, Minimum requirements #1 through 9 shall apply for this project. See the Minimum Requirements Summary included later in this report. Flow control requirements will be met by the existing onsite pond on the northern portion of the site. A discharge structure in the form of weir has been designed to provide adequate flow control for the developed basin. The total existing drainage basin as well as the proposed development was included in the developed drainage basin in order to calculate the required volume for the pond. The water surface elevation for the existing pond will rise 0.21 foot (with sufficient freeboard) due to the proposed development based on the hydraulic calculations for the pond. The detention volume was calculated in WWHM 2012, refer to section 5.0 for the hydraulic analysis. The total required detention volume is 53,950 CF. Enhanced Water quality for the site will be provided an MWS filter manufactured by Bioclean Environmental services Inc. located upstream of detention pond.

Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMPs shall be applied to provide onsite stormwater management and must be considered in the following order per List #2: Full Dispersion, Infiltration, Bioretention, Basic Dispersion, and then Perforated Stub-Out Connections. Full Dispersion is infeasible because the required native vegetation preservation could not be achieved. Full Infiltration, Bioretention, Basic dispersion, Permeable Pavement and Perforated stub out are not feasible due to the presence of steep slopes present on the site. Refer to the geotechnical report located within the Section 6 for more information. The following BMPs shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Sheet flow Dispersion. Full dispersion and is not feasible per explanation above. Permeable Pavement, Bioretention, and then Sheet flow Dispersion are not feasible due to the presence of steep slopes present on the site. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site.

Figure 1 - Minimum Requirements (MR's) for New Development Projects

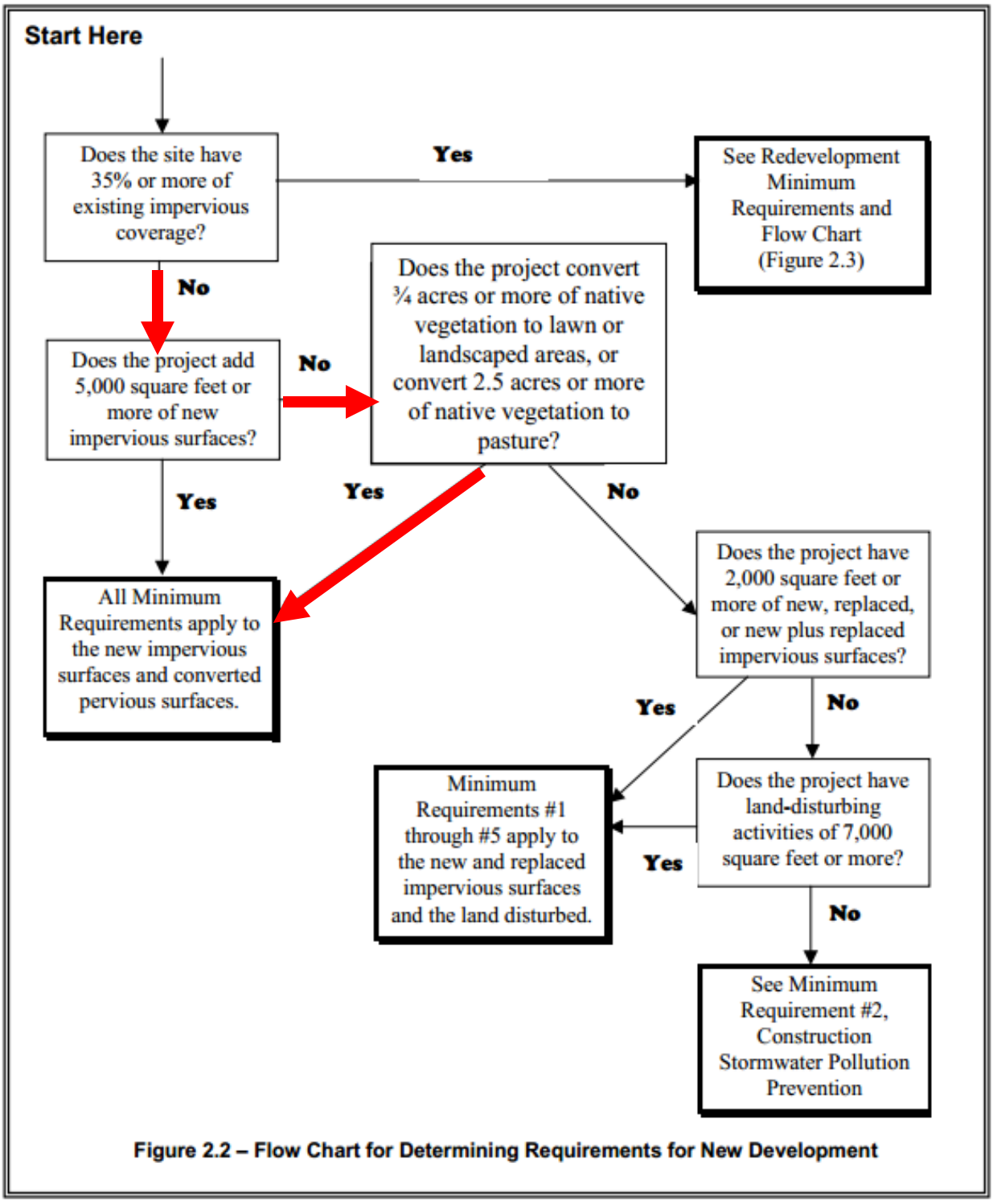


Figure 2.2 – Flow Chart for Determining Requirements for New Development

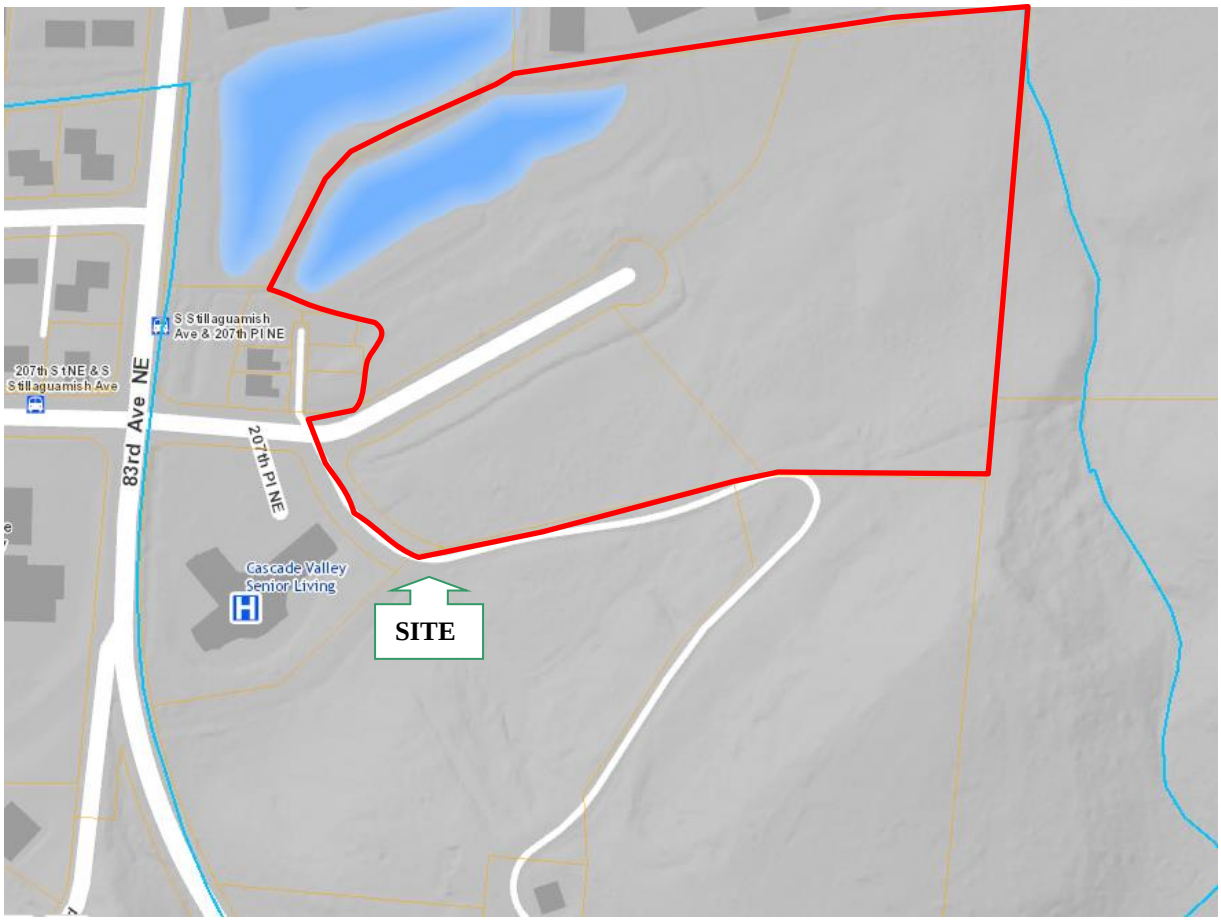
1.1 Drainage Information Summary

Project Name: **Pioneer Point** Project Engineer: **INSIGHT ENGINEERING COMPANY** Project Applicant: **Lavoy Inc.** Total Site Area**: 16 Ac;** Upstream Basin **:7.08 Ac** Project Development Area: **3.92 Ac** Onsite Basin + Upstream Basin**: 23.08 Ac**	Number of Units: **49**

Summary Table

Drainage Basin Information		*Individual Basin Designation*			
		A	*B*	*C*	*D*
On-site Sub-basin Area (Acres)		**23.08**			
Type of Storage Proposed		**Detention pond**			
Approximate Storage Volume (CF)		**NA**			
Soil types (Natural Resource Conservation Service)		**Norma and Pastik(Type C)**			
Pre-developed Runoff Rate					
Q (cfs)	2-year	**1.75**			
	10-year	**3.01**			
	50-year	**4.35**			
Post-developed Runoff Rate (without quantity controls)					
Q (cfs)	2-year	**2.58**			
	10 year	**4.44**			
	50 year	**6.36**			
Post-developed Runoff Rate (with quantity controls)					
Q (cfs)	2-year	**0.84**			
	10 year	**1.36**			
	50 year	**1.97**			
Offsite Upstream Area					
Number of acres		**7.08**			
Offsite Downstream Flow		*1.97*			
Q (cfs)	*50 yr*	**NA**			

FIGURE 2. VICINITY MAP



TAKEN FROM THE PDS Portal MAPS

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Figure 2 -Vicinity Map
Pioneer Point
Arlington, Washington

SCALE: NTS	**DATE:** 11/8/24	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 /doc/Stormwater Site Plan	

1.2 Minimum Requirements Summary

MR : Minimum Requirement

SWPPP : Stormwater Pollution Prevention Plan

MR #1 Stormwater Site Plan Narrative: The Stormwater Site Plan preparation follows the City of Arlington requirements and in accordance with DOE's 2014 SWMMWW. Refer to the executive summary within Section 1.0.

MR #2 SWPPP Narrative: A SWPPP has been included in the Appendix A under Section 6.

MR #3 Water pollution source control for new development: No source control pollutants pertain to the proposed project.

MR #4 Preservation of Natural Drainage Systems and outfalls: The outlet for the proposed flows will be connected to a dispersion trench to disperse the outlet flows to drain into the existing onsite pond. The pond's outlet will continue to its natural drainage path.

MR #5 Onsite Stormwater Management: Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMPs shall be applied to provide onsite stormwater management and must be considered in the following order per List #2: Full Dispersion, Infiltration, Bioretention, Basic Dispersion, and then Perforated Stub-Out Connections. Full Dispersion is infeasible because the required native vegetation preservation could not be achieved. Full Infiltration, Bioretention, Basic dispersion, Permeable Pavement and Perforated stub out are not feasible due to the presence of steep slopes present on the site. Refer to the geotechnical report located within Section 6 for more information. The following BMPs shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Sheet flow Dispersion. Full dispersion and is not feasible per explanation above. Permeable Pavement, Bioretention, and then Sheet flow Dispersion are not feasible due to the presence of steep slopes present on the site. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site.

MR #6 Runoff Treatment: Enhanced Water quality for the site will be provided by two MWS filters manufactured by Bioclean Environmental services Inc. located upstream of detention pond.

MR #7 Flow Control: Flow control requirements will be met by the existing onsite pond on the northern portion of the site. A discharge structure in the form of weir has been designed to provide adequate flow control for the developed basin. The total existing drainage basin as well as the proposed development was included in the developed drainage basin in order to calculate the required volume for the pond. The water surface elevation for the existing pond will rise 0.21 foot (with sufficient freeboard) due to the proposed development based on the hydraulic calculations for the pond. The detention volume was calculated in WWHM 2012. Refer to section 5.0 for the hydraulic analysis. The total required detention volume is 53,950 CF.

MR #8 Wetlands protection: Appropriate signage and buffer will be provided to meet jurisdictional and environmental requirements for the wetlands.

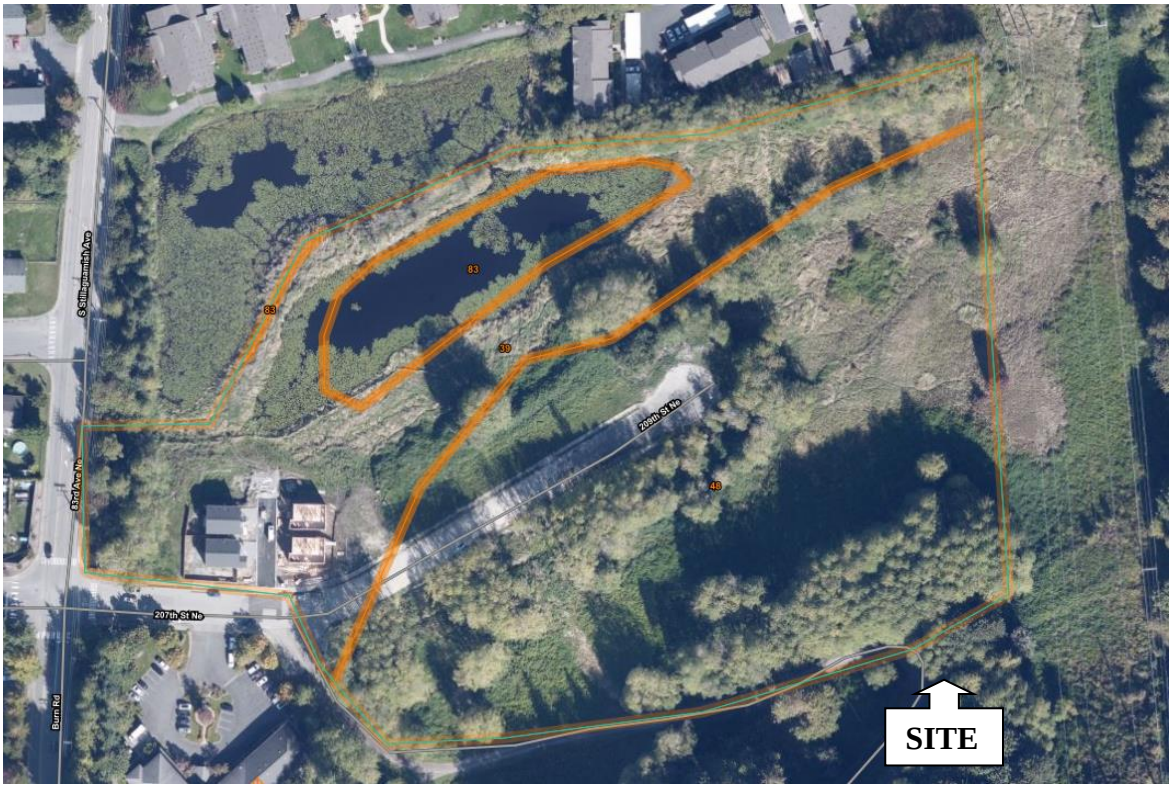
MR #9 Operations and Maintenance: An Operations and Maintenance Manual will be provided for the construction submittal.

2.0 Existing Conditions

The proposed project ***Pioneer Point*** is located at 8500 Block of 207th ST NE Arlington, Washington. More generally, the site is located in Section 12, Township 31 North, and Range 5 East of the Willamette Meridian in Snohomish County, Washington.

The project site contains approximately 16 Acres. The development area includes 3 parcels (APN# 31051200301000, APN# 31051200301400, APN# 31051200301500) The property to the west of the site has been approved for construction. The existing drainage basin includes the development area and two upstream parcels located south of the property. The existing site is currently undeveloped and exists as low growing foliage with few trees and a man-made pond located on the northern portion of the site. There are two wetlands located on the northern portion of the site which will remain undisturbed. The existing site contains two drainage basins. Basin-1 that slopes to the northwest into the existing pond includes the development area. Basin-2 slopes northeast towards the Type-F stream. Basin-2 is a part of the property and will remain undisturbed. Based on the topographic survey of the site, there are upstream flows entering the site. Please refer to the upstream and downstream analysis for more details. Per SCC survey of Snohomish County, the project site contains Norma and Pastik type soils that have a hydrologic classification of Type “C”. Please refer to the soils map and descriptions attached later in this report for more details.

FIGURE 3. SOIL MAP



SOILS LEGEND

39—Norma loam

48—Pastik silt loam, 8 to 25 percent slopes

83—Water

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Figure 3 - Soil Map
Pioneer Point
Arlington, Washington

SCALE: NTS	**DATE:** 11/8/24	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 /doc/Stormwater Site Plan	

Snohomish County Area, Washington

39—Norma loam

Map Unit Setting

- *National map unit symbol:* 2hyx
- *Elevation:* 0 to 1,000 feet
- *Mean annual precipitation:* 35 to 60 inches
- *Mean annual air temperature:* 48 to 52 degrees F
- *Frost-free period:* 150 to 200 days
- *Farmland classification:* Prime farmland if drained

Map Unit Composition

- *Norma, undrained, and similar soils:* 85 percent
- *Minor components:* 15 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Norma, Undrained

Setting

- *Landform:* Depressions, drainageways
- *Parent material:* Alluvium

Typical profile

- *H1 - 0 to 10 inches:* ashy loam
- *H2 - 10 to 28 inches:* sandy loam
- *H3 - 28 to 60 inches:* sandy loam

Properties and qualities

- *Slope:* 0 to 3 percent
- *Depth to restrictive feature:* More than 80 inches
- *Drainage class:* Poorly drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* Frequent
- *Available water capacity:* Moderate (about 9.0 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* B/D
- *Forage suitability group:* Wet Soils (G002XN102WA)
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

Minor Components

Norma, drained

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Seasonally Wet Soils (G002XN202WA)
- *Hydric soil rating:* Yes

Bellingham, undrained

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

Terric medisaprists, undrained

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

Snohomish County Area, Washington

48—Pastik silt loam, 8 to 25 percent slopes

Map Unit Setting

- *National map unit symbol:* 2hz7
- *Elevation:* 200 to 800 feet
- *Mean annual precipitation:* 45 to 70 inches
- *Mean annual air temperature:* 45 to 46 degrees F
- *Frost-free period:* 140 to 200 days
- *Farmland classification:* Farmland of statewide importance

Map Unit Composition

- *Pastik and similar soils:* 100 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Pastik

Setting

- *Landform:* Terraces
- *Parent material:* Volcanic ash and lacustrine deposits

Typical profile

- *H1 - 0 to 6 inches:* ashy silt loam
- *H2 - 6 to 29 inches:* ashy silt loam
- *H3 - 29 to 60 inches:* silt loam

Properties and qualities

- *Slope:* 8 to 25 percent
- *Depth to restrictive feature:* More than 80 inches
- *Drainage class:* Moderately well drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
- *Depth to water table:* About 18 to 30 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water capacity:* Very high (about 14.3 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4e
- *Hydrologic Soil Group:* C
- *Forage suitability group:* Soils with Moderate Limitations (G002XN602WA)
- *Other vegetative classification:* Soils with Moderate Limitations (G002XN602WA)
- *Hydric soil rating:* No

3.0 Offsite Analysis

A site reconnaissance was performed by Brian R. Kalab of Insight engineering on June 22, 2021, to verify the downstream flow paths and observe any drainage problems downstream of the site. The sky was cloudy overcast with a temperature of 73 degrees.

The project site contains approximately 16 Acres. The development area includes 3 parcels (APN# 31051200301000, APN# 31051200301400, APN# 31051200301500) The property to the west of the site has been approved for construction. The existing drainage basin includes the development area and two upstream parcels located south of the property. The existing site is currently undeveloped and exists as low growing foliage with few trees and a man-made pond located on the northern portion of the site. There are two wetlands located on the northern portion of the site which will remain undisturbed. The existing site contains two drainage basins. Basin-1 that slopes to the northwest into the existing pond includes the development area. Basin-2 slopes northeast towards the Type-F stream. Basin-2 is a part of the property and will remain undisturbed. Based on the topographic survey of the site, there are upstream flows entering the site. Please refer to the upstream and downstream analysis for more details. No visible on-site drainage problems were observed at the time of field investigations.

3.1 Upstream Analysis

Upstream flows are entering the site from southern portion of the project. Upstream parcels include APN # 31051200301600 and APN # 31051200300300.The upstream flows were included in the developed drainage basin in order to calculate the required volume for the pond. The upstream flows will be collected through a French drain and conveyed to the existing pond to continue its natural drainage path.

3.2 Downstream Analysis

The existing site contains two drainage basins. Basin-1 that slopes to the northwest into the existing pond includes the development area. Basin-2 that slopes northeast towards stream is outside the clearing limit. The outlet from the existing onsite pond flows into a detention pond

located on the neighboring property to the northwest. The outlet from that pond drains to the west and travels underneath S Stillaguamish Ave into Kruger Creek that flows east in an unrestricted manner for about 2,900 feet and flows into Portage Creek. Portage creek flows west in an unrestricted manner. Basin-2 slopes northeast towards an unnamed watercourse. The watercourse flows north in an unrestricted manner. This is where the 1-mile downstream analysis was completed. There do not appear to be any restrictions or erosion problems within 1 mile of the site.

The Existing detention pond and the proposed discharge structure will store water that is currently flowing in an unrestrained manner and will meter a restricted flow into the downstream channel at smaller flow rates, which theoretically existed in the pre-developed condition. Therefore, the downstream public channel should not experience any future flooding problems due to the proposed development.

The proposed project flow into a detention pond and a control manhole. As per county records properties north and west of the project flows into the detention pond in the existing phase. The total existing drainage basins, as well as the proposed development, was included in the developed drainage basin in order to calculate the water surface elevation for the pond. The water surface elevation for the existing pond will rise 0.21 foot (with sufficient freeboard) due to the proposed development based on the hydraulic calculations for the pond. Please refer to the Hydraulic Analysis Map-1 and 2 in the following pages for more details. The calculations for the pond inputs and the hydraulic analysis are shown in appendix G.

FIGURE 4. DOWNSTREAM ANALYSIS MAP

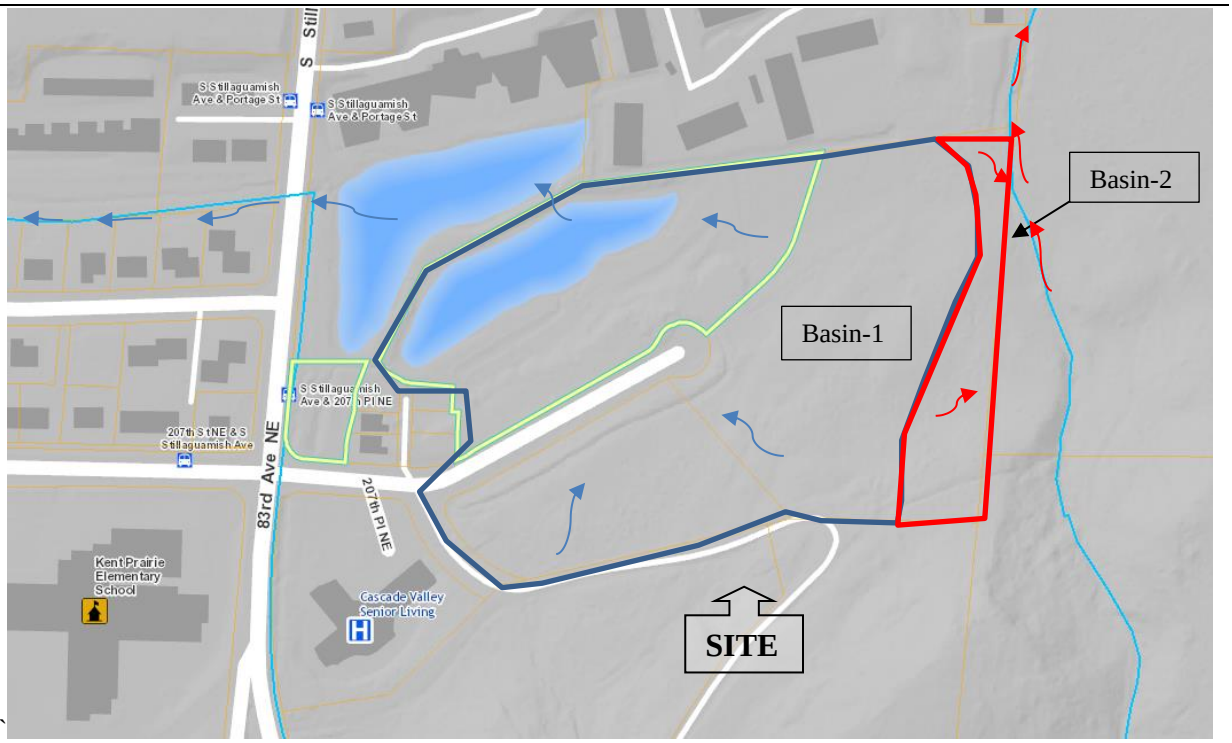

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Figure 4 - Downstream Analysis Map
Pioneer Point
Arlington, Washington

SCALE: NONE	**DATE:** 11/8/24	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 \docs\drainage report	

FIGURE 5. HYDRAULIC ANALYSIS MAP

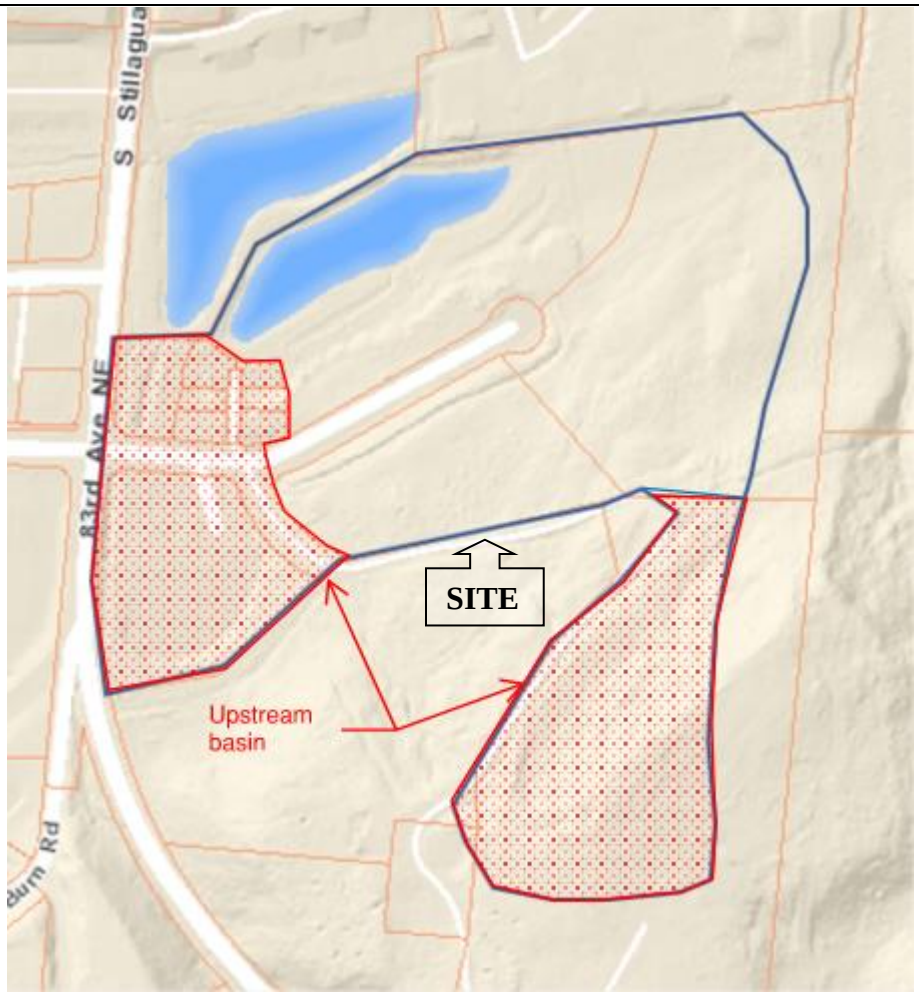

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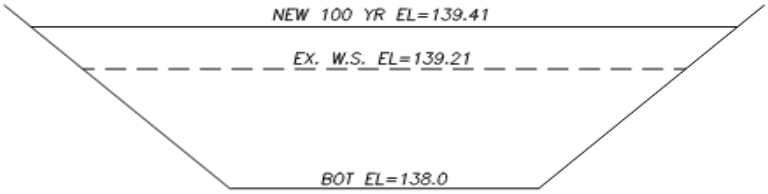
Figure 5 - Hydraulic Analysis Map
Pioneer Point
Arlington, Washington

SCALE: NONE	**DATE:** 11/8/24	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 \docs\drainage report	

FIGURE 6. HYDRAULIC ANALYSIS MAP-2



1 / C3.3 EXISTING POND DETAIL
NOT TO SCALE

Stage Frequency (feet)	1001 hr	1005 hr
2 Year =	0.3598	0.2237
5 Year =	0.5155	0.3457
10 Year =	0.6320	0.4445
25 Year =	0.7951	0.5921
50 Year =	0.9286	0.7200
100 Year =	1.0727	0.8646

1001 : Developed flow
1005 : Predeveloped flow

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Figure 4 - Hydraulic Analysis Map-2
Pioneer Point
Arlington, Washington

SCALE: NONE	DATE: 11/8/24	JOB #: 17-0828
BY: SG	FILE NAME: 17-0828 \docs\drainage report	

4.0 Developed Conditions

The proposed project ***Pioneer Point*** is located at 8500 Block of 207th ST NE Arlington, Washington. More generally, the site is located in Section 12, Township 31 North, and Range 5 East of the Willamette Meridian in Snohomish County, Washington. Per SCC survey of Snohomish County, the project site contains Norma and Pastik type soils that have a hydrologic classification of Type "C".

The site is zoned RHD. The clearing area for the proposed development contains 3.92 Acres. The proposal is to construct 49 townhome units with access road and associated utilities. The access to the new units will be from the new public local access street. The driveway entrances will be constructed per city of Arlington standards.

Per Figure 2.2, (flow chart for new development requirements) Volume I Snohomish County Drainage Manual, Minimum requirements #1 through 9 shall apply for this project. See the Minimum Requirements Summary included later in this report. Flow control requirements will be met by the existing onsite pond on the northern portion of the site. A discharge structure in the form of weir has been designed to provide adequate flow control for the developed basin. The total existing drainage basin as well as the proposed development was included in the developed drainage basin in order to calculate the required volume for the pond. The water surface elevation for the existing pond will rise 0.21 foot (with sufficient freeboard) due to the proposed development based on the hydraulic calculations for the pond. The detention volume was calculated in WWHM 2012. Refer to section 5.0 for the hydraulic analysis. The total required detention volume is 53,950 CF. Enhanced Water quality for the site will be provided an MWS filter manufactured by Bioclean Environmental services Inc. located upstream of detention pond.

Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMPs shall be applied to provide onsite stormwater management and must be considered in the following order per List #2: Full Dispersion, Infiltration, Bioretention, Basic Dispersion, and then Perforated Stub-Out Connections. Full Dispersion is infeasible because the required native

vegetation preservation could not be achieved. Full Infiltration, Bioretention, Basic dispersion, Permeable Pavement and Perforated stub out are not feasible due to the presence of steep slopes present on the site. Refer to the geotechnical report located within Section 6 for more information. The following BMPs shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Sheet flow Dispersion. Full dispersion and is not feasible per explanation above. Permeable Pavement, Bioretention, and then Sheet flow Dispersion are not feasible due to the presence of steep slopes present on the site. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site.

5.0 Site Hydraulic Conditions

From the Soil Conservation Service Map of Snohomish County, the majority of the site contains Norma and Pastik type soils that have a hydrologic classification of Type "C".

5.1 Existing Drainage Basin Summary

Onsite Basin	= 16.00 Acres
Upstream Basin	= 7.08 Acres
Total Existing Basin	= 23.08 Acres

Existing Impervious:

Onsite Basin: = 16.00 Acres

Existing Pond	= 1.50 Acres
Total Site Impervious	= 1.50 Acres

Site Pervious:

Forested area = 14.43 Acres

Upstream Basin: = 7.08 Acres

Existing Roof	= 0.45 Acres
Existing Road	= 0.90 Acres
Existing Sidewalk	= 0.11 Acres
Total Upstream Impervious	= 1.46 Acres

Site Pervious:

Pervious Area (Lawn)	= 0.72 Acres
Forested Area	= 4.90 Acres
Total Pervious area	= 5.62 Acres

Refer to the Existing Basin Map and the following pages for more details.

5.2 Developed Drainage Basin Summary

Onsite Basin (+)	= 16.00 Acres
Upstream Basin (+)	= 7.08 Acres
Total Developed Basin	= 23.08 Acres

Developed Impervious Areas:

Onsite Basin:

Site Impervious:	
Existing Pond	= 1.50 Acres
Proposed Road	= 0.70 Acres
Proposed Roof	= 0.90 Acres
Proposed Driveway	= 0.23 Acres
Proposed Sidewalk	= 0.21 Acres
Total Site Impervious	= 3.44 Acres

Site Pervious:	
Pervious Area (Lawn)	= 3.15 Acres
Forested Area	= 9.31 Acres
Total Pervious area	= 12.56 Acres

Upstream Basin:

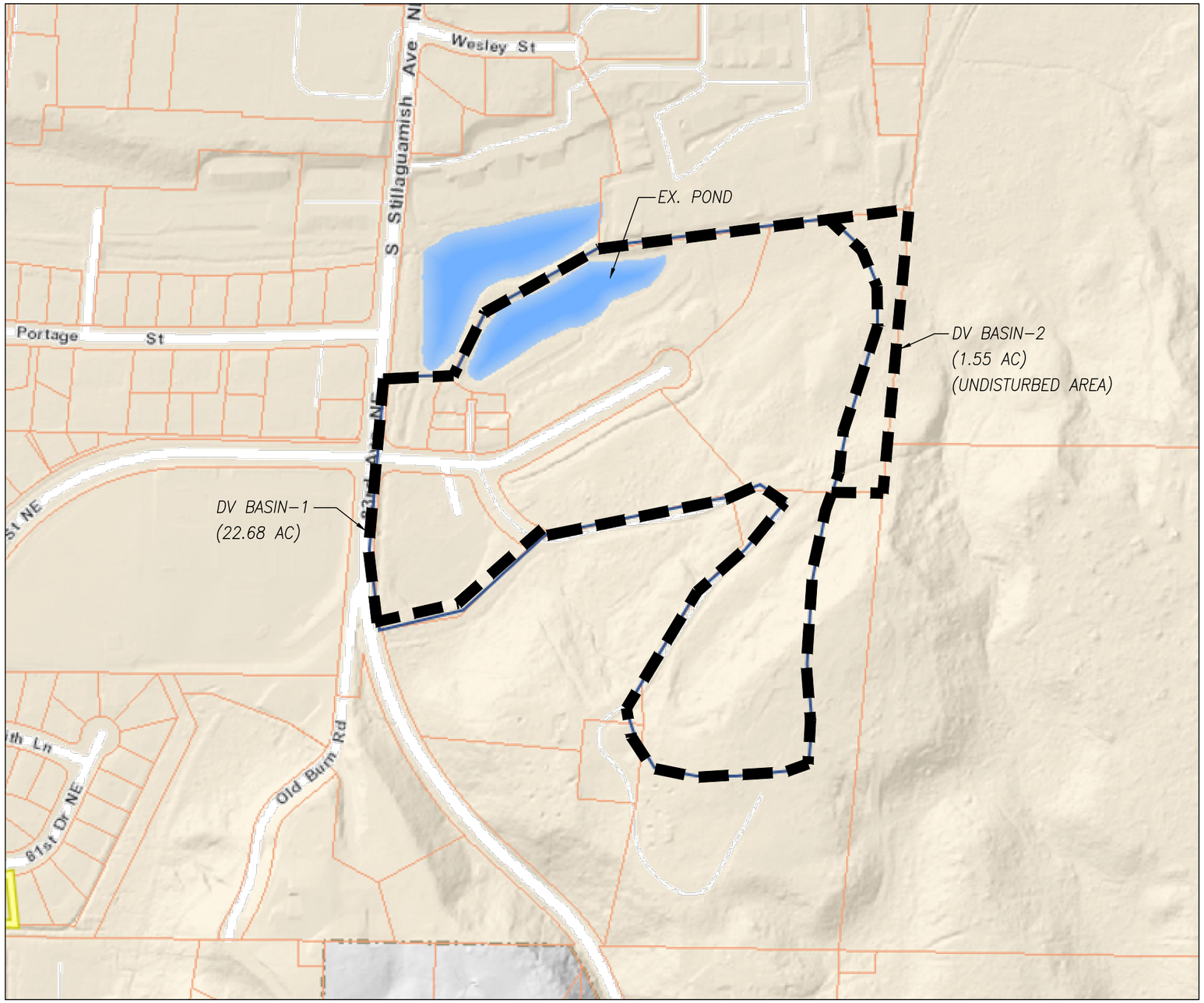
Existing Roof	= 0.45 Acres
Existing Road	= 0.90 Acres
Existing Sidewalk	= 0.11 Acres
Total Upstream Impervious	= 1.46 Acres

Site Pervious:	
Pervious Area (Lawn)	= 0.72 Acres
Forested Area	= 4.90 Acres
Total Pervious area	= 5.62 Acres

Refer to the Developed Basin Map and the following pages for more details.

Total Pond Volume required = 53,950 CF

Total Pond Volume Provided = 125,888 CF



SCALE: 1" = 50'

0 25 50

DEVELOPED BASIN MAP

SCALE: 1" = 50'

0 25 50

EXISTING BASIN MAP

WWHM2012
PROJECT REPORT

Project Name: Detention pond 8-30-24
Site Name: Pioneer Point
Site Address: XXX 207th Pl NE
City : Arlington
Report Date: 9/19/2024
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	3.35
C, Forest, Steep	11.15
Pervious Total	14.5

Impervious Land Use	acre
POND	1.5
Impervious Total	1.5
Basin Total	16

Element Flows To:

Surface	Interflow	Groundwater

Name : Upstream
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Steep	2.65
C, Forest, Mod	2.25
C, Lawn, Flat	.72
Pervious Total	5.62

Impervious Land Use	acre
ROADS MOD	0.9
ROOF TOPS FLAT	0.45
SIDEWALKS FLAT	0.11
Impervious Total	1.46
Basin Total	7.08

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Developed Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	3.15
C, Forest, Mod	3.13
C, Forest, Steep	6.18
Pervious Total	12.46

Impervious Land Use	acre
ROADS MOD	0.7
ROOF TOPS FLAT	0.9
DRIVEWAYS MOD	0.23
SIDEWALKS FLAT	0.21
POND	1.5
Impervious Total	3.54
Basin Total	16

Element Flows To:

Surface	Interflow	Groundwater
SSD Table 1	SSD Table 1	

Name : SSD Table 1
Depth: 0.79 ft.
Discharge Structure: 1
Riser Height: 1.79 ft.
Riser Diameter: 92.4 in.
Notch Type: Rectangular
Notch Width: 1.100 ft.
Notch Height: 1.290 ft.
Orifice 1 Diameter: 7.14 in. **Elevation:** 0 ft.

Element Flows To:

Outlet 1	Outlet 2

SSD Table Hydraulic Table

Stage (feet)	Area (ac.)	Volume (ac-ft.)	Outlet Struct	NotUsed	NotUsed	NotUsed	NotUsed
0.000	1.536	0.000	0.000	0.301	0.000	0.000	0.000
0.010	1.537	0.016	0.138	0.323	0.000	0.000	0.000
0.020	1.538	0.031	0.196	0.345	0.000	0.000	0.000
0.030	1.538	0.047	0.240	0.368	0.000	0.000	0.000
0.040	1.539	0.062	0.277	0.392	0.000	0.000	0.000
0.050	1.540	0.078	0.309	0.457	0.000	0.000	0.000
0.060	1.541	0.093	0.339	0.596	0.000	0.000	0.000
0.070	1.542	0.109	0.366	0.780	0.000	0.000	0.000
0.080	1.542	0.124	0.391	0.999	0.000	0.000	0.000
0.090	1.543	0.140	0.415	1.250	0.000	0.000	0.000
0.100	1.544	0.155	0.437	1.528	0.000	0.000	0.000
0.110	1.545	0.171	0.459	1.831	0.000	0.000	0.000
0.120	1.546	0.186	0.479	2.157	0.000	0.000	0.000
0.130	1.547	0.202	0.499	2.504	0.000	0.000	0.000
0.140	1.547	0.217	0.518	2.872	0.000	0.000	0.000
0.150	1.548	0.233	0.536	3.258	0.000	0.000	0.000
0.160	1.549	0.249	0.553	3.663	0.000	0.000	0.000
0.170	1.550	0.264	0.570	4.086	0.000	0.000	0.000
0.180	1.551	0.280	0.587	4.525	0.000	0.000	0.000
0.190	1.551	0.295	0.603	4.980	0.000	0.000	0.000
0.200	1.552	0.311	0.619	5.451	0.000	0.000	0.000
0.210	1.553	0.326	0.634	5.937	0.000	0.000	0.000
0.220	1.554	0.342	0.649	6.437	0.000	0.000	0.000
0.230	1.555	0.357	0.663	6.952	0.000	0.000	0.000
0.240	1.555	0.373	0.678	7.481	0.000	0.000	0.000
0.250	1.556	0.388	0.692	8.023	0.000	0.000	0.000
0.260	1.557	0.404	0.705	8.578	0.000	0.000	0.000
0.270	1.558	0.419	0.719	9.146	0.000	0.000	0.000
0.280	1.559	0.435	0.732	9.726	0.000	0.000	0.000

0.290	1.559	0.450	0.745	10.32	0.000	0.000	0.000
0.300	1.560	0.466	0.758	10.92	0.000	0.000	0.000
0.310	1.561	0.481	0.770	11.54	0.000	0.000	0.000
0.320	1.562	0.497	0.783	12.17	0.000	0.000	0.000
0.330	1.563	0.513	0.795	12.81	0.000	0.000	0.000
0.340	1.564	0.528	0.807	13.46	0.000	0.000	0.000
0.350	1.564	0.544	0.818	14.12	0.000	0.000	0.000
0.360	1.565	0.559	0.830	14.79	0.000	0.000	0.000
0.370	1.566	0.575	0.842	15.47	0.000	0.000	0.000
0.380	1.567	0.590	0.853	16.17	0.000	0.000	0.000
0.390	1.568	0.606	0.864	16.87	0.000	0.000	0.000
0.400	1.568	0.621	0.875	17.58	0.000	0.000	0.000
0.410	1.569	0.637	0.886	18.31	0.000	0.000	0.000
0.420	1.570	0.652	0.897	19.04	0.000	0.000	0.000
0.430	1.571	0.668	0.907	19.78	0.000	0.000	0.000
0.440	1.572	0.683	0.918	20.53	0.000	0.000	0.000
0.450	1.572	0.699	0.928	21.30	0.000	0.000	0.000
0.460	1.573	0.714	0.938	22.07	0.000	0.000	0.000
0.470	1.574	0.730	0.948	22.85	0.000	0.000	0.000
0.480	1.575	0.746	0.958	23.63	0.000	0.000	0.000
0.490	1.576	0.761	0.968	24.43	0.000	0.000	0.000
0.500	1.577	0.777	0.978	25.24	0.000	0.000	0.000
0.510	1.577	0.792	0.992	26.05	0.000	0.000	0.000
0.520	1.578	0.808	1.008	26.88	0.000	0.000	0.000
0.530	1.579	0.823	1.026	27.71	0.000	0.000	0.000
0.540	1.580	0.839	1.046	28.55	0.000	0.000	0.000
0.550	1.581	0.854	1.067	29.40	0.000	0.000	0.000
0.560	1.581	0.870	1.089	30.26	0.000	0.000	0.000
0.570	1.582	0.885	1.112	31.12	0.000	0.000	0.000
0.580	1.583	0.901	1.136	31.99	0.000	0.000	0.000
0.590	1.584	0.916	1.162	32.88	0.000	0.000	0.000
0.600	1.585	0.932	1.187	33.76	0.000	0.000	0.000
0.610	1.585	0.947	1.214	34.66	0.000	0.000	0.000
0.620	1.586	0.963	1.242	35.56	0.000	0.000	0.000
0.630	1.587	0.978	1.270	36.48	0.000	0.000	0.000
0.640	1.588	0.994	1.299	37.39	0.000	0.000	0.000
0.650	1.589	1.010	1.328	38.32	0.000	0.000	0.000
0.660	1.589	1.025	1.358	39.25	0.000	0.000	0.000
0.670	1.590	1.041	1.389	40.19	0.000	0.000	0.000
0.680	1.591	1.056	1.421	41.14	0.000	0.000	0.000
0.690	1.592	1.072	1.453	42.10	0.000	0.000	0.000
0.700	1.593	1.087	1.485	43.06	0.000	0.000	0.000
0.710	1.594	1.103	1.518	44.03	0.000	0.000	0.000
0.720	1.594	1.118	1.552	45.00	0.000	0.000	0.000
0.730	1.595	1.134	1.586	45.98	0.000	0.000	0.000
0.740	1.596	1.149	1.621	46.97	0.000	0.000	0.000
0.750	1.597	1.165	1.656	47.97	0.000	0.000	0.000
0.760	1.598	1.180	1.692	48.97	0.000	0.000	0.000
0.770	1.598	1.196	1.728	49.98	0.000	0.000	0.000
0.780	1.599	1.211	1.765	50.99	0.000	0.000	0.000
0.790	1.600	1.227	1.802	52.01	0.000	0.000	0.000
1.040	1.664	1.633	2.864	0.000	0.000	0.000	0.000
1.290	1.665	2.045	4.143	0.000	0.000	0.000	0.000
1.540	1.696	2.466	5.602	0.000	0.000	0.000	0.000
1.790	1.720	2.890	7.218	0.000	0.000	0.000	0.000

2.790 1.720 4.520 88.36 0.000 0.000 0.000 0.000

Name : Upstream Basin
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	2.25
C, Forest, Steep	2.65
C, Lawn, Flat	.72
Pervious Total	5.62

Impervious Land Use	acre
ROADS MOD	0.9
ROOF TOPS FLAT	0.45
SIDEWALKS FLAT	0.11
Impervious Total	1.46
Basin Total	7.08

Element Flows To:

Surface	Interflow	Groundwater
SSD Table 1	SSD Table 1	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:20.12
Total Impervious Area:2.96

Mitigated Landuse Totals for POC #1
Total Pervious Area:18.08
Total Impervious Area:5

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.746883
5 year	2.479087

10 year	3.011528
25 year	3.739143
50 year	4.321589
100 year	4.939201

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.843486
5 year	1.139439
10 year	1.36902
25 year	1.70011
50 year	1.978557
100 year	2.286083

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	1.560	0.741
1950	3.125	0.879
1951	1.284	0.760
1952	1.541	0.696
1953	2.081	0.683
1954	2.746	0.805
1955	2.520	1.035
1956	1.437	0.938
1957	2.522	1.095
1958	3.671	0.995
1959	1.550	0.843
1960	1.560	0.909
1961	3.809	1.052
1962	2.429	0.844
1963	3.739	0.927
1964	1.494	0.820
1965	1.072	0.799
1966	1.039	0.615
1967	2.682	0.912
1968	1.799	1.135
1969	3.615	0.757
1970	1.159	0.675
1971	2.052	0.851
1972	3.100	0.906
1973	1.730	0.710
1974	1.654	0.704
1975	1.835	0.714
1976	1.281	0.744
1977	1.181	0.654
1978	1.310	0.652
1979	3.657	1.108
1980	1.251	0.777
1981	1.561	0.726
1982	1.451	0.970
1983	1.642	0.730
1984	1.441	0.917
1985	2.053	0.993

1986	3.011	2.574
1987	1.666	1.290
1988	1.294	0.723
1989	2.202	0.650
1990	1.119	0.831
1991	1.238	0.852
1992	1.576	0.701
1993	1.307	0.694
1994	0.938	0.747
1995	1.217	0.852
1996	2.222	1.318
1997	4.211	2.960
1998	1.837	0.740
1999	1.147	0.752
2000	1.757	0.713
2001	0.839	0.507
2002	1.113	0.825
2003	1.068	0.723
2004	1.905	1.121
2005	1.523	0.846
2006	2.256	1.596
2007	2.469	0.883
2008	3.017	2.781
2009	1.494	0.783

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	4.2112	2.9597
2	3.8090	2.7806
3	3.7393	2.5744
4	3.6712	1.5956
5	3.6573	1.3183
6	3.6150	1.2903
7	3.1249	1.1346
8	3.1002	1.1212
9	3.0173	1.1076
10	3.0111	1.0946
11	2.7456	1.0517
12	2.6822	1.0351
13	2.5218	0.9952
14	2.5197	0.9930
15	2.4690	0.9703
16	2.4286	0.9377
17	2.2562	0.9272
18	2.2221	0.9169
19	2.2018	0.9120
20	2.0811	0.9087
21	2.0532	0.9061
22	2.0520	0.8828
23	1.9048	0.8788
24	1.8375	0.8521
25	1.8351	0.8518
26	1.7987	0.8512

27	1.7572	0.8457
28	1.7297	0.8442
29	1.6656	0.8429
30	1.6544	0.8306
31	1.6419	0.8249
32	1.5760	0.8196
33	1.5610	0.8054
34	1.5601	0.7987
35	1.5596	0.7832
36	1.5503	0.7768
37	1.5408	0.7596
38	1.5230	0.7574
39	1.4939	0.7519
40	1.4936	0.7467
41	1.4512	0.7440
42	1.4410	0.7411
43	1.4366	0.7396
44	1.3100	0.7298
45	1.3074	0.7258
46	1.2936	0.7234
47	1.2841	0.7227
48	1.2811	0.7143
49	1.2511	0.7134
50	1.2376	0.7102
51	1.2172	0.7037
52	1.1813	0.7006
53	1.1591	0.6960
54	1.1473	0.6936
55	1.1190	0.6830
56	1.1131	0.6753
57	1.0721	0.6540
58	1.0683	0.6520
59	1.0394	0.6500
60	0.9384	0.6153
61	0.8390	0.5073

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.8734	1181	527	44	Pass
0.9083	1042	403	38	Pass
0.9431	922	318	34	Pass
0.9779	812	253	31	Pass
1.0128	705	216	30	Pass
1.0476	630	196	31	Pass
1.0824	566	179	31	Pass
1.1172	509	160	31	Pass
1.1521	461	146	31	Pass
1.1869	408	140	34	Pass
1.2217	381	130	34	Pass

1.2566	339	120	35	Pass
1.2914	304	110	36	Pass
1.3262	275	100	36	Pass
1.3611	254	99	38	Pass
1.3959	235	94	40	Pass
1.4307	218	90	41	Pass
1.4655	194	87	44	Pass
1.5004	179	83	46	Pass
1.5352	171	79	46	Pass
1.5700	155	75	48	Pass
1.6049	147	72	48	Pass
1.6397	138	70	50	Pass
1.6745	133	67	50	Pass
1.7094	127	65	51	Pass
1.7442	125	62	49	Pass
1.7790	116	61	52	Pass
1.8138	111	59	53	Pass
1.8487	106	57	53	Pass
1.8835	99	56	56	Pass
1.9183	94	54	57	Pass
1.9532	91	52	57	Pass
1.9880	89	50	56	Pass
2.0228	86	48	55	Pass
2.0577	81	44	54	Pass
2.0925	76	42	55	Pass
2.1273	73	41	56	Pass
2.1621	70	40	57	Pass
2.1970	67	37	55	Pass
2.2318	61	35	57	Pass
2.2666	55	34	61	Pass
2.3015	53	34	64	Pass
2.3363	51	32	62	Pass
2.3711	49	28	57	Pass
2.4060	47	28	59	Pass
2.4408	42	27	64	Pass
2.4756	38	22	57	Pass
2.5104	36	22	61	Pass
2.5453	32	18	56	Pass
2.5801	31	16	51	Pass
2.6149	28	15	53	Pass
2.6498	28	11	39	Pass
2.6846	25	11	44	Pass
2.7194	25	11	44	Pass
2.7542	21	9	42	Pass
2.7891	20	4	20	Pass
2.8239	20	3	15	Pass
2.8587	19	3	15	Pass
2.8936	18	1	5	Pass
2.9284	18	1	5	Pass
2.9632	16	0	0	Pass
2.9981	16	0	0	Pass
3.0329	12	0	0	Pass
3.0677	12	0	0	Pass
3.1025	10	0	0	Pass
3.1374	7	0	0	Pass

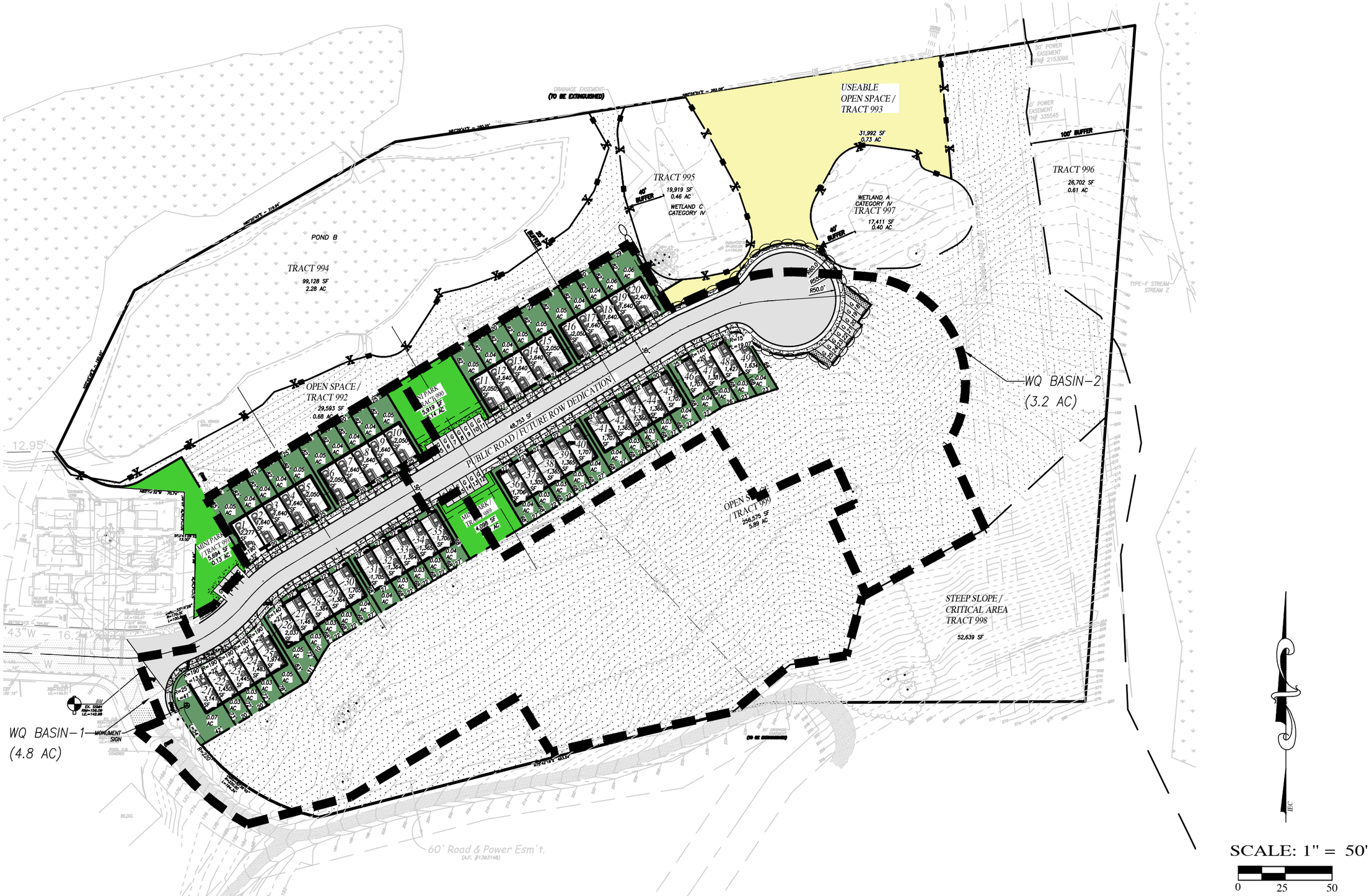
3.1722	7	0	0	Pass
3.2070	7	0	0	Pass
3.2419	7	0	0	Pass
3.2767	7	0	0	Pass
3.3115	7	0	0	Pass
3.3464	6	0	0	Pass
3.3812	6	0	0	Pass
3.4160	6	0	0	Pass
3.4508	6	0	0	Pass
3.4857	6	0	0	Pass
3.5205	6	0	0	Pass
3.5553	6	0	0	Pass
3.5902	6	0	0	Pass
3.6250	5	0	0	Pass
3.6598	4	0	0	Pass
3.6947	3	0	0	Pass
3.7295	3	0	0	Pass
3.7643	2	0	0	Pass
3.7991	2	0	0	Pass
3.8340	1	0	0	Pass
3.8688	1	0	0	Pass
3.9036	1	0	0	Pass
3.9385	1	0	0	Pass
3.9733	1	0	0	Pass
4.0081	1	0	0	Pass
4.0430	1	0	0	Pass
4.0778	1	0	0	Pass
4.1126	1	0	0	Pass
4.1474	1	0	0	Pass
4.1823	1	0	0	Pass
4.2171	0	0	0	Pass
4.2519	0	0	0	Pass
4.2868	0	0	0	Pass
4.3216	0	0	0	Pass

Perlnd and Implnd Changes

No changes have been made.

5.3 Water Quality

Enhanced Water quality for the site will be provided by two MWS filters manufactured by Bioclean Environmental services Inc. located upstream of the detention pond.



WATER QUALITY BASIN MAP

5.4 Conveyance Analysis and Design

A detailed conveyance analysis and design will be provided for the construction submittal.

6.0 Appendix

A. Stormwater Pollution Prevention Plan

B. Geotechnical Engineering Report

A. STORMWATER POLLUTION PREVENTION PLAN

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Pioneer Point

Prepared for:

The Washington State Department of Ecology
Northwest Regional Office
3190 – 160th Avenue SE
Bellevue, WA 98008

Permittee / Owner	Developer	Operator / Contractor
Lavoy Inc.	Lavoy Inc.	To be determined
1602 4th St	1602 4th St	
Marysville, WA 98270	Marysville, WA 98270	

Project Site Location

8500 Block of 207th Pl NE
Arlington, WA 98223

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
Brian R. Kalab, P. E.	Insight Engineering	425-303-9363

SWPPP Prepared By

Name	Organization	Contact Phone Number
Sithara George, BSCE.	Insight Engineering	425-303-9363

SWPPP Preparation Date

August 19, 2021

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction Duration	May 1, 2025	April 10, 2026

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A. Site Map

B. BMP Detail

C. Correspondence

D. Site Inspection Form

E. Construction Stormwater General Permit (CSWGP)

F. 303(d) List Waterbodies / TMDL Waterbodies Information

G. Contaminated Site Information

H. Engineering Calculations

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: Pioneer Point
Street/Location: 8500 Block of 207th Pl NE

City: Arlington State: WA Zip code: 98223
Subdivision:
Receiving waterbody: Portage Creek

1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 16.00 acres
Disturbed acreage: 8.55 acres
Existing structures: 1.57 acres
Landscape 4.85 acres
topography:
Drainage patterns: Sheet Flow
Existing Vegetation: landscape with several trees.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): Buffer area provided from wetland

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: N/A

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
The proposal is to construct 49-unit townhome units and access road with associated utilities. The access to the new units will be from new public local access street. Description of construction activities (example: site preparation, demolition, excavation):
Prepare the site for construction by the installation of the indicated BMP's. Excavate the site for the new single-family homes.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

Flow control requirements will be met by the existing onsite pond on the northern portion of the site. A discharge structure in the form of weir has been designed to provide adequate flow control for the developed basin. The total existing drainage basin as well as the proposed development was included in the developed drainage basin in order to calculate the required volume for the pond. The water surface elevation for the existing pond will rise 0.2 foot (with sufficient freeboard) due to the proposed development based on the hydraulic calculations for the

pond. The detention volume was calculated in WWHM 2012, refer to section 5.0 for the hydraulic analysis. The total required detention volume is 53,950 CF. Enhanced Water quality for the site will be provided by an MWS filter manufactured by Bioclean Environmental services Inc. located upstream of detention pond. The pond's outlet will continue to its natural drainage path.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
The access to the new homes will be from new public local access street.. Typical residential landscaping will be around the homes and the driveway to provide final stabilization.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
Enhanced Water quality for the site will be provided by an MWS filter manufactured by Bioclean Environmental services Inc. located upstream of detention pond.

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e., hand-written notes and deletions). Update the SWPPP when the CESCL or local agency has noted a deficiency in BMPs or deviation from original design.

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible.

A protective barrier shall be placed around the protected trees prior to land preparation or construction activities, and shall remain in place until all construction activity is terminated. No equipment, chemicals, soil deposits or construction materials shall be placed within the protective barriers. Any landscaping activities subsequent to the removal of the barriers shall be accomplished with light machinery or hand labor. (LMC 17.15.160 B1)

List and describe BMPs:

- Preserving Natural Vegetation (BMP C101)
- High Visibility Plastic or Metal Fence (BMP C103)
- Buffer Zones (BMP C102)

Install orange barrier fencing along the clearing limits, according to the approved construction plans, prior to any construction activities. Maintain until all construction activities are completed.

Alternate BMPs for marking clearing limits are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Installation Schedules: The limits of construction will be clearly marked before land-disturbing activities begin.

Inspection and Maintenance plan: Site inspections will be conducted at least once a week and within 24 hours following any rainfall event which causes a discharge of stormwater from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

Responsible Staff: Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters.

List and describe BMPs: Stabilized Construction Entrance (BMP C105)
Alternate construction access BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Installation Schedules: Install the temporary construction entrance, according to the approved construction plans, prior to any clearing or grading activities

Inspection and Maintenance plan: Maintain until the access road is paved.

Responsible Staff: Contractor.

2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems).

Will you construct stormwater retention and/or detention facilities?

☒ Yes ☐ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

☐ Yes ☒ No

List and describe BMPs: High Visibility Plastic or Metal Fence (BMP C103)
Temporary Sediment Pond (C241)

Alternate flow control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Installation Schedules: Install orange high rise fencing along the clearing limits, according to the approved construction plans, prior to any construction activities.

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

2.1.4 Element 4: Install Sediment Controls

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas (BMP C240 paragraph 5, page 4-102).

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or bio-filtration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be re-stabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMP will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls. In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize wash-off of sediments from adjacent streets in runoff.

List and describe BMPs:

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)

Alternate sediment control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Installation Schedules: Install silt fencing, according to the approved plans, prior to any clearing or grading activities. Install catch basin filters, according to the approved construction plans, as catch basins are installed and become operable.

Inspection and Maintenance plan: Maintain Silt Fence and Storm Drain Inlet Protection until all construction activities are completed.

Responsible Staff: Contractor.

2.1.5 Element 5: Stabilize Soils

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: May1, 2025 End date: April 10, 2026

Will you construct during the wet season?
☒ Yes ☐ No

List and describe BMPs:

Exposed and un-worked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)

Installation Schedules:

Apply temporary hydro-seed to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:

Apply permanent hydro-seed to areas at final grade as site grading is completed.

- Mulching (BMP C121)

Installation Schedules:

Apply mulching to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:

Maintain until site grading is completed and permanent hydro-seed is applied.

- Plastic Covering (BMP C123)

Installation Schedules:

Cover stockpiles with plastic sheeting, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:
Maintain until stockpiles are removed from site.

- Dust Control (BMP C140)

Installation Schedules and Inspection and Maintenance plan:

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control. Use of PAM could be a cost-effective dust control method.

Techniques that can be used for unpaved roads and lots include:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
- Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use of paved roadways by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.

 Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

- Early application of gravel base on areas to be paved

Place gravel base on roadways, according to the approved construction plans, after roadways are graded to sub-grade. Maintain until roads are paved.

Alternate soil stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Responsible Staff: Contractor.

2.1.6 Element 6: Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

Will steep slopes be present at the site during construction?
☒ Yes ☐ No

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Plastic Covering (BMP C123)

Alternate slope protection BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

Installation Schedules: Apply temporary hydro-seed to cut and fill slopes, according to the approved construction plans, as needed to minimize erosion during site grading.
Inspection and Maintenance plan: Apply permanent hydro-seed to cut and fill slopes at final grade as site grading is completed.
Responsible Staff: Contractor

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.

List and describe BMPs:

Drop Inlet Protection

- Storm Drain Inet Protection (C220)

If the BMP options listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D), or if no BMPs are listed above but deemed necessary during construction, the Certified Erosion and Sediment Control Lead shall implement one or more of the alternative BMP inlet protection options listed in Appendix C.

Installation Schedules: Install catch basin filters, according to the approved construction plans, as catch basins become operable.

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

2.1.8 Element 8: Stabilize Channels and Outlets

No site runoff is to be conveyed into channels, or discharged to a stream or some other natural drainage point.— The onsite flowrates will be minimal therefore no BMP's are proposed Stabilize Channels and Outlets.

If any BMP's are provideded, the project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

List and describe BMPs:

- Outlet Protection (BMP C209)

Installation Schedules: Install rip-raps, according to the approved construction plans.

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (List pollutants and source, if applicable)
petroleum products
chemicals stored in the construction areas
Dust released from demolished sidewalks
Solid waste

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site permanent fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).

 Process water and slurry resulting from saw-cutting and surfacing operations will be prevented from entering the waters of the State by implementing Saw-cutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

 Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

Sanitary wastewater:

 Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.

Solid Waste:

 Solid waste will be stored in secure, clearly marked containers.

Other:

 Other BMPs will be administered as necessary to address any additional pollutant sources on site.

A SPCC plan is required for this site.

As per the Federal regulations of the Clean Water Act (CWA) and according to Final Rule 40 CFR Part 112, as stated in the National Register, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required for construction activities. A SPCC Plan has been prepared to address an approach to prevent, respond to, and report spills or releases to the environment that could result from construction activities. This Plan must:

 Be well thought out in accordance with good engineering;

List and describe BMPs: BMP C151, BMP C152, BMP C153, BMP C140 and BMP C220.

Installation Schedules:

Inspection and Maintenance plan: All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris.

Achieve three objectives - prevent spills, contain a spill that occurs, and clean up the spill;

 Identify the name, location, owner, and type of facility;
 Include the date of initial operation and oil spill history;
 Name the designated person responsible;
 Show evidence of approval and certification by the person in authority; and
 Contain a facility analysis.

Responsible Staff: Contractor.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

☐ Yes ☒ No

Will wheel wash or tire bath system BMPs be used during construction?

☒ Yes ☐ No

Will pH-modifying sources be present on-site?

☒ Yes ☐ No

Table 3 – pH-Modifying Sources

☐	None
☒	Bulk cement
☒	Cement kiln dust
☒	Fly ash
☒	Other cementitious materials
☒	New concrete washing or curing waters
☒	Waste streams generated from concrete grinding and sawing
☒	Exposed aggregate processes
☒	Dewatering concrete vaults
☐	Concrete pumping and mixer washout waters
☐	Recycled concrete
☐	Recycled concrete stockpiles
☐	Other (i.e., calcium lignosulfate) [please describe:]

Stormwater runoff will be monitored for pH starting on the first day of any activity that includes more than 40 yards of poured or recycled concrete, or after the application of "Engineered Soils" such as, Portland cement treated base, cement kiln dust, or fly ash. This does not include fertilizers. For concrete work, pH monitoring will start the first day concrete is poured and continue until 3 weeks after the last pour. For engineered soils, the pH monitoring period begins when engineered soils are first exposed to precipitation and continue until the area is fully stabilized.

Stormwater samples will be collected daily from all points of discharge from the site and measured for pH using a calibrated pH meter, pH test kit, or wide range pH indicator paper. If the measured pH is 8.5 or greater, the following steps will be conducted:

1. Prevent the high pH water from entering storm drains or surface water.

2. Adjust or neutralize the high pH water if necessary using appropriate technology such as CO_2 sparging (liquid or dry ice).

3. Contact Ecology if chemical treatment other than CO_2 sparging is planned.

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed. Excess concrete must be returned to the plant for recycling if there are no concrete washout areas with appropriate BMPs installed.

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?

☒ Yes ☐ No

2.1.10 Element 10: Control Dewatering

No dewatering is proposed for the development. If dewatering is needed, Transport. off-site in a vehicle (vacuum truck for legal disposal).

Table 4 – Dewatering BMPs

☐	Infiltration
☒	Transport off-site in a vehicle (vacuum truck for legal disposal)
☐	Ecology-approved on-site chemical treatment or other suitable treatment technologies
☐	Sanitary or combined sewer discharge with local sewer district approval (last resort)
☐	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.
Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).
Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.
All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.
Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.
Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

List and describe BMPs :

- Scheduling BMP (C162)

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☒	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
☒	Schedule major earthwork during the dry season
☐	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
Mark Clearing Limits	High Visibility Plastic or Metal Fence (BMP C103)	05/01/2025	Dry
Mobilize equipment on site	Construction Road/Parking area stabilization (BMP C107)	05/01/202	Dry
Mobilize and store all ESC and soil stabilization products	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220) Plastic Covering (BMP C123) Surface roughening (BMP C130)	05/01/2025	Dry
Install ESC measures	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220)	05/01/2025	Dry
Install stabilized construction entrance	Stabilized Construction Entrance (BMP C105)	05/01/2025	Dry
Begin clearing and grubbing	Dust Control (BMP C140)	05/15/2025	Dry
Site grading begins	Dust Control (BMP C140)	05/27/2025	Dry
Grade road and stabilize with gravel base	Dust Control (BMP C140)	05/27/2025	Dry
Begin excavation for new utilities and services		07/01/2025	Wet
Soil stabilization on excavated side slopes (in idle, no work areas)	Mulching (BMP C121) Dust Control (BMP C140) Plastic Covering (BMP C123) Nets and Blankets (BMP C122)	08/05/2025	Wet
Temporary erosion control measures (hydro-seeding)	Temporary Seeding (BMP C120)	09/01/2025	Wet
Site grading ends		09/15/2025	Wet
Begin pouring concrete curbs & sidewalks and implement	BMP C151 Concrete Handling (BMP C151) Sawcutting and Surfacing Pollution Prevention (BMP C152)	10/01/2025	Wet

Pave asphalt roads		11/05/2025	Wet
Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season	Scheduling (BMP C162) CESC Lead (BMP C160)	12/01/2025	Wet
Final landscaping and planting begins		03/1/2026	Dry
Permanent erosion control measures (hydro-seeding)	Permanent Seeding (BMP C120)	04/01/2026	Dry

2.1.13 Element 13: Protect Low Impact Development (LID) BMPs

On-site stormwater management BMPs used for runoff from roofs and other hard surfaces include: full dispersion, roof downspout full infiltration or dispersion systems, perforated stubout connections, rain gardens, bioretention systems, permeable pavement, sheetflow dispersion, and concentrated flow dispersion. The areas on the site to be used for these BMPs shall be protected from siltation and compaction during construction by sequencing the construction in a fashion to install these BMPs at the latter part of the construction grading operations, by excluding equipment from the BMPS and the associated areas, and by using the erosion and sedimentation control BMPs listed below. Additional requirements for protecting these BMPs during the construction process, testing functionality, and restoring functionality are needed at the final stage of the construction process.

Relevant BMPs

BMP C102: Buffer Zone BMP
C103: High Visibility Fence BMP
C200: Interceptor Dike and Swale BMP
C201: Grass-lined Channels BMP
C207: Check Dams BMP
C208: Triangular Silt Dike BMP
C231: Brush Barrier BMP
C233: Silt Fence BMP
C234: Vegetated Strip

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Brian Kalab	425-303-9363
Resident Engineer	Brian Kalab / Insight Engineering	425-303-9363
Emergency Ecology Contact	Tracy Walters	425-649-7000
Emergency Permittee/ Owner Contact	Randy Brockway	206-992-5051
Non-Emergency Owner Contact	Randy Brockway	206-992-5051
Monitoring Personnel	TBD	
Ecology Regional Office	Northwest Regional Office	425-649-7000

4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

The receiving waterbody, Swamp Creek, is impaired for: Bacteria, Bioassessment, DO. pH and Temp. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.
The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.
Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

☒	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
☐	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The limit for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.
If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Stop effluent discharge to receiving waterbody immediately. If discharge continues, this will be a direct violation of the SWPPP and CSWGP. Implement baker tanks to prevent discharge from entering reciving water body. Replace/repair BMP's if not functioning properly. Do not discharge runoff until the turbidity value is 25 nephelometric turbidity units (NTU) or less and a transparency less than 33 centimeters.

2. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the limit.
3. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
4. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
    - **Central Region** (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/CRO_nerts_online.html
    - **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/ERO_nerts_online.html
    - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/NWRO_nerts_online.html
    - **Southwest Region** (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/SWRO_nerts_online.html
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for "Significant concrete work" (i.e., greater than 1000 cubic yards poured concrete over the life of the project). The use of recycled concrete or engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

Table 9 – pH Sampling Method

☒	pH meter
☐	pH test kit
☐	Wide range pH indicator paper

5 Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies

5.1 303(d) Listed Waterbodies

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?
☐ Yes ☒ No
Describe the method(s) for 303(d) compliance:N/A

List and describe BMPs:
Concrete Handling (BMP C151)

Sawcutting and Surfacing Pollution Prevention (BMP C152)

Outlet Protection (BMP C209)

Mulching (BMP C121)
Temporary and Permanent Seeding (BMP C120)
Dust Control (BMP C140)
Polyacrylamide (PAM) for Soil Erosion Protection (BMP C126)

5.2 TMDL Waterbodies

Waste Load Allocation for CWSGP discharges:
List and describe BMPs:
List and describe BMPs:
Concrete Handling (BMP C151)

Sawcutting and Surfacing Pollution Prevention (BMP C152)

Outlet Protection (BMP C209)

Mulching (BMP C121)
Temporary and Permanent Seeding (BMP C120)
Dust Control (BMP C140)

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

6.1.2 Records Retention

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

6.2 Reporting

6.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given

monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.
DMRs will be reported online through Ecology's WQWebDMR System.

6.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- **Central Region** at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- **Eastern Region** at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- **Northwest Region** at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- **Southwest Region** at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

Appendix/Glossary

A. Site Map


USEABLE
OPEN SPACE /
TRACT 993
TRACT 995
TRACT 996
WETLAND A
CATEGORY IV
TRACT 997
WETLAND C
CATEGORY IV
POND B
TRACT 994
OPEN SPACE /
TRACT 992
PUBLIC ROAD / FUTURE ROW DEDICATION
OPEN SPACE
/ TRACT 999
STEEP SLOPE /
CRITICAL AREA
TRACT 998
BURN ROAD
60' Road & Power Esm't.

BMP Detail

Element #1 - Mark Clearing Limits

- High Visibility Plastic or Metal Fence (BMP C103)
- Preserving Natural Vegetation (BMP C101)
- Buffer Zones (BMP C102)

Element #2 - Establish Construction Access

- Stabilized Construction Entrance (BMP C105)

Element #3 - Control Flow Rates

- Temporary Sediment Pond (BMP C 241)

Element #4 - Install Sediment Controls

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)
- Interceptor Dike and Swale (BMP C200)

Element #5 - Stabilize Soils

- Mulching (BMP C121)
- Temporary and Permanent Seeding (BMP C120)
- Plastic Covering (BMP C123)
- Dust Control (BMP C140)

Element #6 - Protect Slopes

- Plastic Covering (BMP C123)
- Temporary and Permanent Seeding (BMP C120)

Element #7 - Protect Drain Inlets

- Storm Drain Inlet Protection (BMP C220)

Element #8 - Stabilize Channels and Outlets

- Outlet Protection (BMP C209)

Element #10 - Control Dewatering

- Additional Advanced BMPs to Control Dewatering:

Element #11 – Maintain BMP's

- Scheduling (BMP C162)

Element #12 – Manage the Project

- CESC Lead (BMP C160)

Element #13 – Protect On-site Stormwater Management BMPs for Runoff from Roofs and Other Hard Surfaces

- BMP C102: Buffer Zone BMP
- C200: Interceptor Dike and Swale
- C207: Check Dams BMP
- C233: Silt Fence BMP

B. Correspondence

Ecology
EPA
Local Government

C. Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

D. Construction Stormwater General Permit (CSWGP)

Download the CSWGP:
http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html

E. 303(d) List Waterbodies / TMDL Waterbodies Information

F. Contaminated Site Information

The Soil profile is provided as Appendix under the Drainage Report.

G. Engineering Calculations

TESC Pond sizing calculations

The total contributing area to the proposed sediment pond is approximately 0.6 acres.
The sediment pond is sized for the developed 10-year / 24-hour design storm

1. Discharge rate

Q 10yr/24hr = 1.59 cfs

Surface Area (SA)

SA = 2 X Q10yr/24hr / Vsed
SA = 2 X 1.59 /0.00096
Where Vsed is the settling velocity.
= 3,313 Sqft

2. Sizing the De-watering Mechanism:

Principal Spillway (Riser pipe)
The diameter shall be the minimum necessary to pass the developed 10-yr/24-hr design storm. Use Figure II.4.30 Riser inflow curves (DOE) to determine this diameter (h = 1 foot)

Q (10yr/24hr dev) = 1.59 cfs x1.6 2.544 cfs
Per figure II.4.30 of the DOE manual, the minimum riser diameter is 12 inches to convey this flow rate.

Emergency Overflow Spillway
The emergency overflow spillway shall convey the 100yr/24hr developed design storm.

Q 100yr/24hr = 2.54 cfs
H = 0.5 ft
Length (L) = $\frac{\text{Q 100yr/24hr}}{\text{3.21 (H)}^{3/2}}$ - 2.4 (H)
= $\frac{2.54}{\text{3.21 (0.5)}^{3/2}}$ -1.2
Length (L) = 1.04 feet. Use the minimum length of 6.0 feet.

De-Watering Orifice:

Size the de-watering orifice (1" minimum diameter) per the following equation:

$$Ao = \frac{As\ (2H)^{1/2}}{0.6 \times 3600\ Tg^{1/2}}$$

where Ao = Orifice area in square feet
As = Pond surface area in square feet
H = Head above the Orifice (height of riser in pipe=2.5-ft)
T = De-watering Time (T = 24 hours)
g = Acceleration due to gravity

$$Ao = \frac{3{,}313\ (2H)^{1/2}}{0.6 \times 3600\ (24)\ (32.2)^{1/2}}$$

Ao = 0.02518 Sqft

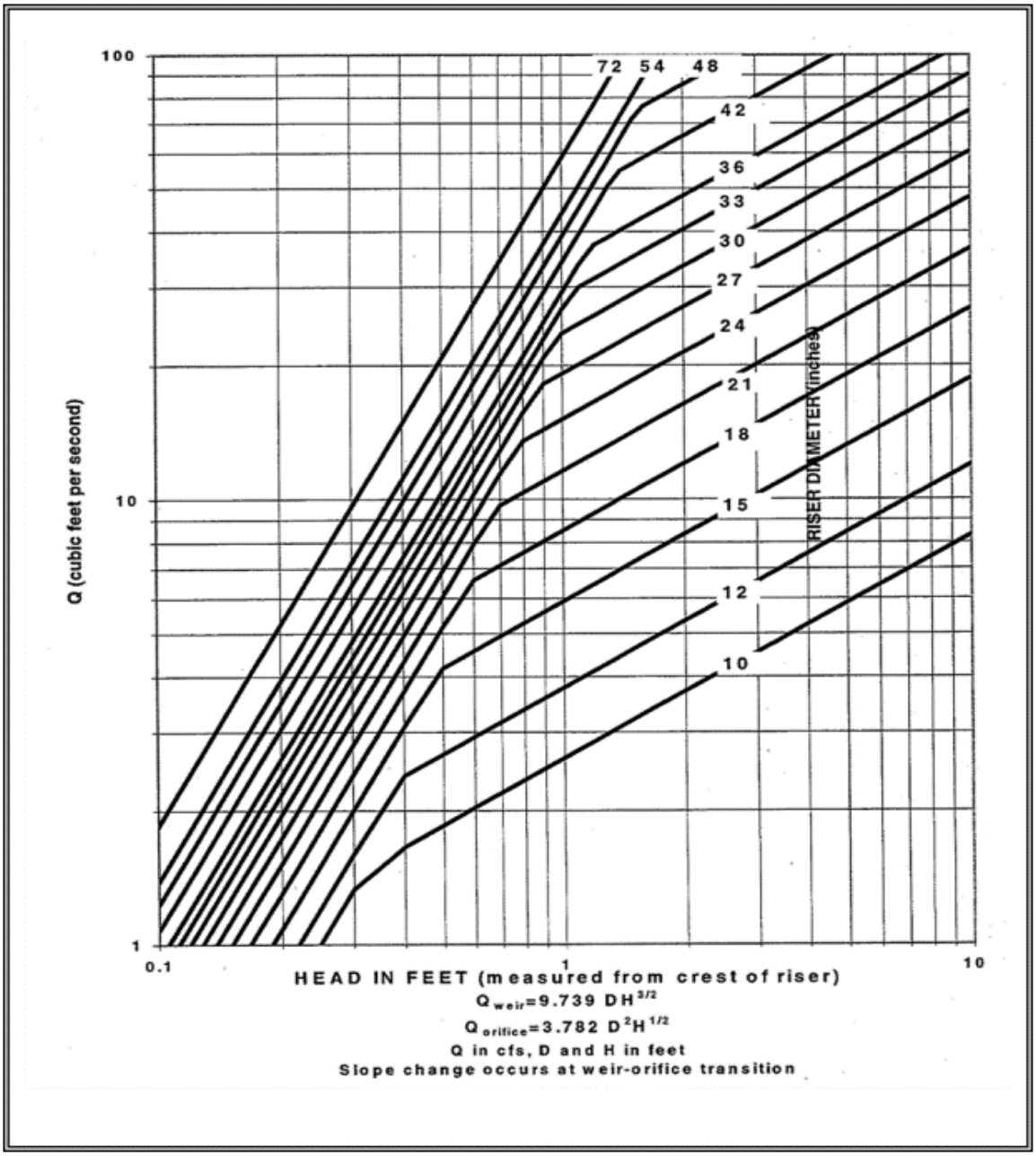
Convert Ao to Diameter (D) in inches

D = 24 x (Ao / 3.14)^1/2

D = 2.15 inches. (Use 1" minimum) Per the DOE design standards; the perforated pipe shall be a minimum of two inches larger than the orifice sizes. Use 4-inch diameter for the perforated pipe.

Refer to the construction plans for more details.

* Sediment pond shall be a minimum of 3.5-ft deep, which includes 1-ft towards free board, 1-ft towards settling depth and 1.5-ft towards sediment storage. Refer to the construction plans for more details.


100
10
1
0.1
1
10
Q (cubic feet per second)
HEAD IN FEET (measured from crest of riser)
RISER DIAMETER (inches)
72
54
48
42
36
33
30
27
24
21
18
15
12
10
$Q_{weir}=9.739\ DH^{3/2}$
$Q_{orifice}=3.782\ D^2H^{1/2}$
Q in cfs, D and H in feet
Slope change occurs at weir-orifice transition

B. GEOTECHNICAL ENGINEERING REPORT

November 1, 2024
ES-8157.03

Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

Bay Equity, LLC
502 State Avenue, Suite 101A
Marysville, Washington 98270

Attention: John Murphy

Subject: Landslide Repair and Stabilization
Proposed Mitigation
Pioneer Point
Arlington, Washington

Dear John:

As requested, Earth Solutions NW, LLC (ESNW) has reviewed recently revised plans for residential development at the subject site. Specifically, development plans have been revised to better facilitate the application of structural elements necessary to achieve total stabilization of the site. Given the unique site characteristics and history of landslide activity, the new development will now incorporate stabilization elements of sufficient size and strength to protect future development areas and fully mitigate the risk of future earth movement. As such, and given that previous (more aggressive) proposals to develop the site have been abandoned, this report intends to provide a method for mitigating the landslide hazard for the new (less aggressive) development proposal. Based on prior discussions with the City of Arlington and their 3rd party consultant, the goal of the design team is to reach agreement with the City on the intended approach for achieving total site stabilization. Once concurrence with the City and their consultant is attained, preparation of final plans and engineering are expected to begin in earnest.

Site History

The attached site plan (Plate 1) illustrates the overall property limits and relevant site features. Such features include an existing road alignment and large expanse of hillside that dominates the site topographic environment. Earlier proposals for developing the site included residential construction and related infrastructure improvement that intended to occupy almost the entirety of the site and areas of associated hillside. In anticipation of this earlier plan for developing the site, a new road was extended along the base of the hillside and into the site. This work was reported to have occurred in 1994. Previous investigations (by others) had characterized the near surface geologic condition as consisting largely of lacustrine silts of moderate plasticity with consistency characterized as stiff to moderately stiff. Groundwater was identified in discrete layers throughout the hillside and overall soil moisture was found to be elevated. Given the identified geologic and topographic setting, and in response to the 1994 excavation and related road cut, a rotational landslide was initiated along the alignment of the completed roadway.

Review of follow up investigative reports and recent observation completed by the undersigned engineer suggest that the depth of rotation associated with the landslide was relatively shallow. The investigations (by others) conducted subsequent to the landslide identified head scarp features 30 to 40 feet uphill of the road cut. Consistent with the behavior of a classic rotational type rupture zone, uplift ("heave") of the slide mass is visible at the termination, and is most pronounced at or near the centerline of the existing road alignment. The photograph below depicts the rough boundary (or edge) of the "heave" within the existing roadway.

Existing Road Alignment – Relic "Heave" Condition (1994 Slide)

It should be noted that underground utility installations within the roadway alignment pictured above still exist today. Additionally, it is our understanding that the original sewer alignment below the road reportedly remains intact. Further, it should be noted that continued creep (or displacement) of the slide mass since the initial 1994 landslide event has not been documented. In any case, and based on recent observations, it is the opinion of the undersigned engineer that the landslide likely has not remobilized to any significant extent since 1994, and probably resides currently in a state of near equilibrium (i.e. FS $\geq$ 1.0).

Proposed Mitigation

Development plans currently propose construction of 10 separate multi-plex building structures combining to produce a total of 49 residential units. In contrast to earlier development proposals, the area of proposed construction will avoid the large expanse of hillside that dominates the central and southerly regions of the site. Instead, development will be focused throughout the topographically lower areas of the site located at the base of the hillside. A representative sippet of the development area is provided below.

Current Development Proposal – Located at Base of Hillside

As represented above, and in contrast to earlier proposals, the planned development will largely reside at the base the existing hillside. The decision to position the development area as shown above was strategic, and is intended to avoid disturbance and modification of the existing hillside to the greatest extent practicable. Also, it should be noted that the old road alignment established in 1994 will be abandoned as part of the new proposal. Access instead will be established along a new alignment positioned further to the north and farther away from the hillside. Notwithstanding the current plans to consolidate and further separate the development area from the hillside, additional measures to fully stabilize the site and mitigate the landslide hazard will be implemented for the project. The following methods of stabilization are proposed:

Rock Keyway and Drain – At the onset of construction, and during the process of abandoning the existing road alignment, installation of a deep rock keyway and drain is proposed along the base of the existing hillside. The rock keyway and drain installation will serve two purposes:

1) Interruption and related strengthening of the landslide rupture zone through the introduction of high shear strength rock aggregate that will penetrate through the zone of slippage.

2) Improved dissipation of excess pore pressure along the slip plane to help further improve the current (residual) shear strength characteristics of the relic slide mass.

Grade Modification (Resisting Force) – As previously mentioned, the current development plan intends to abandon the existing site access road and reestablish a new access positioned further to the north. Realigning the site access as proposed will help facilitate repositioning of the development area further to the north and away from the hillside. Most importantly, the plan to realign the road access will also involve raising the existing site grade 4 to 6 feet above the level of the old road surface. Raising the site in this manner will effectively restore the grade previously lost when the base of the hillside was cut to accommodate construction of the old road access. It should be emphasized that in the opinion of the undersigned engineer, excavation and related cuts executed in 1994 to construct the old road alignment likely provided the catalyst that initiated the rotational landslide at the site. Therefore, filling and restoring the areas of previous cut will effectively serve to reestablish stability of the hillside to its pre-1994 state. With respect to mitigation, the planned fill placement and its associated mass will also provide an added resisting force at the base of the hillside, essentially deriving an increased level of stability to the slope.

Passive Shear Pile (Soldier Pile Wall) – Relative to previous propositions, the current site plan represents a substantial reduction in the overall footprint area proposed for construction. The reduced size and repositioning of the development area will essentially lessen the overall impact to the existing hillside. However, some modification to the effective toe-of-slope resulting from the aforementioned grade modifications will be necessary to accommodate construction along the south margins of the development footprint. Essentially, cuts on the order of 8 feet at the base of the slope will be needed to establish the finish grade along the rear side of the buildings. Permanent support of the excavation will require construction of a retaining wall. More importantly, however, the necessary wall construction will also present an opportunity to install a series of closely spaced soldier piles intended to function both as a retaining wall and as a passive shear pile mitigation measure. Specifically, the soldier piles will be sized with sufficient length such that the pile and its encapsulating grouted shaft will fully penetrate through the landslide rupture zone. Below the zone of rupture, continued advancement of the pile will occur such that sufficient embedment into the undisturbed (very stiff) sediments is achieved. The application of passive shear piles in this manner will serve to reinforce the remanent zone of slippage associated with the 1994 rotational slope failure.

Stability Analysis

For purposes of this report and analysis of stability, the reader is directed to Plates 1 and 2 (attached) and the Slope/W limit equilibrium computer output (also attached). As outlined above, the current development plan intends to incorporate three measures of stabilization to ensure that a state of “total stabilization” is achieved for the site. The results of stability analysis conducted along representative Cross Section A-A’ indicate that stability is satisfied for the post construction (“mitigation”) case. To demonstrate the process by which the results of our analysis were obtained, the following models were developed:

Pre-1994 Rd. Cut – This model is intended to represent the natural topographic condition that predates the 1994 road excavation. Combined with the pre-1994 surface topography, subsurface data (acquired by others) were used to develop a representative cross section for the stability analysis. Once developed, this model formed the framework for subsequent model development.

Back Calculation (Post-1994 Rd. Cut) – The Pre-Road Cut (1994) model described above was used as a basis for formulating the "1994 Road-Cut" cross section. Essentially, this cross section presents a representation of the existing road alignment and areas of associated cut. Most importantly, the model provides the cross-sectional geometry necessary to "back-calculate" the intra-slide strength characteristics of the soil units during the time of slope failure. Traditionally, the process of "back-calculation" is iterative, and resolves to establish a reasonable representation of soil strength when stability is diminished to a state of equilibrium (i.e. FS = 1.0).

Post-Construction Mitigated Condition – The applied stabilization techniques described previously in this report are represented in the "Post-Construction Mitigated Condition" cross section. Specifically, the model geometry portrays the post-construction surface topography that will exist once the site is filled and raised to the level of the future road alignment. Structural elements in the form of the previously described "rock-keyway" and "passive shear piles" are also represented in the model. Most importantly, soil strength characteristics derived from the prior "back-calculation" model are assumed in calculating the static and seismic factors-of-safety for the post-mitigation case.

It is emphasized again that for purposes of this report and analysis of stability, the reader is directed to Plates 1 and 2 and the Slope/W limit equilibrium computer output developed for the three slope stability models outlined above (see attached). With respect to the soil strength parameters input into the Post-Construction Mitigated Condition model geometry, values derived from the "Back Calculation" analysis were selected and assigned to the underlying ("weak" and "strong") native silt deposits. Additionally, for the "Post-Construction Mitigated Condition", strength values were assumed for the "rock keyway" and "new structural fill" layers. For clarity, the strength parameters assumed for all layers in the limit equilibrium analyses are summarized below:

Soil Strength Parameters - Cross Section A-A' Model Geometries

New Structural Fill	Rock Keyway	Silt (Mottled)	Stiff / Hard Silt
γ = 125 pcf	γ = 130 pcf	γ = 115 pcf	γ = 120 pcf
Φ = 34 deg.	Φ = 42 deg.	Φ = 14 deg.	Φ = 28 deg.
c = 0 psf	c = 0 psf	c = 75 psf*	c = 750 psf

* *It should be noted that for the temporary seismic case, an increased value of cohesion (175 psf) was assumed for the Silt (Mottled) soil unit. Such temporary increase for short-term loading (i.e. seismic force) is considered justified due to "dilation" of the soil structure during loading.*

It is reemphasized that the strength values used in the analysis were largely derived from the "back calculation" model geometry in which strength values in the "weak" mottled silt layer were adjusted sufficiently low such that a state of equilibrium (FS~1.0) was achieved. As such, and based on the above soil strength parameters specified for each soil unit represented in the model geometries, the following factors-of-safety were calculated:

Model Geometry Factors-Of-Safety

Model Geometry	Static Factor-of-Safety	Seismic Factor-of-Safety
Pre-1994 Rd. Cut	FS = 1.01	FS = 0.51
Back Calculation (Post 1994 Rd. Cut)	FS = 1.01	N/A
Mitigated Condition	FS = 4.0	FS = 1.1

It should be noted that for the seismic stability case, a lateral seismic coefficient of 0.255 was assumed for the analysis. This coefficient represents one-half of the modified peak ground acceleration mapped for the site. Further, it is noted that a seismic stability analysis was not developed for the "Back Calculation" case as such analysis was not necessary for estimating soil strength characteristics of the underlying native silt deposits.

Based on the above, and given that a general range of reasonable factors-of-safety were derived from analysis of the three model geometries, the following can be concluded:

- Prior to the 1994 excavation and removal of toe support along the existing access road alignment, the static stability of the hillside was generally poor (roughly FS = 1.0).

- Back calculation (Post 1994 Rd. Cut) to estimate soil strength properties based on the post-failure model geometry produced values of soil friction and cohesion that were reasonable and determined by the undersigned engineer as acceptable for use in the analysis of the mitigated (post-construction) model geometry.

- The addition of stabilization measures for the post-construction ("mitigated condition") model geometry improved substantially the static and seismic factors-of-safety for the site.

Conclusions

Model geometry analysis of three representative slope configurations was undertaken for the express purpose of determining the appropriate level of stabilization necessary to mitigate landslide risk for the intended post-construction site configuration. As outlined previously in this report, and as compared to earlier proposals, the owner and project design team have substantially reduced the footprint area within which development is proposed. Specifically, the project development will no longer require significant modification and related impacts to the areas of hillside positioned within the south and central regions of the site. Instead, the majority of planned development will reside throughout topographically lower areas of the site located north of the hillside. Most significant as it relates to the current design concept are plans to raise the existing grade and abandon the current road access positioned along the toe of the hillside. As discussed earlier in this report, the 1994 road cuts and related excavation work along the toe of the hillside created conditions that formed the catalyst for the documented landslide at the site.

In consideration of plans to restore the old road access to its pre-1994 configuration, and as demonstrated through limit equilibrium analysis, the proposed “rock keyway” and passive shear pile installations will combine to achieve a state of total stabilization for the completed development. As demonstrated by way of slope stability analysis and related model geometries developed for the site, implementation of the stabilization methods outlined in this report will mitigate the landslide hazard to a level that meets or exceeds the code specified factors-of-safety for slope stability. More importantly, it is the professional opinion of the undersigned engineer that execution of the proposed mitigation, combined with efforts by the owner and design team to significantly reduce the development footprint and area of disturbance, post-construction total stabilization will be achieved for the project. As emphasized at the onset of this report, the goal of the owner and design team is to reach agreement with the City and their 3rd party consultant on the intended approach for achieving total site stabilization. Based on the findings of this report, it is the opinion of the undersigned engineer that stabilization methods proposed for installation at the site will fully mitigate the landslide risk for the project. In any case, it is acknowledged that ownership and the design team must reach concurrence with the City (and their 3rd party consultant) regarding our intended approach for stabilizing the site and future development area. Once such concurrence is obtained, design efforts to engineer the project are expected to commence.

We trust this report and geotechnical analysis of proposed site stabilization methods meet your current needs. If you have questions, or if additional information is required, please call.

Sincerely,

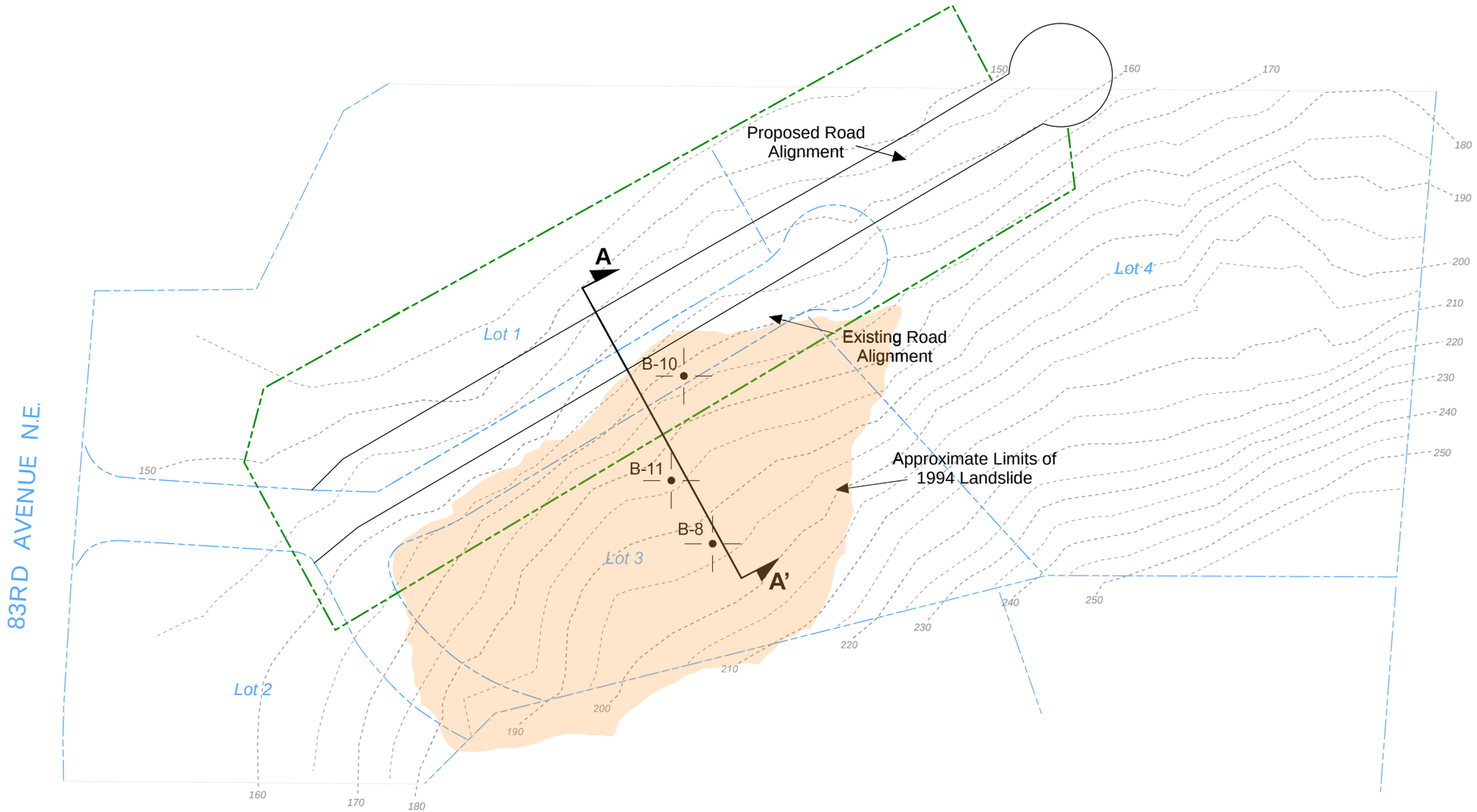
EARTH SOLUTIONS NW, LLC

11/01/2024

Raymond A. Coglas, P.E.
Senior Principal Engineer

Attachments: Plate 1 – Boring Location Plan / Orig. Topo. Overlay
Plate 2 – Cross Section A-A'
Stability Analysis

cc: Insight Engineering
Attention: Brian Kalab, P.E.



LEGEND

B-8 — Approximate Location of Cobalt Boring (2019/2022)

Newly Proposed Development Area

Cross-Section

NORTH

NOT - TO - SCALE

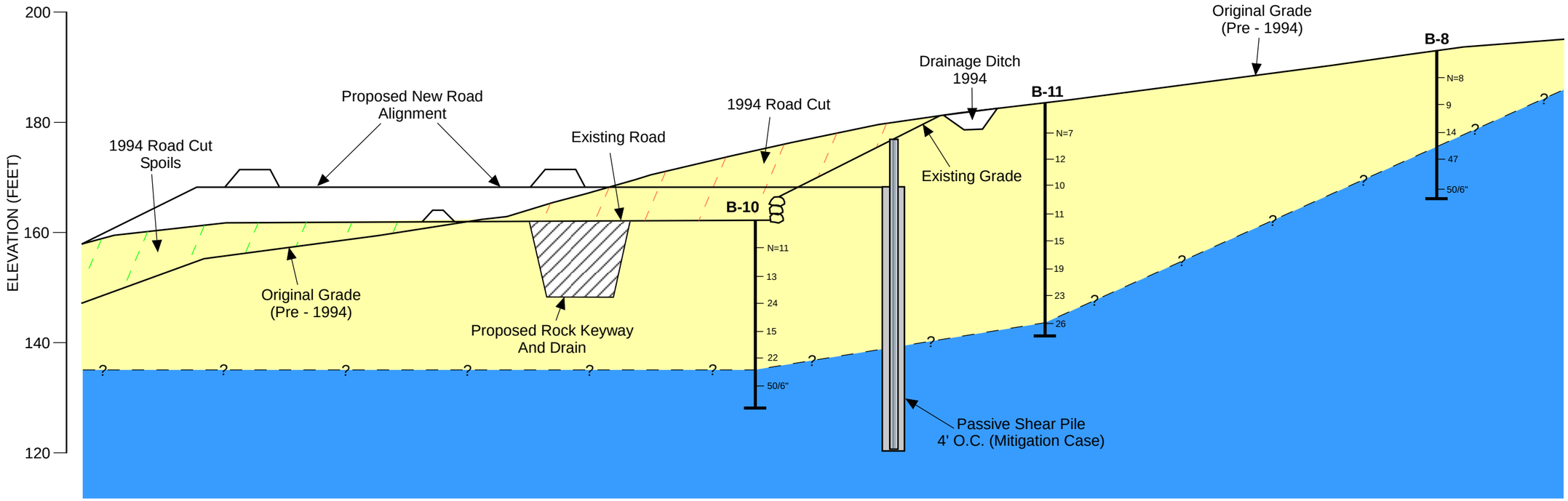
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Boring Location Plan / Orig. Topo. Overlay
Pioneer Point
Arlington, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drawn	MRS
Checked	RAC
Date	11/01/2024
Proj. No.	8157.03
Plate	1



LEGEND

Silt/Clay Lacustrine (Soft / Stiff)

Silt (Stiff / hard

Horizontal Scale 1"=20' 0 10 20 40 Scale in Feet

Vertical Scale 1"=20' 0 10 20 40 Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

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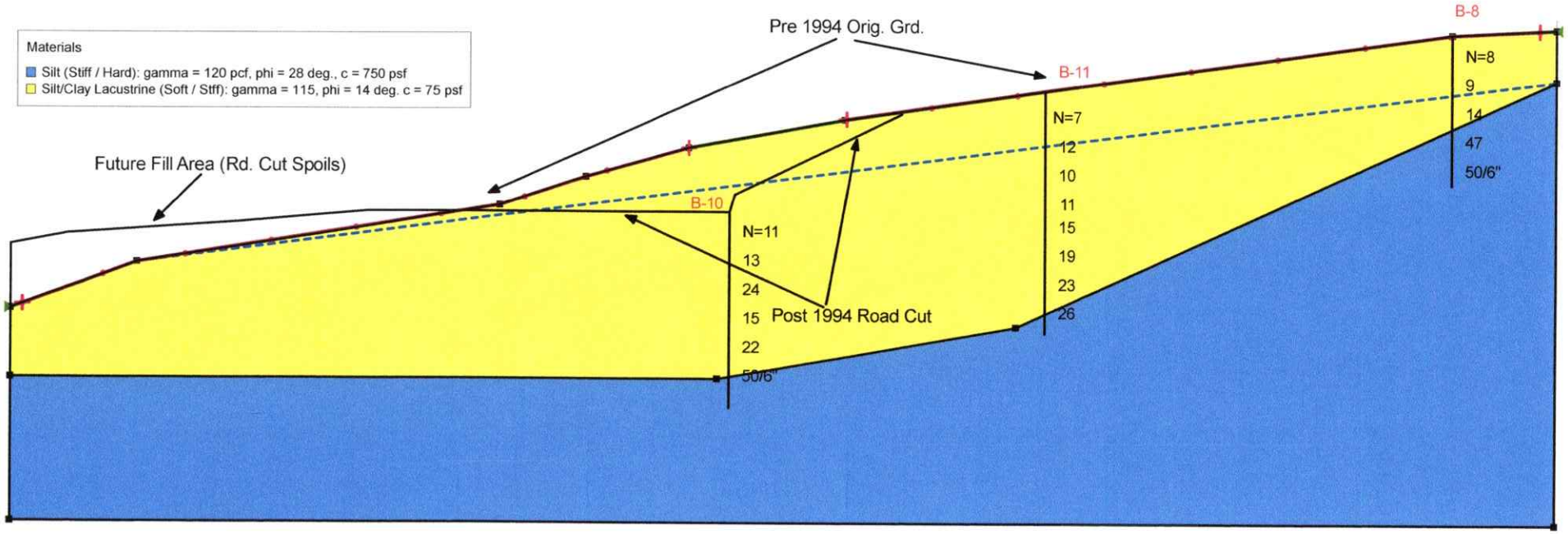
Cross Section A-A'
Pioneer Point
Arlington, Washington

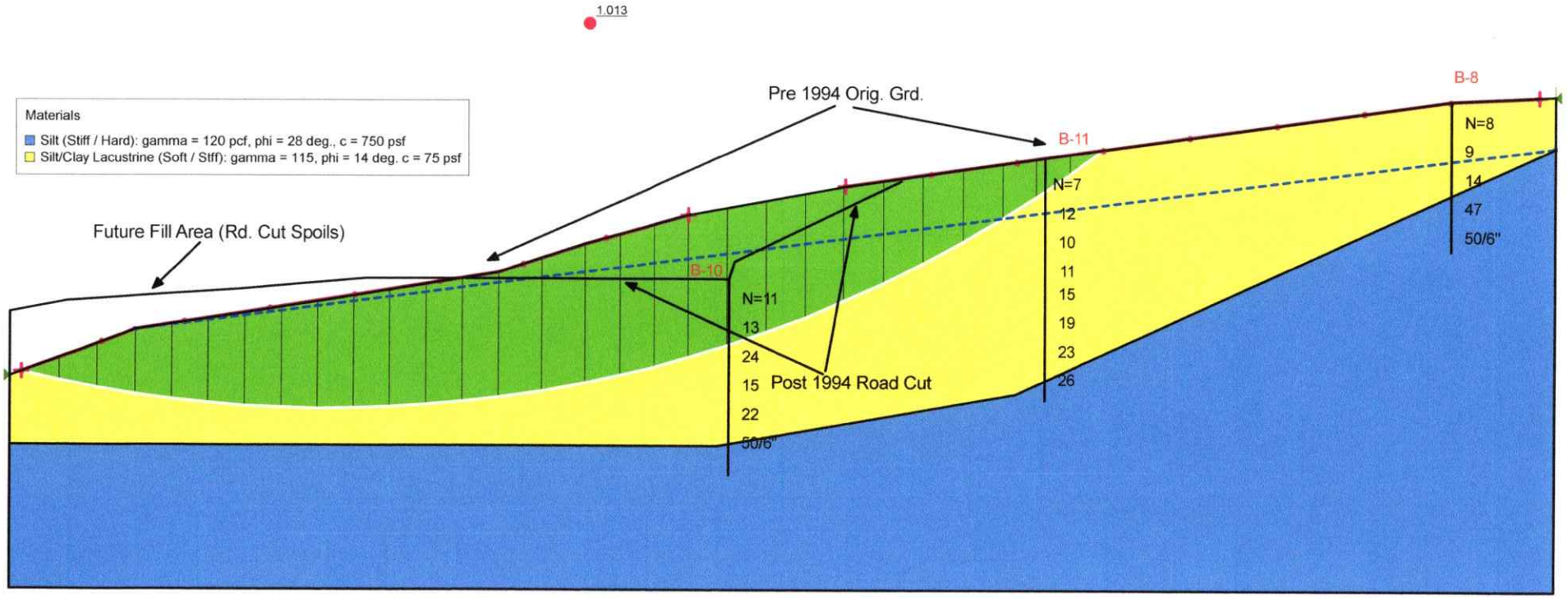
Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drawn	MRS
Checked	RAC
Date	11/01/2024
Proj. No.	8157.03
Plate	2

Section A-A'
Orig. Grd. - Pre 1994 Road Cut
Model Geometry



Section A-A'
Orig. Grd. - Pre 1994 Road Cut
(FS = 1.01 Static)



Pre-1994 Orig. Grd. - Static

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Last Edited By: Ray Coglas
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Last Solved Date: 11/01/2024
Last Solved Time: 05:47:30 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Pre-1994 Orig. Grd.

Description: Orig. Stability
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- 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: 0.001
- 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

Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 75 psf
Phi': 14 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (2, 147.72727) ft
Left-Zone Right Coordinate: (118, 175) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (145.2994, 180.04277) ft
Right-Zone Right Coordinate: (265, 195.83333) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 147) ft
Right Coordinate: (268, 196) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	22 ft	155 ft
Coordinate 2	268 ft	187 ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	147 ft
Point 2	22 ft	155 ft
Point 3	85 ft	165 ft
Point 4	100 ft	170 ft
Point 5	118 ft	175 ft
Point 6	145 ft	180 ft
Point 7	250 ft	195 ft
Point 8	268 ft	196 ft
Point 9	268 ft	187 ft
Point 10	175 ft	144 ft
Point 11	123 ft	135 ft
Point 12	0 ft	135 ft
Point 13	268 ft	110 ft
Point 14	0 ft	110 ft

Regions

	Material	Points	Area
Region 1	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf	1,2,3,4,5,6,7,8,9,10,11,12	7,768 ft²
Region 2	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,11,10,9,13,14	9,770.5 ft²

Slip Results

Slip Surfaces Analysed: 404 of 405 converged

Current Slip Surface

Slip Surface: 17
Factor of Safety: 1.013
Volume: 3,132.9999 ft³
Weight: 360,294.99 lbf
Resisting Moment: 15,496,539 lbf·ft
Activating Moment: 15,295,350 lbf·ft
Resisting Force: 65,756.705 lbf
Activating Force: 64,906.772 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (1.9999991, 147.72727) ft
Entry: (190.13918, 186.44845) ft
Radius: 224.98385 ft
Center: (55.055926, 366.36579) ft

Slip Slices

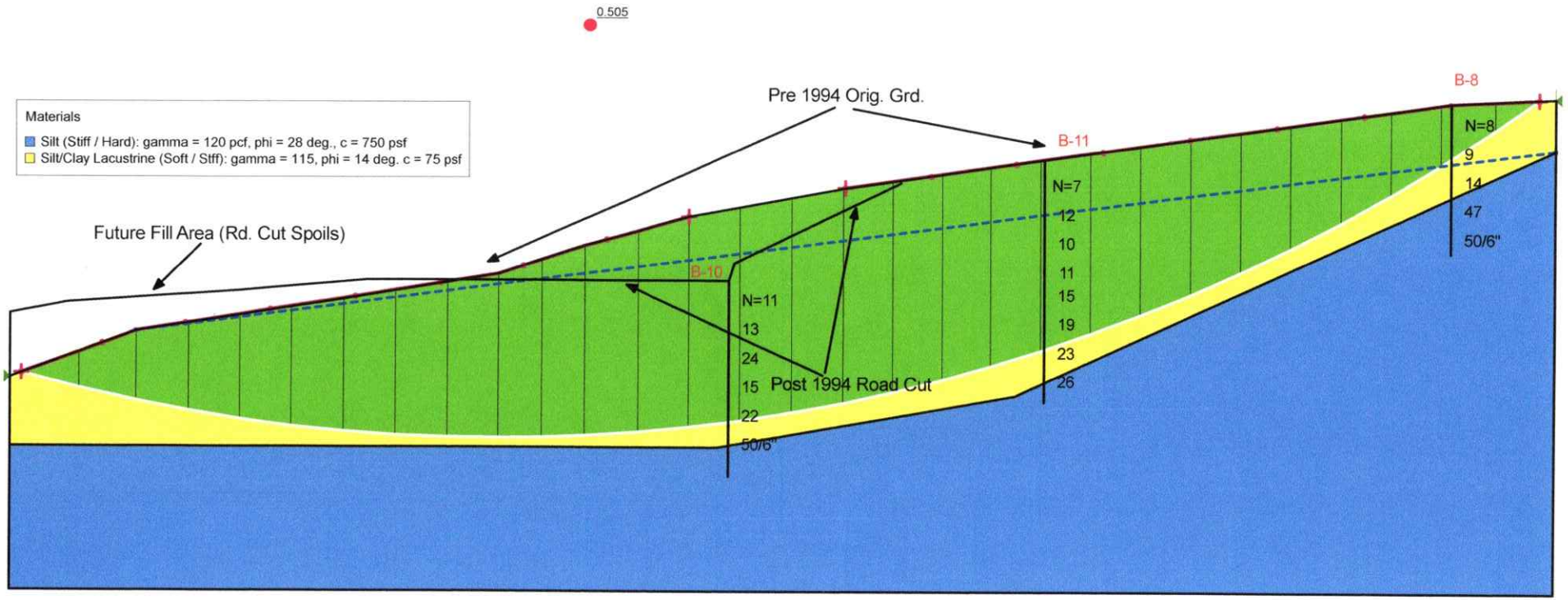
	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	5.3333326 ft	146.97182 ft	0 psf	262.24034 psf	65.383861 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma =

								115, phi = 14 deg. c = 75 psf
Slice 2	12 ft	145.56636 ft	0 psf	738.75611 psf	184.19259 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 3	18.666667 ft	144.36997 ft	0 psf	1,192.7765 psf	297.39258 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 4	25.15 ft	143.40107 ft	749.70468 psf	1,487.9958 psf	184.07666 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 5	31.45 ft	142.64619 ft	847.99423 psf	1,701.7455 psf	212.8641 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 6	37.75 ft	142.07077 ft	935.08004 psf	1,889.5582 psf	237.97814 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 7	44.05 ft	141.67343 ft	1,011.0483 psf	2,050.6937 psf	259.21272 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 8	50.35 ft	141.45323 ft	1,075.9578 psf	2,184.807 psf	276.46714 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 9	56.65 ft	141.40964 ft	1,129.8413 psf	2,291.9523 psf	289.74681 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 10	62.95 ft	141.54257 ft	1,172.705 psf	2,372.559 psf	299.15719 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 11	69.25 ft	141.85232 ft	1,204.5295 psf	2,427.3839 psf	304.89185 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 12	75.55 ft	142.33963 ft	1,225.2688 psf	2,457.4437 psf	307.21571 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 13	81.85 ft	143.00567 ft	1,234.8504 psf	2,463.934 psf	306.44494 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft /

								Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 14	88.75 ft	143.95163 ft	1,231.8284 psf	2,518.345 psf	320.76463 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 15	96.25 ft	145.21826 ft	1,213.6602 psf	2,614.513 psf	349.27183 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 16	103 ft	146.57118 ft	1,184.0138 psf	2,656.6356 psf	367.16584 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 17	109 ft	147.96657 ft	1,145.6256 psf	2,652.5219 psf	375.71146 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 18	115 ft	149.53693 ft	1,096.3133 psf	2,630.5826 psf	382.5363 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 19	121.375 ft	151.40757 ft	1,031.3008 psf	2,554.6809 psf	379.82132 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 20	128.125 ft	153.60793 ft	948.74864 psf	2,424.2352 psf	367.88012 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 21	134.875 ft	156.04789 ft	851.23761 psf	2,273.7933 psf	354.68298 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 22	141.625 ft	158.73593 ft	738.23963 psf	2,102.5886 psf	340.1704 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 23	148.46569 ft	161.72504 ft	607.18214 psf	1,891.4719 psf	320.20941 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 24	155.39707 ft	165.03424 ft	456.87807 psf	1,638.1178 psf	294.51613 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf

Slice 25	162.32846 ft	168.64176 ft	287.94956 psf	1,356.6218 psf	266.44991 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 26	169.25984 ft	172.5643 ft	99.354588 psf	1,043.0088 psf	235.27942 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 27	175.6278 ft	176.44913 ft	-91.461959 psf	735.39751 psf	183.35519 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 28	181.43235 ft	180.26253 ft	-282.39425 psf	440.18919 psf	109.75149 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf
Slice 29	187.2369 ft	184.34091 ft	-489.8696 psf	119.79231 psf	29.867577 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 75 psf

Section A-A'
Orig. Grd. - Pre 1994 Road Cut
(FS = 0.51 Seismic)



Pre-1994 Orig. Grd. – Seismic

File Information

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Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Pre-1994 Orig. Grd\
Last Solved Date: 11/01/2024
Last Solved Time: 06:04:19 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Pre-1994 Orig. Grd.

Description: Orig. Stability
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- 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: 0.001
- 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

Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 175 psf
Phi': 14 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (2, 147.72727) ft
Left-Zone Right Coordinate: (118, 175) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (145.2994, 180.04277) ft
Right-Zone Right Coordinate: (265, 195.83333) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 147) ft
Right Coordinate: (268, 196) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	22 ft	155 ft
Coordinate 2	268 ft	187 ft

Seismic Coefficients

Horz Seismic Coef.: 0.255

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	147 ft
Point 2	22 ft	155 ft
Point 3	85 ft	165 ft
Point 4	100 ft	170 ft
Point 5	118 ft	175 ft
Point 6	145 ft	180 ft
Point 7	250 ft	195 ft
Point 8	268 ft	196 ft
Point 9	268 ft	187 ft
Point 10	175 ft	144 ft
Point 11	123 ft	135 ft
Point 12	0 ft	135 ft
Point 13	268 ft	110 ft
Point 14	0 ft	110 ft

Regions

	Material	Points	Area
Region 1	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf	1,2,3,4,5,6,7,8,9,10,11,12	7,768 ft^2
Region 2	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,11,10,9,13,14	9,770.5 ft^2

Slip Results

Slip Surfaces Analysed: 398 of 405 converged

Current Slip Surface

Slip Surface: 42
Factor of Safety: 0.505
Volume: 6,471.2586 ft^3
Weight: 744,194.74 lbf
Resisting Moment: 46,423,556 lbf·ft
Activating Moment: 91,972,916 lbf·ft
Resisting Force: 145,605.92 lbf
Activating Force: 288,602.97 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (1.9999991, 147.72727) ft
Entry: (265, 195.83333) ft
Radius: 306.87258 ft
Center: (83.799582, 443.49679) ft

Slip Slices

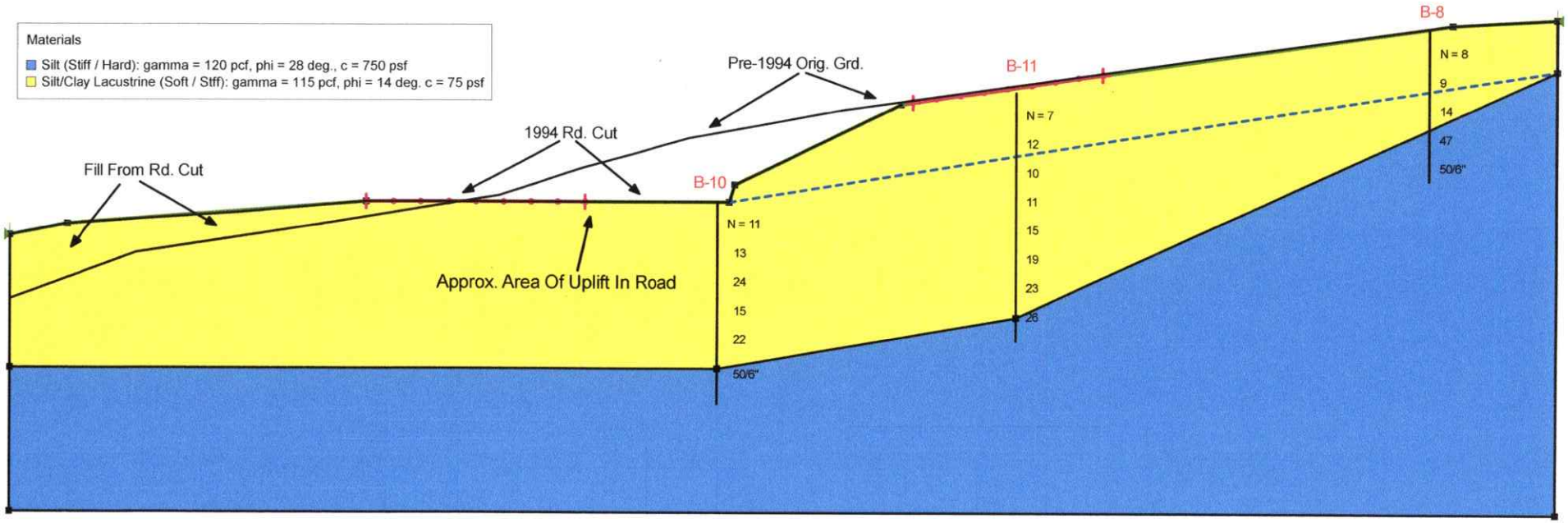
	X	Y	PWP	Base Normal	Frictional Strength	Cohesive Strength	Suction Strength	Base Material

				Stress				
Slice 1	6.9999993 ft	146.43462 ft	0 psf	553.80151 psf	138.07823 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 2	17 ft	144.02667 ft	0 psf	1,442.1608 psf	359.57108 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 3	26.5 ft	142.05599 ft	844.64145 psf	1,967.3498 psf	279.92264 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 4	35.5 ft	140.48332 ft	1,015.9128 psf	2,386.7053 psf	341.77695 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 5	44.5 ft	139.18489 ft	1,170.063 psf	2,752.8192 psf	394.62543 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 6	53.5 ft	138.1572 ft	1,307.3107 psf	3,058.9852 psf	436.74151 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 7	62.5 ft	137.39753 ft	1,427.8262 psf	3,301.168 psf	467.07656 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 8	71.5 ft	136.90387 ft	1,531.7342 psf	3,478.3555 psf	485.34721 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 9	80.5 ft	136.67495 ft	1,619.1147 psf	3,592.545 psf	492.03145 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 10	88.75 ft	136.68707 ft	1,685.3567 psf	3,729.6285 psf	509.69421 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 11	96.25 ft	136.89985 ft	1,732.9797 psf	3,899.6281 psf	540.20612 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 12	104.5 ft	137.35641 ft	1,771.4749 psf	4,010.5793 psf	558.27144 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma =

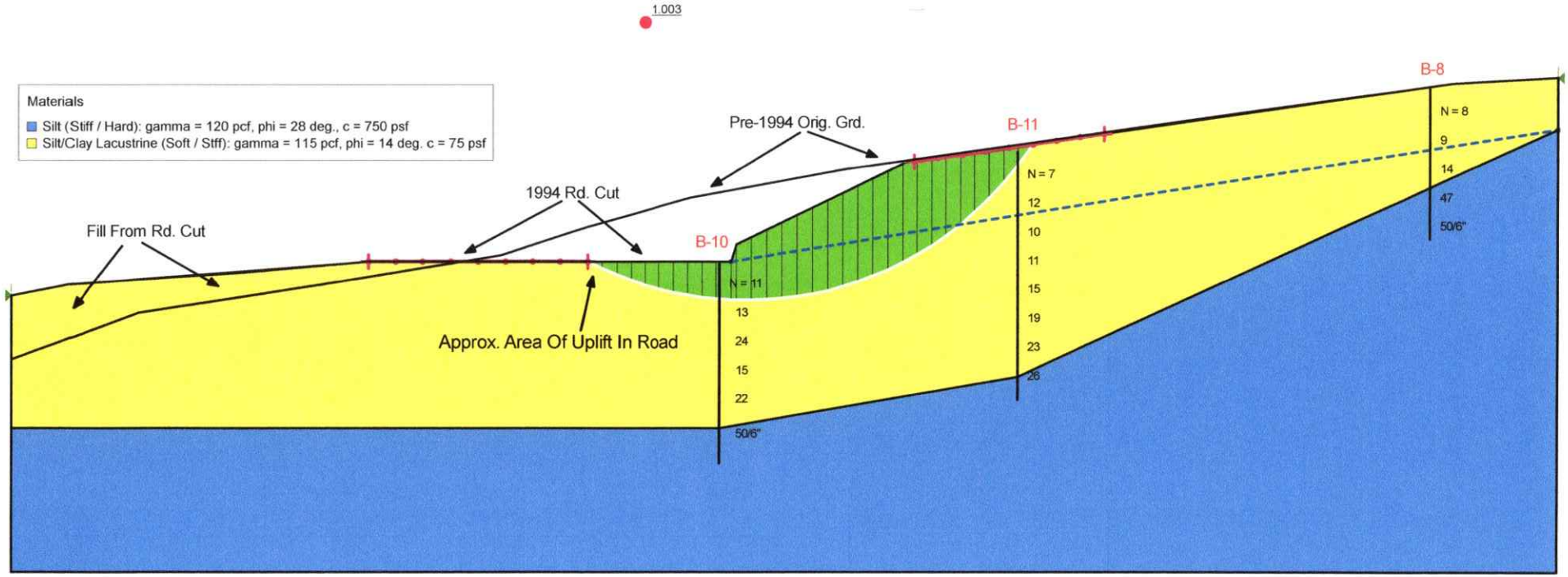
								115, phi = 14 deg. c = 175 psf
Slice 13	113.5 ft	138.09832 ft	1,798.2463 psf	4,061.0929 psf	564.19102 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 14	122.5 ft	139.10809 ft	1,808.2953 psf	4,026.2632 psf	553.00151 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 15	131.5 ft	140.3884 ft	1,801.4546 psf	3,918.1788 psf	527.75861 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 16	140.5 ft	141.94269 ft	1,777.5089 psf	3,792.1966 psf	502.31806 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 17	149.30395 ft	143.7293 ft	1,737.4674 psf	3,638.0461 psf	473.86749 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 18	157.91184 ft	145.74105 ft	1,681.7781 psf	3,460.6318 psf	443.51805 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 19	166.51974 ft	148.01721 ft	1,609.5814 psf	3,277.83 psf	415.9411 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 20	175.12763 ft	150.56396 ft	1,520.4922 psf	3,089.255 psf	391.13648 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 21	183.73553 ft	153.38842 ft	1,414.0652 psf	2,893.169 psf	368.78199 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 22	192.34342 ft	156.49881 ft	1,289.788 psf	2,686.6551 psf	348.27809 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 23	200.95132 ft	159.90454 ft	1,147.0724 psf	2,465.7691 psf	328.78802 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 24	209.55921 ft	163.6164 ft	985.24472 psf	2,225.6556 psf	309.26918 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft /

								Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 25	218.16711 ft	167.64678 ft	803.53231 psf	1,960.6173 psf	288.49369 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 26	226.775 ft	172.00987 ft	601.04838 psf	1,664.1385 psf	265.05814 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 27	235.3829 ft	176.72203 ft	376.77224 psf	1,328.8649 psf	237.38336 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 28	243.99079 ft	181.80214 ft	129.52474 psf	946.53959 psf	203.70468 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 29	249.14737 ft	184.98206 ft	-27.122011 psf	702.82498 psf	175.23395 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 30	253.75 ft	188.02204 ft	-179.53027 psf	459.74124 psf	114.62636 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf
Slice 31	261.25 ft	193.175 ft	-440.32309 psf	34.534745 psf	8.6104789 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115, phi = 14 deg. c = 175 psf

Section A-A'
1994 Rd. Cut - Back Calculation
(Model Geometry)



Section A-A'
1994 Rd. Cut - Back Calculation
(FS = 1.01 Static)



1994 Rd. Cut - Back Calc. – Static Only

File Information

File Version: 10.02
Created By: Ray Coglas
Last Edited By: Ray Coglas
Revision Number: 34
Date: 11/01/2024
Time: 05:59:32 AM
Tool Version: 10.2.1.19666
File Name: 1994 Rd. Cut Back Calculation.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New 1994 Rd. Cut\
Last Solved Date: 11/01/2024
Last Solved Time: 05:59:33 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

1994 Rd. Cut - Back Calc.

Description: Back Calculation
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- 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: 0.001
- 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

Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 75 psf
Phi': 14 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (62, 164) ft
Left-Zone Right Coordinate: (100, 164) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (157, 181.29474) ft
Right-Zone Right Coordinate: (190, 186.15789) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 158) ft
Right Coordinate: (268, 196) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	125 ft	164 ft
Coordinate 2	268 ft	187 ft

Seismic Coefficients

Horz Seismic Coef.: 0

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	158 ft
Point 2	10 ft	160 ft
Point 3	62 ft	164 ft
Point 4	125 ft	164 ft
Point 5	126 ft	167 ft
Point 6	155 ft	181 ft
Point 7	250 ft	195 ft
Point 8	268 ft	196 ft
Point 9	268 ft	187 ft
Point 10	175 ft	144 ft
Point 11	123 ft	135 ft
Point 12	0 ft	135 ft
Point 13	268 ft	110 ft
Point 14	0 ft	110 ft

Regions

	Material	Points	Area
Region 1	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf	1,2,3,4,5,6,7,8,9,10,11,12	7,686 ft^2
Region 2	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,11,10,9,13,14	9,770.5 ft^2

Slip Results

Slip Surfaces Analysed: 300 of 405 converged

Current Slip Surface

Slip Surface: 388
Factor of Safety: 1.003
Volume: 775.96125 ft^3
Weight: 89,235.543 lbf
Resisting Moment: 1,504,929.9 lbf·ft
Activating Moment: 1,499,773.9 lbf·ft
Resisting Force: 22,748.175 lbf
Activating Force: 22,678.117 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (100, 164) ft
Entry: (177.625, 184.33421) ft
Radius: 59.727386 ft
Center: (127.60074, 216.96754) ft

Slip Slices

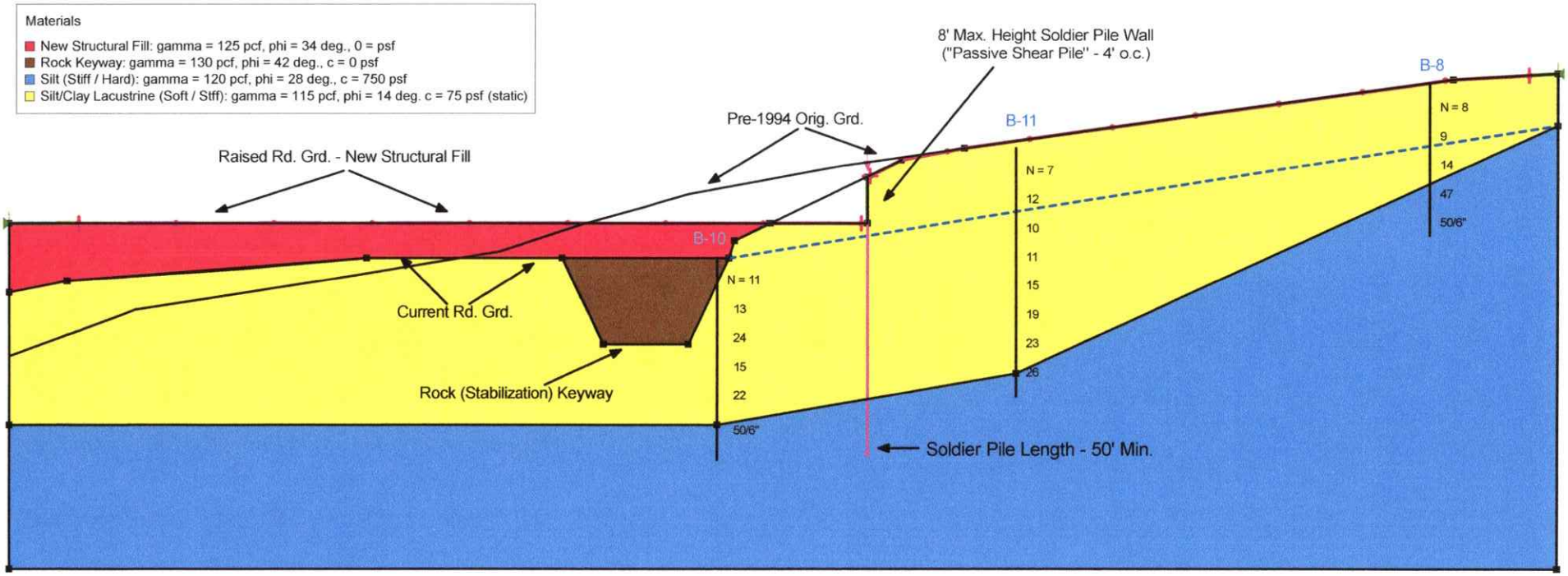
	X	Y	PWP	Base Normal	Frictional Strength	Cohesive Strength	Suction Strength	Base Material

				Stress				
Slice 1	101.25 ft	163.38527 ft	0 psf	127.40232 psf	31.764965 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 2	103.75 ft	162.22593 ft	0 psf	285.85475 psf	71.271594 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 3	106.25 ft	161.20272 ft	0 psf	428.73957 psf	106.89678 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 4	108.75 ft	160.30825 ft	0 psf	554.6949 psf	138.30097 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 5	111.25 ft	159.53649 ft	0 psf	662.48359 psf	165.17571 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 6	113.75 ft	158.88254 ft	0 psf	751.13479 psf	187.27894 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 7	116.25 ft	158.34245 ft	0 psf	820.04565 psf	204.46034 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 8	118.75 ft	157.91309 ft	0 psf	869.03779 psf	216.67546 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 9	121.25 ft	157.59205 ft	0 psf	898.36806 psf	223.98831 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 10	123.75 ft	157.37758 ft	0 psf	908.69758 psf	226.56375 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 11	125.5 ft	157.2792 ft	424.6013 psf	1,063.1532 psf	159.20887 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 12	127.31818 ft	157.25537 ft	444.34609 psf	1,309.0731 psf	215.60066 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma =

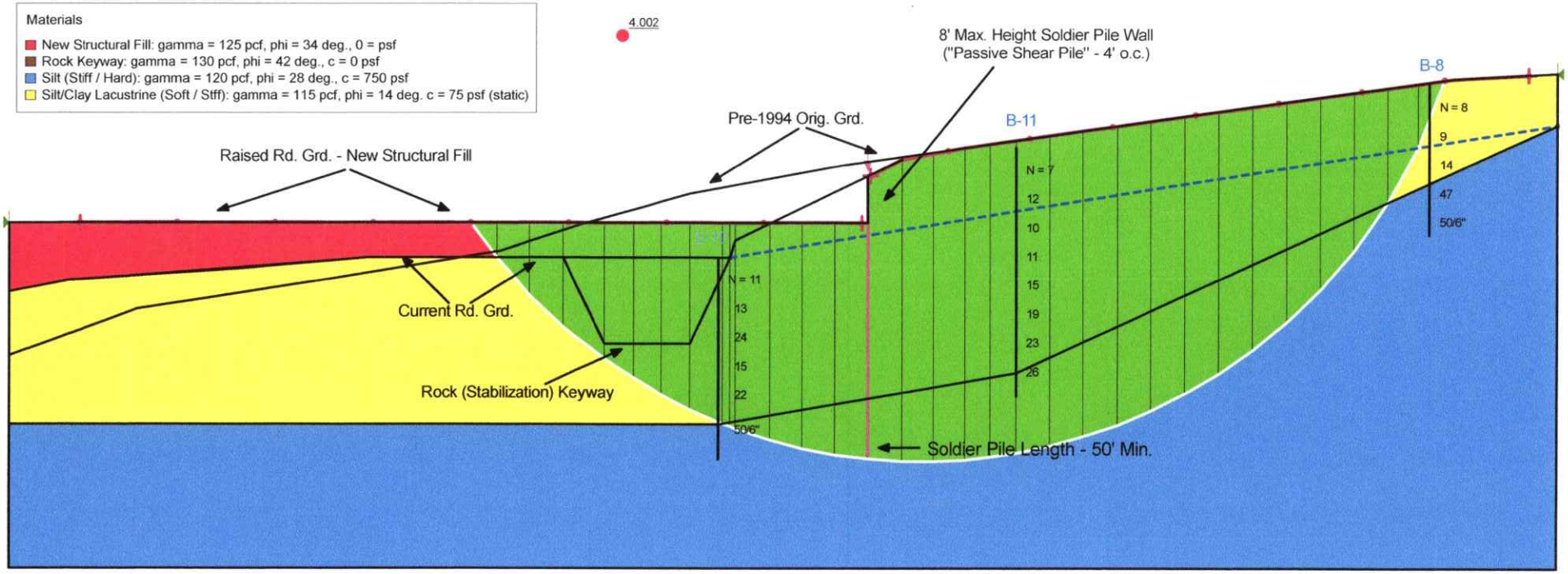
								115 pcf, phi = 14 deg. c = 75 psf
Slice 13	129.95455 ft	157.30113 ft	467.96135 psf	1,422.8122 psf	238.07107 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 14	132.59091 ft	157.46368 ft	484.28574 psf	1,514.5986 psf	256.88585 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 15	135.22727 ft	157.74397 ft	493.25911 psf	1,585.8409 psf	272.41123 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 16	137.86364 ft	158.14371 ft	494.77618 psf	1,638.1429 psf	285.07334 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 17	140.5 ft	158.66533 ft	488.68324 psf	1,673.158 psf	295.32272 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 18	143.13636 ft	159.31217 ft	474.77331 psf	1,692.4576 psf	303.6028 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 19	145.77273 ft	160.0885 ft	452.77906 psf	1,697.4178 psf	310.32329 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 20	148.40909 ft	160.99973 ft	422.36324 psf	1,689.1217 psf	315.83836 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 21	151.04545 ft	162.05259 ft	383.10547 psf	1,668.2751 psf	320.42876 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 22	153.68182 ft	163.25543 ft	334.48424 psf	1,635.1259 psf	324.28638 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 23	156.25677 ft	164.583 ft	277.45961 psf	1,550.1045 psf	317.30601 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 24	158.77032 ft	166.03968 ft	211.75758 psf	1,414.8544 psf	299.96573 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft /

								Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 25	161.28387 ft	167.66753 ft	135.36956 psf	1,267.9521 psf	282.38454 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 26	163.79742 ft	169.48424 ft	47.191296 psf	1,106.5847 psf	264.13643 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 27	166.31128 ft	171.51285 ft	-54.213038 psf	934.80891 psf	233.07404 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 28	168.82544 ft	173.78346 ft	-170.72238 psf	752.72567 psf	187.67559 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 29	171.3396 ft	176.33674 ft	-304.87917 psf	550.22393 psf	137.18623 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 30	173.85376 ft	179.23076 ft	-460.3077 psf	321.29159 psf	80.106989 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf
Slice 31	176.36792 ft	182.55287 ft	-642.46259 psf	57.579287 psf	14.356129 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf

Section A-A'
Proposed Mitigation Case
Model Geometry



Section A-A'
Proposed Mitigation Case
FS = 4.0 (Static)



Proposed Mitigation – Static

File Information

File Version: 10.02
Created By: Ray Coglas
Last Edited By: Ray Coglas
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Tool Version: 10.2.1.19666
File Name: Proposed Mitigation Case.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Mitigation Case\
Last Solved Date: 11/01/2024
Last Solved Time: 06:16:00 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Proposed Mitigation

Description: Mitigation Case
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- 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: 0.001
- 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

Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 75 psf
Phi': 14 °
Phi-B: 0 °
Pore Water Pressure
    Piezometric Line: 1

Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 28 °
Phi-B: 0 °
Pore Water Pressure
    Piezometric Line: 1

New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
    Piezometric Line: 1

Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 42 °
Phi-B: 0 °
Pore Water Pressure
    Piezometric Line: 1

Reinforcements

New Reinforcement

Type: Pile
Shear Force: 162,000 lbf
Shear Force Reduction Factor: 1
Apply Shear: Parallel to Slip
Out-of-Plane Spacing: 4 ft

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (12, 170) ft

Left-Zone Right Coordinate: (148, 170) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (149.43506, 178.21753) ft
Right-Zone Right Coordinate: (263, 195.72222) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 170) ft
Right Coordinate: (268, 196) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	125 ft	164 ft
Coordinate 2	268 ft	187 ft

Seismic Coefficients

Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Reinforcement Lines

Reinforcement Line 1

Reinforcement: New Reinforcement
Lock to Ground Surface: No
Outside Point: (149, 178) ft
Inside Point: (149, 130) ft
Length: 48 ft
Orientation: -90 °
Pullout Force: 0 lbf
Pullout Force per Length: 0 lbf/ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	268 ft	187 ft
Point 2	175 ft	144 ft
Point 3	123 ft	135 ft

Point 4	0 ft	135 ft
Point 5	268 ft	110 ft
Point 6	0 ft	110 ft
Point 7	0 ft	158 ft
Point 8	10 ft	160 ft
Point 9	62 ft	164 ft
Point 10	96 ft	164 ft
Point 11	103 ft	149 ft
Point 12	118 ft	149 ft
Point 13	125 ft	164 ft
Point 14	126 ft	167 ft
Point 15	0 ft	170 ft
Point 16	132.21429 ft	170 ft
Point 17	132 ft	170 ft
Point 18	149 ft	170 ft
Point 19	149 ft	178 ft
Point 20	155 ft	181 ft
Point 21	166 ft	183 ft
Point 22	250 ft	195 ft
Point 23	268 ft	196 ft

Regions

	Material	Points	Area
Region 1	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf	4,3,2,1,5,6	9,770.5 ft²
Region 2	Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf	10,13,12,11	330 ft²
Region 3	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf	15,7,8,9,10,13,14,17	917.5 ft²
Region 4	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)	7,4,3,2,1,23,22,21,20,19,18,17,14,13,12,11,10,9,8	7,306 ft²

Slip Results

Slip Surfaces Analysed: 91 of 405 converged

Current Slip Surface

Slip Surface: 219
Factor of Safety: 4.002
Volume: 6,163.437 ft³
Weight: 723,179.63 lbf
Resisting Moment: 32,178,781 lbf·ft
Activating Moment: 8,041,163.6 lbf·ft
Resisting Force: 298,244.65 lbf
Activating Force: 74,527.684 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (80, 170) ft
Entry: (248.62464, 194.80352) ft
Radius: 94.729954 ft
Center: (158.292, 223.33035) ft

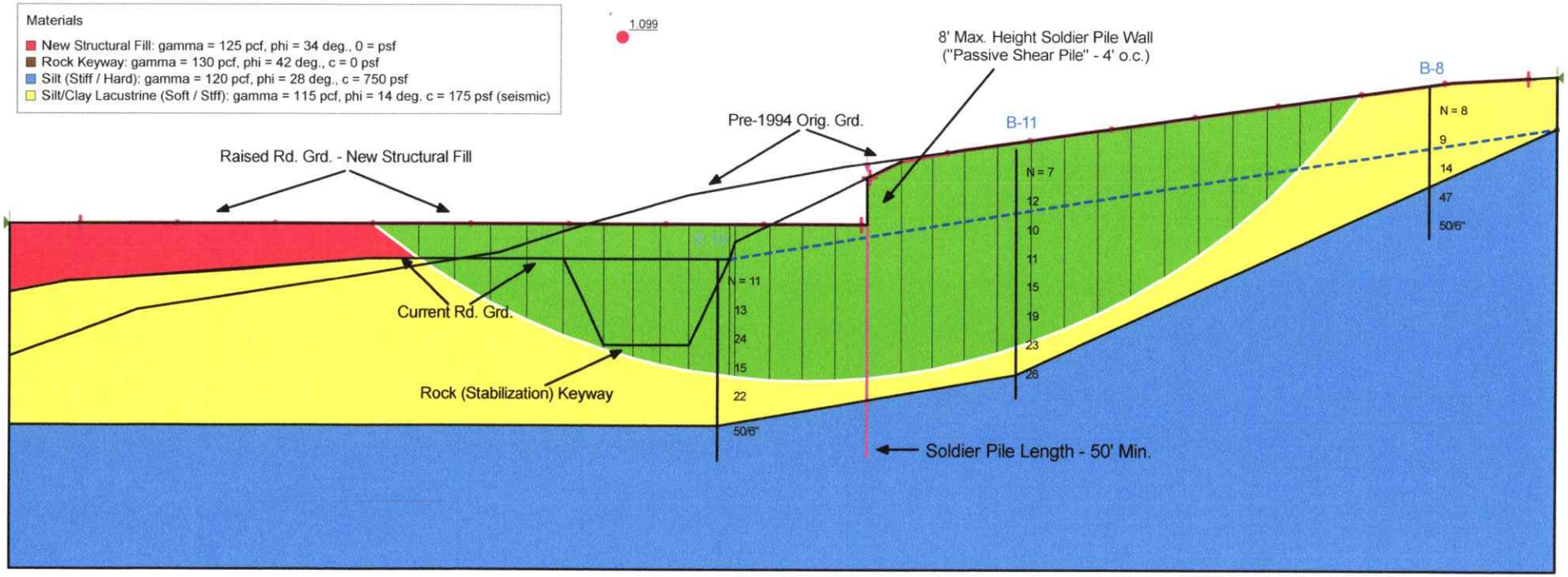
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	82.221506 ft	167 ft	0 psf	497.55724 psf	335.6066 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf
Slice 2	87.332259 ft	160.72519 ft	0 psf	1,292.4237 psf	322.23741 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 3	93.110753 ft	154.70608 ft	0 psf	2,086.6119 psf	520.25077 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 4	99.5 ft	149.18649 ft	0 psf	2,947.7011 psf	734.94444 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 5	105.5 ft	144.73201 ft	0 psf	3,662.2781 psf	913.10848 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 6	110.5 ft	141.59112 ft	0 psf	4,069.9487 psf	1,014.7522 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 7	115.5 ft	138.86287 ft	0 psf	4,410.8997 psf	1,099.7608 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 8	120.86858 ft	136.36197 ft	0 psf	4,604.924 psf	1,148.1365 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 9	124.36858 ft	134.8854 ft	0 psf	4,923.9293 psf	2,618.0996 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 10	125.5 ft	134.45873 ft	1,849.2876 psf	4,795.8547 psf	1,566.7175 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Slice 11	129 ft	133.29819 ft	1,956.8847 psf	4,872.4797 psf	1,550.2494 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 12	134.83333 ft	131.59757 ft	2,121.6282 psf	4,995.6364 psf	1,528.1372 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 13	140.5 ft	130.33096 ft	2,257.6036 psf	5,066.1944 psf	1,493.3542 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 14	146.16667 ft	129.42306 ft	2,371.1839 psf	5,079.0879 psf	1,439.8181 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 15	152 ft	128.85742 ft	2,465.071 psf	6,173.1663 psf	1,971.6292 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 16	157.75 ft	128.64187 ft	2,536.2645 psf	6,301.466 psf	2,001.9932 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 17	163.25 ft	128.77032 ft	2,583.4722 psf	6,269.5041 psf	1,959.8979 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 18	168.25 ft	129.15241 ft	2,609.8241 psf	6,197.9844 psf	1,907.8587 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 19	172.75 ft	129.7379 ft	2,618.4578 psf	6,096.3217 psf	1,849.2131 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 20	177.90358 ft	130.70022 ft	2,610.1282 psf	5,955.3697 psf	1,778.6965 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 21	183.71074 ft	132.12417 ft	2,579.5413 psf	5,770.6233 psf	1,696.7284 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 22	189.51789 ft	133.94775 ft	2,524.0057 psf	5,553.4863 psf	1,610.8034 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 23	195.32505 ft	136.19618 ft	2,441.9472 psf	5,303.9218 psf	1,521.7389 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 24	201.13221 ft	138.90358 ft	2,331.2345 psf	5,020.065 psf	1,429.6765 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 25	206.93936 ft	142.11617 ft	2,188.9827 psf	4,697.7939 psf	1,333.9585 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf,

								phi = 28 deg., c = 750 psf
Slice 26	212.74652 ft	145.89735 ft	2,011.234 psf	4,330.0486 psf	1,232.9356 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 27	218.55368 ft	150.33639 ft	1,792.4147 psf	3,905.6701 psf	1,123.6378 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 28	224.36083 ft	155.56436 ft	1,524.3425 psf	3,407.2632 psf	1,001.1667 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 29	230.16799 ft	161.78624 ft	1,194.2201 psf	2,806.8594 psf	857.45556 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 30	235.97515 ft	169.3563 ft	779.93116 psf	2,055.7372 psf	678.35809 psf	750 psf	0 psf	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf
Slice 31	241.47918 ft	178.344 ft	274.09455 psf	1,510.6875 psf	308.31726 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)
Slice 32	246.35214 ft	188.97809 ft	-340.86373 psf	490.91412 psf	122.39864 psf	75 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 75 psf (static)

Section A-A'
Proposed Mitigation Case
FS = 1.1 (Seismic)



Proposed Mitigation - Seismic

File Information

File Version: 10.02
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File Name: Proposed Mitigation Case.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Mitigation Case\
Last Solved Date: 11/01/2024
Last Solved Time: 06:20:58 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Proposed Mitigation

Description: Mitigation Case
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- 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: 0.001
- 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

Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 175 psf
Phi': 14 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 42 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Reinforcements

New Reinforcement

Type: Pile
Shear Force: 162,000 lbf
Shear Force Reduction Factor: 1
Apply Shear: Parallel to Slip
Out-of-Plane Spacing: 4 ft

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (12, 170) ft

Left-Zone Right Coordinate: (148, 170) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (149.43506, 178.21753) ft
Right-Zone Right Coordinate: (263, 195.72222) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 170) ft
Right Coordinate: (268, 196) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	125 ft	164 ft
Coordinate 2	268 ft	187 ft

Seismic Coefficients

Horz Seismic Coef.: 0.255
Vert Seismic Coef.: 0

Reinforcement Lines

Reinforcement Line 1

Reinforcement: New Reinforcement
Lock to Ground Surface: No
Outside Point: (149, 178) ft
Inside Point: (149, 130) ft
Length: 48 ft
Orientation: -90 °
Slip Surface Intersection: (149, 143.33259) ft
Pullout Force: 0 lbf
Pullout Force per Length: 0 lbf/ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	268 ft	187 ft
Point 2	175 ft	144 ft

Point 3	123 ft	135 ft
Point 4	0 ft	135 ft
Point 5	268 ft	110 ft
Point 6	0 ft	110 ft
Point 7	0 ft	158 ft
Point 8	10 ft	160 ft
Point 9	62 ft	164 ft
Point 10	96 ft	164 ft
Point 11	103 ft	149 ft
Point 12	118 ft	149 ft
Point 13	125 ft	164 ft
Point 14	126 ft	167 ft
Point 15	0 ft	170 ft
Point 16	132.21429 ft	170 ft
Point 17	132 ft	170 ft
Point 18	149 ft	170 ft
Point 19	149 ft	178 ft
Point 20	155 ft	181 ft
Point 21	166 ft	183 ft
Point 22	250 ft	195 ft
Point 23	268 ft	196 ft

Regions

	Material	Points	Area
Region 1	Silt (Stiff / Hard): gamma = 120 pcf, phi = 28 deg., c = 750 psf	4,3,2,1,5,6	9,770.5 ft²
Region 2	Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf	10,13,12,11	330 ft²
Region 3	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf	15,7,8,9,10,13,14,17	917.5 ft²
Region 4	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)	7,4,3,2,1,23,22,21,20,19,18,17,14,13,12,11,10,9,8	7,306 ft²

Slip Results

Slip Surfaces Analysed: 164 of 405 converged

Current Slip Surface

Slip Surface: 168
Factor of Safety: 1.099
Volume: 3,979.8674 ft³
Weight: 466,253.67 lbf
Resisting Moment: 14,994,702 lbf·ft
Activating Moment: 13,642,764 lbf·ft
Resisting Force: 116,490.19 lbf
Activating Force: 105,957.56 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (63, 170) ft
Entry: (234.36008, 192.76573) ft
Radius: 117.60252 ft
Center: (138.17757, 260.43609) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	66.934536 ft	167 ft	0 psf	796.01413 psf	536.91831 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf
Slice 2	74.010437 ft	161.95322 ft	0 psf	1,455.0792 psf	362.79199 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 3	80.293169 ft	158.12909 ft	0 psf	2,043.373 psf	509.4701 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 4	86.575902 ft	154.81697 ft	0 psf	2,544.4364 psf	634.39923 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 5	92.858634 ft	151.9697 ft	0 psf	2,950.927 psf	735.74872 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 6	99.5 ft	149.43761 ft	0 psf	3,406.0768 psf	849.23034 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 7	105.5 ft	147.4947 ft	0 psf	3,738.3527 psf	932.076 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 8	110.5 ft	146.16584 ft	0 psf	3,835.214 psf	956.22625 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 9	115.5 ft	145.06889 ft	0 psf	3,876.7411 psf	966.58011 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 10	121.5 ft	144.07583 ft	0 psf	3,735.9665 psf	931.48107 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma =

								115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 11	125.5 ft	143.51997 ft	1,283.593 psf	3,426.7293 psf	534.34389 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 12	129 ft	143.23084 ft	1,336.7875 psf	3,336.9633 psf	498.69983 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 13	134.83333 ft	142.9153 ft	1,415.0604 psf	3,205.4337 psf	446.3902 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 14	140.5 ft	142.89065 ft	1,473.4993 psf	3,065.1536 psf	396.84399 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 15	146.16667 ft	143.13961 ft	1,514.857 psf	2,904.8982 psf	346.5762 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 16	152 ft	143.68778 ft	1,539.2087 psf	5,207.8893 psf	914.70479 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 17	157.75 ft	144.50725 ft	1,545.786 psf	3,683.3604 psf	532.95716 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 18	163.25 ft	145.5718 ft	1,534.5525 psf	3,546.1024 psf	501.53574 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 19	168.894 ft	146.9554 ft	1,504.8466 psf	3,388.1482 psf	469.55982 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 20	174.68199 ft	148.68408 ft	1,455.0437 psf	3,210.8951 psf	437.78293 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft /

								Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 21	180.46999 ft	150.74523 ft	1,384.4842 psf	3,027.7808 psf	409.71985 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 22	186.25799 ft	153.15809 ft	1,291.9676 psf	2,835.8804 psf	384.9407 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 23	192.04598 ft	155.94711 ft	1,175.9669 psf	2,630.5927 psf	362.67895 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 24	197.83398 ft	159.14351 ft	1,034.5335 psf	2,405.4911 psf	341.8181 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 25	203.62197 ft	162.7875 ft	865.15704 psf	2,152.002 psf	320.84648 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 26	209.40997 ft	166.93174 ft	664.54996 psf	1,858.8135 psf	297.76335 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 27	215.19796 ft	171.64681 ft	428.30548 psf	1,510.8402 psf	269.90623 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 28	220.98596 ft	177.03049 ft	150.31991 psf	1,087.3909 psf	233.63804 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)
Slice 29	226.49999 ft	182.88781 ft	-159.98615 psf	620.63271 psf	154.74111 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)

Slice 30	231.74005 ft	189.31879 ft	-508.85672 psf	109.59405 psf	27.324865 psf	175 psf	0 psf	Silt/Clay Lacustrine (Soft / Stff): gamma = 115 pcf, phi = 14 deg. c = 175 psf (seismic)