



INSIGHT ENGINEERING CO.

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*By Sarah Kress at 12:10 pm, Oct 30, 2020*

## **STORMWATER SITE PLAN**

### **For FRONT PORCH COTTAGES**

**Prepared for**  
City of Mukilteo  
11930 Cyrus Way  
Mukilteo, WA 98275  
425.290.1013

**Applicant:**  
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**Contact:**  
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**Project Site Location:**  
7902 44<sup>th</sup> Ave W  
Mukilteo, WA 98275

**IECO Project:** 19-1004

**Certified Erosion and Sedimentation Control Lead:**  
Brian R. Kalab, P.E.

**Stormwater Site Plan Prepared By:**  
Shilpa Xavier, E. I. T.

**Stormwater Site Plan Preparation Date:**  
October 28, 2020

**Approximate Construction Date:**  
May 1, 2021



10/30/2020

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## Acronyms and Abbreviations

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

## SECTION I: PROJECT DESCRIPTION

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The proposed project *Front Porch Cottages* is located at 7902 44<sup>th</sup> Ave W, Mukilteo, WA 98275. More generally the site is located in Section 9, Township 28 North, and Range 4 East of the Willamette Meridian in the City of Mukilteo, Washington. Please refer to the Vicinity Map attached later in the section.

The site contains 1.62 Acres. The site is currently developed with an existing house and access from 44<sup>th</sup> Ave W. The remainder of the site exists as residential landscaping with few trees. The site contains one drainage basin that slopes to the west. Please refer to the downstream analysis under Section VIII for more details. Per NRCS survey of Snohomish County, the project site contains Alderwood 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 proposal is to construct fourteen cottages with associated utilities. The access to the site will from the 44<sup>th</sup> Ave W. Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the proposed drainage system along 44th Ave W.

Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMP’s 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. The roof will be connected to the onsite detention system. The following BMP’s shall be applied to the other hard

surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The road and driveways will be directed to the onsite detention system through catch basins. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site. Please refer to Section VI Appendix B for LID Feasibility Analysis Table.

## **2014 SWMMWW MINIMUM REQUIREMENTS SUMMARY**

**MR : MINIMUM REQUIREMENT**  
**SSP : STORMWATER SITE PLAN**

### **MR #1 PREPARATION OF STORMWATER SITE PLAN:**

Stormwater site plan follows 2014 Stormwater Management Manual for Western Washington.

### **MR #2 CONSTRUCTION OF STORMWATER POLLUTION PREVENTION PLAN (SWPPP):**

A SWPPP is provided under Section IV.

**MR #3 SOURCE CONTROL OF POLLUTION:** Onsite BMP's will be used to minimize the source pollutant sources that include parts/vehicle cleaning, spills/leaks of fuel and other liquids, replacement of liquids, outdoor storage of batteries/liquids/parts, and vehicle parking.

### **MR #4 PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND**

**OUTFALLS:** The outflow from the wetvault will be pumped to the existing drainage system along 44th Ave W.

**MR #5 ONSITE STORMWATER MANAGEMENT:** Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMP's 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. The roof will be connected to the onsite detention system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The road and driveways will be directed to the onsite detention system through catch basins. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site. Please refer to Section VI Appendix B for LID Feasibility Analysis Table.

**MR #6 RUNOFF TREATMENT:** Runoff treatment will be met by the wetvault.

**MR #7 FLOW CONTROL:** Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the proposed drainage system along 44th Ave W.

**MR #8 WETLANDS PROTECTION:** There are no wetlands present onsite.

**MR #9 OPERATIONS AND MAINTENANCE:** An Operation and Maintenance Manual will be provided for the construction submittal.

## SECTION II: SITE ASSESSMENT

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Based on the site reconnaissance and the available topography we have the following info:

- Topography: The clearing area slopes moderately to the west. Refer to the grading plan for more details.
- Drainage: The site contains one existing drainage that drains to the west of the site.
- Soils: Per NRCS survey of Snohomish County, the project site contains Alderwood gravelly sandy loam, 2 to 8 percent slopes. Refer to the attached soil map later in this report.
- Ground Cover: The site is currently developed with an existing home and access from 44<sup>th</sup> Ave W. The remainder of the site exists as residential landscaping.
- Critical areas: NA
- The property access is from 44<sup>th</sup> Ave W.



# **VICINITY MAP**

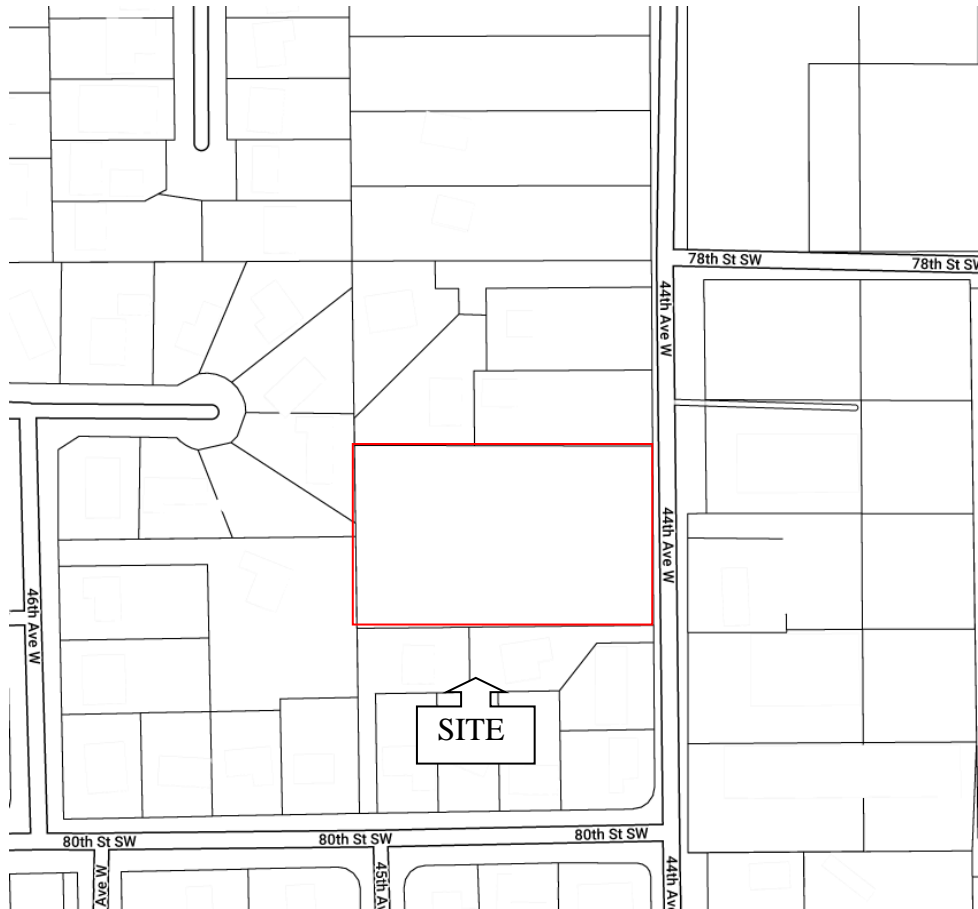


PHOTO TAKEN FROM BLACK AND WHITE SNAZZY MAPS



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## **VICINITY MAP** Front Porch Cottages Mukilteo, Washington

**SCALE:**  
NONE

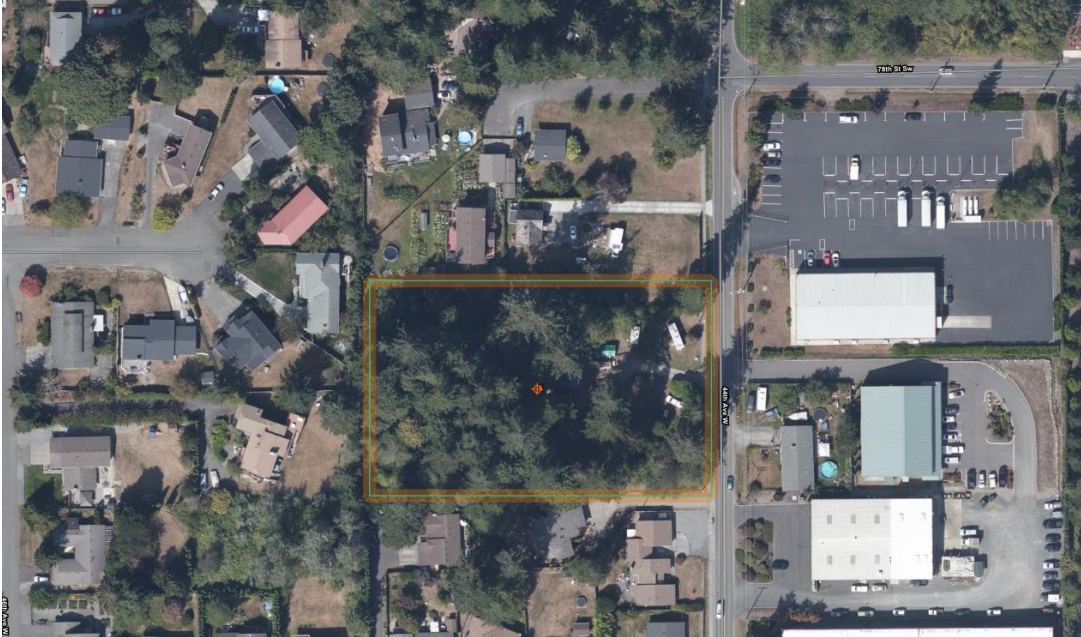
**DATE:** 10/30/20

**JOB #:** 19-1004

**BY:** JDM

**FILE NAME:**  
19-1004/doc/StromwaterSitePlan

## *SOIL MAP*



### SOILS LEGEND

5- Alderwood-Urban land complex, 2 to 8 percent slopes



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## SOIL MAP Front Porch Cottages Mukilteo, Washington

**SCALE:**  
NONE

**DATE:** 10/30/20

**JOB #:** 19-1004

**BY:** JDM

**FILE NAME:**  
19-1018\docs\StromwaterSitePlan

## Snohomish County Area, Washington

5—Alderwood-Urban land complex, 2 to 8 percent slopes

### Map Unit Setting

- *National map unit symbol:* 2hz9
- *Elevation:* 50 to 800 feet
- *Mean annual precipitation:* 25 to 60 inches
- *Mean annual air temperature:* 48 to 52 degrees F
- *Frost-free period:* 180 to 220 days
- *Farmland classification:* Not prime farmland

### Map Unit Composition

- *Alderwood and similar soils:* 60 percent
- *Urban land:* 25 percent
- *Minor components:* 15 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Alderwood

#### Setting

- *Landform:* Till plains
- *Parent material:* Basal till

#### Typical profile

- *H1 - 0 to 7 inches:* gravelly ashy sandy loam
- *H2 - 7 to 35 inches:* very gravelly ashy sandy loam
- *H3 - 35 to 60 inches:* gravelly sandy loam

#### Properties and qualities

- *Slope:* 2 to 8 percent
- *Depth to restrictive feature:* 20 to 40 inches to densic material
- *Natural drainage class:* Moderately well drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)
- *Depth to water table:* About 18 to 36 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 3.0 inches)

#### Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4s
- *Hydrologic Soil Group:* B
- *Forage suitability group:* Limited Depth Soils (G002XN302WA)
- *Hydric soil rating:* No

### Minor Components

#### Mckenna

- *Percent of map unit:* 5 percent

- *Landform: Depressions*
- *Hydric soil rating: Yes*

**Norma, undrained**

- *Percent of map unit: 5 percent*
- *Landform: Depressions*
- *Hydric soil rating: Yes*

**Terric medisaprists, undrained**

- *Percent of map unit: 5 percent*
- *Landform: Depressions*
- *Hydric soil rating: Yes*

### SECTION III: SITE DEVELOPMENT PLAN W/ON-SITE STORMWATER MANAGEMENT

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The proposal is to construct fourteen cottages with associated utilities. The access to the site will from the 44th Ave W. Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the proposed drainage system along 44th Ave W.

Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMP's 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. The roof will be connected to the onsite detention system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The road and driveways will be directed to the onsite detention system through catch basins. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site. Please refer to Section VI Appendix B for LID Feasibility Analysis Table.

## SECTION IV: CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

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Please refer to the following pages for SWPPP.

Construction Stormwater General Permit  
**Stormwater Pollution Prevention Plan (SWPPP)**  
for  
**FRONT PORCH COTTAGES**

Prepared for:  
**The Washington State Department of Ecology**  
**Northwest Regional Office**  
**3190 – 160<sup>th</sup> Avenue SE**  
**Bellevue, WA 98008**

<b>Permittee / Owner</b>	<b>Developer</b>	<b>Operator / Contractor</b>
Meitzner Mukilteo, LLC	Meitzner Mukilteo, LLC	To be determined
11611 Airport Road, Suite B-1	11611 Airport Road, Suite B-1	
Everett, WA 98204	Everett, WA 98204	

**Project Site Location**

7902 44<sup>th</sup> Ave W  
Mukilteo, WA 98275

**Certified Erosion and Sediment Control Lead (CESCL)**

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

**SWPPP Prepared By**

<b>Name</b>	<b>Organization</b>	<b>Contact Phone Number</b>
Shilpa Xavier	Insight Engineering	425-303-9363

**SWPPP Preparation Date**

August 5, 2020

**Project Construction Dates**

<b>Activity / Phase</b>	<b>Start Date</b>	<b>End Date</b>
Construction Duration	May 1, 2021	March 1, 2022

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- B. BMP Detail
- C. Correspondence
- D. Site Inspection Form
- E. Construction Stormwater General Permit (CSWGP)
- F. 303(d) List Waterbodies / TMDL Waterbodies Information
- G. Contaminated Site Information
  
- H. Engineering Calculations

## List of Acronyms and Abbreviations

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<b>Acronym / Abbreviation</b>	<b>Explanation</b>
<b>303(d)</b>	Section of the Clean Water Act pertaining to Impaired Waterbodies
<b>BFO</b>	Bellingham Field Office of the Department of Ecology
<b>BMP(s)</b>	Best Management Practice(s)
<b>CESCL</b>	Certified Erosion and Sediment Control Lead
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>CRO</b>	Central Regional Office of the Department of Ecology
<b>CSWGP</b>	Construction Stormwater General Permit
<b>CWA</b>	Clean Water Act
<b>DMR</b>	Discharge Monitoring Report
<b>DO</b>	Dissolved Oxygen
<b>Ecology</b>	Washington State Department of Ecology
<b>EPA</b>	United States Environmental Protection Agency
<b>ERO</b>	Eastern Regional Office of the Department of Ecology
<b>ERTS</b>	Environmental Report Tracking System
<b>ESC</b>	Erosion and Sediment Control
<b>GULD</b>	General Use Level Designation
<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>NTU</b>	Nephelometric Turbidity Units
<b>NWRO</b>	Northwest Regional Office of the Department of Ecology
<b>pH</b>	Power of Hydrogen
<b>RCW</b>	Revised Code of Washington
<b>SPCC</b>	Spill Prevention, Control, and Countermeasure
<b>su</b>	Standard Units
<b>SWMMEW</b>	Stormwater Management Manual for Eastern Washington
<b>SWMMWW</b>	Stormwater Management Manual for Western Washington
<b>SWPPP</b>	Stormwater Pollution Prevention Plan
<b>TESC</b>	Temporary Erosion and Sediment Control
<b>SWRO</b>	Southwest Regional Office of the Department of Ecology
<b>TMDL</b>	Total Maximum Daily Load
<b>VFO</b>	Vancouver Field Office of the Department of Ecology
<b>WAC</b>	Washington Administrative Code
<b>WSDOT</b>	Washington Department of Transportation
<b>WWHM</b>	Western Washington Hydrology Model

## 1 Project Information

Project/Site Name: Front Porch Cottages  
Street/Location: 7902 44<sup>th</sup> Ave W  
City: Mukilteo State: WA Zip code: 98275  
Subdivision:  
Receiving waterbody: Olympic View Creek

### 1.1 Existing Conditions

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

Total acreage: 1.75 acres

Disturbed acreage: 1.75 acres

Existing structures: 0.10 acres

Landscape 1.65 acres

topography:

Drainage patterns: Sheet Flow

Existing Vegetation: Scattered vegetation.

Critical Areas (wetlands, streams, high erosion No wetland  
risk, steep or difficult to stabilize slopes):

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

**Table 1 – Summary of Site Pollutant Constituents**

Constituent (Pollutant)	Location	Depth	Concentration
NA	NA	NA	NA

### 1.2 Proposed Construction Activities

Description of site development (example: subdivision):

The proposal is to construct fourteen cottages with associated utilities. The access to the site will from the 44<sup>th</sup> Ave W.

Description of construction activities (example: site preparation, demolition, excavation):

Prepare the site for construction by the installation of the indicated BMP's. Grade the site for the building.

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

Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.50-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 2.00-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the existing drainage system along 44th Ave W.

Description of final stabilization (example: extent of revegetation, paving, landscaping):  
The access to the site will from the 44<sup>th</sup> Ave W. Typical residential landscaping will be around the buildings to provide final stabilization.

*Contaminated Site Information:*

Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

Flow control and water quality requirements will be met by an underground Wetvault.

## **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:

- Silt Fence (BMP C233)

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.

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)

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). The wetvault will be used as temporary sediment pond.

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: • Temporary sediment Pond (BMP C241)  
• Check dams

Installation Schedules: Install wetvault and check dams, 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)
- Temporary sediment Pond (BMP C241)

Installation Schedules: Install silt fencing, according to the approved plans, prior to any clearing or grading activities. Install storm drain inlet protection, 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: May 1, 2021 End date: March 1, 2022

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.

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)
- Mulching (BMP C121)
- Interceptor Dike and swale
- Check Dams

Installation Schedules: Apply temporary hydro-seed to cut and fill slopes, mulching. Install interceptor dikes and check dams 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:

- Stormdrain Inlet Protection

Installation Schedules: Install storm drian inlet proetction, 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 provided, 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.

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: Material Delivery, Storage and Containment (BMP C153),  
Concrete Handling (BMP C151),  
Sawcutting and Surfacing Pollution Protection (BMP C152),

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**

<input type="checkbox"/>	None
<input checked="" type="checkbox"/>	Bulk cement
<input checked="" type="checkbox"/>	Cement kiln dust
<input checked="" type="checkbox"/>	Fly ash
<input checked="" type="checkbox"/>	Other cementitious materials
<input checked="" type="checkbox"/>	New concrete washing or curing waters
<input checked="" type="checkbox"/>	Waste streams generated from concrete grinding and sawing
<input checked="" type="checkbox"/>	Exposed aggregate processes
<input checked="" type="checkbox"/>	Dewatering concrete vaults
<input type="checkbox"/>	Concrete pumping and mixer washout waters
<input type="checkbox"/>	Recycled concrete
<input type="checkbox"/>	Recycled concrete stockpiles
<input type="checkbox"/>	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<sub>2</sub> sparging (liquid or dry ice).
3. Contact Ecology if chemical treatment other than CO<sub>2</sub> 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**

<input type="checkbox"/>	Infiltration
<input checked="" type="checkbox"/>	Transport off-site in a vehicle (vacuum truck for legal disposal)
<input type="checkbox"/>	Ecology-approved on-site chemical treatment or other suitable treatment technologies
<input type="checkbox"/>	Sanitary or combined sewer discharge with local sewer district approval (last resort)
<input type="checkbox"/>	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 SWMMWW*).

List and describe BMPs:

- Materials on hand (BMP C150),
- CESL(BMP C160),

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.

### 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.

List and describe BMPs:

- CESL (BMP C160),
- Scheduling (BMP C162),

**Table 5 – Management**

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

**Table 6 – BMP Implementation Schedule**

<b>Phase of Construction Project</b>	<b>Stormwater BMPs</b>	<b>Date</b>	<b>Wet/Dry Season</b>
Mark Clearing Limits	High Visibility Plastic or Metal Fence (BMP C103)	05/01/2021	Dry
Mobilize equipment on site	Construction Road/Parking area stabilization (BMP C107)	05/01/2021	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)	05/01/2021	Dry
Install ESC measures	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220)	05/01/2021	Dry
Install stabilized construction entrance	Stabilized Construction Entrance (BMP C105)	05/01/2021	Dry
Begin clearing and grubbing	Dust Control (BMP C140)	05/15/2021	Dry
Site grading begins	Dust Control (BMP C140)	05/27/2021	Dry
Grade road and stabilize with gravel base	Dust Control (BMP C140)	05/27/2021	Dry
Begin excavation for new utilities and services		07/01/2021	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)	07/05/2021	Wet
Temporary erosion control measures (hydro-seeding)	Temporary Seeding (BMP C120)	09/01/2021	Wet
Site grading ends		09/15/2021	Wet
Begin pouring concrete curbs & sidewalks and implement	BMP C151 Concrete Handling (BMP C151) Sawcutting and Surfacing Pollution Prevention (BMP C152)	10/01/2021	Wet

Pave asphalt roads		11/05/2021	Wet
Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season	Scheduling (BMP C162) CESC Lead (BMP C160)	12/01/2021	Wet
Final landscaping and planting begins		02/1/2022	Dry
Permanent erosion control measures (hydro-seeding)	Permanent Seeding (BMP C120)	03/01/2022	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**

NA



### 3 Pollution Prevention Team

Table 7 – Team Information

<b>Title</b>	<b>Name(s)</b>	<b>Phone Number</b>
<b>Certified Erosion and Sediment Control Lead (CESCL)</b>	Brian Kalab	425-303-9363
<b>Resident Engineer</b>	Brian Kalab / Insight Engineering	425-303-9363
<b>Emergency Ecology Contact</b>	Tracy Walters	425-649-7000
<b>Emergency Permittee/ Owner Contact</b>	Mike Metzner	(425) 212-2490 X 304
<b>Non-Emergency Owner Contact</b>	Mike Metzner	(425) 212-2490 X 304
<b>Monitoring Personnel</b>	Tony Veslic	253-271-7870
<b>Ecology Regional Office</b>	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**

<input checked="" type="checkbox"/>	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
<input type="checkbox"/>	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 biker tanks to prevent discharge from entering receiving 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](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](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](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](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<sub>2</sub>) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO<sub>2</sub> sparging or dry ice.

Method for sampling pH:

**Table 9 – pH Sampling Method**

<input checked="" type="checkbox"/>	pH meter
<input type="checkbox"/>	pH test kit
<input type="checkbox"/>	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

List the impairment(s):

Constituent (Pollutant)	Location	Depth	Concentration
NA	NA	NA	NA

Describe the method(s) for 303(d) compliance:

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:

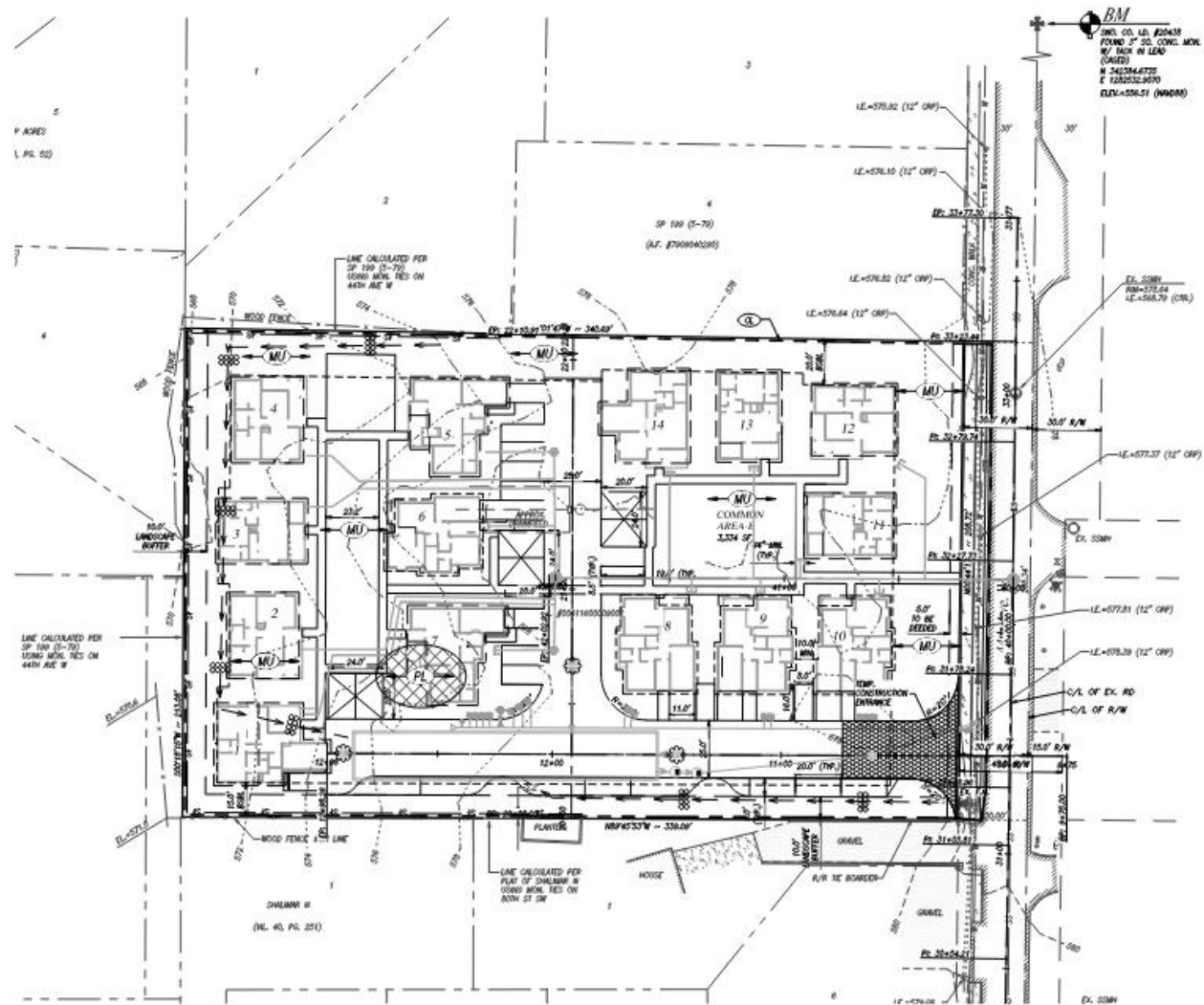
1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

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<sub>2</sub> sparging is planned for adjustment of high pH water.





### A. Site Map



## **B. BMP Detail**

### **Element#1- Preserve Vegetation / Mark Clearing Limits**

- Silt Fence (BMP C233)

### **Element #2 - Establish Construction Access**

- Stabilized Construction Entrance (BMP C105)

### **Element #3 - Control Flow Rates**

- Temporary Sediment Pond (BMP C241)
- Check dam ( C207)

### **Element #4 - Install Sediment Controls**

Silt Fence (BMP C233)

- Storm Drain Inlet Protection (BMP C220)
- Temporary Sediment Pond (BMP C241)

### **Element #5 - Stabilize Soils**

- Mulching (BMP C121)
- Temporary and Permanent Seeding (BMP C120)
- Plastic covering(BMP C123)
- Dust Control (BMP 140)

### **Element #6 - Protect Slopes**

- Mulching (BMP C121)
- Temporary and Permanent Seeding (BMP C120)
- Interceptor Dike and Swale (BMP C200)
- Check dam ( C207)

### **Element #7 – Protect Permenant drain Inlets**

- Stormdrain Inlet Protection

### **Element #9 – Control Pollutants**

- Material Delivery, Storage and Containment (BMP C153)
- Concrete Handling
- Sawcutting and Surfacing Pollution Protection

### **Element #11 – Maintain BMP's**

- CESC Lead (BMP C160)
- Materials oh Hand (BMP C150)

### **Element #12 – Manage the Project**

- CESC Lead (BMP C160)
- Scheduling (BMP C162)

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

- NA

## **C. Correspondence**

Ecology

EPA

Local Government

## **D. Site Inspection Form**

## **E. Construction Stormwater General Permit (CSWGP)**

Download the CSWGP:

<http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html>

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

None

## **G. Contaminated Site Information**

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

## **H. Engineering Calculations**



## SECTION V: SOURCE CONTROL PLAN

---

Onsite BMP's will be used to minimize the source pollutant sources that include parts/vehicle cleaning, spills/leaks of fuel and other liquids, replacement of liquids, outdoor storage of batteries/liquids/parts, and vehicle parking.

## SECTION VI: SPECIAL REPORTS AND STUDIES

---

- A. Geotech Report
- B. LID Feasibility Analysis

## **A. GEOTECH REPORT**



Cobalt Geosciences, LLC  
P.O. Box 82243  
Kenmore, Washington 98028

June 26, 2019

Mike Mietzner  
[mikem@mietznergroupp.com](mailto:mikem@mietznergroupp.com)

**RE: Stormwater Feasibility Evaluation**  
Proposed Residential Development  
7902 – 44<sup>th</sup> Avenue West  
Mukilteo, Washington

Dear Mr. Mietzner,

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our stormwater feasibility evaluation at the referenced site.

The purpose of our evaluation was to determine the feasibility of utilizing infiltration devices for stormwater runoff management.

### **Site and Project Description**

The site is located at 7902 – 44<sup>th</sup> Avenue West in Mukilteo, Washington. The site consists of one rectangular shaped parcel (No. 00611600009001) with a total area of about 1.62 acres.

The eastern portion of the property is developed with a single-family residence and driveway. The remainder of the property is undeveloped and vegetated with grasses, ivy, blackberry vines, ferns, bushes/shrubs, and variable diameter evergreen and deciduous trees.

The site slopes gently to moderately downward from east to west at magnitudes of less than 10 percent and topographic relief of about 10 feet.

The property is bordered to the north, south, and west by single-family residences, and to the east by 44<sup>th</sup> Avenue West.

The project includes construction of up to 14 new cottage homes, driveway areas, open spaces, roadway access, and utilities. The homes will have a footprint of about 800 square feet and some will have garage areas with a footprint of about 200 square feet.. Stormwater management may include dispersion, detention, or infiltration facilities depending on feasibility.

### **Area Geology**

The Geologic Map of Washington – Northwest Quadrant indicates that the site is underlain by Vashon Glacial Till.

Vashon Glacial Till is typically characterized by an unsorted, non-stratified mixture of clay, silt, sand, gravel, cobbles and boulders in variable quantities. These materials are typically dense and relatively impermeable. The poor sorting reflects the mixing of the materials as these sediments were overridden and incorporated by the glacial ice.

## **Soil & Groundwater Conditions**

As part of our evaluation, we excavated two test pits and three hand borings to determine the shallow soil and groundwater conditions, where accessible.

All of the explorations encountered approximately 6 to 12 inches of topsoil and vegetation underlain by approximately 2 to 4 feet of loose to medium dense, silty-fine to medium grained sand with gravel (Weathered Glacial Till). These materials were underlain by dense to very dense, silty-fine to medium grained sand with gravel (Glacial Till), which continued to the termination depth of the explorations.

There are likely areas of fill around the existing residence and yard areas. There was inadequate access to explore the subsurface soil conditions in these areas.

Groundwater was not encountered in the explorations during our investigation; however, mottled soils were observed between 2 and 4 feet below existing grades, indicating that perched groundwater may be present below the site seasonally.

## **Stormwater Management Feasibility**

The site is underlain by very fine-grained glacial deposits. These soils have a very low permeability which decreases with depth. It is likely that there will be shallow perched groundwater throughout the property that further limits infiltration suitability.

We performed an in-situ infiltration test in TP-1 at a depth of 4 feet below grade. Following testing and application of correction factors for site variability (0.33), influent control (0.9), and testing (0.5), the infiltration rate was 0.22 inches per hour, which is lower than what the Department of Ecology considers to be feasible.

We do not recommend utilizing infiltration systems at the site. If there is adequate space, it may be feasible to utilize dispersion trenches with limited flowpaths and sheet flow dispersion for driveway areas. Detention ponds or vaults may be necessary depending on the overall anticipated volume of runoff from the new development. We can provide additional recommendations as the final plans are developed.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

## **Erosion and Sediment Control**

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.

- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

### Closure

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above and for the current site conditions, and should not be used for any other site

Sincerely,

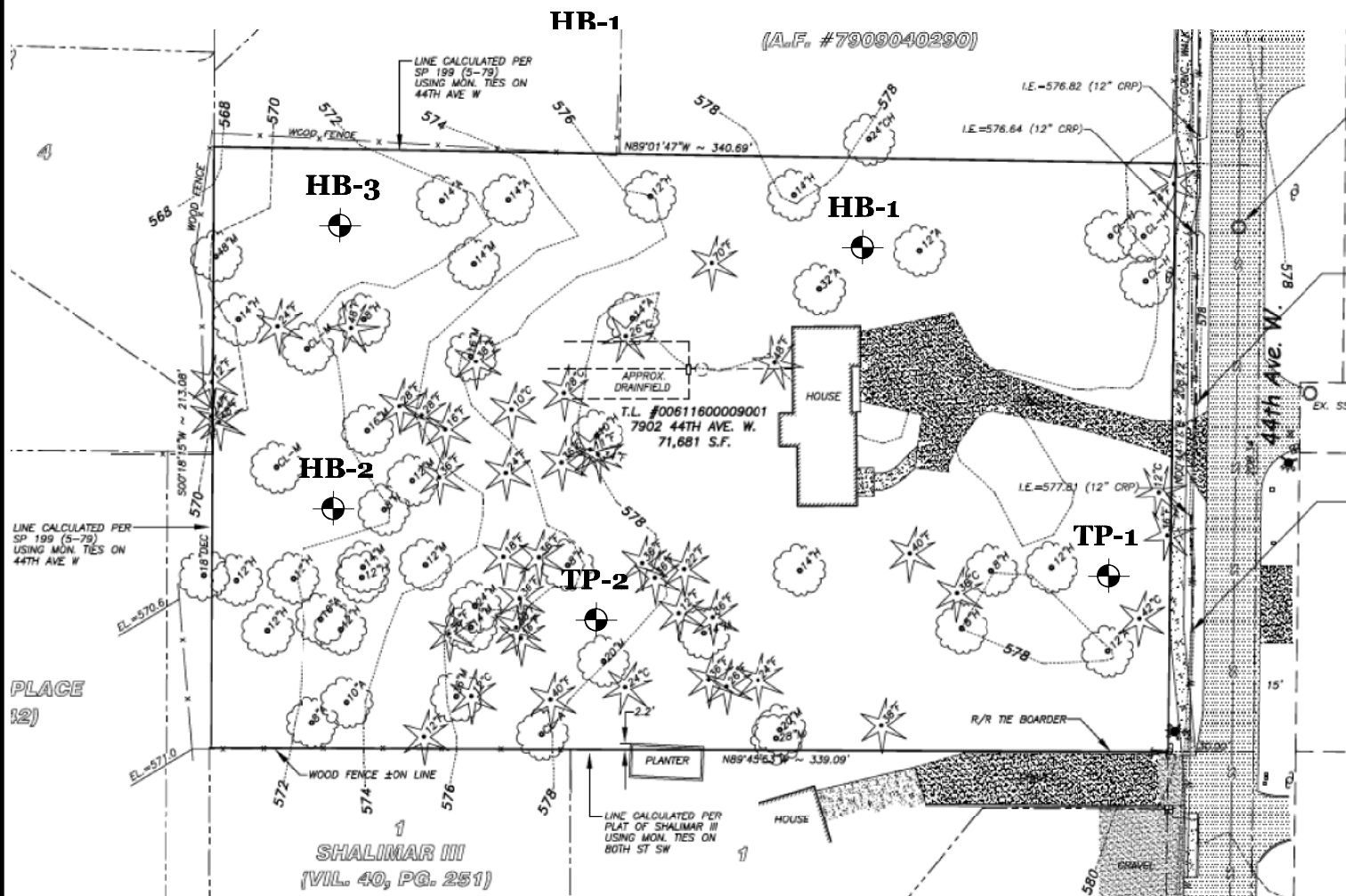
**Cobalt Geosciences, LLC**



Exp. 6/26/2020

Phil Haberman, PE, LG, LEG  
Principal

PH/sc



TP-1  
HB-1



Approximate Test Pit &  
Hand Boring Location


















Proposed Residential Development  
7902 - 44th Avenue West  
Mukilteo, Washington

**SITE PLAN**  
**FIGURE 1**

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## Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	 GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			 GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	 GM	Silty gravels, gravel-sand-silt mixtures
			 GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	 SW	Well-graded sands, gravelly sands, little or no fines
			 SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	 SM	Silty sands, sand-silt mixtures
			 SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	 ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			 CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	 OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	 MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			 CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	 OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		 PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

### Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

#### Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

#### Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

### Grain Size Definitions

Description	Sieve Number and/or Size
Fines	< #200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

### Moisture Content Definitions

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

Soil Classification Chart

Figure C1



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## Test Pit TP-1

Date: June 18, 2019			Depth: 10'			Groundwater: None					
Contractor: Jim			Elevation:			Logged By: PH      Checked By: SC					
Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
						Plastic Limit  -----●-----  Liquid Limit					
						DCP Equivalent N-Value					
						0	10	20	30	40	50
1			SM	Topsoil/Vegetation							
2			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to reddish brown, moist. (Weathered Glacial Till)							
3			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)							
4											
5											
6											
7											
8											
9											
10				End of Test Pit 10'							

## Test Pit TP-2

Date: June 18, 2019			Depth: 10'			Groundwater: None					
Contractor: Jim			Elevation:			Logged By: PH      Checked By: SC					
Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
						Plastic Limit	Moisture Content (%)			Liquid Limit	
						DCP Equivalent N-Value					
						0	10	20	30	40	50
1			SM	Topsoil/Vegetation							
2				Loose to medium dense, silty-fine to medium grained sand with gravel, mottled reddish brown to yellowish brown, moist. (Weathered Glacial Till)							
3											
4			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)							
5											
6											
7											
8											
9											
10				End of Test Pit 10'							



Proposed Residential Development  
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Mukilteo, Washington

**Test Pit  
Logs**

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# Log of Hand Boring HB-1

Date: June 18, 2019

Depth: 6'

Initial Groundwater: None

Contractor:

Elevation: N/A

Sample Type: Grab

Method: Hand Auger

Logged By: PH

Checked By: SC

Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
4									
5									
6						End of Hand Boring 6'			
7									
8									
9									
10									



Proposed Residential Development  
7902 - 44th Avenue West  
Mukilteo, Washington

**Hand  
Boring  
Log**

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# Log of Hand Boring HB-2

Date: June 18, 2019	Depth: 6'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH      Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3									
4									
5					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
6						End of Hand Boring 6'			
7									
8									
9									
10									



Proposed Residential Development  
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Mukilteo, Washington

**Hand  
Boring  
Log**

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# Log of Hand Boring HB-3

Date: June 18, 2019	Depth: 6'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH      Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3									
4					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
5									
6						End of Hand Boring 6'			
7									
8									
9									
10									



Proposed Residential Development  
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**Hand  
Boring  
Log**

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## B. LID FEASIBILITY ANALYSIS

Minimum Requirement #5 BMP	INFEASIBILITY/EVALUATION CRITERIA FOR MR #5 BMPS.	Location of supporting documentation
<b>Lawn and landscaped areas:</b> 1. Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Volume V, Chapter 5 of this manual.	Feasible	BMP T5.13 is proposed for all lawn and landscape areas.
<b>Roofs:</b> 1. Full Dispersion in accordance with BMP T5.30 in Volume V, Chapter 5 of this manual, or,	Infeasible	Full Dispersion is infeasible because the required native vegetation preservation could not be achieved.
2. Downspout Full Infiltration Systems in accordance with BMP T5.10A in Volume III, Chapter 3 of this manual.	<b>Infeasible.</b> <ul style="list-style-type: none"> <li>The depth from final grade to seasonal high water table, hardpan, or other low permeability layer is 3 feet or more;</li> </ul>	As per the Geotech report attached under Section VI Appendix A, glacial till was found at 3-ft below ground in TP-1. Groundwater was not encountered however, mottled soils were observed between 2 and 3 feet below existing grades, indicating that perched groundwater may be present below the site seasonally.
3. Bioretention/Rain-Garden in accordance with Volume V, Chapter 7 of this manual.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>If the measured native soil infiltration rate is less than 0.30 in/hour.</li> </ul>	As per the Geotech report attached under Section VI Appendix A, glacial till was found at 3-ft below ground in TP-1. Groundwater was not encountered however, mottled soils were observed between 2 and 3 feet below existing grades, indicating that perched groundwater may be present below the site seasonally. Also the infiltration rate is only 0.22-in/hr which is lower than what the DOE considers feasible.
4. For single-family residential roofs, Downspout Dispersion Systems in accordance with BMP T5.10B in Volume III, Chapter 3 of this manual.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>Downspout dispersion systems are not allowed if a vegetated flowpath of 25 feet or more cannot be provided or if the use of a dispersion system might cause erosion or flooding problems onsite or on adjacent properties.</li> </ul>	Downspout dispersion systems are not allowed if a vegetated flowpath of 25 feet or more cannot be provided or if the use of a dispersion system might cause erosion or flooding problems onsite or on adjacent properties.

5. Perforated Stub-out Connections in accordance with BMP T5.10C in Volume III, Chapter 3 of this manual.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>Perforated stub-outs are not appropriate when seasonal water table or soil restrictive layer is less than one (1) foot below trench bottom.</li> </ul>	Perforated stub out connections are not feasible because the soil is not good for infiltration.
<b>Other Hard Surfaces:</b>		
1. Full Dispersion in accordance with BMP T5.30 in Volume V, Chapter 5 of this manual.	<b>Infeasible</b>	Full Dispersion is infeasible because the required native vegetation preservation could not be achieved.
2. Permeable pavement in accordance with BMP T5.15 in Volume V, Chapter 5 of this manual. NOTE: This is not a requirement to pave these surfaces. Where pavement is proposed, it must be permeable to the extent feasible unless full dispersion is employed.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>Where appropriate field testing indicates soils have a measured (a.k.a., initial) native soil saturated hydraulic conductivity less than 0.3 inches per hour. (Note: In these instances, unless other infeasibility restrictions apply, roads and parking lots may be built with an underdrain, preferably elevated within the base course, if flow control benefits are desired.)</li> </ul>	As per the Geotech report, the infiltration rate is only 0.22-in/hr which is lower than what the DOE considers feasible.
3. Bioretention in accordance with Volume V, Chapter 7 of this manual.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>Where the a minimum vertical separation of 3 feet to the seasonal high water table, bedrock or other impervious layer would not be achieved below bioretention that: 1) would serve a drainage area that meets or exceeds: a) 5,000 square feet of pollution-generating impervious surface, or b) 10,000 square feet of impervious surface, or c) three-quarter (3/4) acres of pervious surfaces; and 2) cannot reasonably be broken down into amounts smaller than indicated in (1).</li> <li>If the measured native soil infiltration rate is less than</li> </ul>	As per the Geotech report attached under Section VI Appendix A, glacial till was found at 3-ft below ground in TP-1. Groundwater was not encountered however, mottled soils were observed between 2 and 3 feet below existing grades, indicating that perched groundwater may be present below the site seasonally. Also the infiltration rate is only 0.22-in/hr which is lower than what the DOE considers feasible.

	0.30 in/hour.	
4. Sheet Flow Dispersion in accordance with BMP T5.12, or	<b>Infeasible</b> <ul style="list-style-type: none"> <li>If a minimum 10-foot flow path per every 20 feet of contributing surface flow path cannot be provided;</li> </ul>	Sheet flow Dispersion is infeasible because the site cannot provide the required vegetated flow paths for each unit.
5. Concentrated Flow Dispersion in accordance with BMP T5.11 in Volume V, Chapter 5 of this manual.	<b>Infeasible</b> <ul style="list-style-type: none"> <li>If a vegetated flowpath of 25 feet or more cannot be provided;</li> </ul>	Concentrated flow Dispersion is infeasible because the site cannot provide the required vegetated flow paths for each unit.

## SECTION VII: OTHER PERMITS

---

A right of way permit will be required from City of Mukilteo.

A Construction Stormwater General Permit is required from the Department of Ecology.



## SECTION VIII: PERMANENT STORMWATER CONTROL PLAN

---

### A. OFF-SITE ANALYSIS

A site reconnaissance was performed by Brian Kalab of Insight Engineering on May 19, 2020 to verify the downstream flow paths and observe any drainage problems downstream of the site. The sky was cloudy and overcast with a temperature of 62 degrees.

The site contains 1.62 Acres. The site is currently developed with an existing house and access from 44<sup>th</sup> Ave W. The remainder of the site exists as residential landscaping with few trees. The site contains one drainage basin that slopes to the west. Please refer to the downstream analysis under Section VIII for more details. Per NRCS survey of Snohomish County, the project site contains Alderwood 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.

#### **Upstream Analysis**

Based on the site reconnaissance and the topographic survey of the site, the off-site area entering the site is very minimal. Refer to the Downstream Analysis Map attached in the next page for more details.

#### **Downstream Analysis**

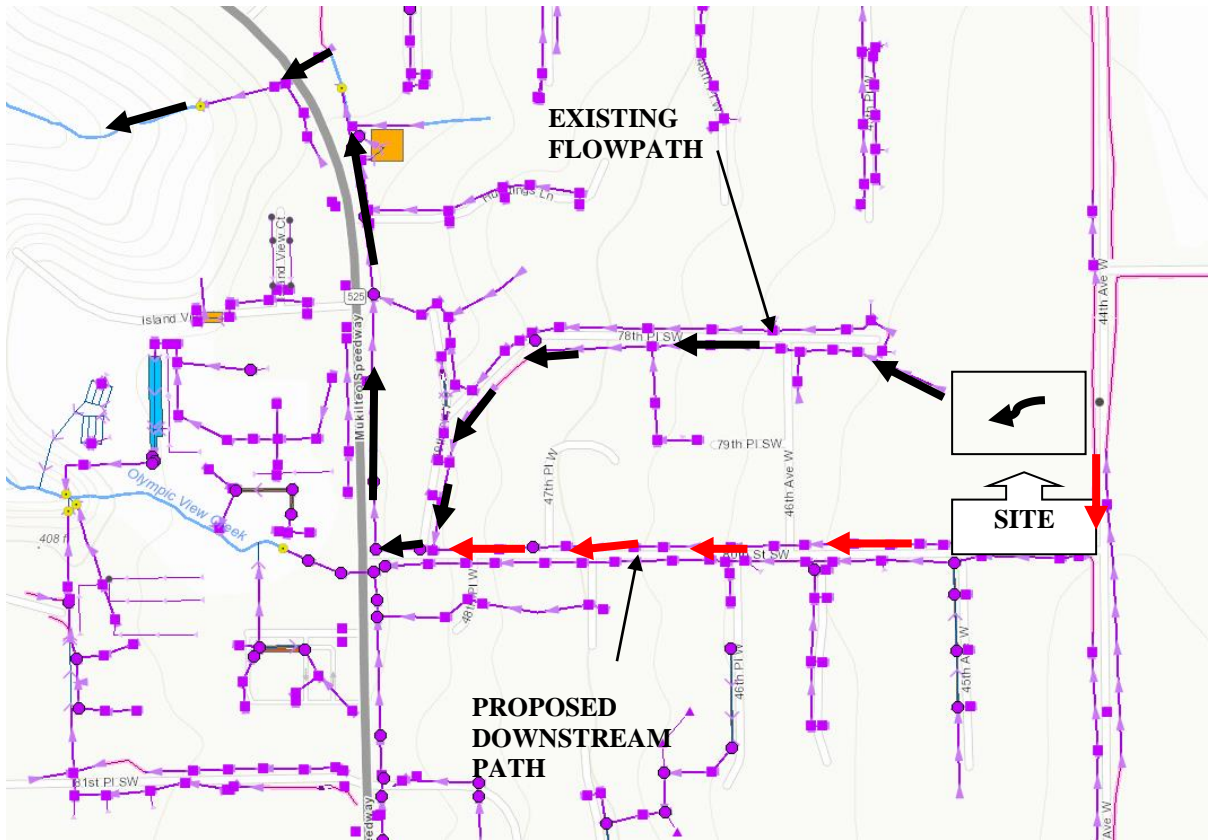
Refer to the Downstream Analysis Maps 1 and 2 attached to the next pages for a visual description of the downstream flow.

The runoff from the existing site flows to the west and enters the existing drainage system along 78<sup>th</sup> Pl SW. The flow continues west for 1,270-ft along 78<sup>th</sup> Pl SW and turns west along 80<sup>th</sup> St SW for 140-ft. The flow drains to the north along Mukilteo Speedway for 1,190-ft. The flow continues across Mukilteo Speedway to discharge into Olympic

View Creek. The creek meanders west in an unrestricted manner to finally drain into Puget Sound. This is where the downstream analysis was concluded.

In the mitigated state the outlet from the wetvault will be connected to the proposed drainage system along 44<sup>th</sup> Ave W. The flow drains to the south along 44<sup>th</sup> Ave W for 200-ft and turns west along 80<sup>th</sup> St SW where it combines with the natural downstream path.

## DOWNSTREAM ANALYSIS MAP-1



**INSIGHT ENGINEERING CO.**

P.O. Box 1478 Everett, WA 98206  
425-303-9363, 425-303-9362 f.  
Info@insightengineering.net

**Figure 4 - Downstream Analysis Map-1**

Front Porch Cottages  
Mukilteo, Washington

SCALE:  
NONE

DATE: 10/30/20

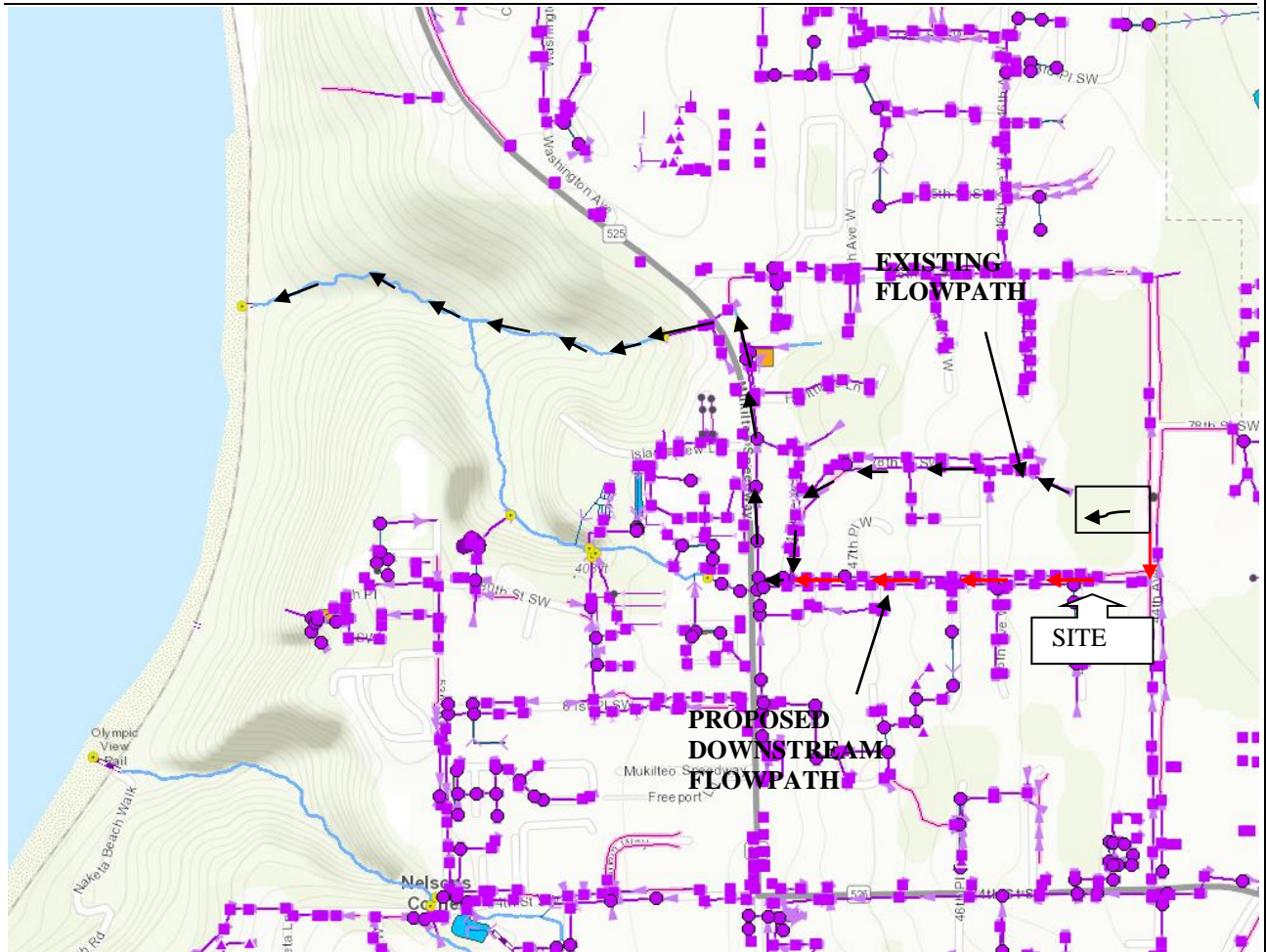
JOB #: 19-1018

BY: JDM

FILE NAME:

19-1018\docs\drainage report

## DOWNSTREAM ANALYSIS MAP-2



**INSIGHT ENGINEERING CO.**

P.O. Box 1478 Everett, WA 98206  
425-303-9363, 425-303-9362 f.  
Info@insightengineering.net

**Figure 5 - Downstream Analysis Map-2**  
Front Porch Cottages  
Mukilteo, Washington

**SCALE:**  
NONE

**DATE:** 10/30/20

**JOB #:** 19-1018

**BY:** JDM

**FILE NAME:**

19-1018\docs\drainage report

## B. PRE-DEVELOPED HYDROLOGY

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The site contains 1.62 Acres. The site is currently developed with an existing house and access from 44th Ave W. The remainder of the site exists as residential landscaping with few trees. The site contains one drainage basin that that slopes to the west. Please refer to the downstream analysis under Section VIII for more details. Per NRCS survey of Snohomish County, the project site contains Alderwood 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.

## C. DEVELOPED HYDROLOGY

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The proposal is to construct fourteen cottages with associated utilities. The access to the site will from the 44<sup>th</sup> Ave W. Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the proposed drainage system along 44th Ave W.

## D. STORMWATER FLOW CONTROL

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The proposal is to construct fourteen cottages with associated utilities. The access to the site will from the 44th Ave W. Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the driveaisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM). The roof and the yard drains will be connected to the onsite detention system. The outflow from the wetvault will be pumped to the proposed drainage system along 44th Ave W.

Per Minimum Requirement #5 (Section 2.5.5 of the SWMMWW), the following NPGIS BMP's 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. The roof will be connected to the onsite detention system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The road and driveways will be directed to the onsite detention system through catch basins. Post-Construction Soil Quality and Depth BMP T.5.13 is proposed to provide onsite stormwater management for the pervious areas of the site. Please refer to Section VI Appendix B for LID Feasibility Analysis Table.

## **DETENTION ANALYSIS**

Per NRCS survey of Snohomish County, the project site contains Alderwood soils that have a hydrologic classification of Type “C”.

Site Area	= 1.62 Acres (70,627 SF)
Frontage Improvement	= 0.08 Acres ( 3,568 SF)
<u>Existing half road</u>	<u>= 0.05 Acres ( 2,206 SF)</u>
Total Area Included in the Analysis	= 1.75 Acres (76,401SF)

### **Existing Basin Summary**

<u>Total Area Included in the Analysis</u>	<u>= 1.75 Acres</u>
Total Existing Basin Area	= 1.75 Acres

### **Impervious Areas:**

<u>Existing Road</u>	<u>= 2,206 SF (0.05 Acres)</u>
Total Impervious	= 2,206 SF (0.05Acres)

Total Pervious Areas = 1.75 Acres – 0.05 Acres= 1.70 Acres

*The entire pervious area was modeled as forested areas.  
Refer to the Existing Basin Map and WWHM Report for basin representation.*

### **Developed Basin Summary**

<u>Total Area Included in the Analysis</u>	<u>= 1.75 Acres</u>
Total Developed Basin Area	= 1.75 Acres

### **Impervious Areas:**

Existing Road	= 2,206 SF (0.05Acres)
Frontage Sidewalk	= 1,252 SF (0.03 Acres)
Frontage Road	= 693 SF (0.02 Acres)
Road	= 16,101 SF (0.37 Acres)
Sidewalk	= 2,664 SF (0.06 Acres)
Roof	= 17,241 SF (0.40 Acres)
<u>Driveway</u>	<u>= 574 SF (0.01 Acres)</u>
Total Impervious	= 40,731 SF (0.94 Acres)

Total Pervious Areas = 1.75 Acres-0.94 Acres= 0.81 Acres

**Detention Volume Required: 21,120 CF**



**Detention Volume Provided: 21,120 CF**

*Refer to the Developed basin map for basin representation. Refer to following pages for the WWHM report for the detention sizing calculations.*

**The Total New Impervious Area for the Project= 38,525 SF (0.89 Acres)**



- LINE CALCULATED PER  
SP 199 (5-79)  
USING MON. TIES ON  
44TH AVE W

$I.E.=576.64$  (12" CRP).

– *DEV. BASIN*  
(1.75 AC)

~~COMMON  
AREA-A~~

COMMON  
AREA-B  
3,334 SF

44th Ave. W.

— I.E. = 57

— I.E. = 57

-C/L OF EX

$$-C/L \text{ OF } R.$$

5.0'  
TO BE  
DEEDED

 $R=2$ 

30.0' R/W

15.0 R/W

45.0

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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X. F.H.

[illegible]

4	11	30.00	
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SCALE: 1" = 30'

## DEVELOPED BASIN MAP

**WWHM2012  
PROJECT REPORT**

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**Project Name:** FRONT PORCH COTTAGES  
**Site Name:** FRONT PORCH COTTAGES  
**Site Address:** 7902 44TH AVE W MUKILTEO, WA  
**City** : MUKILTEO  
**Report Date:** 8/5/2020  
**Gage** : Everett  
**Data Start** : 1948/10/01  
**Data End** : 2009/09/30  
**Precip Scale:** 0.80  
**Version Date:** 2019/09/13  
**Version** : 4.2.17

---

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

---

**High Flow Threshold for POC 1:** 50 year

---

**PREDEVELOPED LAND USE**

**Name** : EXISTING BASIN  
**Bypass:** No

**GroundWater:** No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Mod	1.7
<b>Pervious Total</b>	<b>1.7</b>
<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.05
<b>Impervious Total</b>	<b>0.05</b>
<b>Basin Total</b>	<b>1.75</b>

---

<b>Element Flows To:</b>		
Surface	Interflow	Groundwater

---

**MITIGATED LAND USE**

**Name** : DEVELOPED BASIN  
**Bypass:** No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Mod	.81
 Pervious Total	 0.81
<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.44
ROOF TOPS FLAT	0.4
DRIVEWAYS FLAT	0.01
SIDEWALKS FLAT	0.09
 Impervious Total	 0.94
 Basin Total	 1.75

---

Element Flows To:		
Surface	Interflow	Groundwater
Vault 1	Vault 1	

---

Name : Vault 1  
Width : 20 ft.  
Length : 132 ft.  
Depth: 9 ft.  
Discharge Structure  
Riser Height: 8 ft.  
Riser Diameter: 12 in.  
Orifice 1 Diameter: 0.5 in. Elevation: 0 ft.  
Orifice 2 Diameter: 0.81 in. Elevation: 5.34 ft.  
Orifice 3 Diameter: 0.51 in. Elevation: 6.54 ft.

Element Flows To:  
Outlet 1                      Outlet 2

---

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.060	0.000	0.000	0.000
0.1000	0.060	0.006	0.002	0.000
0.2000	0.060	0.012	0.003	0.000
0.3000	0.060	0.018	0.003	0.000
0.4000	0.060	0.024	0.004	0.000
0.5000	0.060	0.030	0.004	0.000
0.6000	0.060	0.036	0.005	0.000
0.7000	0.060	0.042	0.005	0.000
0.8000	0.060	0.048	0.006	0.000
0.9000	0.060	0.054	0.006	0.000

1.0000	0.060	0.060	0.006	0.000
1.1000	0.060	0.066	0.007	0.000
1.2000	0.060	0.072	0.007	0.000
1.3000	0.060	0.078	0.007	0.000
1.4000	0.060	0.084	0.008	0.000
1.5000	0.060	0.090	0.008	0.000
1.6000	0.060	0.097	0.008	0.000
1.7000	0.060	0.103	0.008	0.000
1.8000	0.060	0.109	0.009	0.000
1.9000	0.060	0.115	0.009	0.000
2.0000	0.060	0.121	0.009	0.000
2.1000	0.060	0.127	0.009	0.000
2.2000	0.060	0.133	0.010	0.000
2.3000	0.060	0.139	0.010	0.000
2.4000	0.060	0.145	0.010	0.000
2.5000	0.060	0.151	0.010	0.000
2.6000	0.060	0.157	0.010	0.000
2.7000	0.060	0.163	0.011	0.000
2.8000	0.060	0.169	0.011	0.000
2.9000	0.060	0.175	0.011	0.000
3.0000	0.060	0.181	0.011	0.000
3.1000	0.060	0.187	0.011	0.000
3.2000	0.060	0.193	0.012	0.000
3.3000	0.060	0.200	0.012	0.000
3.4000	0.060	0.206	0.012	0.000
3.5000	0.060	0.212	0.012	0.000
3.6000	0.060	0.218	0.012	0.000
3.7000	0.060	0.224	0.013	0.000
3.8000	0.060	0.230	0.013	0.000
3.9000	0.060	0.236	0.013	0.000
4.0000	0.060	0.242	0.013	0.000
4.1000	0.060	0.248	0.013	0.000
4.2000	0.060	0.254	0.013	0.000
4.3000	0.060	0.260	0.014	0.000
4.4000	0.060	0.266	0.014	0.000
4.5000	0.060	0.272	0.014	0.000
4.6000	0.060	0.278	0.014	0.000
4.7000	0.060	0.284	0.014	0.000
4.8000	0.060	0.290	0.014	0.000
4.9000	0.060	0.297	0.015	0.000
5.0000	0.060	0.303	0.015	0.000
5.1000	0.060	0.309	0.015	0.000
5.2000	0.060	0.315	0.015	0.000
5.3000	0.060	0.321	0.015	0.000
5.4000	0.060	0.327	0.020	0.000
5.5000	0.060	0.333	0.023	0.000
5.6000	0.060	0.339	0.025	0.000
5.7000	0.060	0.345	0.026	0.000
5.8000	0.060	0.351	0.028	0.000
5.9000	0.060	0.357	0.029	0.000
6.0000	0.060	0.363	0.031	0.000
6.1000	0.060	0.369	0.032	0.000
6.2000	0.060	0.375	0.033	0.000
6.3000	0.060	0.381	0.034	0.000
6.4000	0.060	0.387	0.035	0.000
6.5000	0.060	0.393	0.036	0.000

6.6000	0.060	0.400	0.039	0.000
6.7000	0.060	0.406	0.041	0.000
6.8000	0.060	0.412	0.042	0.000
6.9000	0.060	0.418	0.044	0.000
7.0000	0.060	0.424	0.045	0.000
7.1000	0.060	0.430	0.047	0.000
7.2000	0.060	0.436	0.048	0.000
7.3000	0.060	0.442	0.049	0.000
7.4000	0.060	0.448	0.050	0.000
7.5000	0.060	0.454	0.051	0.000
7.6000	0.060	0.460	0.052	0.000
7.7000	0.060	0.466	0.053	0.000
7.8000	0.060	0.472	0.054	0.000
7.9000	0.060	0.478	0.055	0.000
8.0000	0.060	0.484	0.056	0.000
8.1000	0.060	0.490	0.391	0.000
8.2000	0.060	0.497	0.966	0.000
8.3000	0.060	0.503	1.569	0.000
8.4000	0.060	0.509	2.020	0.000
8.5000	0.060	0.515	2.264	0.000
8.6000	0.060	0.521	2.501	0.000
8.7000	0.060	0.527	2.698	0.000
8.8000	0.060	0.533	2.881	0.000
8.9000	0.060	0.539	3.052	0.000
9.0000	0.060	0.545	3.215	0.000
9.1000	0.060	0.551	3.369	0.000
9.2000	0.000	0.000	3.517	0.000

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## ANALYSIS RESULTS

### Stream Protection Duration

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#### Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.7

Total Impervious Area:0.05

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#### Mitigated Landuse Totals for POC #1

Total Pervious Area:0.81

Total Impervious Area:0.94

---

#### Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.030579
5 year	0.044531
10 year	0.055102
25 year	0.070047
50 year	0.08238
100 year	0.095783

**Flow Frequency Return Periods for Mitigated. POC #1**

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.013914
5 year	0.019884
10 year	0.024629
25 year	0.031618
50 year	0.037607
100 year	0.044324

---

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

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.021	0.011
1950	0.035	0.014
1951	0.033	0.012
1952	0.027	0.011
1953	0.026	0.011
1954	0.066	0.013
1955	0.047	0.030
1956	0.037	0.033
1957	0.043	0.014
1958	0.045	0.013
1959	0.031	0.013
1960	0.027	0.013
1961	0.057	0.015
1962	0.023	0.010
1963	0.035	0.012
1964	0.026	0.010
1965	0.024	0.013
1966	0.019	0.011
1967	0.037	0.012
1968	0.037	0.014
1969	0.041	0.013
1970	0.021	0.012
1971	0.042	0.033
1972	0.029	0.011
1973	0.023	0.014
1974	0.047	0.014
1975	0.023	0.010
1976	0.022	0.013
1977	0.016	0.011
1978	0.026	0.011
1979	0.053	0.011
1980	0.024	0.011
1981	0.026	0.010
1982	0.028	0.014
1983	0.037	0.013
1984	0.025	0.030
1985	0.043	0.025
1986	0.093	0.034
1987	0.035	0.030
1988	0.023	0.014
1989	0.030	0.010
1990	0.027	0.014
1991	0.030	0.014



1992	0.024	0.014
1993	0.016	0.009
1994	0.017	0.014
1995	0.025	0.015
1996	0.063	0.015
1997	0.102	0.056
1998	0.026	0.012
1999	0.026	0.014
2000	0.045	0.015
2001	0.013	0.008
2002	0.025	0.016
2003	0.019	0.012
2004	0.036	0.014
2005	0.021	0.013
2006	0.064	0.028
2007	0.056	0.015
2008	0.053	0.034
2009	0.023	0.013

---

**Stream Protection Duration**

**Ranked Annual Peaks for Predeveloped and Mitigated. POC #1**

<b>Rank</b>	<b>Predeveloped</b>	<b>Mitigated</b>
1	0.1024	0.0561
2	0.0925	0.0341
3	0.0663	0.0340
4	0.0637	0.0329
5	0.0631	0.0329
6	0.0570	0.0305
7	0.0562	0.0304
8	0.0534	0.0296
9	0.0525	0.0278
10	0.0472	0.0253
11	0.0465	0.0156
12	0.0452	0.0154
13	0.0451	0.0154
14	0.0433	0.0148
15	0.0428	0.0147
16	0.0416	0.0146
17	0.0410	0.0144
18	0.0374	0.0142
19	0.0371	0.0142
20	0.0368	0.0141
21	0.0365	0.0141
22	0.0365	0.0140
23	0.0353	0.0139
24	0.0351	0.0139
25	0.0345	0.0139
26	0.0328	0.0139
27	0.0306	0.0138
28	0.0302	0.0137
29	0.0296	0.0135
30	0.0287	0.0134
31	0.0281	0.0133
32	0.0275	0.0132
33	0.0274	0.0130

34	0.0266	0.0130
35	0.0261	0.0130
36	0.0261	0.0127
37	0.0260	0.0126
38	0.0259	0.0125
39	0.0259	0.0125
40	0.0257	0.0125
41	0.0254	0.0123
42	0.0254	0.0122
43	0.0252	0.0121
44	0.0245	0.0120
45	0.0242	0.0116
46	0.0241	0.0115
47	0.0233	0.0115
48	0.0232	0.0115
49	0.0229	0.0114
50	0.0227	0.0113
51	0.0227	0.0112
52	0.0215	0.0106
53	0.0209	0.0105
54	0.0208	0.0105
55	0.0207	0.0104
56	0.0189	0.0103
57	0.0187	0.0101
58	0.0167	0.0100
59	0.0162	0.0096
60	0.0162	0.0090
61	0.0127	0.0075

---

**Stream Protection Duration**

**POC #1**

**The Facility PASSED**

**The Facility PASSED.**

<b>Flow(cfs)</b>	<b>Predev</b>	<b>Mit</b>	<b>Percentage</b>	<b>Pass/Fail</b>
0.0153	10545	5897	55	Pass
0.0160	9394	3730	39	Pass
0.0166	8382	3598	42	Pass
0.0173	7482	3444	46	Pass
0.0180	6654	3332	50	Pass
0.0187	5890	3236	54	Pass
0.0194	5230	3123	59	Pass
0.0200	4663	3001	64	Pass
0.0207	4158	2849	68	Pass
0.0214	3749	2701	72	Pass
0.0221	3354	2541	75	Pass
0.0227	3022	2413	79	Pass
0.0234	2714	2265	83	Pass
0.0241	2449	2141	87	Pass
0.0248	2231	2021	90	Pass
0.0255	2033	1914	94	Pass
0.0261	1847	1793	97	Pass
0.0268	1695	1669	98	Pass
0.0275	1575	1510	95	Pass

0.0282	1456	1351	92	Pass
0.0288	1346	1214	90	Pass
0.0295	1263	1064	84	Pass
0.0302	1182	936	79	Pass
0.0309	1123	818	72	Pass
0.0316	1053	750	71	Pass
0.0322	996	654	65	Pass
0.0329	952	546	57	Pass
0.0336	903	475	52	Pass
0.0343	855	352	41	Pass
0.0349	795	340	42	Pass
0.0356	747	330	44	Pass
0.0363	711	320	45	Pass
0.0370	670	314	46	Pass
0.0377	642	310	48	Pass
0.0383	618	305	49	Pass
0.0390	595	302	50	Pass
0.0397	564	297	52	Pass
0.0404	537	293	54	Pass
0.0410	514	289	56	Pass
0.0417	492	284	57	Pass
0.0424	477	280	58	Pass
0.0431	461	275	59	Pass
0.0438	445	270	60	Pass
0.0444	429	264	61	Pass
0.0451	409	259	63	Pass
0.0458	391	254	64	Pass
0.0465	374	248	66	Pass
0.0471	358	242	67	Pass
0.0478	339	235	69	Pass
0.0485	325	228	70	Pass
0.0492	311	222	71	Pass
0.0499	298	215	72	Pass
0.0505	288	208	72	Pass
0.0512	278	200	71	Pass
0.0519	271	183	67	Pass
0.0526	263	154	58	Pass
0.0532	257	136	52	Pass
0.0539	248	122	49	Pass
0.0546	241	106	43	Pass
0.0553	232	70	30	Pass
0.0560	225	13	5	Pass
0.0566	218	0	0	Pass
0.0573	214	0	0	Pass
0.0580	211	0	0	Pass
0.0587	208	0	0	Pass
0.0593	202	0	0	Pass
0.0600	195	0	0	Pass
0.0607	191	0	0	Pass
0.0614	186	0	0	Pass
0.0620	182	0	0	Pass
0.0627	175	0	0	Pass
0.0634	166	0	0	Pass
0.0641	157	0	0	Pass
0.0648	151	0	0	Pass
0.0654	146	0	0	Pass

0.0661	141	0	0	Pass
0.0668	137	0	0	Pass
0.0675	131	0	0	Pass
0.0681	125	0	0	Pass
0.0688	122	0	0	Pass
0.0695	117	0	0	Pass
0.0702	112	0	0	Pass
0.0709	109	0	0	Pass
0.0715	106	0	0	Pass
0.0722	101	0	0	Pass
0.0729	94	0	0	Pass
0.0736	92	0	0	Pass
0.0742	83	0	0	Pass
0.0749	78	0	0	Pass
0.0756	71	0	0	Pass
0.0763	69	0	0	Pass
0.0770	66	0	0	Pass
0.0776	56	0	0	Pass
0.0783	52	0	0	Pass
0.0790	50	0	0	Pass
0.0797	47	0	0	Pass
0.0803	46	0	0	Pass
0.0810	44	0	0	Pass
0.0817	41	0	0	Pass
0.0824	38	0	0	Pass

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**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.

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**LID Report**

LID Technique	Used for	Total Volume	Volume	Infiltration	Cumulative
Percent	Water Quality	Percent	Comment	Through	Volume
Volume		Treatment?	Needs	Facility	Volume
	Water Quality			(ac-ft.)	
Infiltration Infiltrated		Treatment			Credit
		(ac-ft)		(ac-ft)	
Vault 1 POC	N	136.03			N
0.00					
Total Volume Infiltrated		136.03	0.00	0.00	
0.00	0.00	0%	No Treat. Credit		
Compliance with LID Standard 8					
Duration Analysis Result = Failed					

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**Perlnd and Implnd Changes**

No changes have been made.

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## E. STORMWATER TREATMENT PLAN

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Flow control and water quality requirements will be met by an underground Wetvault (132-ft by 20-ft by 11.00-ft) which will be located underneath the drive aisle. The wetvault will provide a total storage capacity of 21,120 CF. The wetvault will have a detention depth of 8.50-ft, 1.50-ft of wetpool depth and 1-ft of sediment storage. The wetvault was sized using Western Washington Hydrology Model V 4.2.13 (WWHM).

### **Wetpool Depth**

Q(online facility volume) = 0.090 acre-feet = 3,920.40 CF

Water Quality Volume V = Q = 3,920.40 CF

$$\begin{aligned}\text{Wetpool Depth} &= \frac{\text{Wetpool Volume}}{\text{Area of Detention}} \\ &= 3,920.40 / (132' \times 20') = 1.49\text{-ft}\end{aligned}$$

Therefore, the wetvault will have a total depth of 11.00-ft which includes 8.5-ft of detention depth, 1.5-ft of wetpool depth and 1-ft of sediment storage.

## F. CONVEYANCE ANALYSIS

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The 100yr peak flow for the project is only 1.03 cfs. A 12-inch pipe can convey 3 cfs at a minimum slope of 0.5-percent. The minimum size of the proposed system is 12-inch for the project that can easily convey 1.03 cfs and therefore a detailed conveyance analysis was not performed.

## G. MAINTENANCE AND OPERATION MANUAL

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A detailed Operation and Maintenance Manual will be provided for the construction submittal.