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:

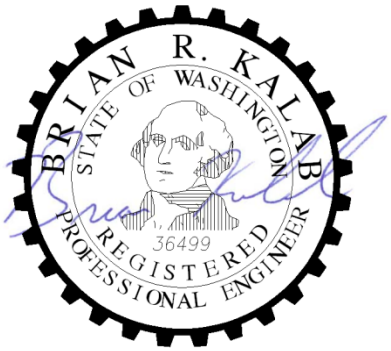
Sithara George, BSCE.

Stormwater Site Plan Preparation Date:

January 12, 2026

Approximate Construction Date:

May 1, 2026



01/21/2026

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TABLE OF CONTENTS

Figures

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 15.60 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 4.23 Acres. The proposal is to construct 25 Single family homes 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 0.20 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. Water quality for the site will be provided four Catch basin filters manufactured ADS pipes 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.

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

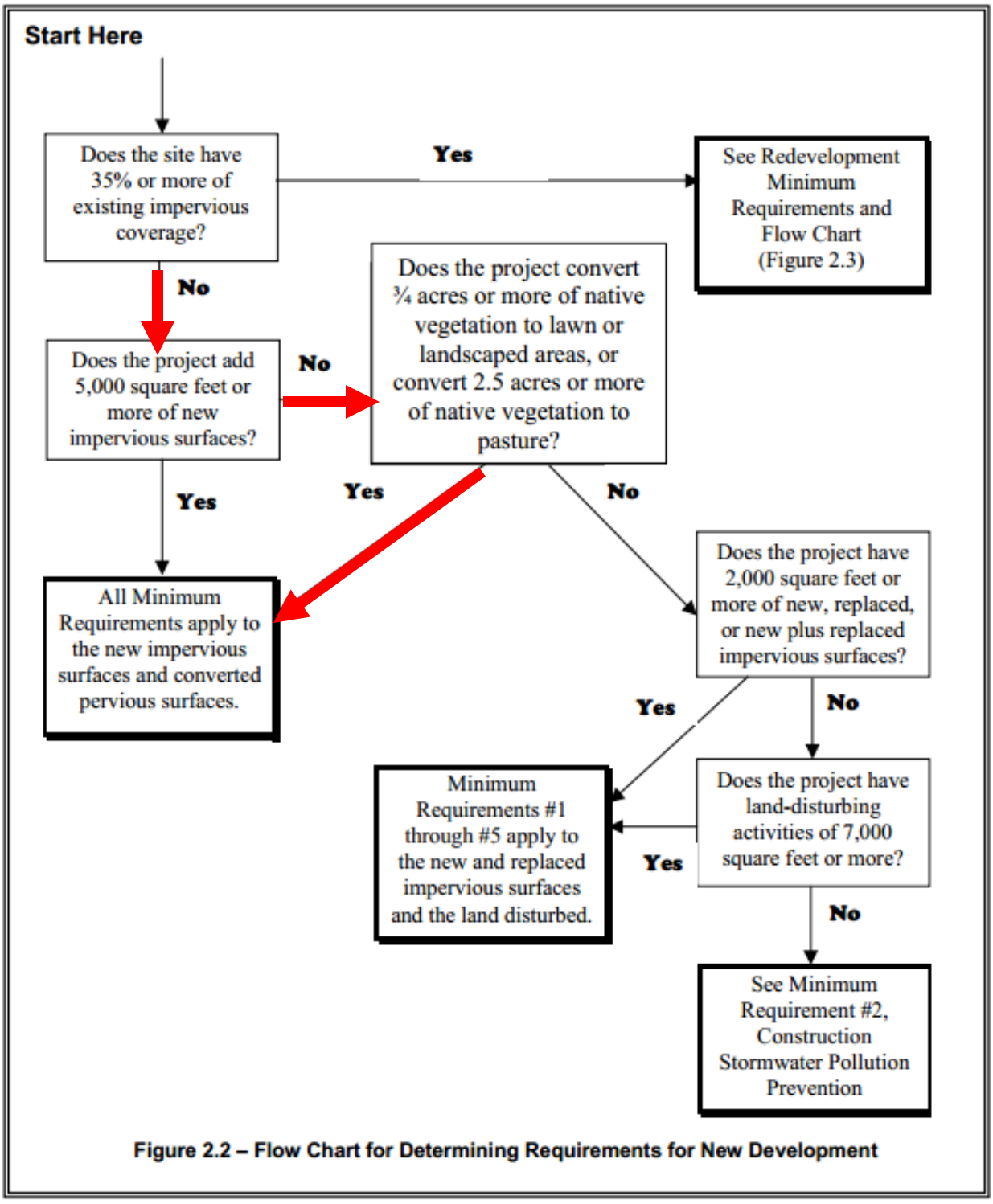


Figure 2.2 – Flow Chart for Determining Requirements for New Development

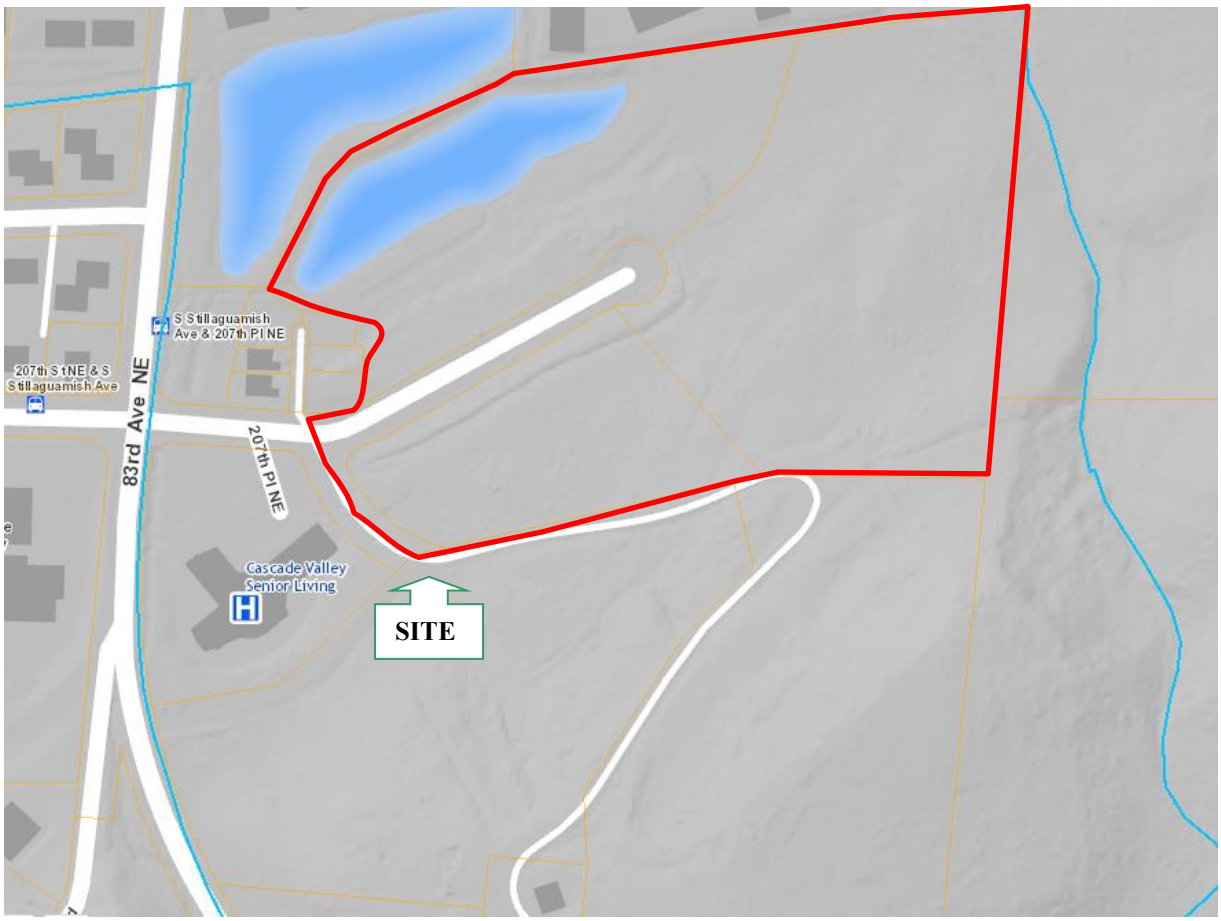
1.1 Drainage Information Summary

Project Name: Pioneer **Point** Project Engineer: **INSIGHT ENGINEERING COMPANY** Project Applicant: **Lavoy Inc.** Total Site Area**: 15.60 Ac;** Upstream Basin **:7.08 Ac** Project Development Area: 4.23 **Ac** Onsite Basin + Upstream Basin**: 22.68 Ac**	Number of Units: **25**

Summary Table

Drainage Basin Information		*Individual Basin Designation*			
		A	*B*	*C*	*D*
On-site Sub-basin Area (Acres)		**22.68**			
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	**4.32**			
Post-developed Runoff Rate (without quantity controls)					
Q (cfs)	2-year	**2.60**			
	10 year	**4.39**			
	50 year	**6.21**			
Post-developed Runoff Rate (with quantity controls)					
Q (cfs)	2-year	**0.85**			
	10 year	**1.38**			
	50 year	**2.00**			
Offsite Upstream Area					
Number of acres		**7.08**			
Offsite Downstream Flow		*2.00*			
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:** 1/21/26	**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.

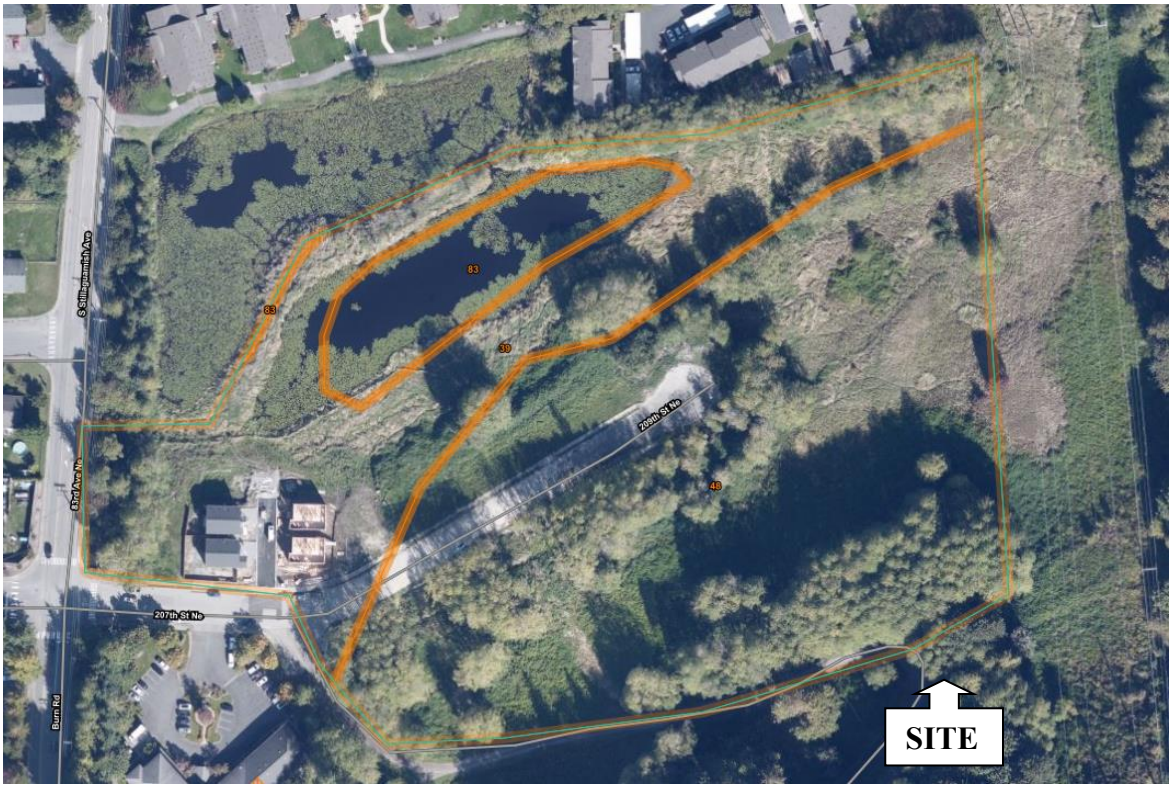
MR #9 Operations and Maintenance: An Operations and Maintenance Manual will be provided for the construction submittal.

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 15.60 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:** 1/21/26	**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 15.60 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 0.20 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

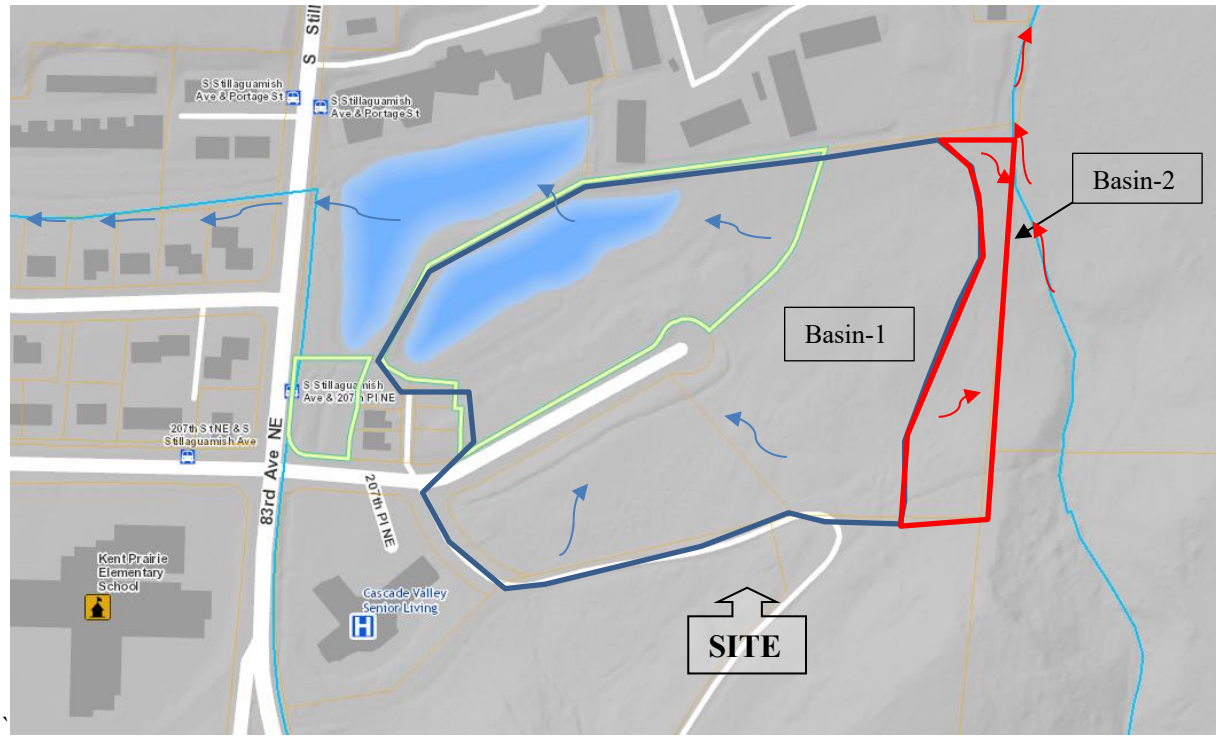

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Figure 4 - Downstream Analysis Map
Pioneer Point
Arlington, Washington

SCALE: NONE	**DATE:** 1/21/26	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 \docs\drainage report	

FIGURE 5. HYDRAULIC ANALYSIS MAP

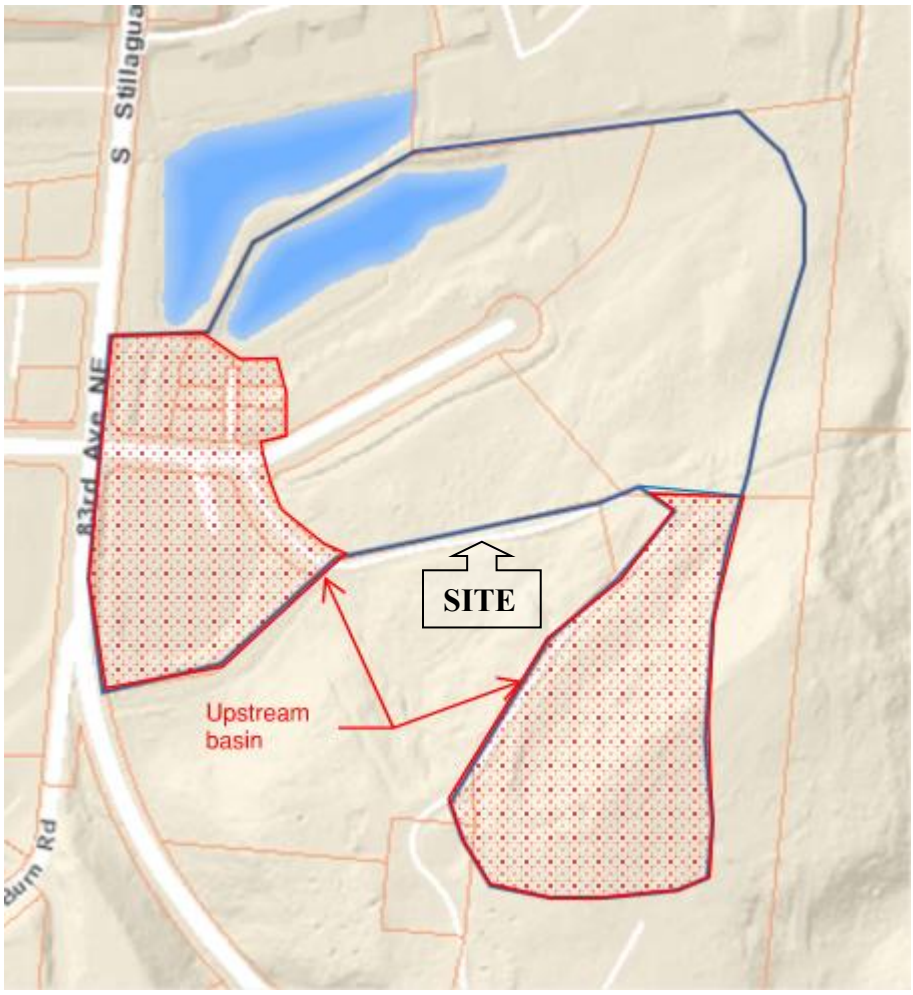

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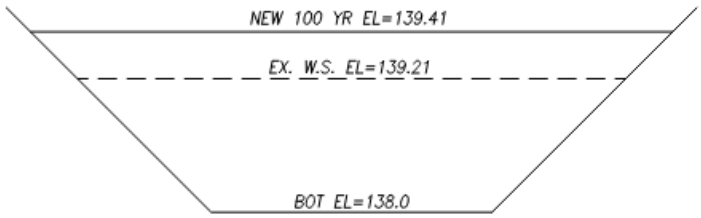
Figure 5 - Hydraulic Analysis Map
Pioneer Point
Arlington, Washington

SCALE: NONE	**DATE:** 1/21/26	**JOB #:** 17-0828
BY: SG	**FILE NAME:** 17-0828 \docs\drainage report	

FIGURE 6. HYDRAULIC ANALYSIS MAP-2



1 / C3.2 EXISTING POND DETAIL
NOT TO SCALE

Stage Frequency (feet)	1001 hr	1005 hr
2 Year =	0.3605	0.2237
5 Year =	0.5149	0.3457
10 Year =	0.6302	0.4445
25 Year =	0.7913	0.5921
50 Year =	0.9229	0.7200
100 Year =	1.0648	0.8646

1005: Pre developed flow
1001:Developed flow

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Figure 6 - Hydraulic Analysis Map-2
Pioneer Point
Arlington, Washington

SCALE: NONE	**DATE:** 1/21/26	**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 4.23 Acres. The proposal is to construct 25 Single family homes 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 0.20 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. Water quality for the site will be provided four Catch basin filters manufactured ADS pipes 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	= 15.60 Acres
Upstream Basin	= 7.08 Acres
Total Existing Basin	= 22.68 Acres

Existing Impervious:

Onsite Basin: = 15.60 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 (+)	= 15.60 Acres
Upstream Basin (+)	= 7.08 Acres
Total Developed Basin	= 22.68 Acres

Developed Impervious Areas:

Onsite Basin:

Site Impervious:

Existing Pond	= 1.50 Acres
Proposed Road	= 1.09 Acres
Proposed Roof	= 0.88 Acres
Proposed Driveway	= 0.20 Acres
Proposed Sidewalk	= 0.12 Acres
Total Site Impervious	= 3.79 Acres

Site Pervious:

Pervious Area (Lawn)	= 1.94 Acres
Forested Area	= 9.87 Acres
Total Pervious area	= 11.81 Acres

Upstream Basin:

Impervious:

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

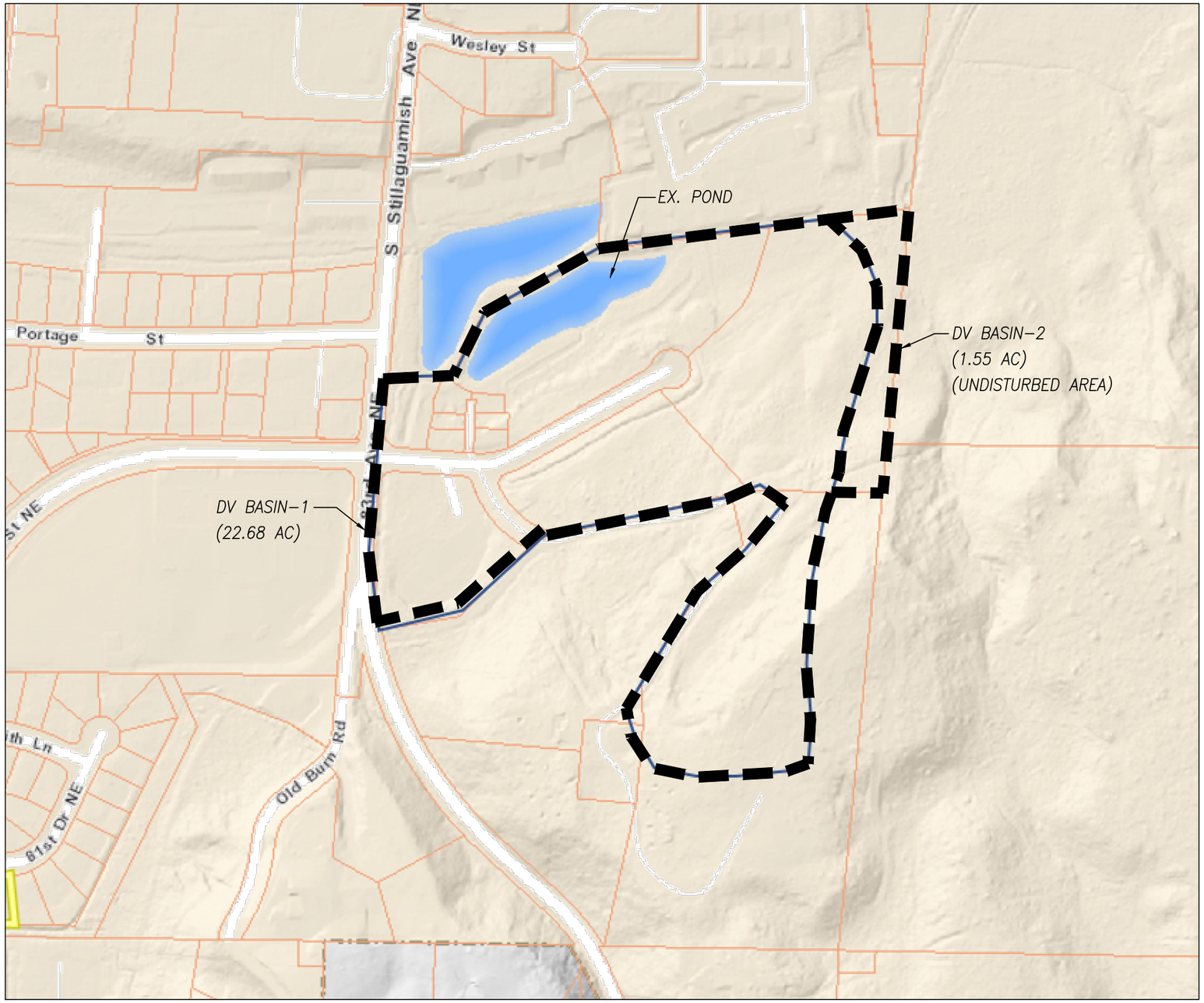
Pervious:

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: Portage Creek
Site Address: XXX 207th Pl NE
City : Arlington
Report Date: 1/20/2026
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2021/08/18
Version : 4.2.18

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	10.75
Pervious Total	14.1

Impervious Land Use	acre
POND	1.5
Impervious Total	1.5
Basin Total	15.6

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	1.94
C, Forest, Mod	3.13
C, Forest, Steep	6.74
Pervious Total	11.81

Impervious Land Use	acre
ROADS MOD	1.09
ROOF TOPS FLAT	0.88
DRIVEWAYS MOD	0.2
SIDEWALKS FLAT	0.12
POND	1.5
Impervious Total	3.79
Basin Total	15.6

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: 7.2 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	0.141	0.323	0.000	0.000	0.000
0.020	1.538	0.031	0.199	0.345	0.000	0.000	0.000
0.030	1.538	0.047	0.244	0.368	0.000	0.000	0.000
0.040	1.539	0.062	0.281	0.392	0.000	0.000	0.000
0.050	1.540	0.078	0.315	0.457	0.000	0.000	0.000
0.060	1.541	0.093	0.345	0.596	0.000	0.000	0.000
0.070	1.542	0.109	0.372	0.780	0.000	0.000	0.000
0.080	1.542	0.124	0.398	0.999	0.000	0.000	0.000
0.090	1.543	0.140	0.422	1.250	0.000	0.000	0.000
0.100	1.544	0.155	0.445	1.528	0.000	0.000	0.000
0.110	1.545	0.171	0.467	1.831	0.000	0.000	0.000
0.120	1.546	0.186	0.487	2.157	0.000	0.000	0.000
0.130	1.547	0.202	0.507	2.504	0.000	0.000	0.000
0.140	1.547	0.217	0.526	2.872	0.000	0.000	0.000
0.150	1.548	0.233	0.545	3.258	0.000	0.000	0.000
0.160	1.549	0.249	0.563	3.663	0.000	0.000	0.000
0.170	1.550	0.264	0.580	4.086	0.000	0.000	0.000
0.180	1.551	0.280	0.597	4.525	0.000	0.000	0.000
0.190	1.551	0.295	0.613	4.980	0.000	0.000	0.000
0.200	1.552	0.311	0.629	5.451	0.000	0.000	0.000
0.210	1.553	0.326	0.645	5.937	0.000	0.000	0.000
0.220	1.554	0.342	0.660	6.437	0.000	0.000	0.000
0.230	1.555	0.357	0.675	6.952	0.000	0.000	0.000
0.240	1.555	0.373	0.689	7.481	0.000	0.000	0.000
0.250	1.556	0.388	0.703	8.023	0.000	0.000	0.000
0.260	1.557	0.404	0.717	8.578	0.000	0.000	0.000
0.270	1.558	0.419	0.731	9.146	0.000	0.000	0.000
0.280	1.559	0.435	0.744	9.726	0.000	0.000	0.000

0.290	1.559	0.450	0.758	10.32	0.000	0.000	0.000
0.300	1.560	0.466	0.771	10.92	0.000	0.000	0.000
0.310	1.561	0.481	0.783	11.54	0.000	0.000	0.000
0.320	1.562	0.497	0.796	12.17	0.000	0.000	0.000
0.330	1.563	0.513	0.808	12.81	0.000	0.000	0.000
0.340	1.564	0.528	0.820	13.46	0.000	0.000	0.000
0.350	1.564	0.544	0.832	14.12	0.000	0.000	0.000
0.360	1.565	0.559	0.844	14.79	0.000	0.000	0.000
0.370	1.566	0.575	0.856	15.47	0.000	0.000	0.000
0.380	1.567	0.590	0.867	16.17	0.000	0.000	0.000
0.390	1.568	0.606	0.879	16.87	0.000	0.000	0.000
0.400	1.568	0.621	0.890	17.58	0.000	0.000	0.000
0.410	1.569	0.637	0.901	18.31	0.000	0.000	0.000
0.420	1.570	0.652	0.912	19.04	0.000	0.000	0.000
0.430	1.571	0.668	0.922	19.78	0.000	0.000	0.000
0.440	1.572	0.683	0.933	20.53	0.000	0.000	0.000
0.450	1.572	0.699	0.944	21.30	0.000	0.000	0.000
0.460	1.573	0.714	0.954	22.07	0.000	0.000	0.000
0.470	1.574	0.730	0.964	22.85	0.000	0.000	0.000
0.480	1.575	0.746	0.975	23.63	0.000	0.000	0.000
0.490	1.576	0.761	0.985	24.43	0.000	0.000	0.000
0.500	1.577	0.777	0.995	25.24	0.000	0.000	0.000
0.510	1.577	0.792	1.008	26.05	0.000	0.000	0.000
0.520	1.578	0.808	1.025	26.88	0.000	0.000	0.000
0.530	1.579	0.823	1.043	27.71	0.000	0.000	0.000
0.540	1.580	0.839	1.063	28.55	0.000	0.000	0.000
0.550	1.581	0.854	1.084	29.40	0.000	0.000	0.000
0.560	1.581	0.870	1.107	30.26	0.000	0.000	0.000
0.570	1.582	0.885	1.130	31.12	0.000	0.000	0.000
0.580	1.583	0.901	1.154	31.99	0.000	0.000	0.000
0.590	1.584	0.916	1.179	32.88	0.000	0.000	0.000
0.600	1.585	0.932	1.206	33.76	0.000	0.000	0.000
0.610	1.585	0.947	1.232	34.66	0.000	0.000	0.000
0.620	1.586	0.963	1.260	35.56	0.000	0.000	0.000
0.630	1.587	0.978	1.288	36.48	0.000	0.000	0.000
0.640	1.588	0.994	1.317	37.39	0.000	0.000	0.000
0.650	1.589	1.010	1.347	38.32	0.000	0.000	0.000
0.660	1.589	1.025	1.377	39.25	0.000	0.000	0.000
0.670	1.590	1.041	1.408	40.19	0.000	0.000	0.000
0.680	1.591	1.056	1.440	41.14	0.000	0.000	0.000
0.690	1.592	1.072	1.472	42.10	0.000	0.000	0.000
0.700	1.593	1.087	1.505	43.06	0.000	0.000	0.000
0.710	1.594	1.103	1.538	44.03	0.000	0.000	0.000
0.720	1.594	1.118	1.572	45.00	0.000	0.000	0.000
0.730	1.595	1.134	1.606	45.98	0.000	0.000	0.000
0.740	1.596	1.149	1.641	46.97	0.000	0.000	0.000
0.750	1.597	1.165	1.676	47.97	0.000	0.000	0.000
0.760	1.598	1.180	1.712	48.97	0.000	0.000	0.000
0.770	1.598	1.196	1.748	49.98	0.000	0.000	0.000
0.780	1.599	1.211	1.785	50.99	0.000	0.000	0.000
0.790	1.600	1.227	1.822	52.01	0.000	0.000	0.000
1.040	1.664	1.633	2.888	0.000	0.000	0.000	0.000
1.290	1.665	2.045	4.170	0.000	0.000	0.000	0.000
1.540	1.696	2.466	5.631	0.000	0.000	0.000	0.000
1.790	1.720	2.890	7.249	0.000	0.000	0.000	0.000

2.790 1.720 4.520 88.40 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:19.72
Total Impervious Area:2.96

Mitigated Landuse Totals for POC #1
Total Pervious Area:17.43
Total Impervious Area:5.25

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.731521
5 year	2.455298

10 year	2.981289
25 year	3.699747
50 year	4.274626
100 year	4.884018

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.850797
5 year	1.143144
10 year	1.368965
25 year	1.693462
50 year	1.965477
100 year	2.265103

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

Year	**Predeveloped**	**Mitigated**
1949	1.547	0.752
1950	3.093	0.895
1951	1.284	0.775
1952	1.527	0.707
1953	2.063	0.695
1954	2.718	0.805
1955	2.494	1.044
1956	1.417	0.941
1957	2.492	1.082
1958	3.633	0.989
1959	1.532	0.854
1960	1.546	0.917
1961	3.784	1.038
1962	2.402	0.858
1963	3.698	0.939
1964	1.477	0.833
1965	1.060	0.800
1966	1.029	0.629
1967	2.682	0.927
1968	1.776	1.143
1969	3.580	0.760
1970	1.153	0.683
1971	2.035	0.864
1972	3.079	0.909
1973	1.719	0.714
1974	1.640	0.713
1975	1.820	0.725
1976	1.271	0.748
1977	1.170	0.666
1978	1.297	0.663
1979	3.614	1.110
1980	1.238	0.793
1981	1.544	0.734
1982	1.434	0.973
1983	1.625	0.738
1984	1.434	0.919
1985	2.033	1.006

1986	2.979	2.561
1987	1.660	1.283
1988	1.290	0.733
1989	2.181	0.659
1990	1.106	0.834
1991	1.225	0.852
1992	1.560	0.713
1993	1.300	0.708
1994	0.928	0.748
1995	1.202	0.857
1996	2.192	1.322
1997	4.150	2.922
1998	1.825	0.746
1999	1.135	0.752
2000	1.757	0.705
2001	0.839	0.525
2002	1.098	0.831
2003	1.068	0.726
2004	1.905	1.107
2005	1.512	0.860
2006	2.223	1.594
2007	2.442	0.890
2008	2.968	2.774
2009	1.484	0.797

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

Rank	Predeveloped	Mitigated
1	4.1501	2.9221
2	3.7842	2.7739
3	3.6980	2.5615
4	3.6333	1.5940
5	3.6142	1.3222
6	3.5800	1.2827
7	3.0932	1.1433
8	3.0789	1.1100
9	2.9788	1.1070
10	2.9680	1.0824
11	2.7178	1.0443
12	2.6822	1.0380
13	2.4936	1.0060
14	2.4921	0.9895
15	2.4423	0.9731
16	2.4016	0.9412
17	2.2232	0.9394
18	2.1917	0.9272
19	2.1805	0.9190
20	2.0627	0.9169
21	2.0351	0.9089
22	2.0329	0.8951
23	1.9047	0.8898
24	1.8248	0.8641
25	1.8204	0.8603
26	1.7764	0.8582

27	1.7571	0.8569
28	1.7192	0.8536
29	1.6596	0.8519
30	1.6403	0.8337
31	1.6245	0.8333
32	1.5600	0.8309
33	1.5472	0.8055
34	1.5456	0.8004
35	1.5444	0.7967
36	1.5317	0.7932
37	1.5267	0.7745
38	1.5121	0.7598
39	1.4840	0.7524
40	1.4774	0.7516
41	1.4345	0.7485
42	1.4341	0.7481
43	1.4169	0.7463
44	1.2995	0.7375
45	1.2965	0.7339
46	1.2904	0.7329
47	1.2841	0.7257
48	1.2715	0.7249
49	1.2382	0.7139
50	1.2254	0.7130
51	1.2024	0.7129
52	1.1695	0.7083
53	1.1532	0.7069
54	1.1350	0.7049
55	1.1062	0.6953
56	1.0976	0.6830
57	1.0683	0.6664
58	1.0604	0.6627
59	1.0288	0.6589
60	0.9282	0.6293
61	0.8389	0.5252

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.8658	1169	561	47	Pass
0.9002	1030	428	41	Pass
0.9346	912	343	37	Pass
0.9691	798	271	33	Pass
1.0035	701	223	31	Pass
1.0379	621	198	31	Pass
1.0724	560	180	32	Pass
1.1068	505	163	32	Pass
1.1412	459	148	32	Pass
1.1757	405	137	33	Pass
1.2101	378	130	34	Pass

1.2445	338	117	34	Pass
1.2790	303	111	36	Pass
1.3134	275	101	36	Pass
1.3478	251	97	38	Pass
1.3823	234	94	40	Pass
1.4167	216	90	41	Pass
1.4511	194	86	44	Pass
1.4856	179	82	45	Pass
1.5200	170	79	46	Pass
1.5544	155	74	47	Pass
1.5889	143	73	51	Pass
1.6233	138	69	50	Pass
1.6577	130	67	51	Pass
1.6922	127	65	51	Pass
1.7266	121	62	51	Pass
1.7610	116	61	52	Pass
1.7955	112	59	52	Pass
1.8299	105	57	54	Pass
1.8643	98	55	56	Pass
1.8988	94	52	55	Pass
1.9332	91	52	57	Pass
1.9676	88	50	56	Pass
2.0020	85	48	56	Pass
2.0365	79	45	56	Pass
2.0709	76	42	55	Pass
2.1053	71	42	59	Pass
2.1398	70	39	55	Pass
2.1742	65	38	58	Pass
2.2086	60	35	58	Pass
2.2431	55	34	61	Pass
2.2775	53	33	62	Pass
2.3119	51	32	62	Pass
2.3464	48	30	62	Pass
2.3808	45	28	62	Pass
2.4152	40	26	65	Pass
2.4497	38	24	63	Pass
2.4841	35	22	62	Pass
2.5185	31	20	64	Pass
2.5530	30	17	56	Pass
2.5874	28	16	57	Pass
2.6218	26	12	46	Pass
2.6563	26	11	42	Pass
2.6907	24	11	45	Pass
2.7251	21	9	42	Pass
2.7596	20	6	30	Pass
2.7940	19	3	15	Pass
2.8284	18	3	16	Pass
2.8629	18	1	5	Pass
2.8973	16	1	6	Pass
2.9317	16	0	0	Pass
2.9662	15	0	0	Pass
3.0006	12	0	0	Pass
3.0350	12	0	0	Pass
3.0695	10	0	0	Pass
3.1039	7	0	0	Pass

3.1383	7	0	0	Pass
3.1728	7	0	0	Pass
3.2072	7	0	0	Pass
3.2416	7	0	0	Pass
3.2761	7	0	0	Pass
3.3105	6	0	0	Pass
3.3449	6	0	0	Pass
3.3794	6	0	0	Pass
3.4138	6	0	0	Pass
3.4482	6	0	0	Pass
3.4827	6	0	0	Pass
3.5171	6	0	0	Pass
3.5515	6	0	0	Pass
3.5860	5	0	0	Pass
3.6204	4	0	0	Pass
3.6548	3	0	0	Pass
3.6893	3	0	0	Pass
3.7237	2	0	0	Pass
3.7581	2	0	0	Pass
3.7926	1	0	0	Pass
3.8270	1	0	0	Pass
3.8614	1	0	0	Pass
3.8959	1	0	0	Pass
3.9303	1	0	0	Pass
3.9647	1	0	0	Pass
3.9992	1	0	0	Pass
4.0336	1	0	0	Pass
4.0680	1	0	0	Pass
4.1025	1	0	0	Pass
4.1369	1	0	0	Pass
4.1713	0	0	0	Pass
4.2058	0	0	0	Pass
4.2402	0	0	0	Pass
4.2746	0	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality Percent Treated	Comment
SSD Table 1 POC	N	1912.22			N	0.00		
Total Volume Infiltrated		1912.22	0.00	0.00				

0.00 0.00 0% No Treat. Credit
Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

5.3 Water Quality

Water quality for the site will be provided four Catch basin filters manufactured ADS pipes located upstream of detention pond.

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

January 12, 2026

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction Duration	May 1, 2026	May 1, 2028

Table of Contents

List of Tables

List of Appendices

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 25-unit single family homes 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. Water quality for the site will be provided by four catch basin filters manufactured by ADS pipes 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):
Water quality for the site will be provided by four catch basin filters manufactured by ADS pipes 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, 2026 End date: April 10, 2027

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

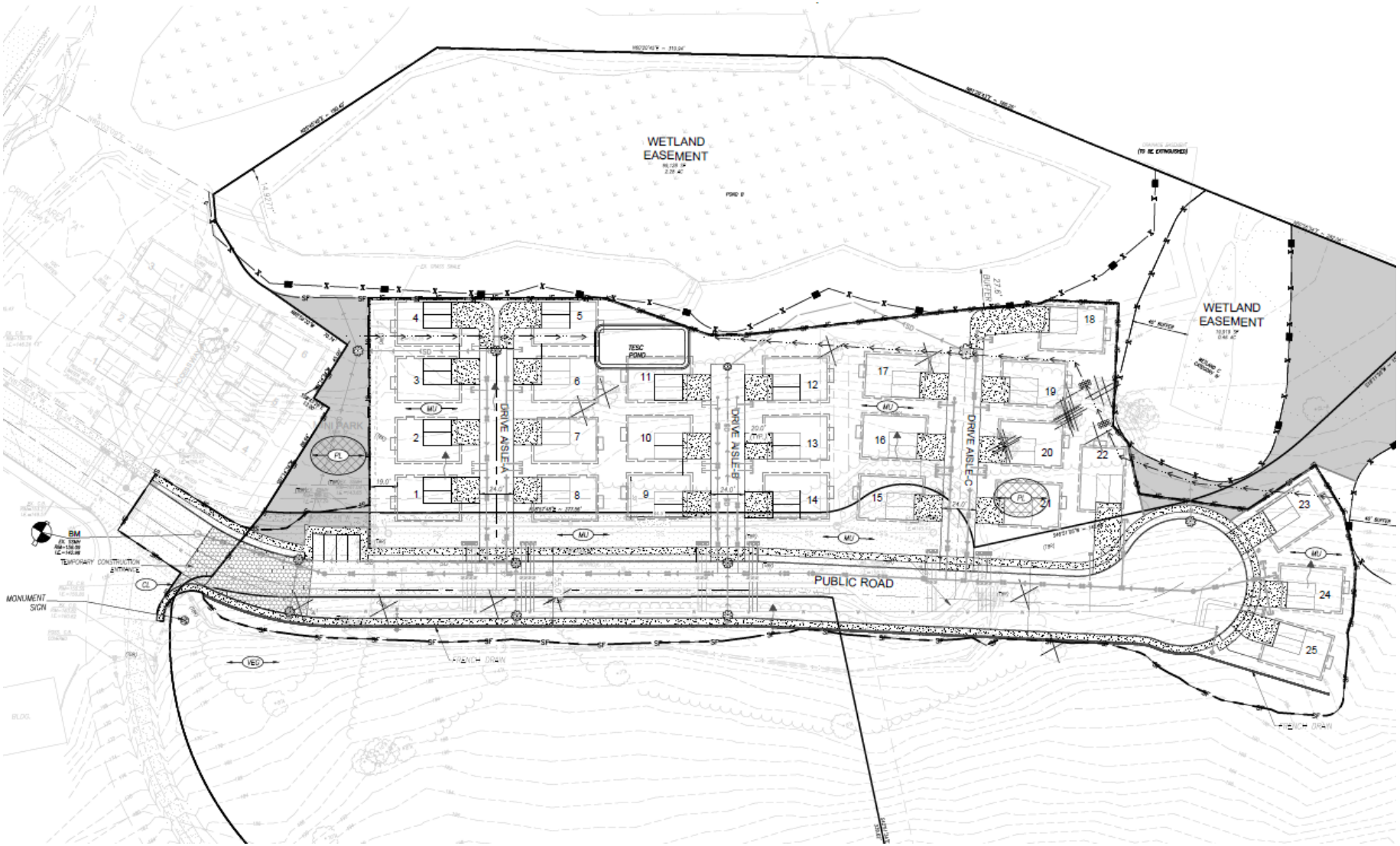
Include the following information:

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


WETLAND EASEMENT
WETLAND EASEMENT
TESC POND
DRIVE AISLE A
DRIVE AISLE B
DRIVE AISLE C
PUBLIC ROAD
MONUMENT SIGN
TEMPORARY CONSTRUCTION ENTRANCE
BM
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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 = 1.74 cfs

Surface Area (SA)

SA = 2 X Q10yr/24hr / Vsed
SA = 2 X 1.74 /0.00096
Where Vsed is the settling velocity.
= 3,625 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) = 1.74 cfs x1.6 2.784 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 = 2.75 cfs
H = 0.5 ft
Length (L) = $\frac{\text{Q 100yr/24hr}}{3.21\ (H)^{3/2}} - 2.4\ (H)$
= $\frac{2.75}{3.21\ (0.5)^{3/2}} - 1.2$
Length (L) = 1.22 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

$$Ao = \frac{3{,}625\ (2H)^{1/2}}{0.6 \times 3600\ (24)\ (32.2)^{1/2}}$$

Ao = 0.02755 Sqft

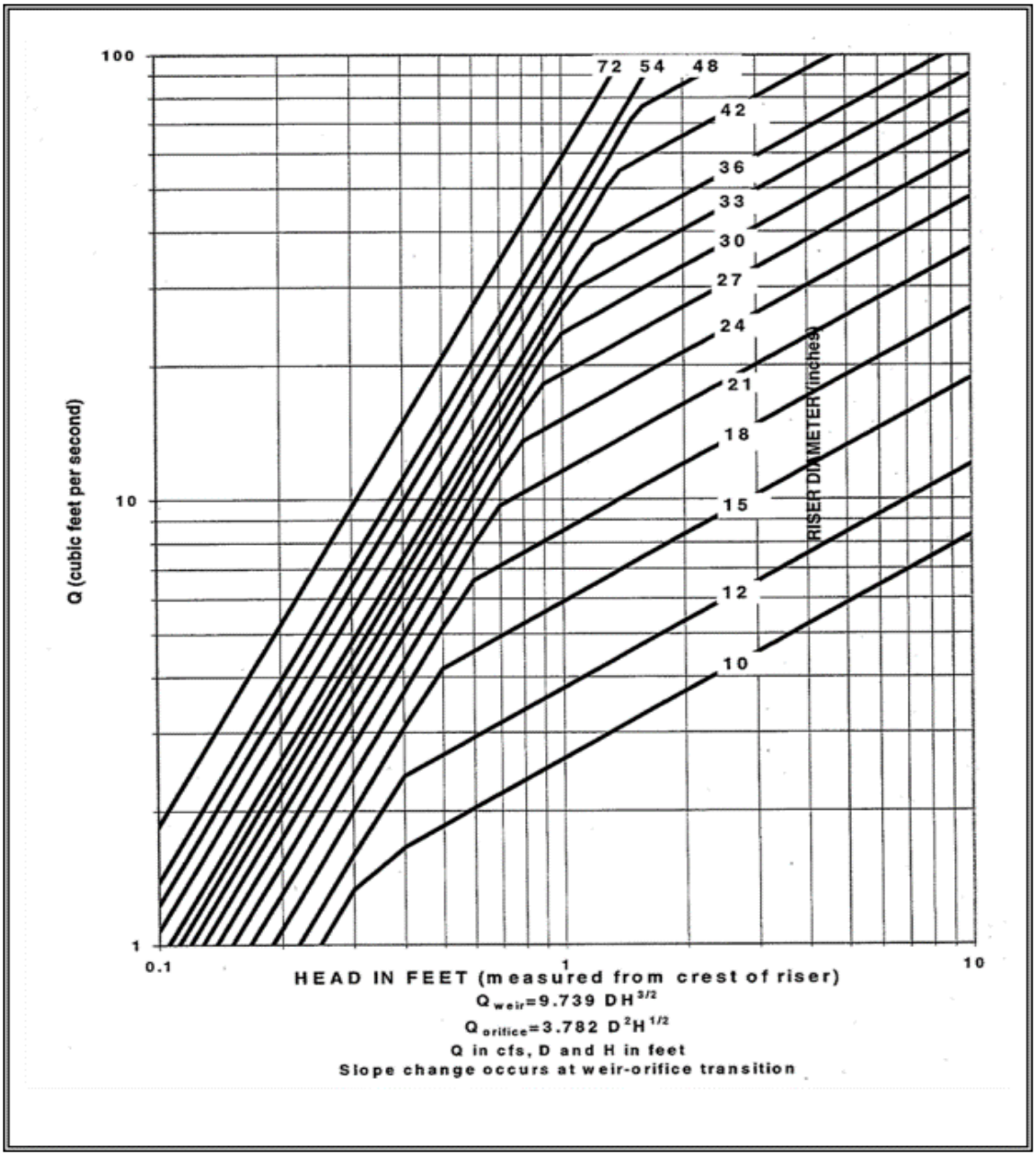
Convert Ao to Diameter (D) in inches

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

D = 2.25 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

EARTH SOLUTIONS NW

Geotechnical Engineering ■ Earthwork Observation & Testing
Environmental Services ■ CESCL & Stormwater Services

esnw.com info@esnw.com

August 5, 2025
Updated August 21, 2025
ES-8157.03

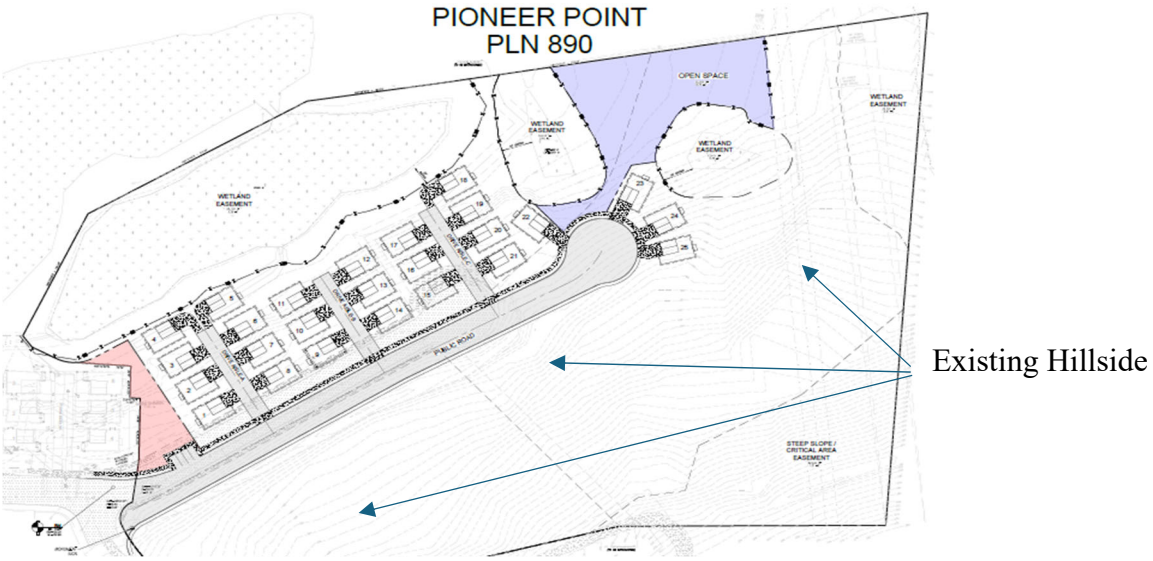
Bay Equity, LLC
502 State Avenue, Suite 101A
Marysville, Washington 98270

Attention: John Murphy

Subject: Geotechnical Evaluation
Site Stabilization
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 within existing areas of hillside prone to landside activity is no longer proposed. Instead, the bulk of the proposed development activity will now occur within the relatively flat (northerly) regions of the site where landslide risk is characterized as low. In any case, given the history of landslide activity, measures to stabilize the existing hillside and mitigate the risk of future landslide activity have been proposed. As such, 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 overall goal with respect to mitigation will be 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. The snippet presented below (extracted from the current civil site plan) illustrates the overall property limits and positioning of the proposed development area relative to the existing hillside.



Proposed Development Area (North of Existing Hillside)

Site History

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 (and transitional beds) of moderate plasticity with consistency characterized as stiff to moderately stiff (near surface). 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.

Based on review of follow up investigative reports and recent observations completed by the undersigned engineer, depth of rotation associated with the 1994 landslide appears to have been relatively shallow. Investigations (by others) conducted subsequent to the landslide reported 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 (significant) displacement of the slide mass since the initial 1994 landslide event has not been detected, although it is likely that small displacements in the form of "creep" have likely occurred. 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 likely resides currently in a state of near equilibrium (i.e. FS $\geq$ 1.0).

Proposed Mitigation

Development plans currently propose construction of 25 (detached) residential building sites and associated site infrastructure improvements. 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. Positioning of the development in this manner 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 newly constructed roadway occupying roughly the same alignment, but only after mitigation to support (and buttress) the base of the hillside has been accomplished. Additionally, and notwithstanding the current plans to consolidate and further separate the development area from the hillside, further measures to fully stabilize the site and mitigate the landslide hazard will also be implemented for the project. Such measures for stabilizing the hillside and mitigating the landslide risk will include the following:

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. The keyway should be lined with a filter fabric and filled with 2” to 4” quarry spalls. If approved by the presiding jurisdiction, a recycled concrete aggregate of similar size may also be considered for use.

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

Grade Modification (Resisting Force) – The current development plan intends to abandon the existing site access road and reestablish a new access positioned roughly along the same alignment. Most importantly, construction of the new road access will also involve abandoning the existing utility alignments and raising the existing site grade roughly 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 (1994) 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) – Subsequent to completing the grade modifications described above, a series of passive shear piles (soldier piles) will be installed along the southerly edge of the new road alignment (toe of slope). The soldier pile elements will be sized with sufficient length such that the pile and its encapsulating grouted shaft will penetrate through the landslide rupture zone. The added shear resistance introduced to the zone of rupture through installation of the passive shear piles will further contribute to stabilization of the hillside. Additionally, a small 4-foot segment of each solder pile will extend above-grade along the pile wall alignment to function as a catchment.

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. Application of these mitigation measures ("rock keyway", "fill-buttress", and "passive shear piles") were modeled in our slope stability analysis for the "post-mitigation" site condition. As demonstrated based on the results of our analysis along representative Cross Section A-A', 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" slope stability 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. 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 (Soft / Stiff)*	Silt (Stiff / Hard)**
ϒ = 125 pcf	ϒ = 130 pcf	ϒ = 115 pcf	ϒ = 120 pcf
Φ = 34 deg.	Φ = 42 deg.	Φ = 18 deg.	Φ = 28 deg.
c = 0 psf	c = 0 psf	c = 75 psf*	c = 750 psf

* *Lacustrine (or Transitional Bed) Deposits.*
** *Transitional Bed Deposit.*

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

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 = 1.40	FS = 0.79
Back Calculation (Post 1994 Rd. Cut)	FS = 0.99	N/A
Mitigated Condition	FS = 3.16	FS = 1.13

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 (lacustrine / transitional bed) 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 calculated as moderately stable (approx. FS = 1.40). This assessment of stability was based on the back calculation strength values calculated for the Post 1994 Rd. Cut condition.

- 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 “mitigated”) model geometry.

- The addition of the previously described 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 “passive shear pile” and “rock keyway” mitigation measures will further contribute to achieving 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 and final engineering for the project are expected to commence.

We trust this report and geotechnical evaluation 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

08/21/2025

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

Attachments: Plate 1 – Geotechnical Cross Section Assessment
Plate 2 – Cross Section A-A’
Stability Analysis

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

LEGEND

- B-10 — Approximate Location of Cobalt Boring (2019/2022)
- Subject Site
- Proposed Building
- Wetland (Delineated by Others)
- Approximate Area of 1994 Landslide
- Cross Section

Pond B
Wetland Easement
Open Space
Wetland Easement
Wetland Easement
Stream
40' Buffer
25' Buffer
40' Buffer
Drive Aisle-A
Drive Aisle-B
Drive Aisle-C
Existing Power Lines
Mini Park
Proposed Public Road
B-10
B-11
B-8
A
A'
207TH STREET N.E.
Existing Road
Steep Slope / Critical Area Easement
NORTH
1"=100'
0 50 100 200
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.

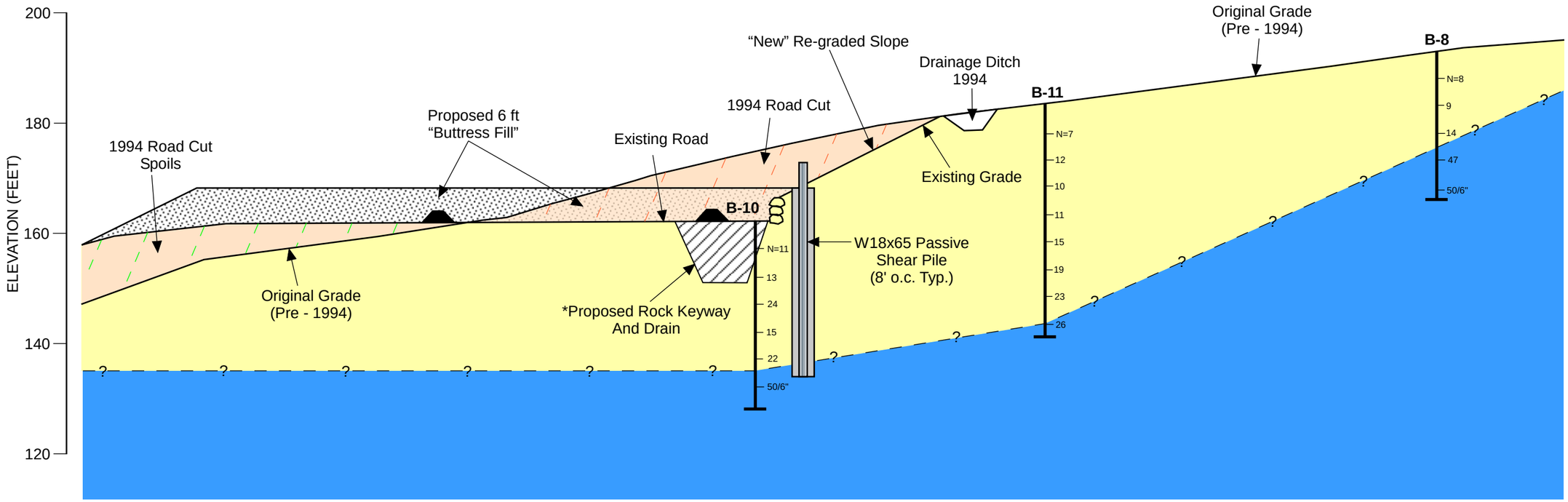
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Geotechnical Cross Section Assessment
Proposed (New) Site Layout
Pioneer Point
Arlington, Washington

Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

EARTH SOLUTIONS NW
REDMOND • PASCO • SILVERDALE

Drawn	CAM
Checked	RAC
Date	08/05/2025
Proj. No.	8157.03
Plate	1



*Rock Keyway and Drain to be Installed Along Edge of Existing Road Alignment Prior to Placement of 6 ft Fill (Buttress).

LEGEND

Silt/Clay Lacustrine (Soft / Stiff) / (Transitional Bed?)

Silt (Stiff / Hard) Transitional Bed

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

Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

EARTH SOLUTIONS NW
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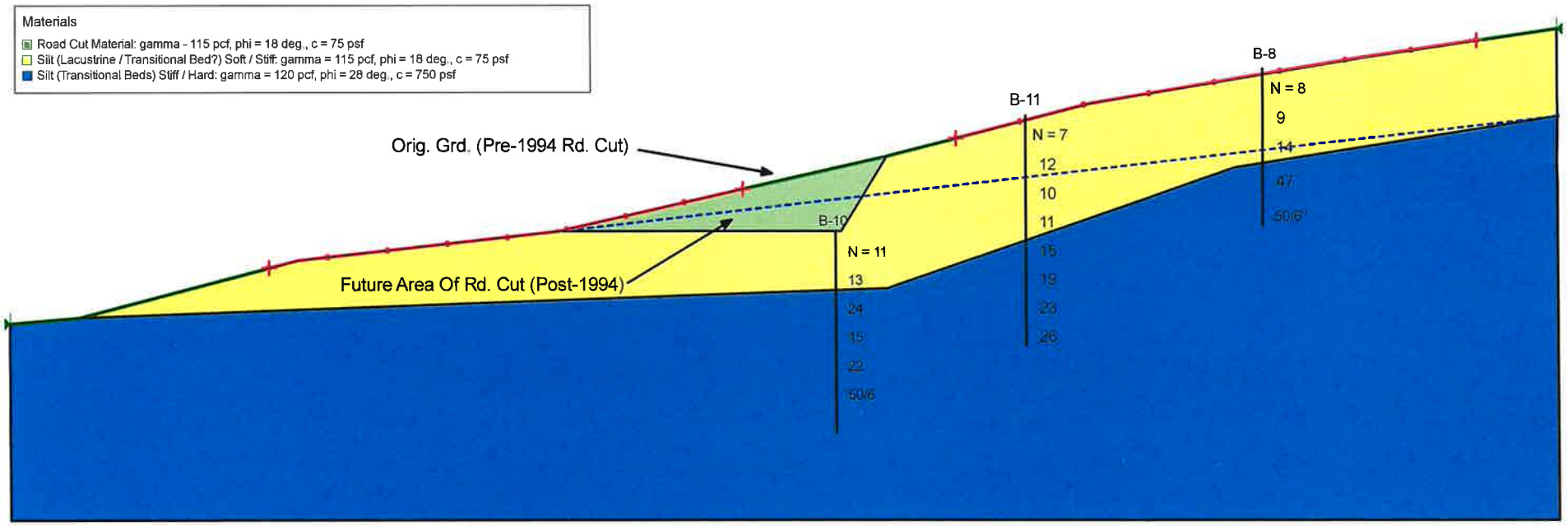
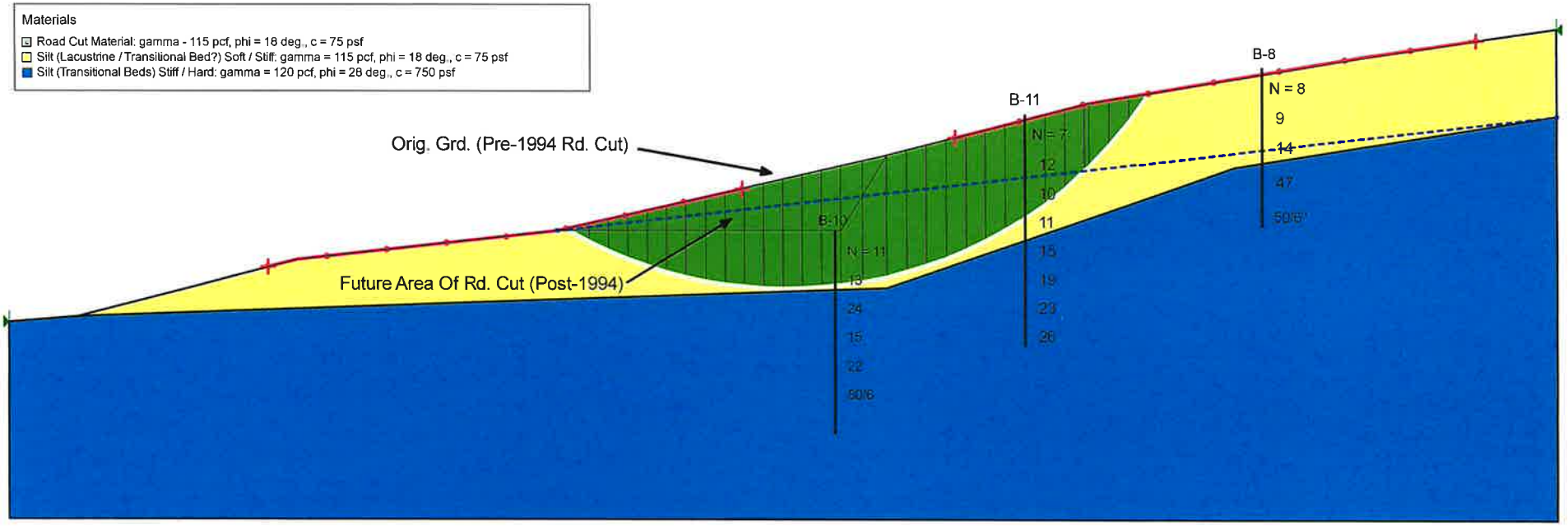
Drawn	CAM
Checked	RAC
Date	08/05/2025
Proj. No.	8157.03
Plate	2

"Model Geometry"
Section A-A'
Pre-1994 Rd. Cut



Section A-A'
Pre-1994 Rd. Cut
FS = 1.40 (Static)



Pre-1994 Rd. Cut (STATIC)

File Information

File Version: 11.07
Product Version: 24.2.1.28
Created By: Ray Coglas
Last Edited By: Ray Coglas
Revision Number: 45
Date: 08/04/2025
Time: 03:31:32 PM
File Name: Pre 1994 Orig. Grd.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Pre-1994 Orig. Grd\
Last Solved Date: 08/04/2025
Last Solved Time: 03:31:32 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Pre-1994 Rd. Cut

Description: "Existing" Stability
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- 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

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Columns: 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 (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 75 psf

Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 750 psf
Effective Friction Angle: 28 °
Phi-B: 0 °

Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 75 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 75 psf
Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (45, 156.68421) ft
Left-Zone Right Coordinate: (127, 170.29825) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (163.87656, 179.05397) ft
Right-Zone Right Coordinate: (254, 195.94118) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 147) ft
Right Coordinate: (268, 198) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	95 ft	163 ft
Coordinate 2	268 ft	183 ft

Seismic Coefficients

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

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	12 ft	148 ft

Point 2	50 ft	158 ft
Point 3	95 ft	163 ft
Point 4	144 ft	163 ft
Point 5	152 ft	176 ft
Point 6	187 ft	185 ft
Point 7	234 ft	193 ft
Point 8	268 ft	198 ft
Point 9	268 ft	183 ft
Point 10	212 ft	174 ft
Point 11	152 ft	153 ft
Point 12	0 ft	147 ft
Point 13	268 ft	113 ft
Point 14	0 ft	113 ft

Regions

	Material	Points	Area
Region 1	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf	1,2,3,4,5,6,7,8,9,10,11	3,351 ft²
Region 2	Silt (Transitional Beds) Stiff / Hard: gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,1,11,10,9,13,14	12,362 ft²
Region 3	Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 75 psf	3,5,4	318.5 ft²

Slip Results

Slip Surfaces Analysed: 405 of 405 converged

Current Slip Surface

Slip Surface: 243
Factor of Safety: 1.401
Volume: 1,464.7331 ft³
Weight: 168,444.31 lbf
Resisting Moment: 3,448,339.9 lbf·ft
Activating Moment: 2,460,439.2 lbf·ft
Resisting Force: 41,649.493 lbf
Activating Force: 29,737.998 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (197.38745, 186.76808) ft
Entry: (96.555929, 163.35486) ft
Radius: 75.43111 ft
Center: (134.56028, 228.51253) ft

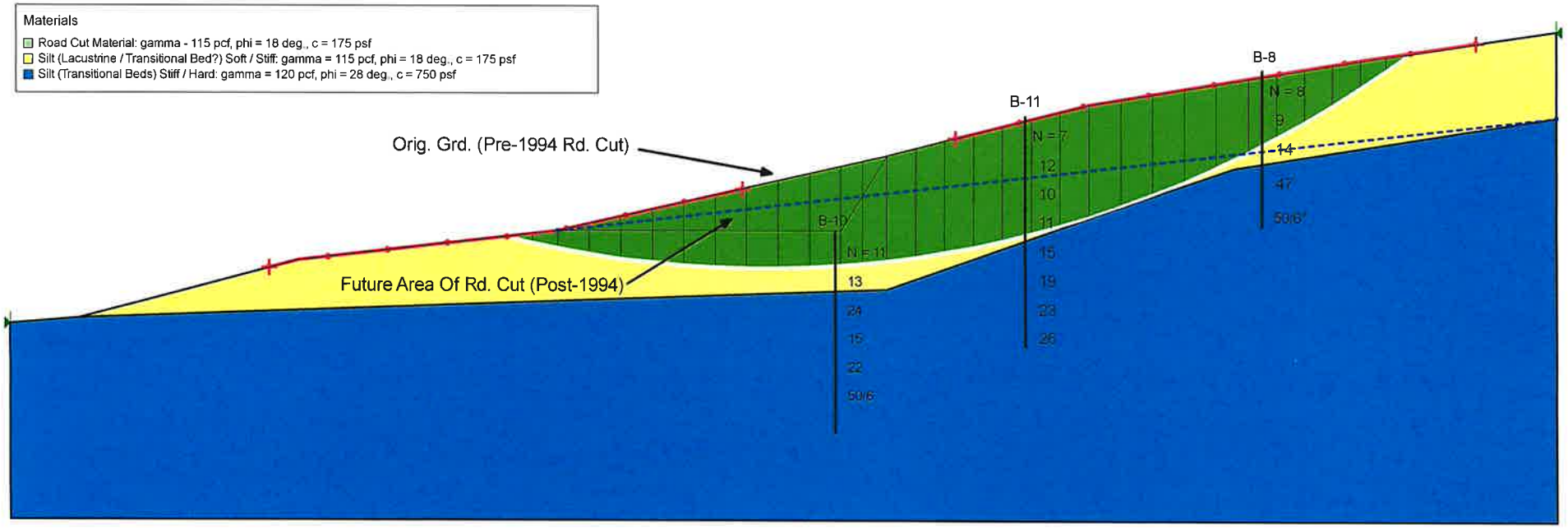
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	195.65621 ft	184.37183 ft	-607.77522 psf	125.24449 psf	40.6944 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 2	192.19373 ft	179.92215 ft	-354.97063 psf	471.36362 psf	153.15532 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 3	188.73124 ft	176.08007 ft	-140.09855 psf	768.81052 psf	249.80168 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 4	186.60873 ft	173.91840 ft	-20.464062 psf	933.98177 psf	303.46907 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 5	184.50659 ft	172.03242 ft	82.105993 psf	1,074.6294 psf	322.49039 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 6	181.08484 ft	169.17796 ft	235.6144 psf	1,287.4259 psf	341.75427 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

								115 pcf, phi = 18 deg., c = 75 psf
Column 7	177.66310 ft	166.64451 ft	369.08234 psf	1,469.9299 psf	357.68705 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 8	174.24135 ft	164.39375 ft	484.90126 psf	1,628.0548 psf	371.43309 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 9	170.81960 ft	162.39667 ft	584.88358 psf	1,766.0104 psf	383.77136 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 10	167.39786 ft	160.63076 ft	670.43355 psf	1,886.7235 psf	395.19657 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 11	163.97611 ft	159.07832 ft	742.65676 psf	1,992.1015 psf	405.96921 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 12	160.55437 ft	157.72525 ft	802.43311 psf	2,083.2044 psf	416.14781 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 13	157.13262 ft	156.56027 ft	850.46701 psf	2,160.3633 psf	425.6111 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 14	153.71087 ft	155.57435 ft	887.3227 psf	2,223.2695 psf	434.07544 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 15	149.87650 ft	154.68460 ft	915.19549 psf	2,281.3186 psf	443.88029 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 16	145.87650 ft	153.95924 ft	931.61077 psf	2,327.744 psf	453.6312 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 17	142.32753 ft	153.50123 ft	934.59013 psf	2,347.9295 psf	459.22179 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 18	138.98260 ft	153.22980 ft	927.39369 psf	2,346.1706 psf	460.98858 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 19	135.63767 ft	153.10766 ft	910.87743 psf	2,322.5464 psf	458.67905 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 20	132.29274 ft	153.13408 ft	885.08676 psf	2,274.8669 psf	451.56694 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 21	128.94781 ft	153.30920 ft	850.01187 psf	2,201.0791 psf	438.98837 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 22	125.60288 ft	153.63409 ft	805.58751 psf	2,099.4253 psf	420.39338 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 23	122.25795 ft	154.11070 ft	751.69093 psf	1,968.5974 psf	395.39688 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

								115 pcf, phi = 18 deg., c = 75 psf
Column 24	118.91302 ft	154.74199 ft	688.13816 psf	1,807.8731 psf	363.82392 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 25	115.56809 ft	155.53197 ft	614.67807 psf	1,617.2152 psf	325.74406 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 26	112.22315 ft	156.48587 ft	530.98392 psf	1,397.3201 psf	281.48968 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 27	108.87822 ft	157.61034 ft	436.64162 psf	1,149.6023 psf	231.65498 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 28	105.53329 ft	158.91366 ft	331.13365 psf	876.11125 psf	177.07396 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 29	102.18836 ft	160.40613 ft	213.81708 psf	579.38201 psf	118.77924 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 30	98.84343 ft	162.10054 ft	83.893144 psf	262.23368 psf	57.946354 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 31	96.98910 ft	163.10446 ft	7.8343177 psf	81.351199 psf	23.887083 psf	75 psf	0 psf	Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 75 psf
Column 32	96.68158 ft	163.28190 ft	-5.4621674 psf	49.599809 psf	16.115955 psf	75 psf	0 psf	Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 75 psf

Section A-A'
Pre-1994 Rd. Cut
FS = 0.79 (Seismic)



Pre-1994 Rd. Cut (SEISMIC)

File Information

File Version: 11.07
Product Version: 24.2.1.28
Created By: Ray Coglas
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File Name: Pre 1994 Orig. Grd.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Pre-1994 Orig. Grd\
Last Solved Date: 08/04/2025
Last Solved Time: 03:35:41 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Pre-1994 Rd. Cut

Description: "Existing" Stability
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- 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

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Columns: 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 (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 175 psf

Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 750 psf
Effective Friction Angle: 28 °
Phi-B: 0 °

Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 175 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 175 psf
Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (45, 156.68421) ft
Left-Zone Right Coordinate: (127, 170.29825) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (163.87656, 179.05397) ft
Right-Zone Right Coordinate: (254, 195.94118) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 147) ft
Right Coordinate: (268, 198) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	95 ft	163 ft
Coordinate 2	268 ft	183 ft

Seismic Coefficients

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

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	12 ft	148 ft

Point 2	50 ft	158 ft
Point 3	95 ft	163 ft
Point 4	144 ft	163 ft
Point 5	152 ft	176 ft
Point 6	187 ft	185 ft
Point 7	234 ft	193 ft
Point 8	268 ft	198 ft
Point 9	268 ft	183 ft
Point 10	212 ft	174 ft
Point 11	152 ft	153 ft
Point 12	0 ft	147 ft
Point 13	268 ft	113 ft
Point 14	0 ft	113 ft

Regions

	Material	Points	Area
Region 1	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf	1,2,3,4,5,6,7,8,9,10,11	3,351 ft^2
Region 2	Silt (Transitional Beds) Stiff / Hard: gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,1,11,10,9,13,14	12,362 ft^2
Region 3	Road Cut Material: gamma - 115 pcf, phi = 18 deg., c = 175 psf	3,5,4	318.5 ft^2

Slip Results

Slip Surfaces Analysed: 403 of 405 converged

Current Slip Surface

Slip Surface: 217
Factor of Safety: 0.792
Volume: 2,018.1505 ft^3
Weight: 232,087.31 lbf
Resisting Moment: 14,986,816 lbf·ft
Activating Moment: 18,918,041 lbf·ft
Resisting Force: 76,576.001 lbf
Activating Force: 96,708.826 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (242.65121, 194.27224) ft
Entry: (86.241175, 162.0268) ft
Radius: 187.11154 ft
Center: (130.27878, 343.88229) ft

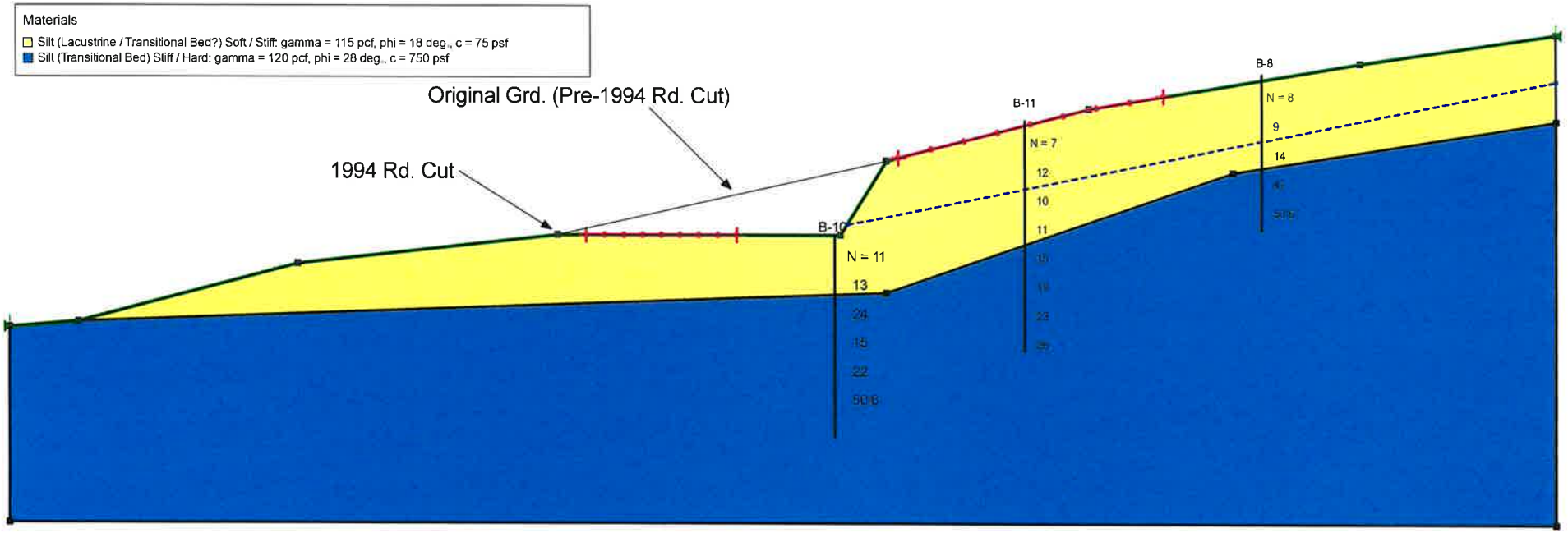
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	240.48841 ft	192.69563 ft	-803.86125 psf	-6.3592654 psf	-2.0662506 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 2	236.16280 ft	189.63436 ft	-643.96512 psf	221.90771 psf	72.102186 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 3	231.56832 ft	186.58386 ft	-486.68186 psf	435.52021 psf	141.50909 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 4	226.70496 ft	183.55553 ft	-332.72301 psf	635.73694 psf	206.56345 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 5	221.84161 ft	180.72836 ft	-191.32299 psf	817.1991 psf	265.52408 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 6	216.97825 ft	178.09205 ft	-61.838324 psf	983.25954 psf	319.48039 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

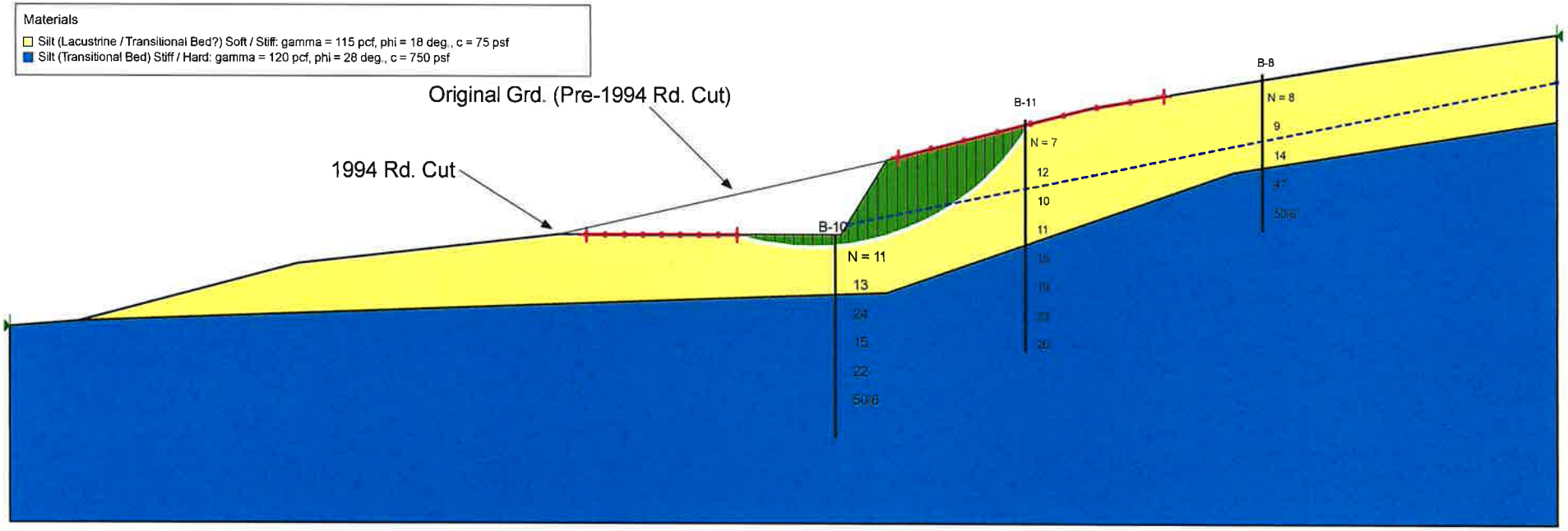
								115 pcf, phi = 18 deg., c = 175 psf
Column 7	211.79191 ft	175.48700 ft	63.36396 psf	1,149.8181 psf	353.01034 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 8	206.28260 ft	172.92890 ft	183.30402 psf	1,312.487 psf	366.89379 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 9	200.77329 ft	170.58367 ft	289.95434 psf	1,457.7761 psf	379.44829 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 10	195.26397 ft	168.44276 ft	383.84862 psf	1,589.8038 psf	391.83857 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 11	189.75466 ft	166.49878 ft	465.44934 psf	1,711.8853 psf	404.99159 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 12	184.50000 ft	164.81815 ft	532.44675 psf	1,801.1384 psf	412.2229 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 13	179.50000 ft	163.37941 ft	586.18024 psf	1,857.8542 psf	413.19192 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 14	174.50000 ft	162.08956 ft	630.61903 psf	1,908.0877 psf	415.07474 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 15	169.50000 ft	160.94544 ft	665.95989 psf	1,951.2223 psf	417.60707 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 16	164.50000 ft	159.94433 ft	692.37275 psf	1,985.9378 psf	420.30475 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 17	159.50000 ft	159.08390 ft	710.00282 psf	2,010.2202 psf	422.46623 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 18	154.50000 ft	158.36219 ft	718.97239 psf	2,021.4207 psf	423.19112 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 19	149.87650 ft	157.81214 ft	719.94278 psf	2,024.883 psf	424.00079 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 20	145.87650 ft	157.43150 ft	714.83655 psf	2,021.9196 psf	424.69704 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 21	141.27778 ft	157.11421 ft	701.45471 psf	1,999.6627 psf	421.81334 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 22	135.83333 ft	156.87304 ft	677.21649 psf	1,947.5324 psf	412.75064 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 23	130.38889 ft	156.79058 ft	643.0698 psf	1,862.0775 psf	396.07961 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

								115 pcf, phi = 18 deg., c = 175 psf
Column 24	124.94444 ft	156.86662 ft	599.02776 psf	1,740.4274 psf	370.86323 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 25	119.50000 ft	157.10137 ft	545.07826 psf	1,581.2347 psf	336.66763 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 26	114.05556 ft	157.49540 ft	481.18384 psf	1,384.9306 psf	293.64512 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 27	108.61111 ft	158.04975 ft	407.28119 psf	1,153.748 psf	242.54175 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 28	103.16667 ft	158.76585 ft	323.28032 psf	891.49057 psf	184.6227 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 29	97.72222 ft	159.64560 ft	229.06337 psf	603.08085 psf	121.52565 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 30	92.81029 ft	160.57422 ft	0 psf	373.9134 psf	121.49183 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf
Column 31	88.43088 ft	161.52430 ft	0 psf	165.16188 psf	53.664346 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 175 psf

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



Section A-A'
Back Calculation (Post-1994 Rd. Cut)
FS = 0.99



Pioneer Point - Post 1994 (RD. CUT) - BACK CALC.

File Information

File Version: 11.07
Product Version: 24.2.1.28
Created By: Ray Coglas
Last Edited By: Ray Coglas
Revision Number: 30
Date: 08/04/2025
Time: 03:59:11 PM
File Name: 1994 Rd. Cut Back Calculation.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New 1994 Rd. Cut\
Last Solved Date: 08/04/2025
Last Solved Time: 03:59:11 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Pioneer Point - Post 1994

Description: Back Calculation
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Half-Sine
- PWP Conditions from: Piezometric Surfaces
- 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

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Columns: 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 (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 75 psf

Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 750 psf
Effective Friction Angle: 28 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (100, 163) ft
Left-Zone Right Coordinate: (126, 163) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (154, 176.51429) ft
Right-Zone Right Coordinate: (200, 187.21277) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 147) ft
Right Coordinate: (268, 198) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	145.23077 ft	165 ft
Coordinate 2	268 ft	190 ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	12 ft	148 ft
Point 2	50 ft	158 ft
Point 3	95 ft	163 ft
Point 4	144 ft	163 ft
Point 5	152 ft	176 ft
Point 6	187 ft	185 ft
Point 7	234 ft	193 ft
Point 8	268 ft	198 ft
Point 9	268 ft	183 ft
Point 10	212 ft	174 ft
Point 11	152 ft	153 ft
Point 12	0 ft	147 ft
Point 13	268 ft	113 ft
Point 14	0 ft	113 ft

Regions

	Material	Points	Area
Region 1	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf	1,2,3,4,5,6,7,8,9,10,11	3,351 ft²
Region 2	Silt (Transitional Bed) Stiff / Hard: gamma = 120 pcf, phi = 28 deg., c = 750 psf	12,1,11,10,9,13,14	12,362 ft²

Slip Results

Slip Surfaces Analysed: 226 of 405 converged

Current Slip Surface

Slip Surface: 383
Factor of Safety: 0.990
Volume: 309.62798 ft³
Weight: 35,607.218 lbf
Resisting Moment: 635,546.94 lbf·ft
Activating Moment: 642,191.43 lbf·ft
Resisting Force: 12,652.305 lbf
Activating Force: 12,786.767 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (176.88575, 182.39919) ft
Entry: (126, 163) ft
Radius: 44.211228 ft
Center: (139.03524, 205.24589) ft

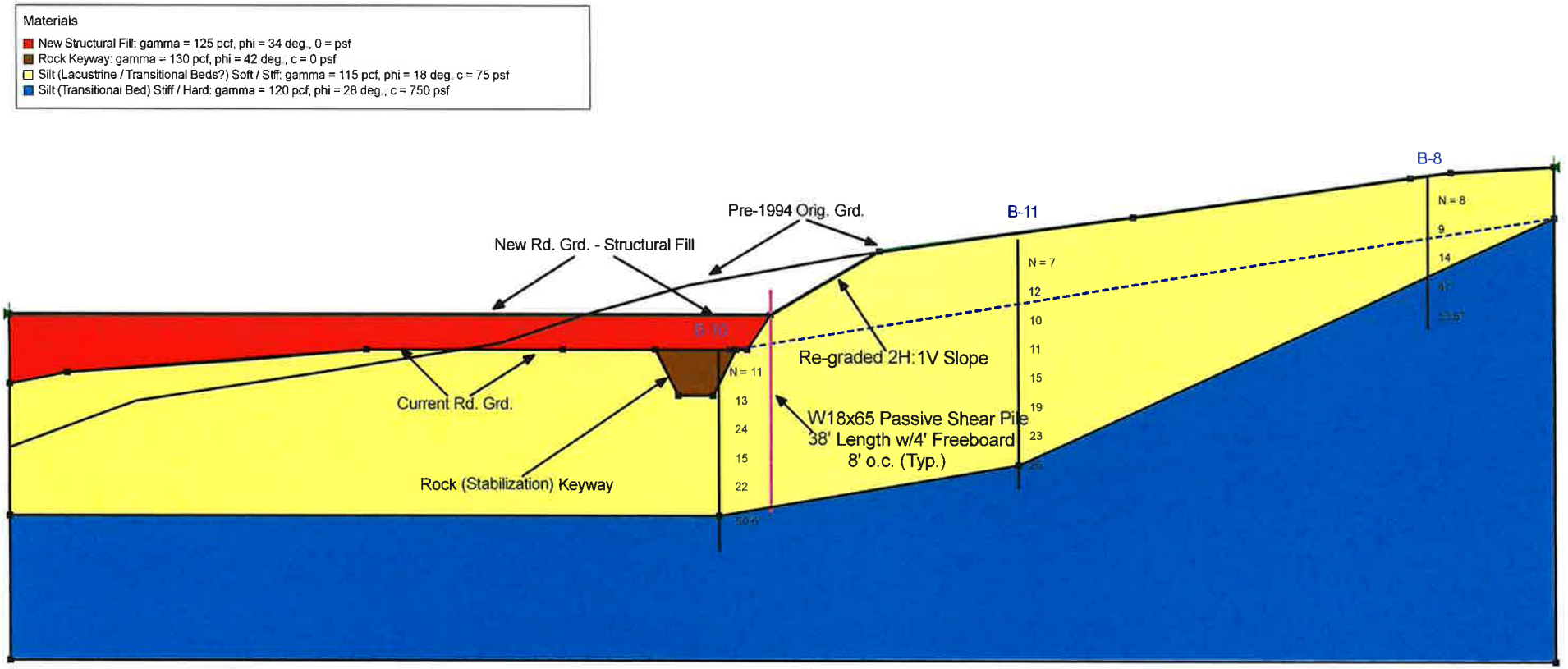
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	176.08872 ft	181.17242 ft	-617.35288 psf	2.3616199 psf	0.76733682 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 2	174.49467 ft	178.87398 ft	-494.12563 psf	158.97433 psf	51.653893 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 3	172.90062 ft	176.85170 ft	-388.13953 psf	294.44325 psf	95.67041 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 4	171.30656 ft	175.04931 ft	-295.88095 psf	414.07942 psf	134.54256 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 5	169.71251 ft	173.42904 ft	-214.99237 psf	521.7364 psf	169.52243 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 6	168.11846 ft	171.96408 ft	-143.79977 psf	620.27754 psf	201.54039 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 7	166.52440 ft	170.63458 ft	-81.064029 psf	711.85279 psf	231.29499 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 8	164.93035 ft	169.42539 ft	-25.838551 psf	798.0696 psf	259.30853 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 9	163.26666 ft	168.28108 ft	24.450159 psf	885.63513 psf	279.81596 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 10	161.53333 ft	167.20046 ft	69.878011 psf	973.45002 psf	293.58834 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

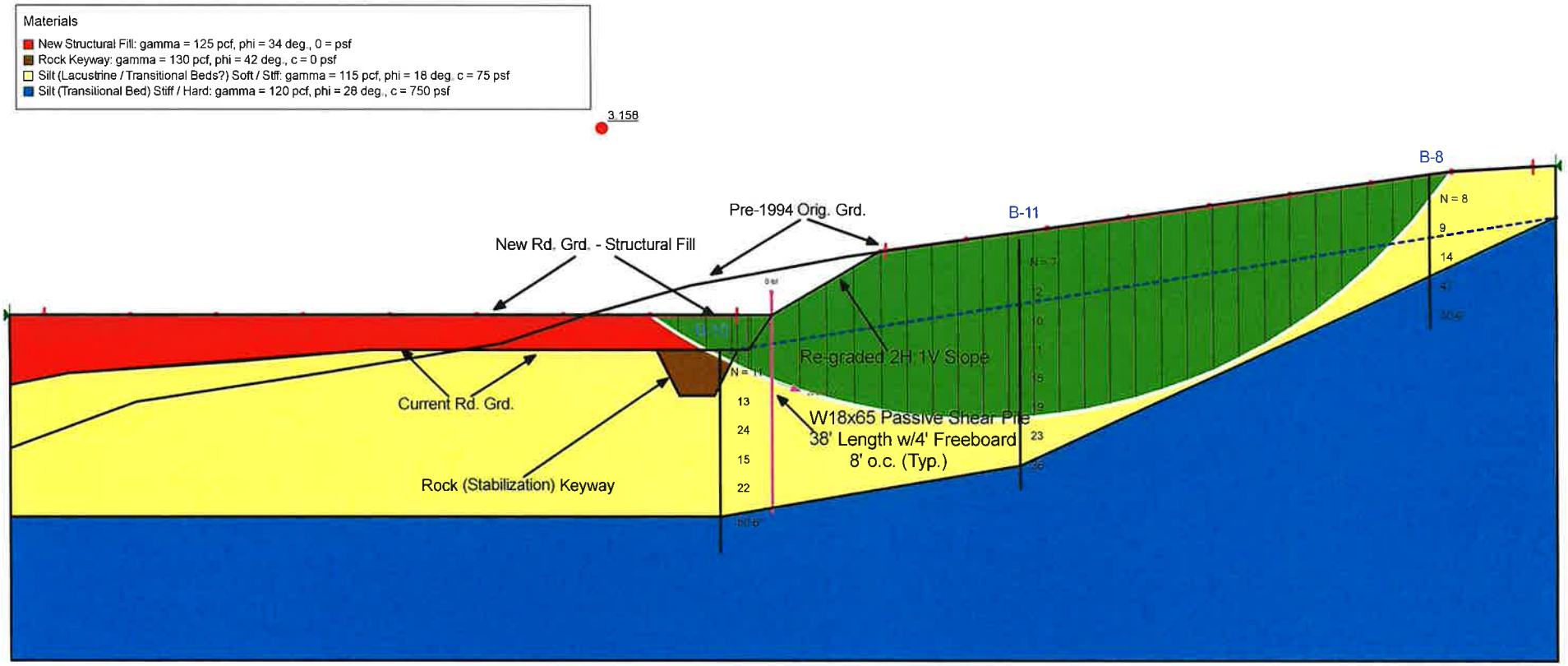
								115 pcf, phi = 18 deg., c = 75 psf
Column 11	159.79999 ft	166.22674 ft	108.63142 psf	1,055.6353 psf	307.70022 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 12	158.06666 ft	165.35209 ft	141.20073 psf	1,133.0481 psf	322.27074 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 13	156.33333 ft	164.57008 ft	167.98603 psf	1,206.0391 psf	337.2839 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 14	154.60000 ft	163.87545 ft	189.31619 psf	1,274.4837 psf	352.5923 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 15	152.86667 ft	163.26385 ft	205.46261 psf	1,337.8015 psf	367.91922 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 16	151.15385 ft	162.73709 ft	216.57327 psf	1,270.8435 psf	342.55317 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 17	149.46154 ft	162.29049 ft	222.94088 psf	1,062.0409 psf	272.64011 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 18	147.76923 ft	161.91455 ft	224.89641 psf	831.00115 psf	196.93537 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 19	146.07692 ft	161.60746 ft	222.55408 psf	577.05675 psf	115.1849 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 20	144.61539 ft	161.39261 ft	0 psf	355.12536 psf	115.38722 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 21	143.18182 ft	161.23722 ft	0 psf	265.23792 psf	86.181024 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 22	141.54545 ft	161.11359 ft	0 psf	289.96539 psf	94.215465 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 23	139.90909 ft	161.05087 ft	0 psf	305.10312 psf	99.134013 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 24	138.27273 ft	161.04881 ft	0 psf	309.98067 psf	100.71882 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 25	136.63636 ft	161.10740 ft	0 psf	304.16279 psf	98.82848 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 26	135.00000 ft	161.22687 ft	0 psf	287.50897 psf	93.417327 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 27	133.36364 ft	161.40772 ft	0 psf	260.20615 psf	84.546103 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma =

								115 pcf, phi = 18 deg., c = 75 psf
Column 28	131.72727 ft	161.65073 ft	0 psf	222.76722 psf	72.381459 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 29	130.09091 ft	161.95693 ft	0 psf	175.99262 psf	57.183469 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 30	128.45455 ft	162.32769 ft	0 psf	120.89769 psf	39.282039 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf
Column 31	126.81818 ft	162.76470 ft	0 psf	58.614182 psf	19.044902 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Bed?) Soft / Stiff: gamma = 115 pcf, phi = 18 deg., c = 75 psf

"Model Geometry"
Section A-A'
Proposed Mitigation Case



Section A-A'
Proposed Mitigation Case
FS = 3.16 (Static)



Proposed Mitigation (STATIC)

File Information

File Version: 11.07
Product Version: 24.2.1.28
Created By: Ray Coglas
Last Edited By: Ray Coglas
Revision Number: 166
Date: 08/04/2025
Time: 05:58:34 PM
File Name: Proposed Mitigation Case 2.gsz
Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Mitigation Case\
Last Solved Date: 08/04/2025
Last Solved Time: 05:58:35 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Proposed Mitigation

Description: Mitigation Case
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Constant
- PWP Conditions from: Piezometric Surfaces
- 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

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Columns: 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 (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 75 psf

Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 750 psf
Effective Friction Angle: 28 °
Phi-B: 0 °

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 42 °
Phi-B: 0 °

Reinforcements

Passive Shear Pile

Type: Pile
Shear Force: 162,000 lbf
Shear Force Reduction Factor: 1
Apply Shear: Parallel to Slip
Out-of-Plane Spacing: 8 ft

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (6, 170) ft
Left-Zone Right Coordinate: (126, 170) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (151.83024, 181.11321) ft
Right-Zone Right Coordinate: (264, 195.77778) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

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

Piezometric Surfaces

Piezometric Surface 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

	Assigned Reinforcement	Lock to Ground Surface	Outside Point	Inside Point	Length	Orientation	Slip Surface Intersection	Pullout Force	Pullout Force per Length
Reinforcement Line 1	Passive Shear Pile	No	(132, 174)	(132, 136)	38 ft	-90 °	(132, 158.70588)	0 lbf	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	96 ft	164 ft
Point 8	125 ft	164 ft
Point 9	0 ft	158 ft
Point 10	10 ft	160 ft
Point 11	62 ft	164 ft
Point 12	128 ft	164 ft
Point 13	132 ft	170 ft
Point 14	0 ft	170 ft
Point 15	112 ft	164 ft
Point 16	116 ft	156 ft
Point 17	122 ft	156 ft
Point 18	126 ft	164 ft
Point 19	151 ft	181 ft
Point 20	195 ft	187 ft
Point 21	243 ft	194 ft
Point 22	250 ft	195 ft
Point 23	268 ft	196 ft

Regions

	Material	Points	Area
Region 1	Silt (Transitional Bed) Stiff / Hard: gamma = 120 pcf, phi = 28 deg., c = 750 psf	4,3,2,1,5,6	9,770.5 ft²
Region 2	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf	14,13,12,18,8,15,7,11,10,9	934 ft²
Region 3	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf	9,10,11,7,15,16,17,18,12,13,19,20,21,22,23,1,2,3,4	7,630.5 ft²
Region 4	Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf	15,16,17,18,8	80 ft²

Slip Results

Slip Surfaces Analysed: 205 of 405 converged

Current Slip Surface

Slip Surface: 353
Factor of Safety: 3.158
Volume: 3,003.4972 ft³
Weight: 346,350.42 lbf
Resisting Moment: 10,209,533 lbf·ft
Activating Moment: 3,232,698 lbf·ft
Resisting Force: 94,713.606 lbf
Activating Force: 29,986.58 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (249.87663, 194.98238) ft
Entry: (111, 170) ft
Radius: 99.125444 ft
Center: (168.11077, 251.01984) ft

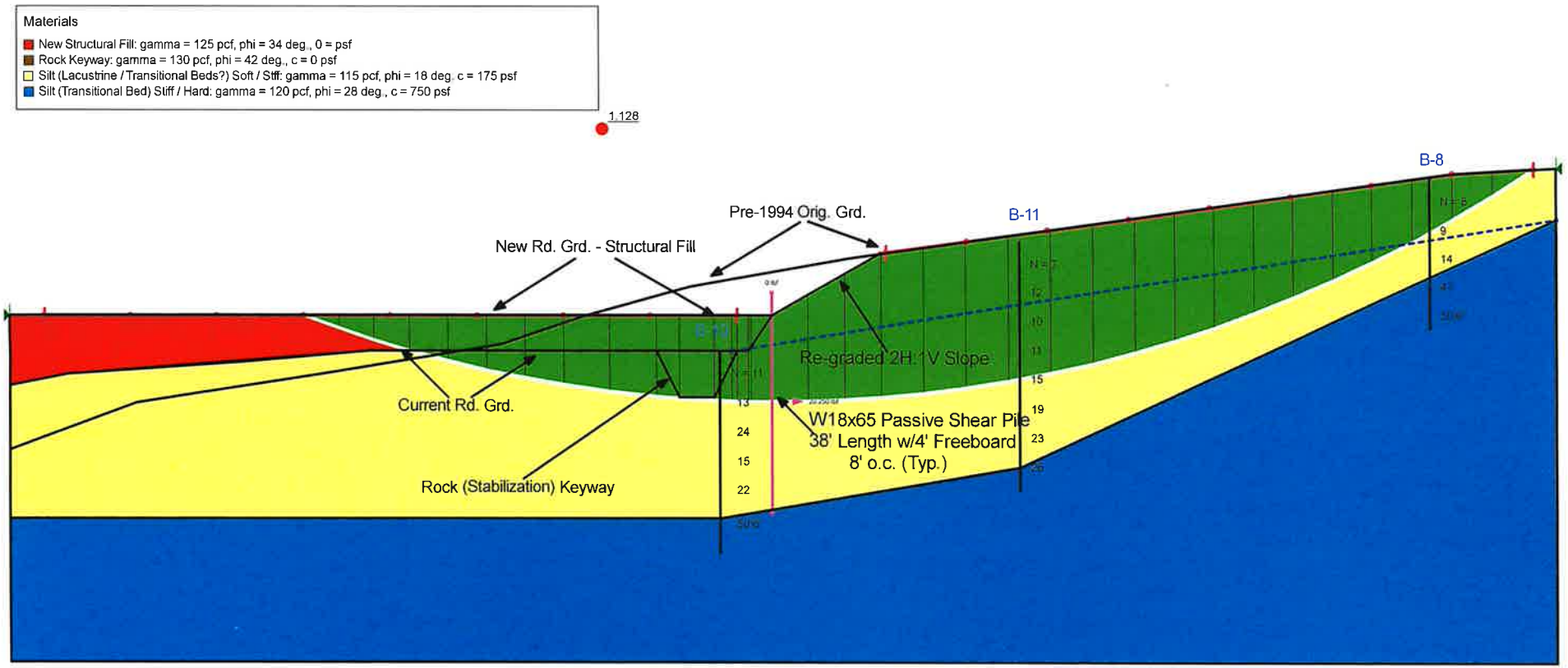
Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	246.43832 ft	190.53013 ft	-436.89246 psf	333.91168 psf	108.49448 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 2	241.34493 ft	184.26226 ft	-96.731482 psf	864.85105 psf	281.00714 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 3	237.45538 ft	180.25692 ft	114.26679 psf	1,221.3628 psf	359.71729 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 4	232.98639 ft	176.13147 ft	326.94496 psf	1,600.3201 psf	413.74465 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 5	228.51740 ft	172.47720 ft	510.20772 psf	1,937.5762 psf	463.78014 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 6	224.04842 ft	169.23044 ft	668.02924 psf	2,237.3967 psf	509.9184 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 7	219.57943 ft	166.34403 ft	803.35478 psf	2,503.0749 psf	552.27256 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 8	215.11044 ft	163.78199 ft	918.42917 psf	2,737.1947 psf	590.95274 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 9	210.64145 ft	161.51635 ft	1,014.9993 psf	2,941.8041 psf	626.05683 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 10	206.17247 ft	159.52501 ft	1,094.4451 psf	3,118.5349 psf	657.66663 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 11	201.70348 ft	157.79032 ft	1,157.8677 psf	3,268.6863 psf	685.84653 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 12	197.23449 ft	156.29815 ft	1,206.1501 psf	3,393.2846 psf	710.64306 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 13	192.80000 ft	155.04518 ft	1,239.8459 psf	3,494.8354 psf	732.69051 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma =

								115 pcf, phi = 18 deg. c = 75 psf
Column 14	188.40000 ft	154.01907 ft	1,259.7247 psf	3,574.3643 psf	752.072 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 15	184.00000 ft	153.20154 ft	1,266.5815 psf	3,630.9694 psf	768.23619 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 16	179.60000 ft	152.58740 ft	1,260.7415 psf	3,664.9002 psf	781.15849 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 17	175.20000 ft	152.17283 ft	1,242.4419 psf	3,676.2624 psf	790.7962 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 18	170.80000 ft	151.95532 ft	1,211.8394 psf	3,665.0212 psf	797.08709 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 19	166.40000 ft	151.93358 ft	1,169.0151 psf	3,631.0005 psf	799.94753 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 20	162.00000 ft	152.10748 ft	1,113.9772 psf	3,573.877 psf	799.26989 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 21	157.60000 ft	152.47806 ft	1,046.6608 psf	3,493.1701 psf	794.91905 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 22	153.20000 ft	153.04754 ft	966.92642 psf	3,388.2258 psf	786.72786 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 23	148.62500 ft	153.85868 ft	870.34854 psf	3,123.628 psf	732.13489 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 24	143.87500 ft	154.93403 ft	755.51808 psf	2,691.1093 psf	628.9117 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 25	139.12500 ft	156.25956 ft	625.06953 psf	2,219.2988 psf	517.99648 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 26	134.37500 ft	157.84596 ft	478.33441 psf	3,857.1207 psf	1,097.8342 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 27	130.18016 ft	159.45979 ft	335.46129 psf	1,380.9404 psf	339.69675 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 28	128.18016 ft	160.29299 ft	263.36218 psf	1,320.2969 psf	343.4189 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 29	127.00000 ft	160.82809 ft	218.10522 psf	1,262.0447 psf	339.19649 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 75 psf
Column 30	125.50000 ft	161.52196 ft	159.72497 psf	1,199.0885 psf	337.70968 psf	75 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma =

								115 pcf, phi = 18 deg. c = 75 psf
Column 31	122.82038 ft	162.88001 ft	0 psf	1,186.9394 psf	1,068.725 psf	0 psf	0 psf	Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf
Column 32	118.23057 ft	165.40419 ft	0 psf	739.39283 psf	498.72676 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf
Column 33	113.41019 ft	168.40419 ft	0 psf	265.92184 psf	179.36655 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf

Section A-A'
Proposed Mitigation Case
FS = 1.13 (Seismic)



Proposed Mitigation (SEISMIC)

File Information

File Version: 11.07
Product Version: 24.2.1.28
Created By: Ray Coglas
Last Edited By: Ray Coglas
Revision Number: 168
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Directory: C:\Users\ray.coglas\Desktop\Pioneer Point 2\New Mitigation Case\
Last Solved Date: 08/04/2025
Last Solved Time: 06:02:21 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Proposed Mitigation

Description: Mitigation Case
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Intercolumn force function option: Constant
- PWP Conditions from: Piezometric Surfaces
- 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

Convergence
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Columns: 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 (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 115 pcf
Effective Cohesion: 175 psf

Effective Friction Angle: 18 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 120 pcf
Effective Cohesion: 750 psf
Effective Friction Angle: 28 °
Phi-B: 0 °

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

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

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 130 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 42 °
Phi-B: 0 °

Reinforcements

Passive Shear Pile

Type: Pile
Shear Force: 162,000 lbf
Shear Force Reduction Factor: 1
Apply Shear: Parallel to Slip
Out-of-Plane Spacing: 8 ft

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (6, 170) ft
Left-Zone Right Coordinate: (126, 170) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (151.83024, 181.11321) ft
Right-Zone Right Coordinate: (264, 195.77778) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

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

Piezometric Surfaces

Piezometric Surface 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

	Assigned Reinforcement	Lock to Ground Surface	Outside Point	Inside Point	Length	Orientation	Slip Surface Intersection	Pullout Force	Pullout Force per Length
Reinforcement Line 1	Passive Shear Pile	No	(132, 174)	(132, 136)	38 ft	-90 °	(132, 155.2441)	0 lbf	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	96 ft	164 ft
Point 8	125 ft	164 ft
Point 9	0 ft	158 ft
Point 10	10 ft	160 ft
Point 11	62 ft	164 ft
Point 12	128 ft	164 ft
Point 13	132 ft	170 ft
Point 14	0 ft	170 ft
Point 15	112 ft	164 ft
Point 16	116 ft	156 ft
Point 17	122 ft	156 ft
Point 18	126 ft	164 ft
Point 19	151 ft	181 ft
Point 20	195 ft	187 ft
Point 21	243 ft	194 ft
Point 22	250 ft	195 ft
Point 23	268 ft	196 ft

Regions

	Material	Points	Area
Region 1	Silt (Transitional Bed) Stiff / Hard: gamma = 120 pcf, phi = 28 deg., c = 750 psf	4,3,2,1,5,6	9,770.5 ft²
Region 2	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf	14,13,12,18,8,15,7,11,10,9	934 ft²
Region 3	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf	9,10,11,7,15,16,17,18,12,13,19,20,21,22,23,1,2,3,4	7,630.5 ft²
Region 4	Rock Keyway: gamma = 130 pcf, phi = 42 deg., c = 0 psf	15,16,17,18,8	80 ft²

Slip Results

Slip Surfaces Analysed: 246 of 405 converged

Current Slip Surface

Slip Surface: 177
Factor of Safety: 1.128
Volume: 3,265.9975 ft³
Weight: 381,002.58 lbf
Resisting Moment: 32,468,481 lbf·ft
Activating Moment: 28,787,911 lbf·ft
Resisting Force: 134,489.76 lbf
Activating Force: 119,303.27 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (264, 195.77778) ft
Entry: (51, 170) ft
Radius: 233.15085 ft
Center: (132.62926, 388.3941) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	260.50000 ft	193.48163 ft	-479.95861 psf	127.57202 psf	41.450663 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 2	253.50000 ft	189.06315 ft	-274.40034 psf	482.04639 psf	156.62637 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 3	246.50000 ft	184.98150 ft	-89.871073 psf	794.23576 psf	258.06284 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 4	239.52224 ft	181.22776 ft	74.410866 psf	1,065.2483 psf	321.9426 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 5	232.62412 ft	177.80917 ft	218.56797 psf	1,317.0301 psf	356.91199 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 6	225.78337 ft	174.69406 ft	344.35599 psf	1,545.6415 psf	390.32133 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 7	218.94262 ft	171.83980 ft	453.85831 psf	1,753.6541 psf	422.32925 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 8	212.10187 ft	169.23620 ft	547.71208 psf	1,941.2763 psf	452.79645 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 9	205.26112 ft	166.87441 ft	626.46979 psf	2,108.6528 psf	481.59046 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 10	198.42037 ft	164.74675 ft	690.61026 psf	2,255.8671 psf	508.58276 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 11	191.33333 ft	162.78649 ft	741.82748 psf	2,390.218 psf	535.59456 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 12	184.00000 ft	161.00405 ft	779.4697 psf	2,510.4415 psf	562.42684 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 13	176.66667 ft	159.47035 ft	801.58326 psf	2,607.5984 psf	586.80989 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma =

								115 pcf, phi = 18 deg. c = 175 psf
Column 14	169.33333 ft	158.18041 ft	808.47888 psf	2,681.4873 psf	608.57734 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 15	162.00000 ft	157.13014 ft	800.41148 psf	2,731.8231 psf	627.55366 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 16	154.66667 ft	156.31630 ft	777.58441 psf	2,758.2314 psf	643.55123 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 17	147.83333 ft	155.76116 ft	743.62677 psf	2,605.0199 psf	604.80328 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 18	141.50000 ft	155.43362 ft	700.48099 psf	2,267.5241 psf	509.16318 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 19	135.16667 ft	155.27857 ft	646.56638 psf	2,726.1126 psf	675.68552 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 20	130.18016 ft	155.26322 ft	597.45408 psf	1,743.5042 psf	372.37425 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 21	128.18016 ft	155.28577 ft	575.96344 psf	1,781.9498 psf	391.84872 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 22	127.00000 ft	155.31336 ft	562.39078 psf	1,787.9204 psf	398.19872 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 23	125.50000 ft	155.35281 ft	544.86622 psf	1,807.0149 psf	410.09698 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 24	123.50000 ft	155.42689 ft	0 psf	1,919.8569 psf	623.79932 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 25	119.00000 ft	155.66135 ft	0 psf	1,964.4795 psf	638.29809 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 26	114.00000 ft	155.99736 ft	0 psf	1,889.7789 psf	614.02637 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 27	108.00000 ft	156.58267 ft	0 psf	1,788.0908 psf	580.98593 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 28	100.00000 ft	157.57311 ft	0 psf	1,709.0875 psf	555.31618 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 29	92.66644 ft	158.71858 ft	0 psf	1,603.3846 psf	520.97123 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 30	85.99931 ft	159.97915 ft	0 psf	1,475.0288 psf	479.2659 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma =

								115 pcf, phi = 18 deg. c = 175 psf
Column 31	79.33219 ft	161.44253 ft	0 psf	1,314.7828 psf	427.19884 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 32	72.66506 ft	163.11269 ft	0 psf	1,119.9961 psf	363.90879 psf	175 psf	0 psf	Silt (Lacustrine / Transitional Beds?) Soft / Stff: gamma = 115 pcf, phi = 18 deg. c = 175 psf
Column 33	66.27625 ft	164.90710 ft	0 psf	996.23628 psf	671.96985 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf
Column 34	60.16575 ft	166.81336 ft	0 psf	650.82523 psf	438.98716 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf
Column 35	54.05525 ft	168.90626 ft	0 psf	233.93605 psf	157.79186 psf	0 psf	0 psf	New Structural Fill: gamma = 125 pcf, phi = 34 deg., 0 = psf