INSIGHT ENGINEERING CO.

STORMWATER SITE PLAN
For
MSR Tuscany Woods

Prepared for
City of Marysville
80 Columbia Ave.
Marysville, WA 98270

Project Site Location:
4407 84th ST NE
Marysville, WA 98270

Applicant:
MSR communities 5
2018 156th Ave NE, Ste. 100, Bldg. F
Bellevue, WA 98007

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

Tax Id: 30052100105200
IECO Project:22-1215

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

Stormwater Site Plan Prepared By:

Sithara George, BCSE

Stormwater Site Plan Preparation Date:

May 31, 2023

Approximate Construction Date:

May 1, 2024

06/29/2023

TABLE OF CONTENTS

Figures

Acronyms and Abbreviations

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

1.0 Executive Summary

The proposed project ***MSR Tuscany Woods*** is located at 4407 84th ST NE, Marysville, Washington. More generally, the site is located within the SW ¼ of Section 21, Township 30 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section. This report follows City of Marysville Drainage and Erosion Control Design Standards (April 1999, revised June 2016) and the 2019 SWMMWW.

The site contains 2.76 acres. The site is currently developed with a single-family home, detached garages, and sheds. The remainder of the site is undeveloped and comprised of a large and sparsely forested grass field open area. The entire site is flat and contains one drainage basin that slopes slightly towards the southeast. Based on the topographic survey of the upstream runoff appears to be minimal. Please refer to the upstream and downstream analysis for more details. Per NRCS survey of Snohomish County, the project site contains Ragnar soils that have a hydrologic classification of Type "A". Please refer to the soils map and descriptions attached later in this report for more details.

The project proposal is to construct thirty-two townhome units with an access road and associated utilities. Access to the site will be from 84th ST NE.

Per Figure 2.4.1, (flow chart for new development requirements) Volume I of the 2012/2014 SWMMWW, Minimum requirements #1 through 9 shall apply for this project. See section 1.2 of this report for the Minimum Requirements Summary. Flow control requirements for the site will be met by onsite infiltration through a StormTech DC-780 system which will be located within the open space. The StormTech system will provide a total storage capacity of 9,440 CF. An infiltration rate of 1.5-in/hr was assumed as per the Geotech Report attached under Section 6 Appendix A. Water quality requirements will be met by providing a CBF-5 Bayfilter manufactured by Baysaver Technologies located upstream of Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed StormTech will store and infiltrate

runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

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 drains will be connected to the Stormtech system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The runoff from the road and driveways will be directed to the stormtech 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 Appendix B Section 6 for LID Feasibility Analysis Table. The impervious areas will be connected to the Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed Stormtech system will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

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

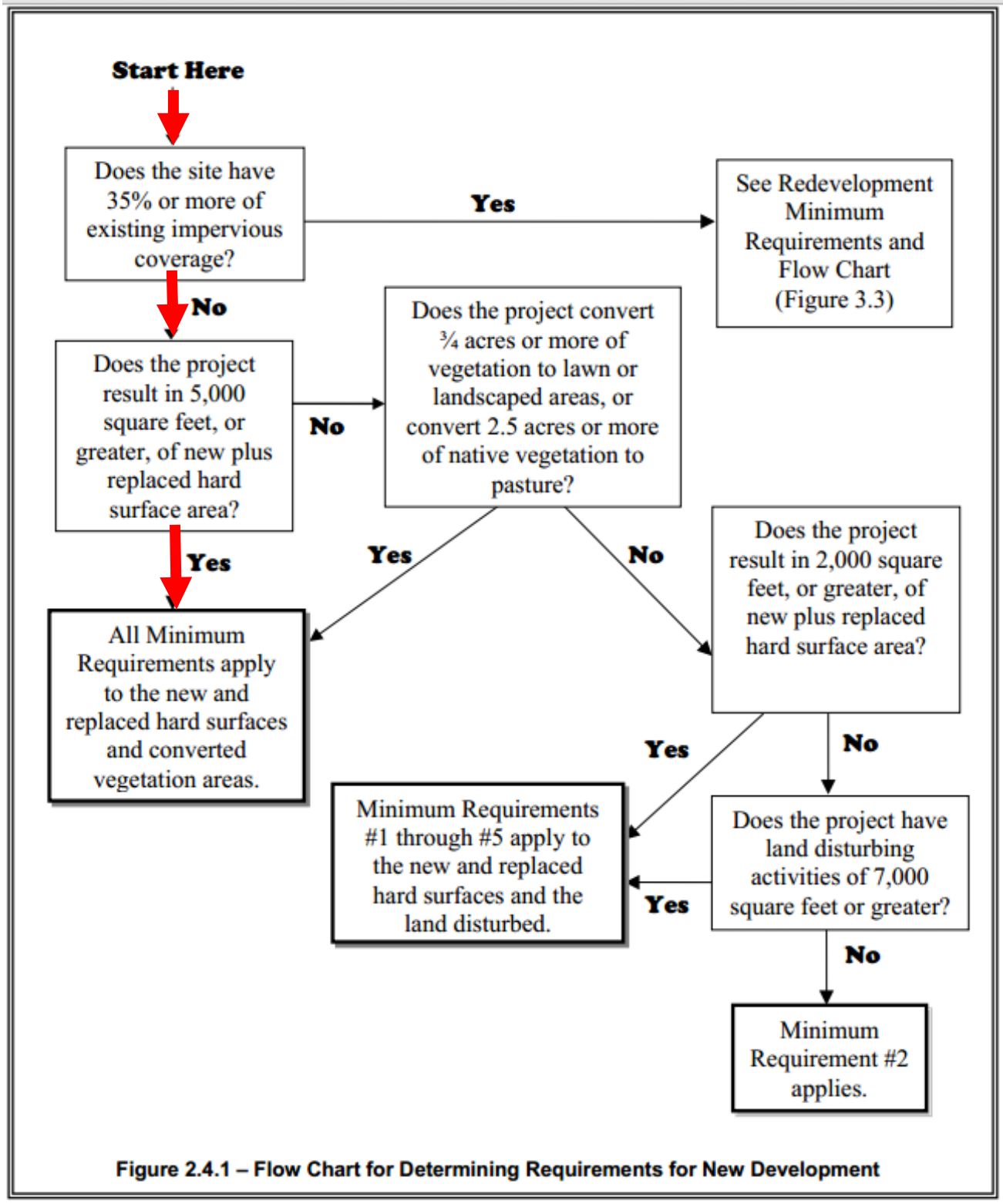
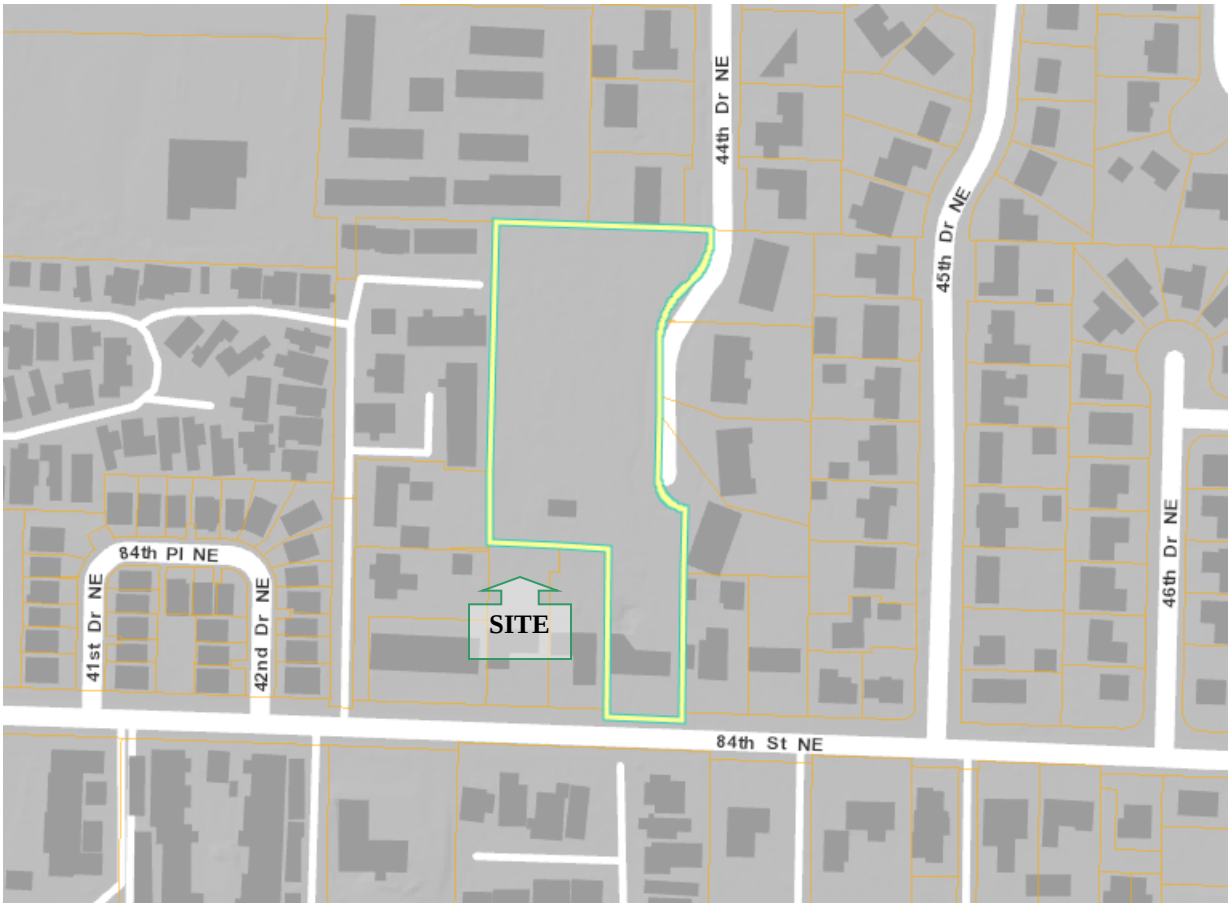


Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

VICINITY MAP



TAKEN FROM PDS PORTAL MAPS

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Figure 2 -Vicinity Map
MSR Tuscany Woods
Marysville, Washington

SCALE: NTS	**DATE:** 6/29/23	**JOB #:** 22-1215
BY: SG	**FILE NAME:** 22-1215/doc/drainage report	

1.2 Minimum Requirements Summary

MR : Minimum Requirement

SWPPP : Stormwater Pollution Prevention Plan

MR #1 Stormwater Site Plan Narrative: This report follows City of Marysville Standards and the 2012/2014 SWMMWW.

MR #2 SWPPP Narrative: A SWPPP is provided under the Section 5.

MR #3 Water Pollution Source Control for New Development: No source control pollutants pertain to the proposed project.

MR #4 Preservation of Natural Drainage Systems and Outfalls: The impervious areas will be connected to the Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed infiltration trenches will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

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 drains will be connected to the Stormtech system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The runoff from the road and driveways will be directed to the stormtech 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 Appendix B Section 6 for LID Feasibility Analysis Table.

MR #6 Runoff Treatment: Water quality requirements will be met by providing a CBF-5 Bayfilter manufactured by Baysaver Technologies located upstream of Stormtech system.

MR #7 Flow Control: Flow control requirements for the site will be met by onsite infiltration through a StormTech DC-780 system which will be located within the open space. The StormTech system will provide a total storage capacity of 9,440 CF. An infiltration rate of 1.5-in/hr was assumed as per the Geotech Report attached under Section 6 Appendix A.

MR #8 Wetlands Protection: There are no wetlands located on or adjacent to the site.

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

2.0 Existing Conditions

The proposed project ***MSR Tuscany Woods*** is located at 4407 84th ST NE, Marysville, Washington. More generally, the site is located within the SW ¼ of Section 21, Township 30 North, and Range 5 East of the Willamette Meridian.

The site contains 2.76 acres. The site is currently developed with a single-family home, detached garages, and sheds. The remainder of the site is undeveloped and comprised of a large and sparsely forested grass field open area. The entire site is flat and contains one drainage basin that slopes slightly towards the southeast. Based on the topographic survey of the upstream runoff appears to be minimal. Please refer to the upstream and downstream analysis for more details. Per NRCS survey of Snohomish County, the project site contains Ragnar soils that have a hydrologic classification of Type "A". Please refer to the soils map and descriptions attached later in this report for more details.

SOIL MAP

SOILS LEGEND

57-Ragnar fine sandy loam, 0 to 8 percent slopes

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Figure 3 - Soil Map
MSR Tuscany Woods
Marysville, Washington

SCALE: NONE	**DATE:** 6/29/23	**JOB #:** 22-1215
BY: SG	**FILE NAME:** 22-1215\docs\drainage report	

Snohomish County Area, Washington

57—Ragnar fine sandy loam, 0 to 8 percent slopes

Map Unit Setting

- *National map unit symbol:* 2hzk
- *Elevation:* 300 to 1,000 feet
- *Mean annual precipitation:* 35 to 65 inches
- *Mean annual air temperature:* 50 to 54 degrees F
- *Frost-free period:* 150 to 210 days
- *Farmland classification:* All areas are prime farmland

Map Unit Composition

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

Description of Ragnar

Setting

- *Landform:* Outwash plains
- *Parent material:* Glacial outwash

Typical profile

- *H1 - 0 to 2 inches:* ashy fine sandy loam
- *H2 - 2 to 24 inches:* ashy sandy loam
- *H3 - 24 to 60 inches:* loamy sand

Properties and qualities

- *Slope:* 0 to 8 percent
- *Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification
- *Drainage class:* Well drained
- *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water supply, 0 to 60 inches:* Low (about 3.4 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2e
- *Hydrologic Soil Group:* A
- *Ecological site:* F002XA004WA - Puget Lowlands Forest
- *Forage suitability group:* Droughty Soils (G002XN402WA)
- *Other vegetative classification:* Droughty Soils (G002XN402WA)
- *Hydric soil rating:* No

3.0 Offsite Analysis

A site reconnaissance was performed by Brian Kalab of Insight engineering on October 1, 2019 to verify the downstream flow paths and observe any drainage problems downstream of the site. The sky was sunny with a temperature of 50 degrees.

The site contains 2.76 acres. The site is currently developed with a single-family home, detached garages, and sheds. The remainder of the site is undeveloped and comprised of a large and sparsely forested grass field open area. The entire site is flat and contains one drainage basin that slopes slightly towards the southeast.No visible on-site drainage problems were observed at the time of field investigations.

3.1 Upstream Analysis

Based on the site reconnaissance and the topographic survey of the site, the upstream flows appear to be minimal. Refer to the Downstream Analysis Map attached in the next page for more details.

3.2 Downstream Analysis

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

The entire site is generally flat and contains one drainage basin that slopes slightly towards the southeast. Most of the runoff gets infiltrated and the reamining flows enter the ex drainage system on 84^{TH} ST. The drainage flows west for about 1,200ft. The flow then crosses State Ave before joining Quilceda creek. The area is very flat and almost all the runoff appears to be infiltrated.

The proposed infiltration system will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

FIGURE 4. DOWNSTREAM ANALYSIS MAP-1

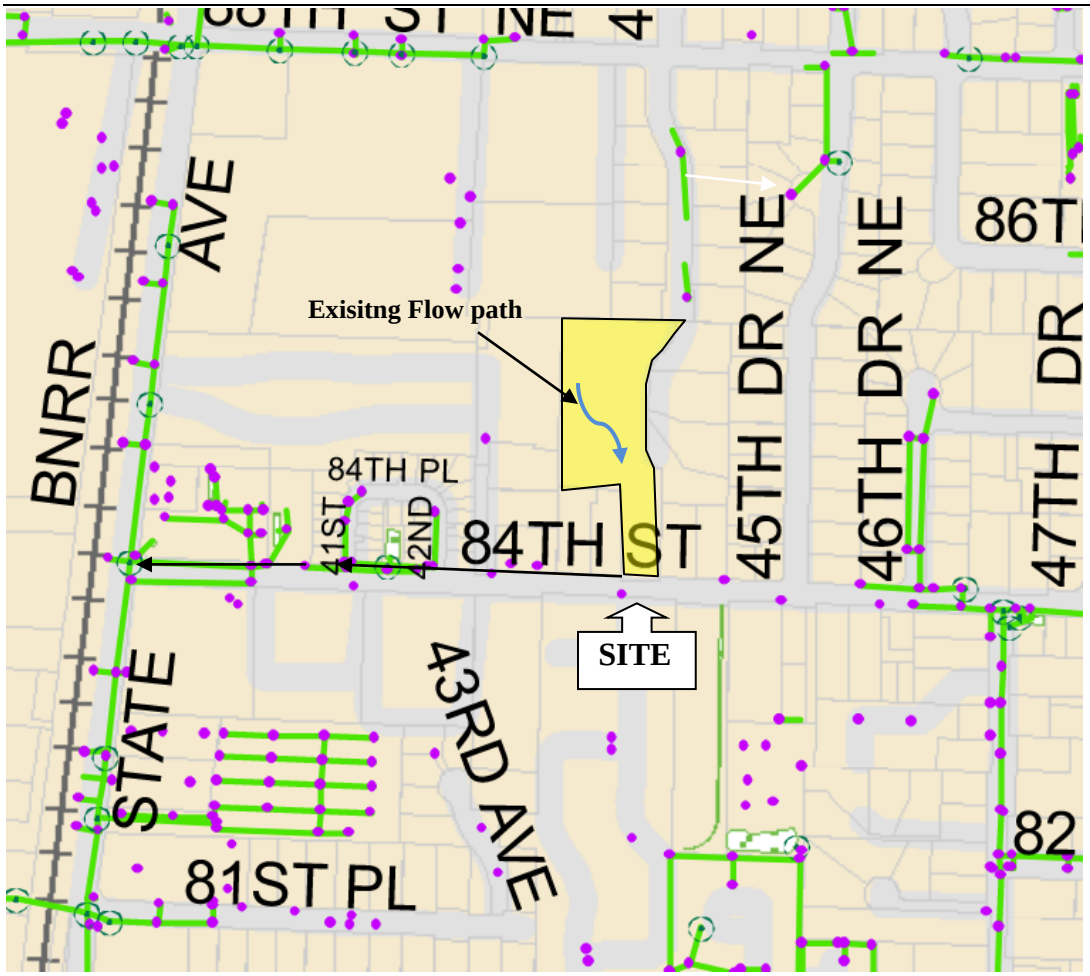

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Figure 4 - Downstream Analysis Map-1
MSR Tuscany Woods
Marysville, Washington

SCALE: NONE	**DATE:** 6/29/23	**JOB #:** 22-1215
BY: SG	**FILE NAME:** 22-1215\docs\drainage report	

4.0 Developed Conditions

The proposed project ***MSR Tuscany*** Woods is located at 4407 84th ST NE, Marysville, Washington. More generally, the site is located within the SW ¼ of Section 21, Township 30 North, and Range 5 East of the Willamette Meridian.Per NRCS survey of Snohomish County, the project site contains Ragnar soils that have a hydrologic classification of Type "B".

Flow control requirements for the site will be met by onsite infiltration through a StormTech DC-780 system which will be located within the open space. The StormTech system will provide a total storage capacity of 9,440 CF. An infiltration rate of 1.5-in/hr was assumed as per the Geotech Report attached under Section 6 Appendix A. Water quality requirements will be met by providing a CBF-5 Bayfilter manufactured by Baysaver Technologies located upstream of Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed StormTech will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

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 drains will be connected to the Stormtech system. The following BMP's shall be applied to the other hard surfaces: Full dispersion, Permeable Pavement, Bioretention, and then Dispersion. The runoff from the road and driveways will be directed to the stormtech 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 Appendix B Section 6 for LID Feasibility Analysis Table. The impervious areas will be connected to the Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed Stormtech system will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the

site. Therefore, the downstream public channel should not experience any future flooding problems.

4.1 Site Hydraulic Calculations

Site area = 2.76 Acres

Total Area Included in the Analysis =2.76 Acres

4.2 Existing Basin Summary

Existing Basin = 2.76 Acres

The existing basin was modeled as second growth forest.

Refer to the Existing Basin Map on the following pages and the WWHM Report attached under Appendix A.

4.3 Developed Basin Summary

Total Area Included in the Analysis =2.67 Acres

Developed Basin = 2.67 Acres

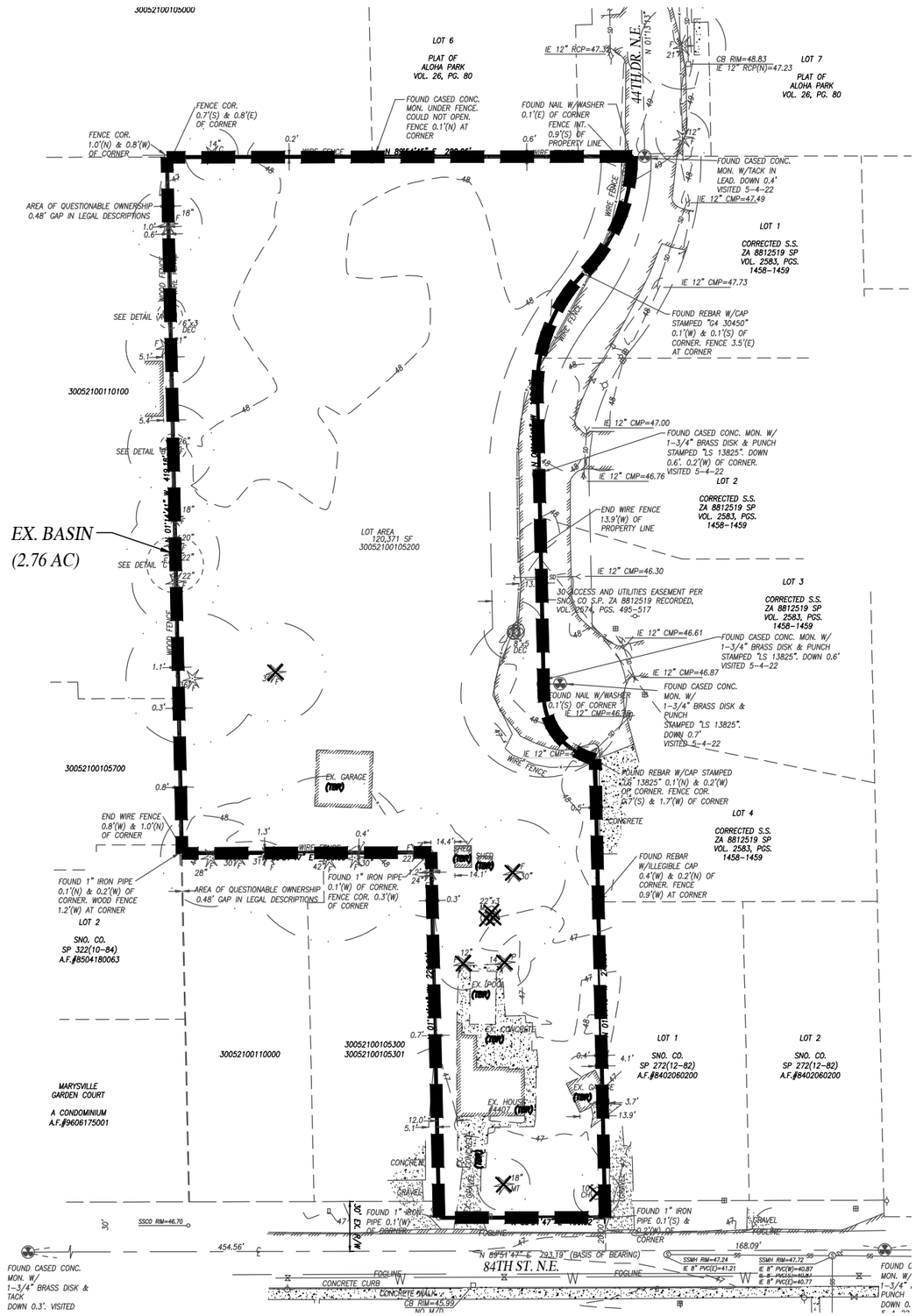
Total Site Impervious:

Road	= 0.47 Acres (20,435 SF)
Sidewalk	= 0.14 Acres (6,200 SF)
Driveway	= 0.28 Acres (12,100 SF)
Roof	= 0.75 Acres (32,500 SF)
Total Impervious	= 1.64 Acres (71,235 SF)

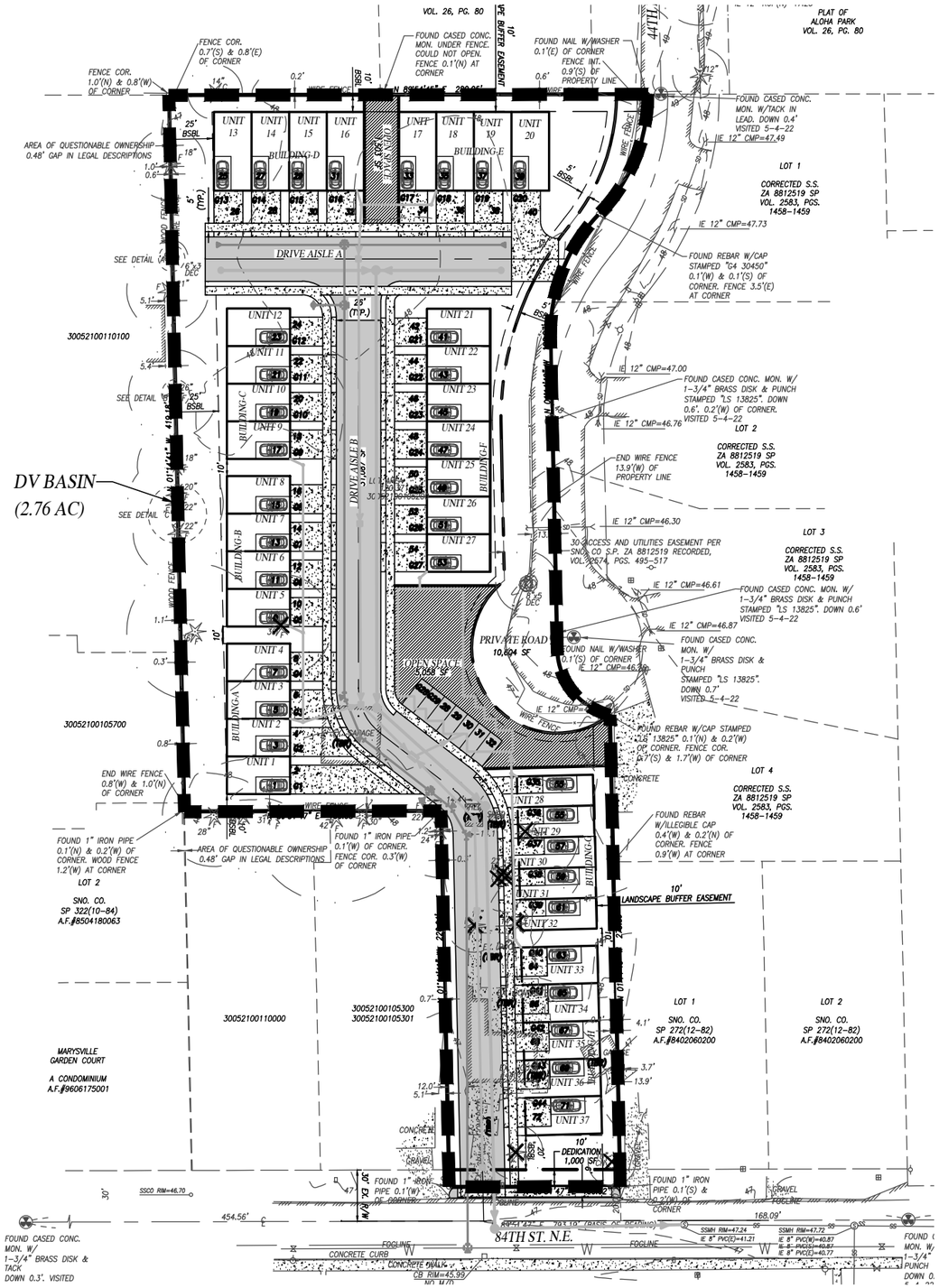
Total Site Pervious = 2.67 Acres - 1.64 Acres = 1.03 Acres

Stormtech Volume Required: 9,440 CF
Stormtech Volume Provided: 9,440 CF

Refer to the Developed Basin Map on the following pages and the WWHM Report attached under Appendix A.



EXISTING BASIN MAP



DEVELOPED BASIN MAP

4.4 Water Quality

Water quality will be met by providing a CBF-5 Bayfilter manufactured by Baysaver Technologies located upstream of infiltration trench.

WQ Basin

Total Area	*= 0.75 Acres*
Impervious:	
Road	= 0.46 Acres (20,435 SF)
Sidewalk	= 0.14 Acres (6,200 SF)
Driveway	= 0.28 Acres (12,100 SF)
Roof	= 0.41 Acres (17,890 SF)
` Total Impervious	= 1.28 Acres (56,625 SF)

4.5 Conveyance Analysis and Design

A 12-inch pipe can convey 3 cfs at a minimum slope of 0.5-percent. The proposed individual infiltration trenches will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. The flow through the catch basins and the pipes is less than 3-cfs and therefore a detailed conveyance analysis was not performed.

5.0 Construction Stormwater Pollution Prevention Plan

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

MSR Tuscany Woods

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

Permittee / Owner	Developer	Operator / Contractor
MSR Communities 5	MSR Communities 5	To be determined
2018 156th Ave NE Ste. 100, Bldg. F	2018 156th Ave NE Ste. 100, Bldg. F	
Bellevue, WA 98007	Bellevue, WA 98007	

Project Site Location

4407 84th ST NE
Marysville, WA 98270

Certified Erosion and Sediment Control Lead (CESCL)

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

SWPPP Prepared By

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

SWPPP Preparation Date
May 31, 2023

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction Duration	May 1, 2024	May 1, 2025

Table of Contents

List of Tables

List of Appendices

A. Site Map

B. BMP Detail

C. Correspondence

D. Site Inspection Form

E. Construction Stormwater General Permit (CSWGP)

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

G. Contaminated Site Information

H. Engineering Calculations

List of Acronyms and Abbreviations

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

1 Project Information

Project/Site Name: MSR Tuscany Woods
Street/Location: 4407 84th ST NE,

City: Marysville State: WA Zip code: 98270
Subdivision:
Receiving waterbody: Quilceda Creek

1.1 Existing Conditions

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

Total acreage: 2.76 acres
Disturbed acreage: 2.76 acres
Existing structures: 0.10 acres
Landscape topography: 2.66 acres
Drainage patterns: Sheet Flow
Existing Vegetation: Scattered vegetation.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): No wetland

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
Dissolved Oxygen	SNOCO-QCLD, QA 140TH E	N/A	Sample Result >Criteria (8.0 mg/L)
pH	QA 140TH E	N/A	Sample Result excursion of the criteria

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
The clearing area for the project is 2.76 Acres. The project proposal is to construct thirty-two townhome units with an access road and associated utilities. Access to the site will be from 84th ST NE.
Description of construction activities (example: site preparation, demolition, excavation):
Prepare the site for construction by the installation of the indicated BMP's. Excavate the site for the homes.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
Flow control requirements for the site will be met by providing a StormTech DC-780 system which will be located within the open space. The StormTech system will provide a total storage capacity of 9,440 CF. An infiltration rate of 1.5-in/hr was assumed as per the Geotech Report attached under Section 6 Appendix A. Water quality will be met by providing a CBF-5 Bayfilter manufactured by Baysaver Technologies located upstream of Stormtech system. The pervious area will infiltrate into the underlaying soils. The proposed StormTech will store and infiltrate runoff that is currently flowing in an unrestrained manner. No runoff is anticipated to leave the site. Therefore, the downstream public channel should not experience any future flooding problems.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
The acces to the site will be from the 84th ST NE. 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):
The enhanced water quality treatment will be met by a CB filter located upstream of the StormTech.

2 Construction Stormwater Best Management Practices (BMPs)

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

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

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

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

List and describe BMPs:

- Preserving Natural Vegetation (BMP C101)
- 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 detention vault 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 orange high rise fencing along the clearing limits, according to the approved construction plans, prior to any construction activities.

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

Responsible Staff: Contractor

2.1.4 Element 4: Install Sediment Controls

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

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

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

List and describe BMPs:

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)
- Temporary sediment Pond (BMP C241)

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

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

Responsible Staff: Contractor.

2.1.5 Element 5: Stabilize Soils

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

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

West of the Cascade Mountains Crest

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

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

Anticipated project dates: Start date: May 1, 2024 End date:March 1,2025

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, 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 catch basin filters, according to the approved construction plans, as catch basins become operable.

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

Responsible Staff: Contractor

2.1.8 Element 8: Stabilize Channels and Outlets

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

If any BMP's are 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

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

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

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

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

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

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

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

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

☒ Yes ☐ No

2.1.10 Element 10: Control Dewatering

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

Table 4 – Dewatering BMPs

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

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the 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

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

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
Mark Clearing Limits	High Visibility Plastic or Metal Fence (BMP C103)	05/01/2024	Dry
Mobilize equipment on site	Construction Road/Parking area stabilization (BMP C107)	05/01/2024	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)	05/01/2024	Dry
Install ESC measures	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220)	05/01/2024	Dry
Install stabilized construction entrance	Stabilized Construction Entrance (BMP C105)	05/01/2024	Dry
Begin clearing and grubbing	Dust Control (BMP C140)	05/15/2024	Dry
Site grading begins	Dust Control (BMP C140)	05/27/2024	Dry
Grade road and stabilize with gravel base	Dust Control (BMP C140)	05/27/2024	Dry
Begin excavation for new utilities and services		07/01/2024	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)	07/05/2024	Wet
Temporary erosion control measures (hydro-seeding)	Temporary Seeding (BMP C120)	09/01/2024	Wet
Site grading ends		09/15/2024	Wet
Begin pouring concrete curbs & sidewalks and implement	BMP C151 Concrete Handling (BMP C151) Sawcutting and Surfacing Pollution Prevention (BMP C152)	10/01/2024	Wet

Pave asphalt roads		11/05/2024	Wet
Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season	Scheduling (BMP C162) CESC Lead (BMP C160)	12/01/2024	Wet
Final landscaping and planting begins		02/1/2025	Dry
Permanent erosion control measures (hydro-seeding)	Permanent Seeding (BMP C120)	03/01/2025	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

C200: Interceptor Dike and Swale BMP
C207: Check Dams BMP
C233: Silt Fence BMP

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Brian Kalab	425-303-9363
Resident Engineer	Brian Kalab / Insight Engineering	425-303-9363
Emergency Ecology Contact	Tracy Walters	425-649-7000
Emergency Permittee/ Owner Contact	Larry Kiel	425-379-2844
Non-Emergency Owner Contact	Larry Kiel	425-379-2844
Monitoring Personnel	Tony Veslic	253-271-7870
Ecology Regional Office	Northwest Regional Office	425-649-7000

4 Monitoring and Sampling Requirements

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

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

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

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

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

4.1 Site Inspection

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

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

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

Table 8 – Turbidity Sampling Method

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

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

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

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

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

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

4.2.2 pH Sampling

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

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

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

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

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

Method for sampling pH:

Table 9 – pH Sampling Method

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

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

5.1 303(d) Listed Waterbodies

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?
☒ Yes ☐ No
List the impairment(s):

Constituent (Pollutant)	Location	Depth	Concentration
Dissolved Oxygen	SNOCO-QCLD, QA 140TH E	N/A	Sample Result >Criteria (8.0 mg/L)
pH	QA 140TH E	N/A	Sample Result excursion of the criteria

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

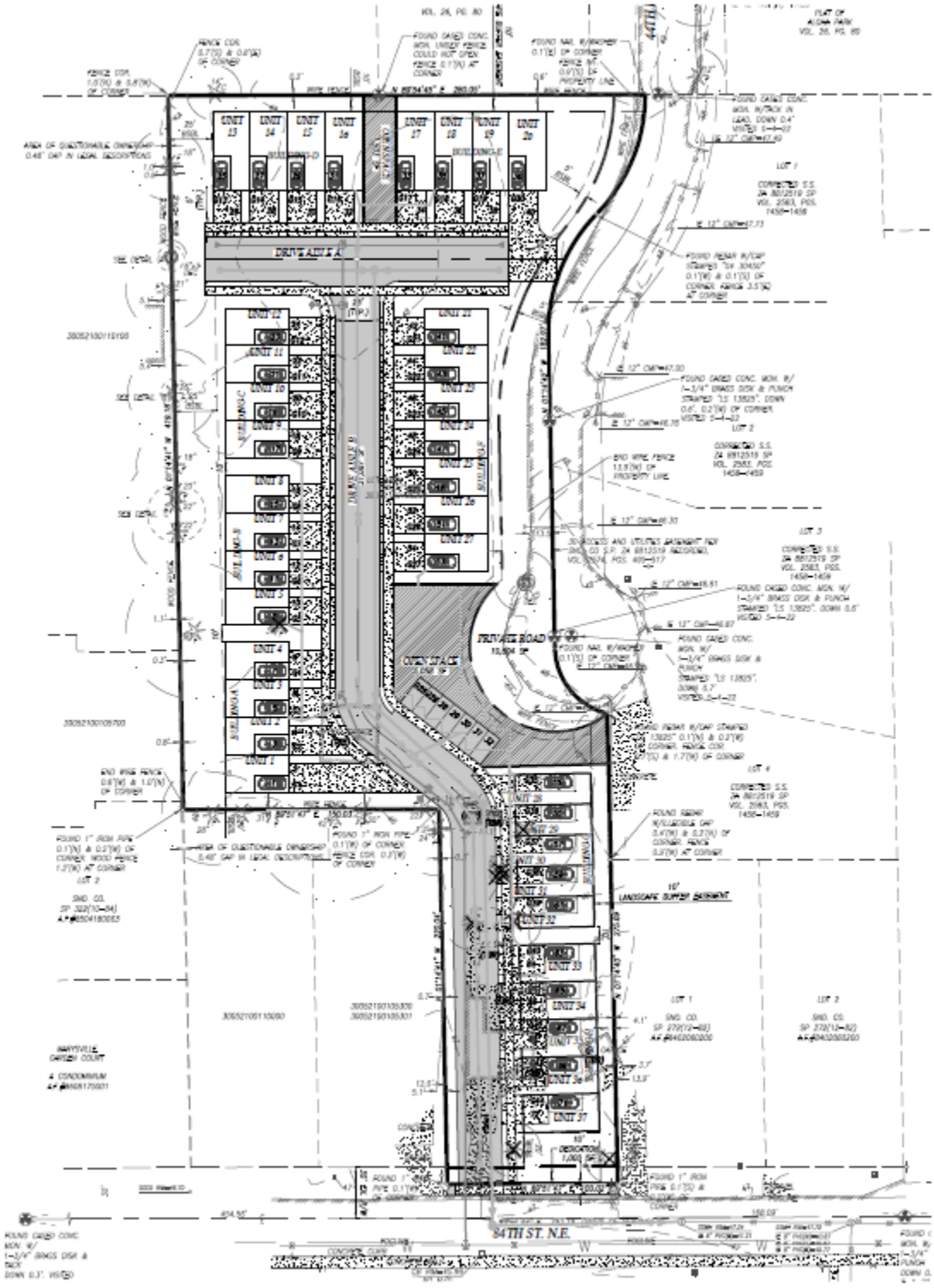
Include the following information:

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_2 sparging is planned for adjustment of high pH water.

Appendix/Glossary

A. Site Map


DRIVE AISLE A
DRIVE AISLE B
DRIVE AISLE C
PRIVATE ROAD
OPEN SPACE
84TH ST. N.E.
UNIT 1
UNIT 2
UNIT 3
UNIT 4
UNIT 5
UNIT 6
UNIT 7
UNIT 8
UNIT 9
UNIT 10
UNIT 11
UNIT 12
UNIT 13
UNIT 14
UNIT 15
UNIT 16
UNIT 17
UNIT 18
UNIT 19
UNIT 20
UNIT 21
UNIT 22
UNIT 23
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UNIT 28
UNIT 29
UNIT 30
UNIT 31
UNIT 32
UNIT 33
UNIT 34
UNIT 35
UNIT 36
UNIT 37
LANDSCAPE BUFFER EASEMENT

B. BMP Detail

Element#1- Preserve Vegetation / Mark Clearing Limits

- Preserving Natural Vegetation (BMP C101)
- 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)
- Nets and Blankets (BMP C122
- 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

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

C. Correspondence

Ecology
EPA
Local Government

D. Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

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

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

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

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

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

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

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

C. Questions:

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

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

_____

_____

_____

_____

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

Sampling Results: Date: _____

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

Construction Stormwater Site Inspection Form

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

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

Construction Stormwater Site Inspection Form

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

Construction Stormwater Site Inspection Form

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

E. Check all areas that have been inspected. ✔

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

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

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

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

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

Title/Qualification of Inspector: _____

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

6.0 Special Reports and Studies

A. LID FEASIBILITY ANALYSIS TABLE

Minimum Requirement #5 BMP	**INFEASIBILITY/EVALUATION CRITERIA FOR MR #5 BMPS.**	**Location of supporting documentation**
Lawn and landscaped areas: 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.
Roofs: 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 for the LDMR zoned project per Vol. V CH. 5 of the SWMMWW.
2.Downspout Full Infiltration Systems in accordance with BMP T5.10A in Volume III, Chapter 3 of this manual.	**Feasible**	The roof drains will be directed to the Stormtech with infiltration at the bottom.
3. Bioretention/Rain-Garden in accordance with Volume V, Chapter 7 of this manual.	**NA**	
4. For single-family residential roofs, Downspout Dispersion Systems in accordance with BMP T5.10B in Volume III, Chapter 3 of this manual.	**NA**	
5. Perforated Stub-out Connections in accordance with BMP T5.10C in Volume III, Chapter 3 of this manual.	**NA**	
Other Hard Surfaces:		
1. Full Dispersion in accordance with BMP T5.30 in Volume V, Chapter 5 of this manual.	**Infeasible**	Full Dispersion is infeasible because the required native vegetation preservation could not be achieved for the LDMR zoned project per Vol. V CH. 5 of the SWMMWW.

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.	**Infeasible**	The runoff from the driveways and the road will be directed to Stormtech with infiltration at bottom.
3. Bioretention in accordance with Volume V, Chapter 7 of this manual.	**NA**	
4. Sheet Flow Dispersion in accordance with BMP T5.12, or	**NA**	
5. Concentrated Flow Dispersion in accordance with BMP T5.11 in Volume V, Chapter 5 of this manual.	**NA**	

7.0 Other Permits

A right-of-way permit will be required for the city of Marysville.

8.0 Appendix

A. WWHM Report

B. Geotechnical Report

A. WWHM Report

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Stormtech
Site Name:	MSR Tuscany Woods
Site Address:	4407 84th ST NE
City:	Marysville
Report Date:	6/8/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Perdeveloped 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	1.62
Pervious Total	1.62
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.62

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Developed Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.46
ROOF TOPS FLAT	0.75
DRIVEWAYS FLAT	0.27
SIDEWALKS FLAT	0.14
Impervious Total	1.62
Basin Total	1.62

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	87.25 ft.
Bottom Width:	40.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	5
Pour Space of material for first layer:	0.67
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	1.5
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	252.229
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	252.229
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.

Element Flows To:
Outlet 1 Outlet 2

Gravel Trench Bed Hydraulic Table

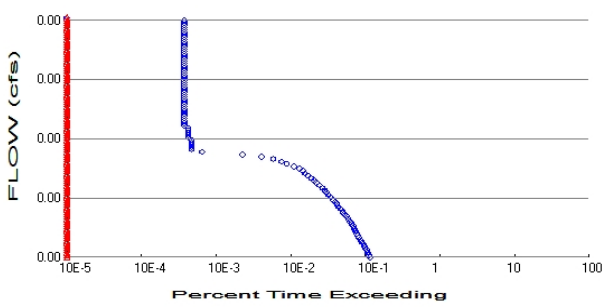
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.080	0.000	0.000	0.000
0.0667	0.080	0.003	0.000	0.121
0.1333	0.080	0.007	0.000	0.121
0.2000	0.080	0.010	0.000	0.121
0.2667	0.080	0.014	0.000	0.121
0.3333	0.080	0.017	0.000	0.121
0.4000	0.080	0.021	0.000	0.121
0.4667	0.080	0.025	0.000	0.121
0.5333	0.080	0.028	0.000	0.121
0.6000	0.080	0.032	0.000	0.121
0.6667	0.080	0.035	0.000	0.121
0.7333	0.080	0.039	0.000	0.121
0.8000	0.080	0.042	0.000	0.121
0.8667	0.080	0.046	0.000	0.121
0.9333	0.080	0.050	0.000	0.121
1.0000	0.080	0.053	0.000	0.121
1.0667	0.080	0.057	0.000	0.121
1.1333	0.080	0.060	0.000	0.121
1.2000	0.080	0.064	0.000	0.121
1.2667	0.080	0.068	0.000	0.121
1.3333	0.080	0.071	0.000	0.121
1.4000	0.080	0.075	0.000	0.121
1.4667	0.080	0.078	0.000	0.121
1.5333	0.080	0.082	0.000	0.121

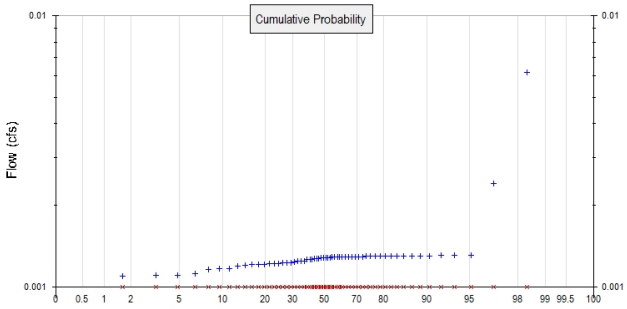
1.6000	0.080	0.085	0.000	0.121
1.6667	0.080	0.089	0.000	0.121
1.7333	0.080	0.093	0.000	0.121
1.8000	0.080	0.096	0.000	0.121
1.8667	0.080	0.100	0.000	0.121
1.9333	0.080	0.103	0.000	0.121
2.0000	0.080	0.107	0.000	0.121
2.0667	0.080	0.110	0.000	0.121
2.1333	0.080	0.114	0.000	0.121
2.2000	0.080	0.118	0.000	0.121
2.2667	0.080	0.121	0.000	0.121
2.3333	0.080	0.125	0.000	0.121
2.4000	0.080	0.128	0.000	0.121
2.4667	0.080	0.132	0.000	0.121
2.5333	0.080	0.136	0.000	0.121
2.6000	0.080	0.139	0.000	0.121
2.6667	0.080	0.143	0.000	0.121
2.7333	0.080	0.146	0.000	0.121
2.8000	0.080	0.150	0.000	0.121
2.8667	0.080	0.153	0.000	0.121
2.9333	0.080	0.157	0.000	0.121
3.0000	0.080	0.161	0.000	0.121
3.0667	0.080	0.164	0.000	0.121
3.1333	0.080	0.168	0.000	0.121
3.2000	0.080	0.171	0.000	0.121
3.2667	0.080	0.175	0.000	0.121
3.3333	0.080	0.178	0.000	0.121
3.4000	0.080	0.182	0.000	0.121
3.4667	0.080	0.186	0.000	0.121
3.5333	0.080	0.189	0.000	0.121
3.6000	0.080	0.193	0.000	0.121
3.6667	0.080	0.196	0.000	0.121
3.7333	0.080	0.200	0.000	0.121
3.8000	0.080	0.204	0.000	0.121
3.8667	0.080	0.207	0.000	0.121
3.9333	0.080	0.211	0.000	0.121
4.0000	0.080	0.214	0.000	0.121
4.0667	0.080	0.218	0.000	0.121
4.1333	0.080	0.221	0.000	0.121
4.2000	0.080	0.225	0.000	0.121
4.2667	0.080	0.229	0.000	0.121
4.3333	0.080	0.232	0.000	0.121
4.4000	0.080	0.236	0.000	0.121
4.4667	0.080	0.239	0.000	0.121
4.5333	0.080	0.243	0.000	0.121
4.6000	0.080	0.246	0.000	0.121
4.6667	0.080	0.250	0.000	0.121
4.7333	0.080	0.254	0.000	0.121
4.8000	0.080	0.257	0.000	0.121
4.8667	0.080	0.261	0.000	0.121
4.9333	0.080	0.264	0.000	0.121
5.0000	0.080	0.270	0.000	0.121
5.0667	0.080	0.275	0.000	0.121
5.1333	0.080	0.280	0.000	0.121
5.2000	0.080	0.286	0.000	0.121
5.2667	0.080	0.291	0.000	0.121
5.3333	0.080	0.296	0.000	0.121
5.4000	0.080	0.302	0.000	0.121

5.4667	0.080	0.307	0.000	0.121
5.5333	0.080	0.312	0.000	0.121
5.6000	0.080	0.318	0.000	0.121
5.6667	0.080	0.323	0.000	0.121
5.7333	0.080	0.328	0.000	0.121
5.8000	0.080	0.334	0.000	0.121
5.8667	0.080	0.339	0.000	0.121
5.9333	0.080	0.344	0.000	0.121
6.0000	0.080	0.350	0.000	0.121

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.62
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 1.62

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.001279
5 year	0.001558
10 year	0.00174
25 year	0.001966
50 year	0.002133
100 year	0.002301

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.001	0.000
1950	0.001	0.000
1951	0.001	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.001	0.000
1955	0.001	0.000
1956	0.001	0.000
1957	0.001	0.000
1958	0.001	0.000

1959	0.001	0.000
1960	0.001	0.000
1961	0.001	0.000
1962	0.001	0.000
1963	0.001	0.000
1964	0.001	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.001	0.000
1972	0.001	0.000
1973	0.001	0.000
1974	0.001	0.000
1975	0.001	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.001	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.001	0.000
1987	0.001	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.001	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.002	0.000
1997	0.006	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.001	0.000
2002	0.001	0.000
2003	0.001	0.000
2004	0.001	0.000
2005	0.001	0.000
2006	0.001	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.001	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0062	0.0000
2	0.0024	0.0000
3	0.0013	0.0000

4	0.0013	0.0000
5	0.0013	0.0000
6	0.0013	0.0000
7	0.0013	0.0000
8	0.0013	0.0000
9	0.0013	0.0000
10	0.0013	0.0000
11	0.0013	0.0000
12	0.0013	0.0000
13	0.0013	0.0000
14	0.0013	0.0000
15	0.0013	0.0000
16	0.0013	0.0000
17	0.0013	0.0000
18	0.0013	0.0000
19	0.0013	0.0000
20	0.0013	0.0000
21	0.0013	0.0000
22	0.0013	0.0000
23	0.0013	0.0000
24	0.0013	0.0000
25	0.0013	0.0000
26	0.0013	0.0000
27	0.0013	0.0000
28	0.0013	0.0000
29	0.0013	0.0000
30	0.0013	0.0000
31	0.0013	0.0000
32	0.0013	0.0000
33	0.0013	0.0000
34	0.0013	0.0000
35	0.0013	0.0000
36	0.0013	0.0000
37	0.0013	0.0000
38	0.0013	0.0000
39	0.0012	0.0000
40	0.0012	0.0000
41	0.0012	0.0000
42	0.0012	0.0000
43	0.0012	0.0000
44	0.0012	0.0000
45	0.0012	0.0000
46	0.0012	0.0000
47	0.0012	0.0000
48	0.0012	0.0000
49	0.0012	0.0000
50	0.0012	0.0000
51	0.0012	0.0000
52	0.0012	0.0000
53	0.0012	0.0000
54	0.0012	0.0000
55	0.0012	0.0000
56	0.0012	0.0000
57	0.0011	0.0000
58	0.0011	0.0000
59	0.0011	0.0000
60	0.0011	0.0000
61	0.0010	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0006	2496	0	0	Pass
0.0007	2385	0	0	Pass
0.0007	2291	0	0	Pass
0.0007	2205	0	0	Pass
0.0007	2116	0	0	Pass
0.0007	2036	0	0	Pass
0.0007	1941	0	0	Pass
0.0007	1857	0	0	Pass
0.0008	1761	0	0	Pass
0.0008	1705	0	0	Pass
0.0008	1650	0	0	Pass
0.0008	1593	0	0	Pass
0.0008	1517	0	0	Pass
0.0008	1455	0	0	Pass
0.0009	1389	0	0	Pass
0.0009	1327	0	0	Pass
0.0009	1258	0	0	Pass
0.0009	1197	0	0	Pass
0.0009	1121	0	0	Pass
0.0009	1064	0	0	Pass
0.0009	996	0	0	Pass
0.0010	939	0	0	Pass
0.0010	891	0	0	Pass
0.0010	846	0	0	Pass
0.0010	793	0	0	Pass
0.0010	741	0	0	Pass
0.0010	692	0	0	Pass
0.0010	648	0	0	Pass
0.0011	608	0	0	Pass
0.0011	566	0	0	Pass
0.0011	518	0	0	Pass
0.0011	469	0	0	Pass
0.0011	439	0	0	Pass
0.0011	402	0	0	Pass
0.0012	365	0	0	Pass
0.0012	336	0	0	Pass
0.0012	308	0	0	Pass
0.0012	280	0	0	Pass
0.0012	234	0	0	Pass
0.0012	188	0	0	Pass
0.0012	163	0	0	Pass
0.0013	125	0	0	Pass
0.0013	87	0	0	Pass
0.0013	48	0	0	Pass
0.0013	14	0	0	Pass
0.0013	10	0	0	Pass
0.0013	10	0	0	Pass
0.0013	10	0	0	Pass
0.0014	10	0	0	Pass
0.0014	10	0	0	Pass
0.0014	9	0	0	Pass
0.0014	9	0	0	Pass
0.0014	9	0	0	Pass

0.0014	9	0	0	Pass
0.0015	9	0	0	Pass
0.0015	8	0	0	Pass
0.0015	8	0	0	Pass
0.0015	8	0	0	Pass
0.0015	8	0	0	Pass
0.0015	8	0	0	Pass
0.0015	8	0	0	Pass
0.0016	8	0	0	Pass
0.0016	8	0	0	Pass
0.0016	8	0	0	Pass
0.0016	8	0	0	Pass
0.0016	8	0	0	Pass
0.0016	8	0	0	Pass
0.0017	8	0	0	Pass
0.0017	8	0	0	Pass
0.0017	8	0	0	Pass
0.0017	8	0	0	Pass
0.0017	8	0	0	Pass
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0.0018	8	0	0	Pass
0.0019	8	0	0	Pass
0.0019	8	0	0	Pass
0.0019	8	0	0	Pass
0.0019	8	0	0	Pass
0.0019	8	0	0	Pass
0.0019	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0020	8	0	0	Pass
0.0021	8	0	0	Pass
0.0021	8	0	0	Pass
0.0021	8	0	0	Pass
0.0021	8	0	0	Pass
0.0021	8	0	0	Pass
0.0021	8	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Gravel Trench Bed 1 POC	☐	229.53			☐	100.00			
Total Volume Infiltrated		229.53	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

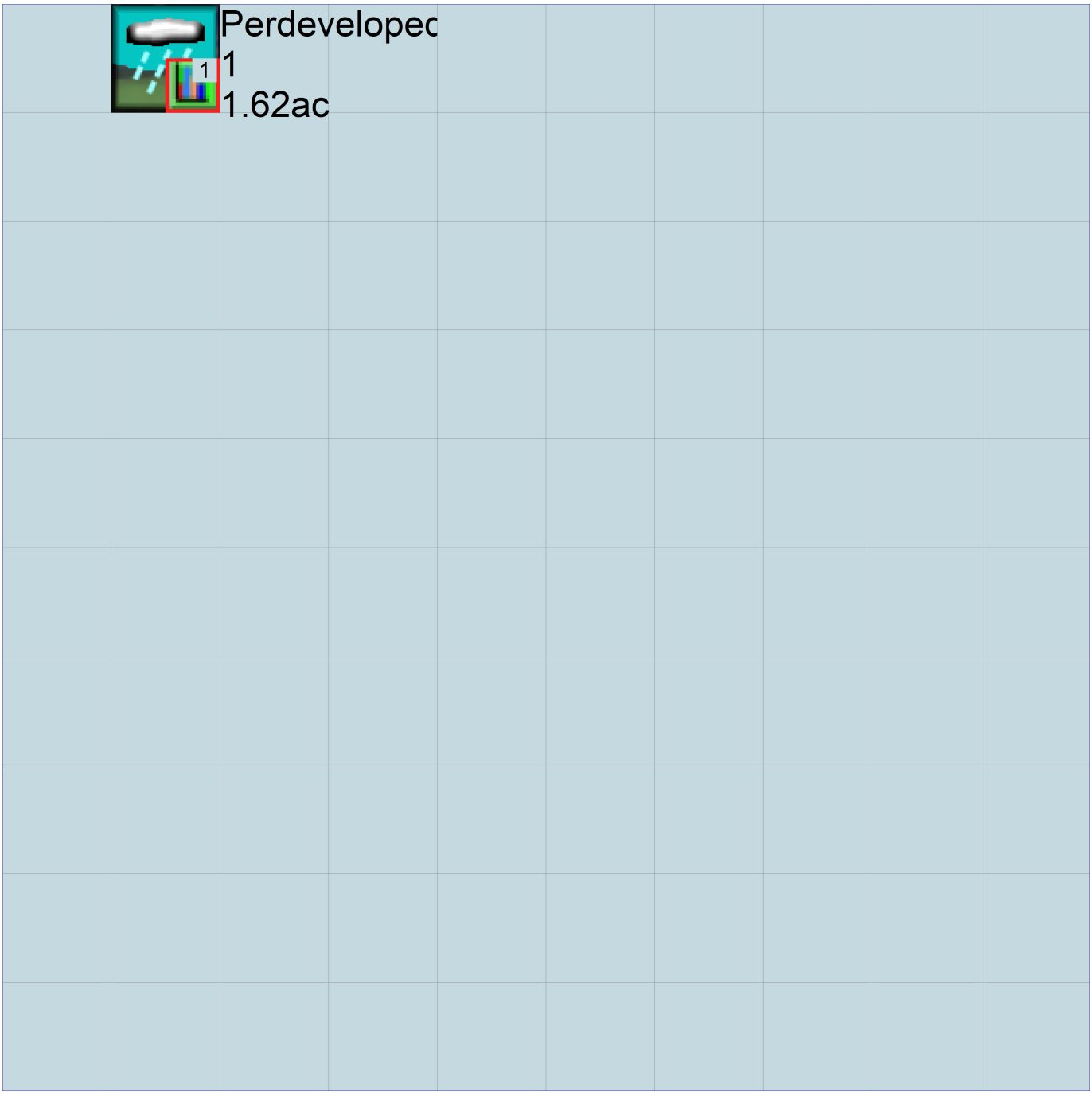
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic

B. Geotechnical Report

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
4407 – 84TH STREET NORTHEAST
MARYSVILLE, WASHINGTON

ES-8608

15365 N.E. 90th Street, Suite 100 Redmond, WA 98052
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

MSR COMMUNITIES, LLC

June 20, 2022

06/20/2022

Raymond A. Coglas, P.E.
Principal Engineer

GEOTECHNICAL ENGINEERING STUDY
4407 – 84TH STREET NORTHEAST
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Redmond, Washington 98052
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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

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

June 20, 2022
ES-8608

MSR Communities, LLC
18323 Bothell-Everett Highway, Suite 310
Bothell, Washington 98012

Attention: Mr. Ravi Teja Gottapu

Dear Mr. Teja Gottapu:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, 4407 – 84th Street Northeast, Marysville, Washington". Although development plans and feasibility are currently being evaluated, we anticipate final site development activities will involve construction of a residential plat and related site infrastructure improvements. The subject property is roughly 2.76 acres and is identified as Snohomish County Parcel 30052100105200. A single residential structure and several outbuildings currently occupy the southerly end of the property along (and near) the 84th Street Northeast frontage. The remainder of the site is undeveloped and comprised of a fairly large and sparsely forested grass field open area. Overall topography is gently sloping to flat. Based on review of the City of Marysville Geologic Hazards mapping (2014), there are no geologic hazardous areas identified within or immediately adjacent to the subject site.

Onsite investigation completed in May (2022) suggests that sand deposits associated with the Marysville Sand Member are present at-depth throughout the entirety of the site. On this basis, and given the overall findings of this geotechnical engineering study, residential site development activities as planned are considered feasible from a geotechnical standpoint. Additional findings of this investigation and pertinent design criteria and recommendations are provided within this body of this geotechnical study.

We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Raymond A. Coglas, P.E.
Principal Engineer

Table of Contents

ES-8608

Table of Contents

Cont'd

ES-8608

GEOTECHNICAL ENGINEERING STUDY
4407 – 84TH STREET NORTHEAST
MARYSVILLE, WASHINGTON

ES-8608

INTRODUCTION

General

This geotechnical engineering study was prepared for the subject property located at 4407 – 84th Street Northeast in Marysville, Washington. The Vicinity Map (Plate 1) provided in this study illustrates the approximate location of the site. This study provides the results of site-specific subsurface investigation, site reconnaissance work, and geotechnical analyses. The scope of service for completing this geotechnical engineering study included the following:

- Review of available geotechnical information and maps relevant to the site and surrounding area;
- Site specific subsurface investigation (excavation of 5 test pits);
- Site reconnaissance and observations of overall existing conditions;
- Review of a currently available geologic maps, critical areas mapping, and other relevant surveys and studies, and;
- Preparation of this final geotechnical study presenting the results of our investigation and recommendations for design.

The following documents/maps were reviewed as part of our report preparation:

- City of Marysville, Geologic Hazards (Map), 2014;
- City of Marysville Municipal Code, Ch. 22E.010 (Article IV);
- Faults and Earthquakes In Washington State, Jessica L. Czajkowski1 and Jeffrey D. Bowman;
- Geologic map of the Marysville Quadrangle, Snohomish County, Washington, Miscellaneous Field Studies Map 1743, By: J.P. Minard, and;
- Web Soil Survey (WSS) online resource, maintained by the Natural Resources Conservation Service (NRCS) under the United States Department of Agriculture.

Project Description

Although development plans and feasibility are currently being evaluated, we anticipate final site development activities will involve construction of a residential plat and related site infrastructure improvements. An existing single-family residence positioned at the south end of the site and remaining areas of the site to the north would likely be entirely cleared to make way for the new development. Due to the relatively flat existing grade, we anticipate site mass grading activities will only necessitate relatively minor cuts and fill (generally less than 5 feet). Stormwater may incorporate some form of infiltration into the natural sand deposits identified onsite. Otherwise, detention and discharge to established offsite conveyance will be utilized. Building design loads are expected to be relatively light, with wood frame wall loads of roughly 2 kips per foot and slab-on-grade loading of 150 psf.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review the final design to verify the geotechnical recommendations provided in this report have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject property is roughly 2.76 acres and is identified as Snohomish County Parcel 30052100105200 (see Vicinity Map – Plate 1 for site location). A single residential structure and several outbuildings currently occupy the southerly end of the property along (and near) the 84th Street Northeast frontage. The remainder of the site is undeveloped and comprised of a fairly large and sparsely forested grass field open area. Overall topography is gently sloping to flat. Based on review of the City of Marysville Geologic Hazards mapping (2014), there are no geologic hazardous areas identified within or immediately adjacent to the subject site.

Subsurface

To complete the site subsurface investigation, five test pits were excavated throughout representative locations of the subject property. Plate 2 of this study (Test Pit Location Plan) illustrates the approximate locations of the test sites. With the exception of the existing developed areas of the site, sod and topsoil comprise the vast majority of the surface condition. The topsoil depth exposed at the test locations generally did not exceed 12 inches. Native sand with silt transitioning to clean sands at-depth were identified below the topsoil at each test site. Please see the test pit logs included in Appendix A of this study for a more detailed description of the encountered subsurface condition.

Geologic Setting

The referenced Geologic Map of the Marysville Quadrangle identifies the Marysville Sand Member (Qvrm) underlies the entirety of the subject site and surrounding areas. According to the referenced geologic map, the Marysville Sand Member deposits fill a broad, flat, north-south valley in the Marysville area. These deposits consist primarily of well-drained, stratified to massive outwash sand, some fine gravel, and local sequences of silt and clay. The sand deposit was laid down by meltwater emanating from the north receding (and stagnating) Vashon glacier.
With respect to the NRCS soil survey, Ragnar fine sandy loam, 0 to 8 percent slopes is identified throughout the site and surrounding areas. The Ragnar fine sandy loam is characterized by the NRCS as Hydrologic Group A with depth to water of more than 80 inches.

Groundwater

Groundwater was identified at several test pit locations during the May 2022 site investigation. In general, the groundwater table that resides at depth regionally within the Marysville Sand Member was identified at depths of roughly 7.5 to 8.5 feet below the existing ground surface. In our experience, seasonal fluctuations of several feet are typical within the native sand member. On this basis, winter season monitoring of groundwater fluctuations (or review of available data in the area) is generally recommended if an infiltration approach to accommodating site storm water is pursued. In any case, the contractor should be prepared to dewater deeper excavations (such as utility installation) during the course of the site development activities. Typical of the Puget Sound area, groundwater levels and seepage rates are generally higher during the wet season (generally October through May).

Critical Areas Assessment

Based on review of the referenced Marysville Geologic Hazard Map (2014), steep slope, landslide, or seismic hazard areas are not identified on the site. Further these hazards are not identified on surrounding properties within 500 feet of the subject property. As such, no further geotechnical assessment of geologic hazards is deemed necessary for the future development.

DISCUSSION AND RECOMMENDATIONS

General

Provided the recommendations of this geotechnical engineering study are incorporated into final development plans, residential construction and related site improvements at the subject property are considered feasible from a geotechnical standpoint. Based on the identified subsurface condition, future building structures may be supported on conventional foundations bearing on a well compacted subgrade comprised of the native sand or equivalent structural fill material. The following sections of this study provide geotechnical recommendations for purposes of assisting with the final site designs.

This study has been prepared for the exclusive use of MSR Communities, LLC and their representatives. No warranty, expressed or implied, is made. This report has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Initial site preparation activities will consist of site clearing and stripping (as necessary), installing temporary erosion control measures, and establishing grading limits. An ESNW representative should be onsite during stripping activities to evaluate and document the necessary stripping depths (over stripping of site surfaces should be avoided). Additionally, it should be noted that voids present around areas of demolition (if applicable) should be restored with structural fill.

Temporary Erosion Control

Temporary construction entrances and drive lanes consisting of at least six inches of quarry spalls should be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. Geotextile fabric may also be considered underlying the quarry spalls for greater stability of the temporary construction entrance. Erosion control measures should consist of silt fencing or similar sediment barriers placed around the perimeter, especially down gradient portions of the site. Soil stockpiles should be covered or otherwise protected to reduce soil erosion during inclement weather. Temporary measures for controlling surface water runoff during construction should be established prior to beginning earthwork activities. Additional BMPs should be incorporated into construction activities as specified on the TESC plan, and as recommended by the geotechnical engineer or CESCL.

Wet Season Grading

Soils excavated and stockpiled during mass grading activities should be protected from excessive moisture or extended rainfall. As such, if grading takes place during the wetter winter, spring, or early summer months, a contingency should be included in the project budget to address managing and protecting soil stockpiles from wet weather. Similarly, consideration should also be given to including a contingency in the project budget for export of soils that become too wet and unsuitable for use as structural fill. Soil amendment and related cement treatment of saturated soils may also be an option for this project.

In-situ Soils

From a geotechnical standpoint, the native soils deposits may be suitable for use as structural fill provided the moisture content of the soil is at or near the (field) optimum level at the time of placement and compaction. Remedial measures, such as soil aeration, may be necessary as part of site grading and earthwork activities. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. As such, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill. Such a contingency would most likely be necessary if grading activities take place during extended periods of rainfall activity (wet season). It should be noted that soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of extended rainfall during active grading operations.

Imported Soils

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or near) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). The geotechnical engineer (or his representative) should work with the contractor to evaluate suitability of imported soil proposed for use in structural fill areas.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, reinforced fill zones, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D-1557). If deemed appropriate by the geotechnical engineer, a minimum relative compaction of 90 percent may also be acceptable during overall mass grading activities depending on the specific application. Additionally, where structural fill will be placed on an existing slope surface, a series of keyway excavations should be constructed to better secure to the fill to the native slope surface. With respect to soil placed in utility trenches, pavement areas and in the upper 12 inches of slab-on-grade areas, a relative compaction of at least 95 percent should be obtained. Additionally, specifications for utility trench backfill and compaction may also be dictated by the responsible utility district or jurisdiction.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Soils that exhibit a high compressive strength are allowed steeper temporary slope inclinations than are soils that exhibit lower strength characteristics.

Based on the identified soil conditions, Type C soil conditions are likely to be most prevalent across the site. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than 1.5H:1V (Horizontal:Vertical). Type A soils may also be exposed in excavations advanced within the underlying glacial deposits. The geotechnical engineer (or his representative) should observe site excavations to confirm the soil type and allowable slope inclination are appropriate for the soil exposed by the excavation.

As a general rule, permanent slopes should maintain a gradient of 2H:1V, or flatter, and should be planted with vegetation to enhance stability and to minimize erosion. In some instances, permanent slope inclinations steeper than 2H:1V may be permissible pending further assessment by the geotechnical and civil engineers. In any case, the geotechnical engineer (or representative) should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions, and to provide additional excavation and slope recommendations, as necessary.

Gravity and/or Mechanically Stabilized Landscape Walls

The planned site grading activities may incorporate construction of gravity or mechanically stabilized earth landscape walls of limited height for the purpose of facilitating grade transitions. In our opinion, application of these wall systems is considered feasible from a geotechnical standpoint. A formal wall design with supporting calculations should be prepared (where applicable) as part of final design and preparation of the construction plan set. Rockery, segmental, and block style wall types are considered feasible for site applications, pending preparation of an engineered design.

Foundations

Based on the results of our study, future residential structures may be supported on a conventional foundation system bearing on a properly prepared and well compacted subgrade comprised of the native sand deposits or equivalent structural fill material. Assuming preparation of a suitable subgrade surface (as confirmed by the engineer or his representative during construction), the following values may be used for foundation design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of approximately one-half inch is anticipated. The majority of anticipated settlement should occur during construction as dead loads are applied.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on a firm and unyielding (well compacted) subgrade. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill prior to placement of the slab capillary break material. A capillary break consisting of a minimum of four inches of free draining crushed rock or gravel should be placed below the slab. The free draining crushed rock or gravel material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Seismic Design

The 2018 International Building Code (IBC) recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions (ASCE 7-16). As such, and based on geologic mapping and soil conditions identified at the exploration sites, Site Class D (stiff soil profile) should be used for design. Liquefaction is a phenomenon where saturated or loose soils suddenly lose internal strength and behave as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or other intense ground shaking. As previously discussed, City of Marysville Geologic Hazard mapping does not identify the site or surrounding areas as prone to liquefaction. Additionally, based on the identified soil condition, it is our professional opinion that the site possesses a low susceptibility to liquefaction. It should also be noted that based on review of the referenced "Faults and Earthquakes In Washington State" mapping, there are no identified faults located near the site or surrounding properties.

Cast-In-Place Retaining Walls

Cast-in-place retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 50 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 6H psf*

** H equals the retained height (in feet).*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil, if desired. It should be noted that some wall backfill applications may allow for use of a sheet drain material in lieu of free draining rock or gravel. The geotechnical engineer should be consulted where such applications are proposed to confirm acceptability. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical Retaining Wall Drainage Detail is provided on Plate 3. If drainage is not provided, hydrostatic pressure should be considered in the wall design.

Drainage

Temporary measures to control surface water runoff during construction would likely involve interceptor trenches, berms, temporary ponds, or other pertinent BMP's. With respect to groundwater, the contractor should be prepared to dewater deeper site excavations (such as deeper utility trench excavations) during construction. Finish grades must be designed to direct surface water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration

The Marysville sand deposits identified throughout the site are considered conducive to infiltration. Groundwater was observed at depths of roughly 7.5 to 8.5 feet below existing grade at the time of our May 2022 investigation. As such, facility design would need to consider appropriate separation between the seasonal high groundwater level and any future infiltration device. It should be noted that the identified groundwater level(s) at the time of our May 2022 investigation is not what we would consider the seasonally high level. Further assessment of the seasonal high groundwater level (and possible winter monitoring) will be needed to ascertain a seasonal high water level for design purposes. In any case, for preliminary design purposes, an allowable infiltration rate of 1.5 inches per hour can be assumed at this time. This preliminary rate should be confirmed through insitu infiltration testing during the design phase of the project.

Utility Support and Trench Backfill

In our opinion, on-site soils will generally be suitable for support of utilities. Remedial measures may be necessary in some areas in order to provide support for utilities such as overexcavation and replacement with structural fill, or placement of geotextile fabric. In general, on-site soils may be suitable for use as structural backfill throughout utility trench excavations. Such suitability will largely be dictated by the moisture content of the soil at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. In any case, each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the responsible jurisdiction or agency.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should exhibit a firm and unyielding condition when subjected to proof rolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

Where applicable, and for preliminary purposes, the following pavement sections may be considered for the site access drive roadway:

- A minimum of two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the governing jurisdiction may supersede the recommendations provided in this report. The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557.

LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions identified at the test locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.

NORTH

Reference:
Snohomish County, Washington
OpenStreetMap.org

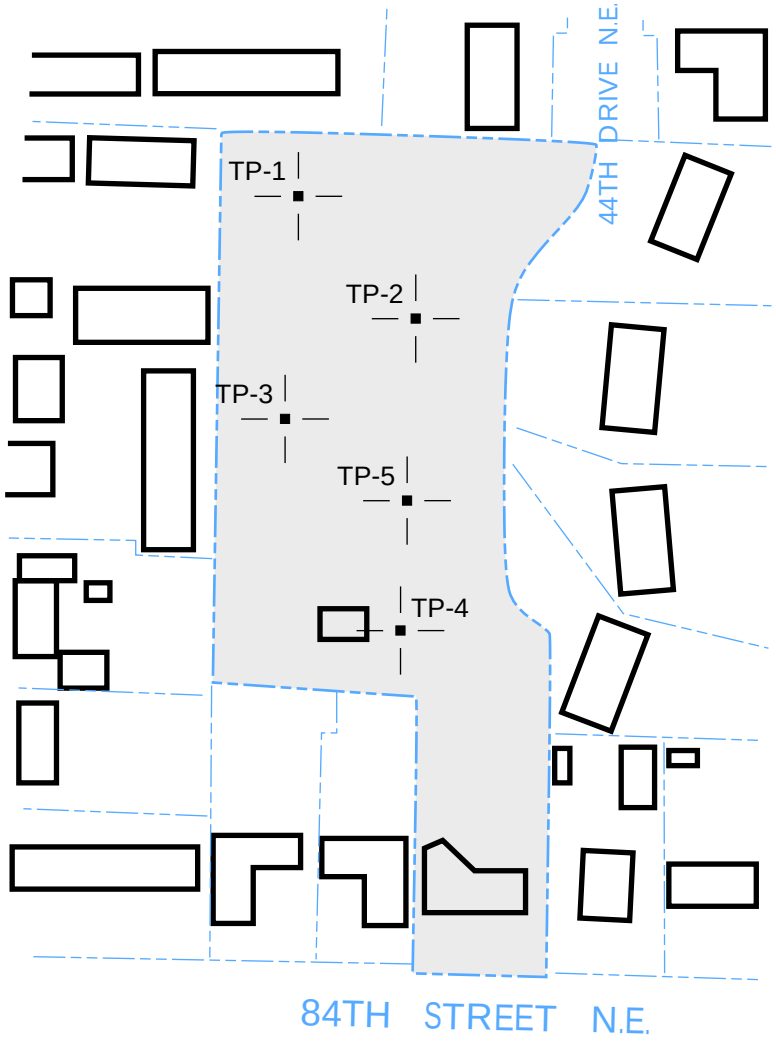
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
4407 - 84th Street N.E.
Marysville, Washington

Drwn. CAM	Date 06/20/2022	Proj. No. 8608
Checked RAC	Date June 2022	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-8608, May 2022

Subject Site

Existing Building

NORTH

NOT - TO - SCALE

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

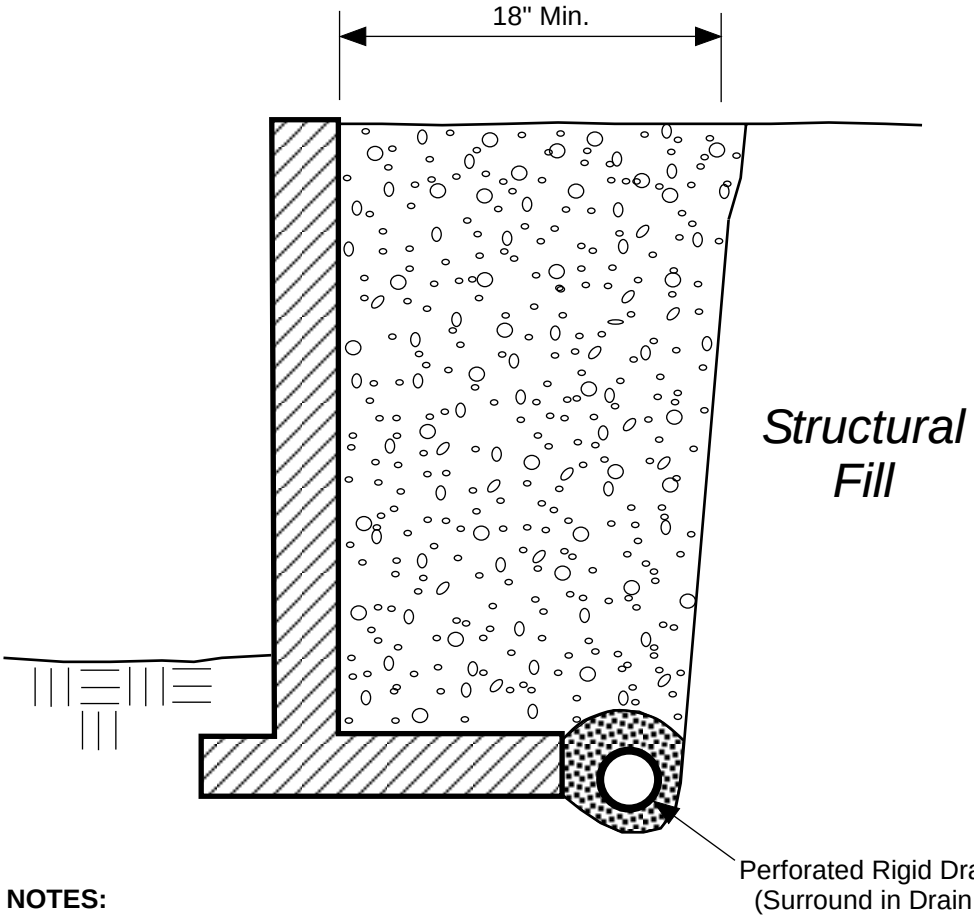
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
4407 - 84th Street N.E.
Marysville, Washington

Drwn. CAM	Date 06/20/2022	Proj. No. 8608
Checked RAC	Date June 2022	Plate 2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Free-draining Structural Backfill

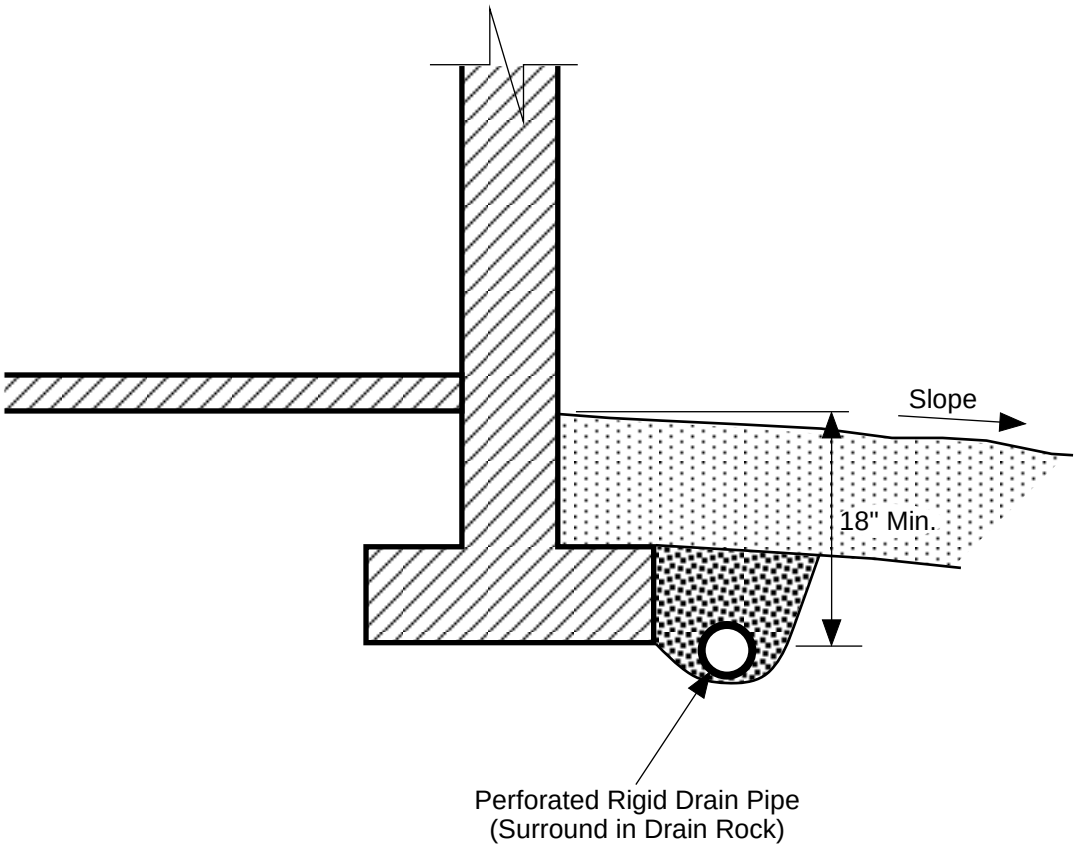
1-inch Drain Rock

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
4407 - 84th Street N.E.
Marysville, Washington

Drwn. CAM	Date 06/20/2022	Proj. No. 8608
Checked RAC	Date June 2022	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

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

Footing Drain Detail
4407 - 84th Street N.E.
Marysville, Washington

Drwn. CAM	Date 06/20/2022	Proj. No. 8608
Checked RAC	Date June 2022	Plate 4

Appendix A

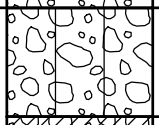
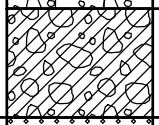
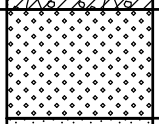
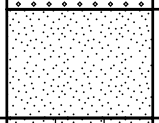
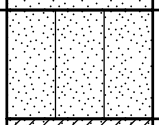
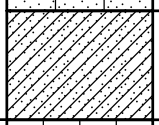
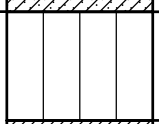
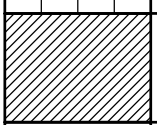
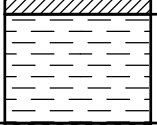
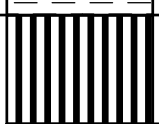
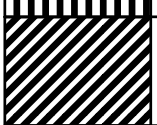
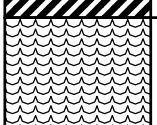
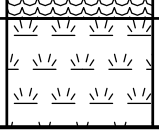
Subsurface Exploration
Test Pit Logs

ES-8608

The subsurface conditions at the site were explored by excavating five test pits. The approximate locations of the test pits are depicted on the Test Pit Location Plan (Plate 2). The subsurface test pit logs are provided in this Appendix. The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.

DATE STARTED 5/6/22 **COMPLETED** 5/6/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Loren Harris **LATITUDE** **LONGITUDE**

LOGGED BY WR **CHECKED BY** RAC **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION** 8.5 ft

SURFACE CONDITIONS Sod/Topsoil **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL		Sod and TOPSOIL
				0.7	
			SP-SM		Brown poorly graded SAND with silt, loose to medium dense, moist
	GB	MC = 10.0% Fines = 5.9%			
2.5				2.0	
			SP		Grades to brown poorly graded SAND, medium dense, moist [USDA Classification: slightly gravelly SAND]
5.0					
7.5	GB	MC = 22.1%			
					▽ -groundwater table
				9.0	

Test pit terminated at 9.0 feet below existing grade. Groundwater table encountered at 8.5 feet during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.

DATE STARTED 5/6/22 **COMPLETED** 5/6/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Loren Harris **LATITUDE** **LONGITUDE**

LOGGED BY WR **CHECKED BY** RAC **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Sod/Topsoil **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL		Sod and TOPSOIL
0.5			SM		Brown silty fine SAND, loose, wet
1.5	GB	MC = 16.8% Fines = 14.0%	SP		Grades to brown poorly graded SAND, loose to medium dense, moist [USDA Classification: slightly gravelly SAND]
2.5					
5.0	GB	MC = 9.3%			
7.0					

Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.

DATE STARTED 5/6/22 **COMPLETED** 5/6/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Loren Harris **LATITUDE** **LONGITUDE**

LOGGED BY WR **CHECKED BY** RAC **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION** 7.5 ft

SURFACE CONDITIONS Sod/Topsoil **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL		Sod and TOPSOIL
				0.5	
			SP-SM		Brown poorly graded SAND with silt, loose, moist to wet
				1.5	
	GB	MC = 10.6%	SP		Grades to brown poorly graded SAND, medium dense, moist
2.5					
5.0	GB	MC = 6.6% Fines = 0.8%			[USDA Classification: slightly gravelly SAND]
7.5					▽ -groundwater table
				8.0	

Test pit terminated at 8.0 feet below existing grade. Groundwater table encountered at 7.5 feet during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.

DATE STARTED 5/6/22 **COMPLETED** 5/6/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Loren Harris **LATITUDE** **LONGITUDE**

LOGGED BY WR **CHECKED BY** RAC **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Sod/Topsoil **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL		Sod and TOPSOIL
				0.5	
			SP-SM		Brown poorly graded SAND with silt, loose, moist
				1.5	
	GB	MC = 7.4%	SP		Grades to brown poorly graded SAND, medium dense, moist
2.5					
5.0	GB	MC = 10.4% Fines = 2.5%			[USDA Classification: slightly gravelly coarse SAND]
				7.0	

Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.

DATE STARTED 5/6/22 **COMPLETED** 5/6/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Loren Harris **LATITUDE** **LONGITUDE**

LOGGED BY WR **CHECKED BY** RAC **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Sod/Topsoil **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL		Sod and TOPSOIL
0.5					Brown poorly graded SAND with silt, loose, moist
2.5	GB	MC = 7.8%	SP-SM		
5.0	GB	MC = 18.3% Fines = 5.3%			[USDA Classification: slightly gravelly SAND]
7.0					

Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Appendix B

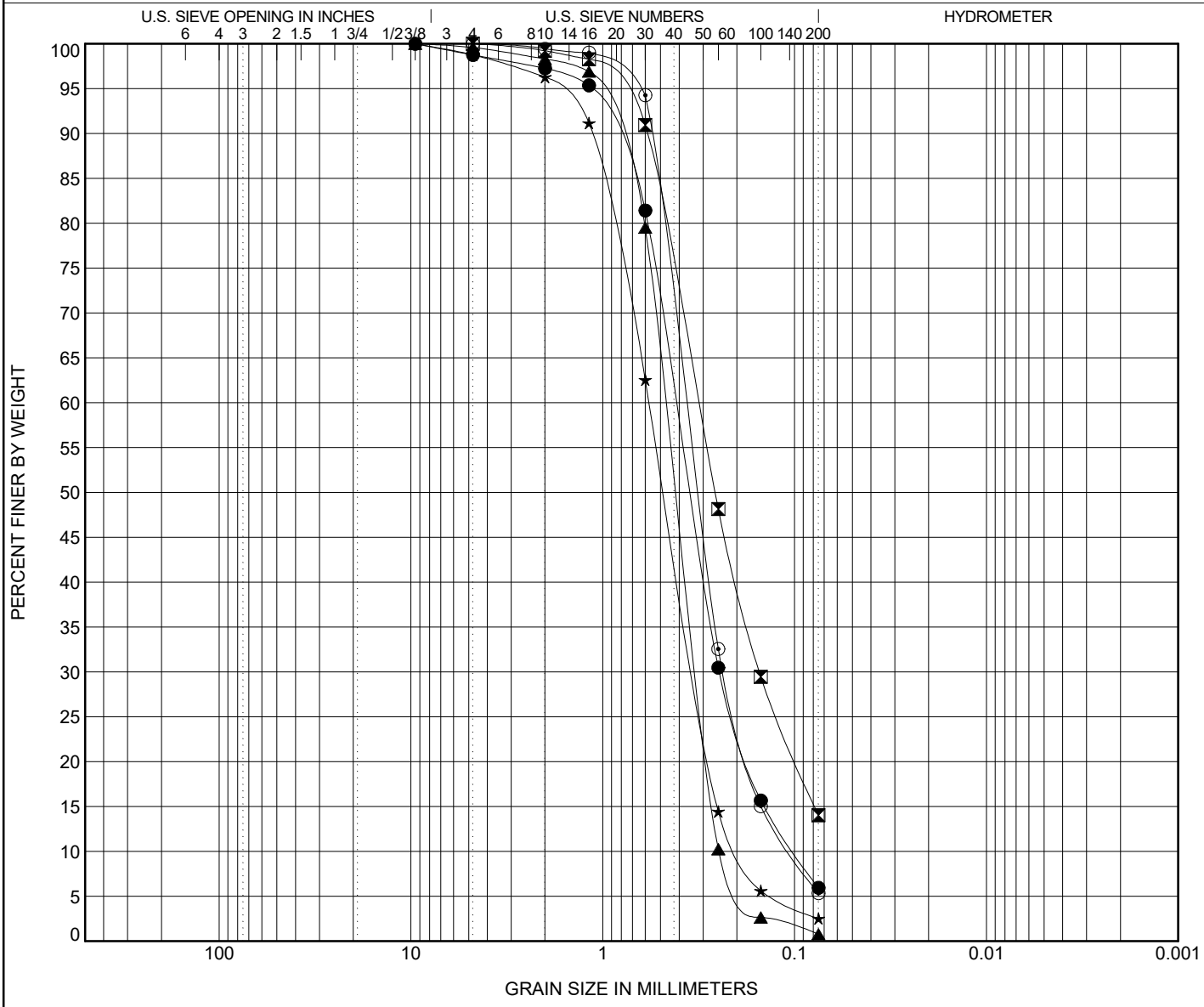
Laboratory Test Results

ES-8608

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8608 **PROJECT NAME** 4407 - 84th Street N.E.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-01	2.00ft.	USDA: Brown Slightly Gravelly Sand. USCS: SP-SM.	1.45	4.15
⊠	TP-02	2.00ft.	USDA: Brown Slightly Gravelly Sand. USCS: SM.		
▲	TP-03	6.00ft.	USDA: Gray-Brn Slightly Gravelly Sand. USCS: SP.	0.89	1.91
★	TP-04	6.00ft.	USDA: Gray-Brn Slightly Gravelly Coarse Sand. USCS: SP.	0.99	2.96
⊙	TP-05	6.00ft.	USDA: Gray-Brn Slightly Gravelly Sand. USCS: SP-SM.	1.39	3.53

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	2.0ft.	9.5	0.415	0.246	0.1				5.9	
⊠	TP-02	2.0ft.	4.75	0.319	0.152					14.0	
▲	TP-03	6.0ft.	9.5	0.469	0.321	0.246				0.8	
★	TP-04	6.0ft.	9.5	0.573	0.332	0.193				2.5	
⊙	TP-05	6.0ft.	4.75	0.369	0.232	0.105				5.3	

Report Distribution

ES-8608

EMAIL ONLY

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