STORMWATER SITE PLAN
EAGLEMONT-PHASE III-C
PRELIMINARY PLAT
MOUNT VERNON, WA

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1.0 Site Information

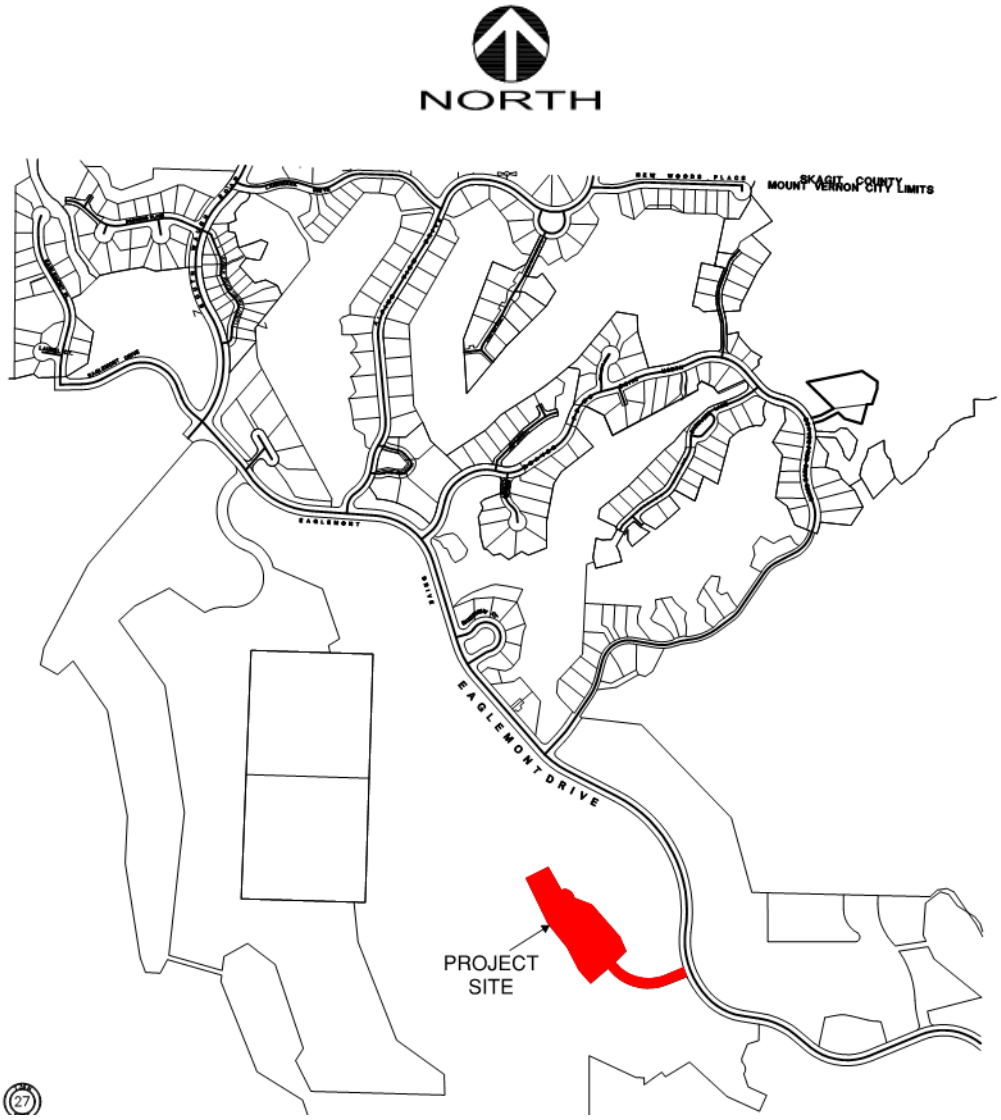


Figure 1: Vicinity Map - Not To Scale

1.1 - Executive Summary

Polyield Summit, LLC is proposing to construct a planned unit development (PUD) as part of Eaglemont Phase III-C, the project proposes a 19-lot plat on the 3.72 acre parcel located at approximately 4800 Eaglemont Drive in Mount Vernon, WA 98273, tax parcel number P133779. The parcel is bordered on all sides by Eaglemont Golf Course which is owned and operated by Eaglemont Operating Partners USA, LLC. To the south is the Eaglemont Clubhouse and parking lot. To the east is Eaglemont Drive which runs relatively north south. The project site is accessible via public drive existing from the previously constructed clubhouse parking lot.

Project location is in southeast Mount Vernon, WA approximately 1.7 to the northwest of Big Lake. As stated before the parcel is surrounded by golf course property, but beyond the golf course property to the south, east and west are wooded areas, with intermittent single family developments to the north toward Mount Vernon.

This project proposes the construction of 19 lots on the parcel. The parcel has been cleared, mulched and seeded to protect against erosion. Silt fencing is installed around the perimeter of the area in order to prevent any sediment from leaving the site.

Existing stormwater runoff on site currently sheet flows away from the center of the site in all directions. Where pavement currently exists at the access point to/from Eaglemont Drive, stormwater runoff sheet flows along the gutter and into the existing storm conveyance system that was constructed with the Eaglemont Golf Course Clubhouse. Storm drainage from portions of the site not tributary to the existing conveyance system shall be dispersed through native vegetation before reaching the golf course.

1.2 – Minimum Requirements

This report provides stormwater requirements and design calculations for the proposed improvements. The project will result in more than 7,000 square feet of disturbing land activity; Therefore, in accordance with Figure 2.4.2 in Volume I of the 2012 Stormwater Management Manual for Western Washington (SMMWW), all Minimum Requirements will apply to this project.

<u>Minimum Requirement #1: Preparation of Stormwater Site Plans</u>

A Stormwater Site Plan has been prepared for the project. Full size clearing plans have been included with this submittal and a reduced size copy is included in within the appendix of this report. The USDA Soil Conservation Service has classified the soils as Dystric Xerochrepts-Rock outcrop complex slopes and Tokul gravelly medial loam. Per table 2.3.1 of volume III in the DOE manual, both soils are considered to be within Hydrologic Soil Group B.

This report and accompanying plans constitute the Stormwater Site Plan.

Minimum Requirement #2: Stormwater Pollution Prevention Plan

A SWPPP has been prepared for this project. Erosion control best management practices (BMPs) which fulfill the minimum erosion control requirements outlined by the Department of Ecology will be installed and maintained during the clearing. The thirteen elements of the SWPPP are summarized in Section 7.0 of this report.

Minimum Requirement #3: Source Control of Pollution

All applicable source control BMPs have been considered for use on the project site. All applicable maintenance BMPs will be included in ongoing use of the site.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Existing drainage patterns on-site include sheet flow in all directions as a high point is located near the center of the project site. Existing drainage flowing easterly toward the paved access road is tributary to the existing stormwater conveyance system of the Eaglemont Clubhouse and parking lot. Storm drainage from all other areas sheet flow away from the property through natively vegetated areas and are dispersed toward the surrounding golf course. Drainage within this Basin is tributary to the Skagit River. All drainage from the proposed developed site will discharge into the original drainage basin via dispersed flows. Natural drainage patterns will be preserved.

Minimum Requirement #5: On-Site Stormwater Management

In accordance with Table 1.1, Volume I of the 2012 SMMWW this project shall meet the requirements of List 2. Post Construction Soil Quality and Depth (BMP T5.13), Full Dispersion (BMP T5.30) and a detention facility will be utilized to disperse and retain stormwater runoff on-site to the maximum extent feasible without causing flooding or erosion impacts. Please refer to the BMP Feasibility Analysis within Section 3.0 of this report.

Minimum Requirement #6: Runoff Treatment

All projects shall provide treatment of stormwater. This requirement serves to reduce pollutant loads and concentration in stormwater runoff using physical, biological and chemical removal mechanisms. Treatment BMPs shall be sized to capture and treat the water quality design storm, defined as the 6-month, 24-hour return period storm. Runoff treatment shall be provided for this project through use of basic dispersion, full dispersion and a water quality structure upstream of detention. These instruments will allow for the settling and capture of suspended solids before stormwater is discharged into surrounding drainage basins.

Minimum Requirement #7: Flow Control

Flow control shall be provided through utilization of full dispersion, basic dispersion and a detention tank on site. The detention facility has been designed with appropriate capacity to detain stormwater within the tank before discharging to the pre-developed flow path at pre-developed discharge rates.

Minimum Requirement #8: Wetlands Protection

A critical areas evaluation was performed by Wetland Resources, Inc and confirmed that no wetlands lay within the proximity of this project. Therefore, this requirement is not applicable.

Minimum Requirement #9: Operations and Maintenance

An Operation and Maintenance Manual is included within the Appendix of this report.

2.0 Existing Site Conditions

The 3.72-acre property is currently almost completely encompassed by pervious native vegetation. There is an existing road that enters through the south end of the parcel and connects into the main arterial Eaglemont Drive. This existing impervious pavement is already included in drainage control systems as part of the Eaglemont golf course parking lot.

The site slopes down from the center in all directions with slopes ranging from 2-50%. As a high point exists near the center of the site, drainage from the site currently sheet flows away from the center of the site in all directions. Stormwater sheet flows over native vegetation where it is fully dispersed towards the surrounding golf course.

The USDA Soil Conservation Service has classified the soils as Dystric Xerochrepts-Rock outcrop complex and Tokul gravelly medial loam. Per table 2.3.1 of volume III in the DOE manual, both soils are considered to be within Hydrologic Soil Group B.

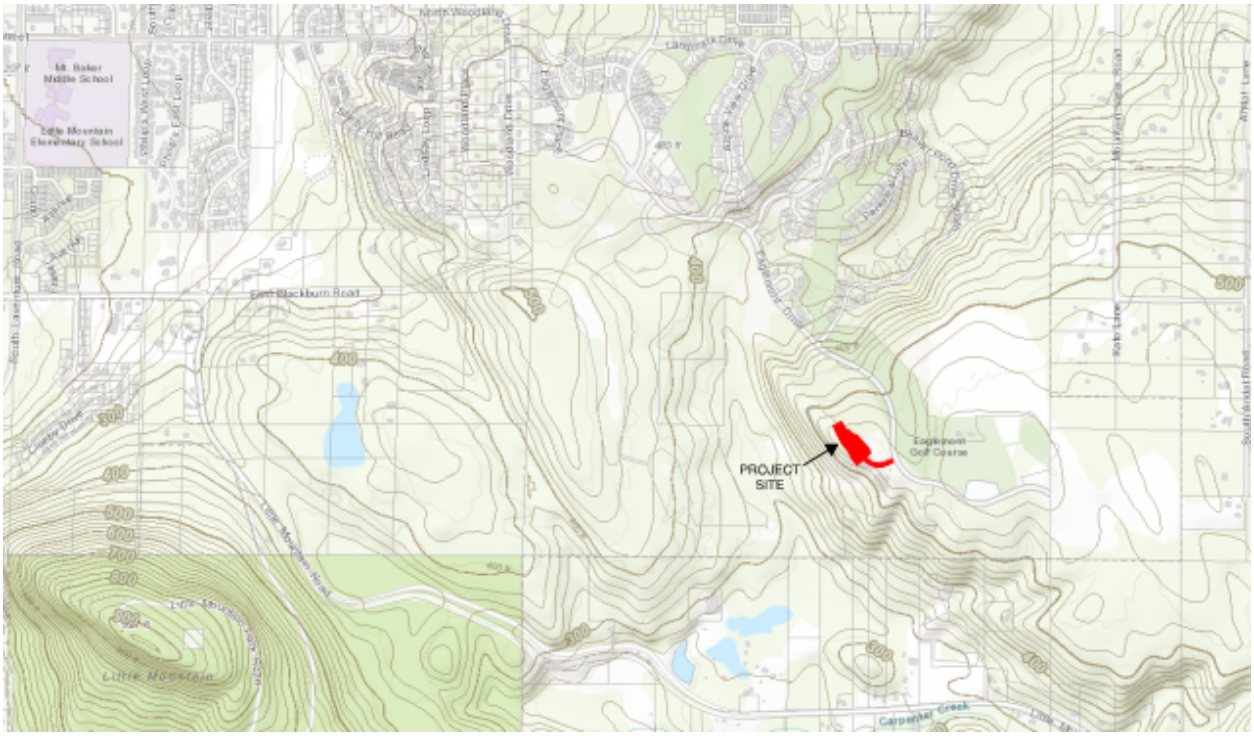


Figure 2: Existing Topography

3.0 BMP Feasibility Analysis

Due to the fact that the proposed planned unit development results in 5,000 square feet or more of new plus replaced hard surface area, per Figure 1-2.3.1 within the 2014 Stormwater Management Manual for Western Washington, this project is required to implement BMP T5.13 and guidelines set forth in List #2. For each surface, feasibility of Stormwater BMP's have been considered in the order outlined in List #2.

3.1 Lawn and Landscaped Areas

Post-Construction Soil Quality and Depth (BMP T5.13)

This project shall implement post-construction quality and depth in accordance with BMP 5.13 within Volume V, Chapter 5 of the WDOE Stormwater Management Manual for Western Washington. Natively vegetated areas to remain on site shall be protected from compaction during construction. Disturbed soils in areas on site which are proposed to be lawn or landscaped shall be amended.

3.2 Roofs

Full Dispersion (BMP T5.30)

As the developed portion of the site that would be proposed to drain into native vegetation exceeds the maximum 10% of impervious area, full dispersion is not a viable option for flow control.

Downspout Full Infiltration (BMP T5.10A)

Due to the soil conditions, rock content and results of infiltration tests, downspout full infiltration is not an option for flow control.

Bioretention (BMP T7.30)

Due to the soil conditions, rock content and results of infiltration tests, bioretention is not an option for flow control.

Downspout Dispersion Systems (BMP T5.10B)

It has been determined that Downspout Dispersion Systems will be utilized to control flow from the roof tops. The downspouts will convey stormwater to dispersion trenches which will be designed to manage flow and disperse water over a vegetated flow path.

3.3 Other Hard Surfaces

Full Dispersion (BMP T5.30)

As the developed portion of the site that would be proposed to drain into native vegetation exceeds the maximum 10% of impervious area, full dispersion is not a viable option for flow control.

Permeable Pavement (BMP T5.15)

Permeable pavement has been considered for this project but deemed infeasible due mainly to existing soil conditions on site. Field testing indicated that the soils on site have an infiltration rate of less than 0.3 inches per hour and would therefore not allow permeable pavement to perform sufficiently during storm events.

Bioretention (BMP T7.30)

Due to the soil conditions, rock content and results of infiltration tests, bioretention is not an option for the proposed site improvements.

Sheet Flow Dispersion (BMP T5.12)

Due to slopes being greater than 20% within the possible flow path for the impervious area, sheet flow dispersion is not a viable option for flow control.

Concentrated Flow Dispersion (BMP T5.11)

Due to the fact that only 700 square feet of impervious area may drain from each concentrated flow dispersion point and there is approximately 29,000 square feet of impervious surface with only a few slopes below 15%, concentrated flow dispersion is not a viable option for flow control.

On-site Detention Facility

It has been determined that an underground detention facility will be installed in order to control the flow of stormwater off of the site from the impervious surfaces. The detention facility will release controlled flows to a dispersion trench which will meet all requirements in terms of flow path.

4.0 Developed Site Conditions

An approximately 3.7 acre 19-lot planned unit development is proposed where there is currently vegetation and a small existing paved access road with connection to Eaglemont Drive. The completed project will consist of a public road splitting the 19 single family homes, a cul-de-sac and all associated utilities. In order to limit the amount of impervious surfacing, landscaping will be implemented along the access road where feasible.

Storm drainage resulting from the pollution generating impervious surfaces (PGIS) on site will be directed to a detention facility at the northwest end of the project where controlled flows will be released via dispersion and through a natively vegetated drainage path.

4.1 Detention Facility

The detention tanks in the northwest corner of the site has been designed to control flow and store peak flows for stormwater runoff accumulated from the impervious roadway and sidewalks within the development. Upstream of the detention facility, water quality will be provided by flow through a StormFilter catch basin. The controlled flows from the detention facility will be discharged via a dispersion trench where stormwater will be released over a vegetated flow path. Drainage released from the detention tank shall be tributary to the Carpenter Creek drainage basin. The detention facility design has been summarized in the table below.

Table 1: Detention Facility Design

Tank Material	Corrugated Metal Pipe
Tank Diameter	10 ft.
Tank Length	180 ft. (2 x 90 ft.)
Live Volume (9.5' depth)	13,873 cu. ft.
Dead Volume/Sediment Storage (0.5' depth)	264 cu. ft.

Table 2: Control Structure Design

Riser Diameter	18 in
Riser Type	Flat
Orifice #1	0.53" diameter at 0 ft
Orifice #2	1.13" diameter at 5.71 ft
Orifice #3	0.59" diameter at 6.46 ft

Although the detention tank has been sized to take in all impervious area within the right-of-way, a small portion of the roadway surface is not able to flow to the tank and will instead connect into the system that flows north along Eaglemont Drive which is tributary to a pond previously sized for this development. Runoff generated from the PGIS bypassing the detention tank is less than 5,000 square feet and is part of a separate threshold discharge area than the PGIS being routed to

the detention facility. Therefore, no runoff treatment is required for this portion of the site improvements.

4.2 Dispersion Systems (BMP T5.10B&C)

Stormwater from the rooftops of the residences within the lots will be conveyed toward the back edge of the lot through downspouts. This stormwater will be directed to dispersion trenches located on minimal slopes where the released water will be conveyed though a vegetated flow path.

5.0 Off-Site Analysis

This section evaluates the upstream and downstream drainage system. The intent of this section is to identify any existing or potential drainage impacts created or exacerbated by the proposed project and drainage facilities.

Aerial imagery, City of Mount Vernon maps, Skagit County maps and surveyed topography of the site form the basis of this analysis.

5.1 Upstream Analysis

As the project site contains a ridgeline running along the center of the site, there is no upstream drainage tributary to this project.

5.2 Downstream Analysis

Based on existing site topography, the on-site storm drainage naturally sheet flows away from the center of the site in all directions.

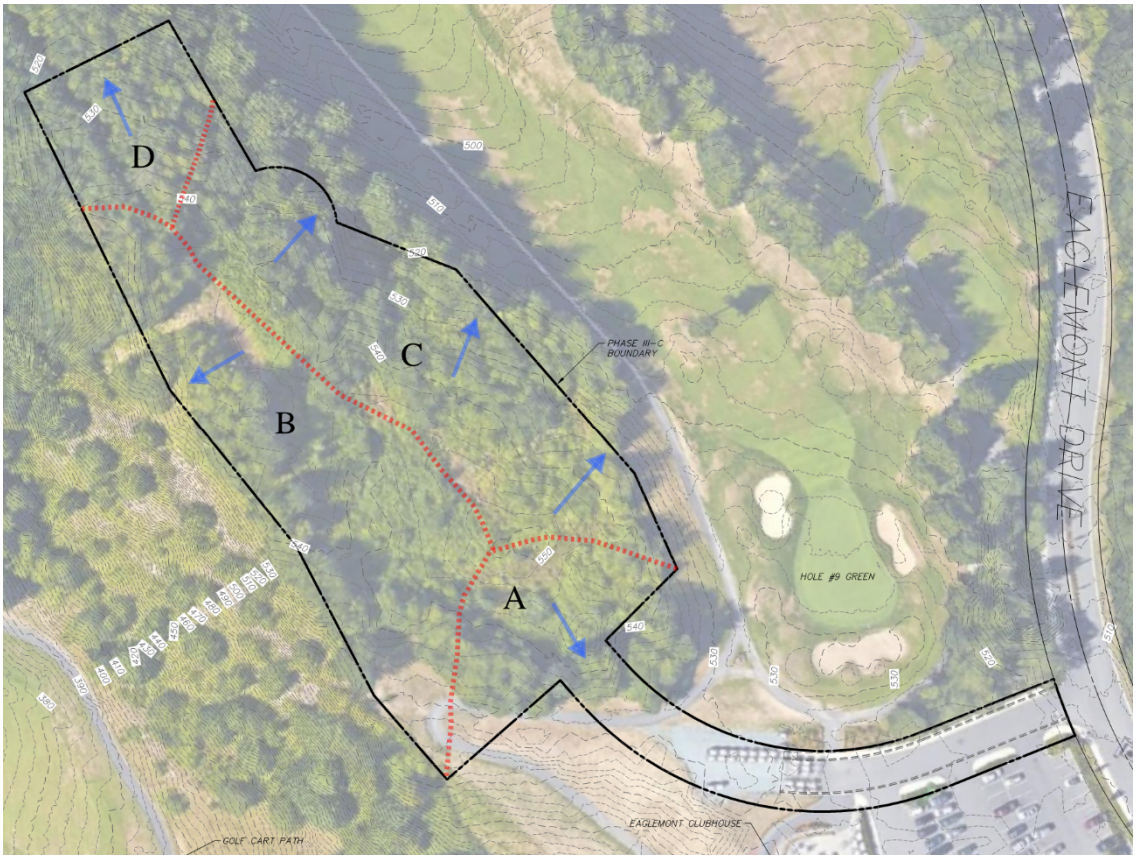


Figure 3: On Site Drainage Basins

Existing Drainage Basin A sheet flows in a southeasterly direction and is tributary to the existing storm conveyance system that was constructed as part of the Eaglemont Golf Course Clubhouse project. This drainage continues within the conveyance system along Eaglemont Drive until reaching the detention facility north of the project site. This pond was oversized during Eaglemont Phase 1A to compensate for developed drainage flows resulting from the future Eaglemont Phase III-C residential development. This pond outlets to a stream tributary to Nookachamps Creek.

Existing Drainage Basin B sheet flows in a southwesterly direction through approximately 200 lineal feet of native vegetation before reaching the fairway for Hole #1 on the Eaglemont Golf Course. Drainage from the site will continue to sheet flow across the golf course before sheet flowing through more native vegetation. The drainage will eventually flow into a stream tributary to Carpenter Creek slightly less than a quarter mile downstream from the project site.

Existing Drainage Basin C sheet flows in a northeasterly direction through approximately 50 lineal feet of native vegetation before reaching the fairway for Hole #9 on the Eaglemont Golf Course. Drainage from the site will continue to sheet flow along the golf course before flowing into a pond approximately a quarter mile downstream from the project site. This pond outlets to a stream tributary to Nookachamps Creek.

Existing Drainage Basin D sheet flows offsite in a northwesterly direction through native vegetation. Existing topography indicates that the drainage begins to flow westerly for a short distance and then southwesterly, continuing through native vegetation. Drainage from the site sheet flows into a stream tributary to Carpenter Creek approximately a quarter of a mile downstream from the project site.

As soils surrounding the site are classified as Type A and Type B soils with moderate to high infiltration rates, it is likely that much of the drainage from the site will infiltrate prior to discharging into the pond or stream.

Please refer to Figure 4 below to see the downstream drainage path of each existing drainage basin.

Figure 4: Downstream Flow Path

6.0 Stormwater Control Plan

Developed Site Hydrology

Drainage tributary to the right-of-way and drainage tract on site shall sheet flow along the road surface toward the gutter where drainage shall flow to the nearest catch basin. Once in the proposed conveyance system, drainage will flow toward the detention facility at the northwestern portion of the site. Upstream of detention, drainage shall flow through a StormFilter in order to provide water quality for the runoff tributary to the pollution generating surface on site. Stormwater will then be detained within the detention facility which is comprised of two 90-foot long, 10-foot diameter corrugated metal pipes which are connected to a control structure. Stormwater within this system shall flow through the control structure, being released at pre-developed flow rates and connect to a dispersion trench where stormwater may be dispersed through a natively vegetated flow path.

Although the detention facility was sized to capture all new improvements within the right-of-way, a small area of the lower portion of the road is incapable of being conveyed to the detention facility. Drainage tributary to this area shall flow to the existing conveyance system which flows north along Eaglemont Drive. This drainage is tributary to the pond just north of the site along the west side of Eaglemont Drive, which was intended as part of the master plan to capture drainage from the developed Phase III-C site. As the PGIS proposed within this threshold discharge area is less than 5,000 square feet, no runoff treatment is required for this portion of the site improvements.

Please see the Appendix for the WWHM modeling results.

Low Impact Development Features

This project proposes to implement BMP T5.13 for Post-Construction Soil Quality and Depth. Existing top soil on site will be retained and shall meet depth and organic matter quality standards upon completion of clearing. Compaction will be prevented to the maximum extent feasible and where compaction is unavoidable, soils shall be amended prior to seeding.

7.0 Stormwater Pollution Prevention Plan (SWPPP)

In order to protect the downstream conditions from sediments, several erosion control Best Management Practices (BMPs) from the DOE manual will be utilized. A temporary gravel construction entrance shall be used between the road and development area, as necessary, to remove mud from tires on vehicles exiting the site. Additionally, limiting earthwork and utility construction activities to dry weather conditions, minimizing area and duration of soil exposure, implementing storm drain inlet protection and stockpiling and sheathing of strippings will further reduce the potential for silt-laden runoff. Interim measures to be employed during construction will include the installation of silt fences along the low side of areas to be cleared and graded. Stockpiles will be covered with polyethylene sheathing.

1. **Factors expected to create an erosion risk when developed:**
   - Exposure of soils during clearing

2. **Location relative to critical areas:**
   - No critical areas on-site

3. **Soil types:**
   - Dystric Xerochrepts-Rock outcrop complex

   - Tokul gravelly medial loam

4. **Potential for slides or other ground movement:**
   - None anticipated

5. **Sources of water for erosion:**
   - Rainfall

6. **Measures proposed to minimize and prevent erosion to the greatest extent possible for the development:**
   - Preparation and implementation of an erosion and sedimentation plan which is sensitive to the soils, slopes and construction season
   - Silt fencing
   - Catch basin protection
   - Gravel construction entrance

A SWPPP will be prepared as a separate document for use during construction. The following section provides a detailed description of the BMPs to be implemented based on the 13 required elements of the SWPPP. For additional information reference the project TESC plans and SWPPP.

Element #1 – 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. Clearing limits will be delineated by silt fence and high visibility fence. The following relevant BMPs for this project include:

BMP C103: High Visibility Plastic or Metal Fence
BMP C233: Silt Fence

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. The following relevant BMPs for this project include:

BMP C105: Stabilized Construction Entrance/Exit

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. Surface water from disturbed areas must be routed through the project's onsite flow control facility or other provisions must be made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the project site during construction.

BMP C209: Outlet Protection
BMP C241: Sediment Trap

Element #4 – Install Sediment Controls
All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before entering a receiving water body. The following relevant BMPs for this project include:

BMP C220: Storm Drain Inlet Protection
BMP C233: Silt Fence

Element #5 – Stabilize Soils
Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The following relevant BMPs for this project include:

BMP C140: Dust Control

In general, soils shall be stabilized if they are to remain unworked for a certain period of time depending on the season. The site will be periodically sprinkled with water until the surface is wet in order to prevent dust in the air and sediment on the roadways.

Element #6 – Protect Slopes
Stormwater run-off shall be minimal as construction of the proposed improvements are to commence and be completed during the dry season. The following relevant BMPs for this project include:

BMP C120: Temporary and Permanent Seeding
BMP C121: Mulching

Element #7 – Protect Permanent Drain Inlets
All existing storm drain inlets and culverts made operable during construction that may receive stormwater on and downstream of the site shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. The following relevant BMPs for this project include:

BMP C220: Storm Drain Inlet Protection

Element #8 – Stabilize Channels and Outlets
As no channels or outlets are proposed as part of this project, no BMPs for stabilization of channels and outlets are proposed.

Element #9 – Control Pollutants
All pollutants, including waste materials and demolition debris that occur during construction 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 in order to prevent leaks or spills.

- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.

- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

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).

In order to prevent, reduce or eliminate the discharge of pollutants from material delivery and storage to the stormwater system, Material Delivery and Storage Contamination (BMP C153) shall be implemented.

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.

Element #10 – Control Dewatering
Dewatering is not anticipated for this project. In the event that dewatering is necessary, any runoff generated by dewatering shall be treated through construction of a sediment trap (Section II-3.3.3 of the 2014 SMMWW) when there is sufficient space or by releasing the water to a well vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment laden water away from the surface water so that vegetation can be more effectively utilized for treatment. Discharge of sediment laden water from dewatering activities to surface and stormwaters is prohibited. If dewatering occurs from areas where the water has come in contact with new concrete such as tanks, vaults or foundations, the pH of the water must be monitored and must be neutralized prior to discharge. Clean non-turbid dewatering water, such as well point ground water can be discharged to systems tributary or directly to surface waters provided the flows are controlled so that no erosion or flooding occurs. Clean water must not be routed through a stormwater sediment pond. Highly turbid or contaminated dewatering water must be handled separately from stormwater.

Element #11 – Maintain BMPs
All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMP's specifications. Visual monitoring of the BMPs will be conducted at least once every calendar week and within 24 hours of any rainfall event that causes a discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

Provide protection to all BMPs installed for the permanent control of stormwater from sediment and compaction. All BMPs that are to remain in place following completion of construction shall

be examined and placed in full operating conditions. If sediment enters the BMPs during construction, it shall be removed and the BMP shall be returned to the conditions specified in the construction documents or as required for full BMP replacement.

Remove or stabilize trapped sediment on site. Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.

Element #12 – Manage the Project
Erosion and sediment control BMPs for this project have been designed based on the following principles:

- 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.

In addition, project management will incorporate the key components listed below:

As this project site is located west of the Cascade Mountain Crest, the project will be managed according to the following key project components:

Inspection and Monitoring

- All BMPs shall be inspected, maintained and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control at least once every calendar week and within 24 hours of any major rainfall event. This person has the necessary skills to:
    - Assess the site conditions and construction activities that could impact the quality of stormwater.
    - Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

- A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.

- Whenever inspection and/or monitoring reveals that the BMPs identified in this SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP

- This SWPPP shall be retained near the construction activities or within reasonable access.

- The SWPPP shall be modified whenever there is a change in the 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 shall be modified if, during inspections or investigations conducted by the owner/operator or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

Element #13 – Protect Low Impact Development BMP's

The low impact development BMPs proposed for this project are required to be protected. The project shall meet requirements for Post-Construction Quality and Depth and therefore soil compaction shall be prevented to the maximum extent feasible. Limits shall be delineated in order to keep heavy equipment away from areas that soils could be unnecessarily compacted. The following relevant BMPs for this project include:

BMP C103: High Visibility Fence

8.0 Appendix

Included in the Appendix:

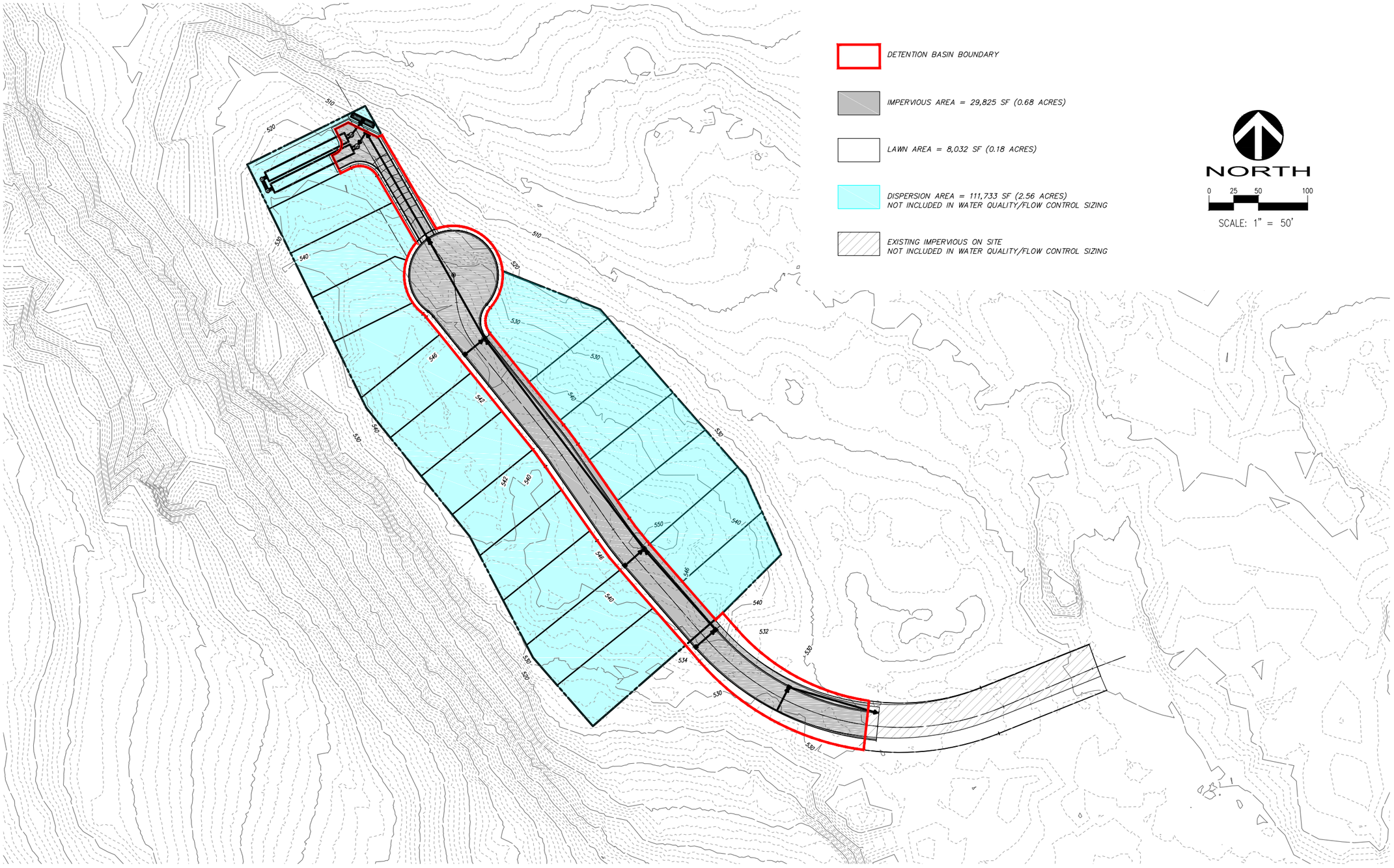
A. Drainage Exhibit

B. WWHM2012 Modeling Results

C. Operation and Maintenance Manual

APPENDIX A

Drainage Exhibit


DETENTION BASIN BOUNDARY
IMPERVIOUS AREA = 29,825 SF (0.68 ACRES)
LAWN AREA = 8,032 SF (0.18 ACRES)
DISPERSION AREA = 111,733 SF (2.56 ACRES)
NOT INCLUDED IN WATER QUALITY/FLOW CONTROL SIZING
EXISTING IMPERVIOUS ON SITE
NOT INCLUDED IN WATER QUALITY/FLOW CONTROL SIZING
NORTH
0 25 50 100
SCALE: 1" = 50'

APPENDIX B

WWHM2012 Modeling Results

WWHM2012
PROJECT REPORT

Project Name: 2018-05-29
Site Name:
Site Address:
City :
Report Date: 5/29/2018
Gage : Burlington
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2017/04/14 s
Version : 4.2.13

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Steep	.87
Pervious Total	0.87

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.87

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : .533.
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.19
Pervious Total	**0.19**

Impervious Land Use	acre
ROADS MOD	0.68
Impervious Total	**0.68**
Basin Total	**0.87**

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 37.9483643294309 ft.
Length : 37.9483643294309 ft.
Depth: 10 ft.

Discharge Structure

Riser Height: 9 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.53 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 1.13 in. **Elevation:** 5.713 ft.
Orifice 3 Diameter: 0.59 in. **Elevation:** 6.46 ft.

Element Flows To:

Outlet 1	Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.033	0.000	0.000	0.000
0.1111	0.033	0.003	0.002	0.000
0.2222	0.033	0.007	0.003	0.000
0.3333	0.033	0.011	0.004	0.000
0.4444	0.033	0.014	0.005	0.000
0.5556	0.033	0.018	0.005	0.000
0.6667	0.033	0.022	0.006	0.000
0.7778	0.033	0.025	0.006	0.000
0.8889	0.033	0.029	0.007	0.000
1.0000	0.033	0.033	0.007	0.000
1.1111	0.033	0.036	0.008	0.000
1.2222	0.033	0.040	0.008	0.000
1.3333	0.033	0.044	0.008	0.000
1.4444	0.033	0.047	0.009	0.000
1.5556	0.033	0.051	0.009	0.000
1.6667	0.033	0.055	0.009	0.000

1.7778	0.033	0.058	0.010	0.000
1.8889	0.033	0.062	0.010	0.000
2.0000	0.033	0.066	0.010	0.000
2.1111	0.033	0.069	0.011	0.000
2.2222	0.033	0.073	0.011	0.000
2.3333	0.033	0.077	0.011	0.000
2.4444	0.033	0.080	0.011	0.000
2.5556	0.033	0.084	0.012	0.000
2.6667	0.033	0.088	0.012	0.000
2.7778	0.033	0.091	0.012	0.000
2.8889	0.033	0.095	0.013	0.000
3.0000	0.033	0.099	0.013	0.000
3.1111	0.033	0.102	0.013	0.000
3.2222	0.033	0.106	0.013	0.000
3.3333	0.033	0.110	0.013	0.000
3.4444	0.033	0.113	0.014	0.000
3.5556	0.033	0.117	0.014	0.000
3.6667	0.033	0.121	0.014	0.000
3.7778	0.033	0.124	0.014	0.000
3.8889	0.033	0.128	0.015	0.000
4.0000	0.033	0.132	0.015	0.000
4.1111	0.033	0.135	0.015	0.000
4.2222	0.033	0.139	0.015	0.000
4.3333	0.033	0.143	0.015	0.000
4.4444	0.033	0.146	0.016	0.000
4.5556	0.033	0.150	0.016	0.000
4.6667	0.033	0.154	0.016	0.000
4.7778	0.033	0.158	0.016	0.000
4.8889	0.033	0.161	0.016	0.000
5.0000	0.033	0.165	0.017	0.000
5.1111	0.033	0.169	0.017	0.000
5.2222	0.033	0.172	0.017	0.000
5.3333	0.033	0.176	0.017	0.000
5.4444	0.033	0.180	0.017	0.000
5.5556	0.033	0.183	0.018	0.000
5.6667	0.033	0.187	0.018	0.000
5.7778	0.033	0.191	0.027	0.000
5.8889	0.033	0.194	0.033	0.000
6.0000	0.033	0.198	0.037	0.000
6.1111	0.033	0.202	0.040	0.000
6.2222	0.033	0.205	0.043	0.000
6.3333	0.033	0.209	0.046	0.000
6.4444	0.033	0.213	0.049	0.000
6.5556	0.033	0.216	0.054	0.000
6.6667	0.033	0.220	0.057	0.000
6.7778	0.033	0.224	0.060	0.000
6.8889	0.033	0.227	0.063	0.000
7.0000	0.033	0.231	0.066	0.000
7.1111	0.033	0.235	0.068	0.000
7.2222	0.033	0.238	0.071	0.000
7.3333	0.033	0.242	0.073	0.000
7.4444	0.033	0.246	0.075	0.000
7.5556	0.033	0.249	0.077	0.000
7.6667	0.033	0.253	0.079	0.000
7.7778	0.033	0.257	0.081	0.000
7.8889	0.033	0.260	0.083	0.000
8.0000	0.033	0.264	0.085	0.000

8.1111	0.033	0.268	0.087	0.000
8.2222	0.033	0.271	0.089	0.000
8.3333	0.033	0.275	0.091	0.000
8.4444	0.033	0.279	0.092	0.000
8.5556	0.033	0.282	0.094	0.000
8.6667	0.033	0.286	0.096	0.000
8.7778	0.033	0.290	0.097	0.000
8.8889	0.033	0.293	0.099	0.000
9.0000	0.033	0.297	0.100	0.000
9.1111	0.033	0.301	0.690	0.000
9.2222	0.033	0.304	1.740	0.000
9.3333	0.033	0.308	2.987	0.000
9.4444	0.033	0.312	4.210	0.000
9.5556	0.033	0.315	5.205	0.000
9.6667	0.033	0.319	5.864	0.000
9.7778	0.033	0.323	6.360	0.000
9.8889	0.033	0.326	6.793	0.000
10.000	0.033	0.330	7.200	0.000
10.111	0.033	0.334	7.585	0.000
10.222	0.000	0.000	7.950	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.87
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.19
Total Impervious Area:0.68

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.029987
5 year	0.053393
10 year	0.072651
25 year	0.101391
50 year	0.12609
100 year	0.153686

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.01518
5 year	0.025753
10 year	0.035557
25 year	0.052029
50 year	0.067923
100 year	0.087556

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

Year	Predeveloped	Mitigated
1949	0.079	0.030
1950	0.040	0.041
1951	0.076	0.016
1952	0.035	0.017
1953	0.045	0.013
1954	0.039	0.013
1955	0.029	0.013
1956	0.024	0.014
1957	0.043	0.016
1958	0.029	0.011
1959	0.035	0.017
1960	0.027	0.017
1961	0.020	0.014
1962	0.006	0.014
1963	0.019	0.011
1964	0.022	0.012
1965	0.033	0.017
1966	0.023	0.011
1967	0.025	0.012
1968	0.048	0.018
1969	0.020	0.011
1970	0.012	0.010
1971	0.047	0.038
1972	0.023	0.014
1973	0.027	0.015
1974	0.040	0.018
1975	0.150	0.329
1976	0.038	0.014
1977	0.023	0.012
1978	0.034	0.016
1979	0.020	0.012
1980	0.044	0.018
1981	0.025	0.012
1982	0.053	0.018
1983	0.034	0.017
1984	0.069	0.018
1985	0.016	0.011
1986	0.036	0.025
1987	0.032	0.017
1988	0.057	0.013
1989	0.015	0.013
1990	0.039	0.064
1991	0.057	0.066
1992	0.031	0.012
1993	0.029	0.012
1994	0.009	0.010
1995	0.012	0.011
1996	0.073	0.012
1997	0.277	0.016
1998	0.029	0.012
1999	0.019	0.013
2000	0.013	0.009

2001	0.004	0.009
2002	0.022	0.014
2003	0.017	0.013
2004	0.035	0.017
2005	0.022	0.014
2006	0.049	0.016
2007	0.032	0.014
2008	0.076	0.061
2009	0.018	0.013

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

Rank	Predeveloped	Mitigated
1	0.2769	0.3288
2	0.1501	0.0660
3	0.0788	0.0637
4	0.0757	0.0613
5	0.0756	0.0406
6	0.0733	0.0376
7	0.0685	0.0295
8	0.0568	0.0250
9	0.0565	0.0185
10	0.0534	0.0182
11	0.0492	0.0180
12	0.0482	0.0177
13	0.0465	0.0175
14	0.0451	0.0174
15	0.0438	0.0172
16	0.0426	0.0171
17	0.0398	0.0171
18	0.0396	0.0170
19	0.0394	0.0170
20	0.0394	0.0165
21	0.0380	0.0162
22	0.0362	0.0161
23	0.0354	0.0160
24	0.0352	0.0158
25	0.0350	0.0157
26	0.0342	0.0148
27	0.0337	0.0141
28	0.0331	0.0141
29	0.0321	0.0139
30	0.0321	0.0138
31	0.0314	0.0138
32	0.0292	0.0138
33	0.0291	0.0137
34	0.0288	0.0136
35	0.0287	0.0134
36	0.0271	0.0134
37	0.0267	0.0134
38	0.0250	0.0134
39	0.0246	0.0133
40	0.0240	0.0129
41	0.0233	0.0129
42	0.0228	0.0125
43	0.0227	0.0125

44	0.0222	0.0124
45	0.0218	0.0124
46	0.0216	0.0123
47	0.0199	0.0122
48	0.0198	0.0122
49	0.0196	0.0122
50	0.0194	0.0118
51	0.0192	0.0117
52	0.0180	0.0115
53	0.0168	0.0113
54	0.0156	0.0111
55	0.0152	0.0110
56	0.0133	0.0107
57	0.0120	0.0106
58	0.0116	0.0099
59	0.0093	0.0095
60	0.0062	0.0095
61	0.0044	0.0093

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0150	11347	10359	91	Pass
0.0161	9813	5935	60	Pass
0.0172	8543	2969	34	Pass
0.0184	7407	1059	14	Pass
0.0195	6528	1016	15	Pass
0.0206	5709	981	17	Pass
0.0217	4977	946	19	Pass
0.0228	4359	919	21	Pass
0.0240	3807	895	23	Pass
0.0251	3315	862	26	Pass
0.0262	2913	839	28	Pass
0.0273	2571	815	31	Pass
0.0285	2248	776	34	Pass
0.0296	2003	741	36	Pass
0.0307	1794	706	39	Pass
0.0318	1605	676	42	Pass
0.0329	1425	642	45	Pass
0.0341	1274	594	46	Pass
0.0352	1133	540	47	Pass
0.0363	1019	509	49	Pass
0.0374	902	484	53	Pass
0.0386	771	458	59	Pass
0.0397	690	438	63	Pass
0.0408	636	418	65	Pass
0.0419	575	402	69	Pass
0.0430	524	389	74	Pass
0.0442	476	376	78	Pass
0.0453	439	361	82	Pass
0.0464	417	348	83	Pass
0.0475	383	331	86	Pass

0.0487	363	307	84	Pass
0.0498	341	292	85	Pass
0.0509	323	285	88	Pass
0.0520	295	277	93	Pass
0.0531	270	270	100	Pass
0.0543	260	262	100	Pass
0.0554	241	253	104	Pass
0.0565	226	239	105	Pass
0.0576	211	224	106	Pass
0.0588	199	212	106	Pass
0.0599	191	199	104	Pass
0.0610	182	182	100	Pass
0.0621	176	163	92	Pass
0.0632	168	147	87	Pass
0.0644	149	136	91	Pass
0.0655	134	126	94	Pass
0.0666	125	121	96	Pass
0.0677	123	118	95	Pass
0.0689	117	108	92	Pass
0.0700	107	105	98	Pass
0.0711	103	102	99	Pass
0.0722	101	100	99	Pass
0.0733	97	95	97	Pass
0.0745	94	93	98	Pass
0.0756	89	90	101	Pass
0.0767	83	87	104	Pass
0.0778	81	86	106	Pass
0.0790	77	81	105	Pass
0.0801	75	77	102	Pass
0.0812	72	71	98	Pass
0.0823	71	66	92	Pass
0.0834	65	64	98	Pass
0.0846	63	55	87	Pass
0.0857	58	49	84	Pass
0.0868	57	47	82	Pass
0.0879	54	45	83	Pass
0.0891	53	43	81	Pass
0.0902	52	41	78	Pass
0.0913	50	39	78	Pass
0.0924	49	37	75	Pass
0.0935	47	33	70	Pass
0.0947	46	30	65	Pass
0.0958	45	27	60	Pass
0.0969	44	23	52	Pass
0.0980	43	20	46	Pass
0.0992	43	17	39	Pass
0.1003	42	14	33	Pass
0.1014	40	9	22	Pass
0.1025	38	9	23	Pass
0.1036	36	9	25	Pass
0.1048	35	9	25	Pass
0.1059	35	9	25	Pass
0.1070	34	9	26	Pass
0.1081	33	9	27	Pass
0.1093	32	9	28	Pass
0.1104	30	9	30	Pass
0.1115	28	9	32	Pass

0.1126	27	9	33	Pass
0.1137	26	9	34	Pass
0.1149	25	9	36	Pass
0.1160	24	9	37	Pass
0.1171	23	9	39	Pass
0.1182	20	9	45	Pass
0.1194	18	9	50	Pass
0.1205	16	7	43	Pass
0.1216	14	7	50	Pass
0.1227	13	7	53	Pass
0.1238	11	7	63	Pass
0.1250	8	7	87	Pass
0.1261	7	7	100	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0133 **acre-feet**
On-line facility target flow: 0.0067 **cfs.**
Adjusted for 15 min: 0.0067 **cfs.**
Off-line facility target flow: 0.0042 **cfs.**
Adjusted for 15 min: 0.0042 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volumn Needs Treatment (ac-ft)	Volumn Through Facility (ac-ft)	Infiltration Volumn (ac-ft.)	Cumulative Volumn Infiltration Credit	Percent Volumn Infiltrated	Water Quality Treated	Comment
Vault 1 POC	N	92.10				N	0.00	
Total Volume Infiltrated		92.10	0.00	0.00		0.00	0.00	0% No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

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APPENDIX C

Operation and Maintenance Manual

OPERATIONS & MAINTENANCE CHECKLIST

Project: Eaglemont-Phase III-C Plat
Inspector:
Date: Time:

Facility Description:

Stormwater flow control shall be provided through utilization of full dispersion, basic dispersion, and a detention tank on site. Drainage tributary to the right-of-way and drainage tract on site shall sheet flow along the road surface toward the gutter where drainage shall flow to the nearest catch basin. Once in the proposed conveyance system, drainage will flow toward the detention facility at the northwestern portion of the site. Upstream of detention, drainage shall flow through a StormFilter in order to provide water quality for the runoff tributary to the pollution generating surface on site. Stormwater will then be detained within the detention facility which is comprised of two ninety foot long, ten foot diameter corrugated metal pipes which are connected to a control structure. Stormwater within this system shall flow through the control structure, being released at pre-developed flow rates and connect to a dispersion trench where stormwater may be dispersed through a natively vegetated flow path. Drainage released from the detention tanks shall be tributary to the Carpenter Creek drainage basin.

The 2012 Stormwater Management Manual for Western Washington outlines maintenance standards in Volume V, pg. 4-32, Table 4.5.2 identifies and describes maintenance tasks and frequency needed and are included in this O&M Manual following this checklist.

Site Facilities	Overall Condition			Need Repair?		Comments/Observations
	G	F	P	Y	N	
Closed Detention Systems	☐	☐	☐	☐	☐	
Control Structure	☐	☐	☐	☐	☐	
Catch Basins	☐	☐	☐	☐	☐	
Filter Strips	☐	☐	☐	☐	☐	
Wetvaults	☐	☐	☐	☐	☐	
Manufactured Media Filters	☐	☐	☐	☐	☐	
Catch Basin Inserts	☐	☐	☐	☐	☐	
Media Filter Drain	☐	☐	☐	☐	☐	
Conveyance Storm Pipes	☐	☐	☐	☐	☐	
Facility Discharge Points	☐	☐	☐	☐	☐	

G=Good F=Fair P=Poor Y=Yes N=No N/A=Not Applicable

Will existing Site Facilities need to be repaired, cleaned or maintained? ☐ YES ☐ NO

IF YES, list the action items to be completed on the following table:

OPERATIONS & MAINTENANCE CHECKLIST

Project: Eaglemont-Phase III-C Plat
Inspector:
Date: Time:

Actions to be Completed	Date Completed/ Initials
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See "Catch Basins" (No. 5)	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).
Catch Basin	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(6) Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4

Table V-4.5.2(9) Maintenance Standards - Wet Biofiltration Swale (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
		by very dense clumps of cattail, which do not allow water to flow through the clumps.	Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See "Detention Ponds" (No. 1).	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

Table V-4.5.2(10) Maintenance Standards - Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other veget-	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.

Table V-4.5.2(10) Maintenance Standards - Filter Strips (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
		ation starts to take over.	
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, over-seed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

Table V-4.5.2(11) Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per	Trash and debris removed from pond.

Table V-4.5.2(11) Maintenance Standards - Wetponds (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
			berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-4.5.2(12) Maintenance Standards - Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to	Maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks

Table V-4.5.2(12) Maintenance Standards - Wetvaults (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Frame and/or Top Slab	inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

Table V-4.5.2(13) Maintenance Standards - Sand Filters (Above Ground/Open)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Above Ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging

Table V-4.5.2(14) Maintenance Standards - Sand Filters (Below Ground/Enclosed) (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
			area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

Table V-4.5.2(15) Maintenance Standards - Manufactured Media Filters

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accu-	Sediment depth exceeds 0.25-inches.	No sediment depos-

Table V-4.5.2(15) Maintenance Standards - Manufactured Media Filters (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	mulation on Media.		its which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.

Table V-4.5.2(15) Maintenance Standards - Manufactured Media Filters (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

Table V-4.5.2(16) Maintenance Standards - Baffle Oil/Water Separators (API Type)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with out thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulations that exceed 1-inch, at the surface of the water.	Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.

Table V-4.5.2(17) Maintenance Standards - Coalescing Plate Oil/Water Separators (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Table V-4.5.2(18) Maintenance Standards - Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

Table V-4.5.2(19) Maintenance Standards - Media Filter Drain (MFD)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/-flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach	If possible, trim back overhanging limbs and remove

Table V-4.5.2(19) Maintenance Standards - Media Filter Drain (MFD) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
		embankment.	brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

Table V-4.5.2(20) Maintenance Standards - Compost Amended Vegetated Filter Strip (CAVFS)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.

Materials Testing & Consulting, Inc.

Geotechnical Engineering ● Materials Testing ● Special Inspection ● Environmental Consulting

July 2, 2018; ***REVISED August 3, 2018***

Ed Young
Polyield Summit, LLC
4800 Eaglemont Drive
Mount Vernon, WA 98274

cc: John Smith, PE
David Evans & Associates, Inc

Subject: Report of Geotechnical Investigation and Engineering
Proposed Eaglemont Phase III-C Subdivision Development
4800 Eaglemont Drive, Mount Vernon, Washington

MTC Project No.: **18B177**

Dear Mr. Young:

This letter transmits our Geotechnical Engineering Investigation Report for the above-referenced project. Materials Testing & Consulting, Inc. (MTC) has performed this study in accordance with our Proposal for Geotechnical Services, dated May 24, 2018.

We would be pleased to continue our role as your geotechnical consultants through project planning and construction. We also have a keen interest in providing materials testing and special inspection during the construction phase. We will be pleased to meet at your convenience to discuss these services.

We appreciate the opportunity to provide our geotechnical services to you for this project. If you have any questions regarding this report, or if we can provide assistance with other aspects of the project, please contact me at (360) 755-1990.

Respectfully Submitted,
MATERIALS TESTING & CONSULTING, INC.

Medhanie Tecle, P.E.
Engineering Manager

Cass Dimitroff, G.I.T.
Project Geologist

Attachment: Geotechnical Investigation and Engineering Report

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GEOTECHNICAL INVESTIGATION AND ENGINEERING REPORT

PROPOSED DEVELOPMENT – EAGLEMONT PHASE III-C

4800 EAGLEMONT DRIVE
MOUNT VERNON, WASHINGTON

Prepared for:

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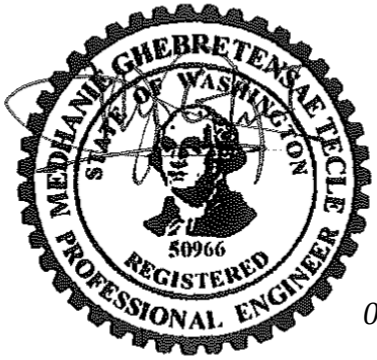

08-03-2018

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July 2, 2018; ***REVISED August 3, 2018***
MTC Project Number: **18B177**

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1.0 INTRODUCTION

1.1 GENERAL

This report presents the findings and recommendations of Materials Testing & Consulting, Inc.'s (MTC) geotechnical investigation conducted for design and construction of the proposed Eaglemont Phase III-C Plat development. The project site is a single parcel of approximately 4 acres total size, that is comprised entirely of undeveloped, forested land situated being adjacent golf course fairways. It is located near the northwest portion of the Eaglemont Golf Course Clubhouse grounds at the address of 4800 Eaglemont Drive, in Mt. Vernon, Washington. The location vicinity and a current master site plan of the project site are shown in Figures 1 and 2 of Appendix A.

1.2 PROJECT DESCRIPTION

We understand the project consists of a 19-lot residential subdivision within the Eaglemont Golf Course development area to the southeast of Mt. Vernon, Washington. According to present civil layout, the project will include construction of a single roadway corridor, connecting to the existing access road for the Eaglemont Clubhouse, serving a layout of 4,800 to 7,400 SF residential lots. Dedicated open space for a primary stormwater facility is planned among the northwestern terminus of the property. Preliminary plans show that stormwater from individual lots and paved roadways will be collected in a centralized conveyance and routed to a detention facility within the stormwater tract on the northwest corner of the site, then dispersed via dispersion trench outfalling to the north. Construction of residential lots is assumed to employ slab-on-grade or elevated floors and shallow spread or perimeter foundations to support typical SFR loads near present grade. MTC assumes that existing grade of the property is roughly equivalent to planned final grade, with exception the central roadway profile and the area near the proposed retaining wall in the northern portion of the site requiring regrading due to local topographic variations.

MTC should be allowed to review the final plans and specifications for the project to ensure that the recommendations presented herein are appropriate. Recommendations and conclusions presented by this report will need to be re-evaluated in the event that changes to the proposed construction are made.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of our study was to explore subsurface conditions at the site and provide geotechnical recommendations for design and construction of the proposed subdivision development. Geotechnical aspects related to residence construction are addressed in general accordance with applicable building codes and industry standard practices. Additionally, MTC has provided a critical area review of slopes descending from the southwestern and northeastern boundaries of the site. Slopes bounding the site are characterized as geologically hazardous slopes due to gradients at or exceeding 40%, warranting

evaluation per Mt. Vernon Critical Area Code (MVMC 15.40.070). A summary of MTC's findings, interpretations, and recommendations are provided herein for the client's design and permitting purposes. Our scope of services was consistent with that presented in our Proposal for Geotechnical Engineering Services, dated May 24, 2018.

2.0 SITE EXPLORATION AND LABORATORY TESTING

2.1 SITE EXPLORATION

Our site exploration activities were performed on June 13, 2018 and June 19, 2018, and involved directing and logging of 10 geotechnical test pits excavated throughout the proposed development area to a maximum depth of approximately 6.5 feet below present grade (BPG), in general accordance with the project proposal. In an addition to the site visits for subsurface exploration, an MTC geologist performed visual reconnaissance of surface and topographic features of the sloping terrain on the southwest and northeast facing slopes for a geologic hazard assessment and slope morphology characterization. Exploration locations were selected for optimal coverage of the property with consideration of locations of test pits in previous studies and needs for focused investigation in areas proposed for site development. Test pits were excavated until reaching practical refusal on bedrock conditions in all locations.

Test pits TP-1 through TP-4 were excavated along the southwestern half of the site within proposed residential lots and were spaced approximately 100 feet apart. Test pits TP-6, TP-8 and TP-10 were excavated along the eastern portions of the property within proposed lots, similarly spaced approximately 100 feet apart. Test pits TP-5, TP-7 and TP-9 were excavated through the central interior of the site within the proposed access roadway and in the terminal col-de-sac near the proposed retaining wall feature. Visual reconnaissance was performed throughout the gently undulating site interior and along the adjacent slopes on the southwest and northeast sides of the property as access allowed.

Exploration locations are shown on the site plan in Appendix B, Figure 2. Additional information on the site exploration program is provided with our exploration logs in Appendix C of this report.

2.2 LABORATORY TESTING

Laboratory tests were performed on selected soil samples in accordance with ASTM standards to determine index and engineering properties of the site soils. Tests included supplementary soil classification and grain-size distribution analysis via sieve methods. Laboratory test results are presented on test reports included in Appendix D.

3.0 EXISTING SITE CONDITIONS

3.1 SURFACE DESCRIPTION

The proposed project site is located on an undeveloped, 3.7-acre lot that is currently forested with dense coverage of trees and blackberry growth, located between two golf course fairways at the Eaglemont Golf Course in Mt. Vernon, WA. The property is roughly wedge-shaped with roadway access to the existing access road and parking lot for the Eaglemont Golf Course Clubhouse. The site vicinity among the eastern limits of Mt. Vernon is moderately developed with medium residential use and increasing population density to the west toward the Mt. Vernon city center. The lot is located near the center of the golf course, surrounded by facilities and golf course grounds, as well as multiple older phases of development within the Eaglemont Residential Community. Topography in the vicinity rolls with foothills of the Cascades creating a wide variety of topographic features.

The project site is located on an isolated ridge that contains generally gently sloping and undulatory topography within the site interior and is bound by bedrock supported slopes on the southwest and northeast side of the project site. Topography drops much less long the northeast side of the project site, approximately 10 to 20 vertical feet, whereas, the vertical relief of slopes on the southwest side of the property are much greater. Total elevation from the upland project site to lower gradient golf course grounds to the southwest are up to 150 feet along moderate to locally steep slopes. Critical area slopes are discussed in further detail in Section 3.5 of this report.

Vegetation within the project site is comprised of moderately sized trees with focused density in the northern portion of the site and around the perimeter of the property, with a few localized groves of deciduous tree growth near the central portions of the site. The central interior of site surface is heavily overgrown by blackberry brambles. Blackberry density diminishes near the more heavily forested areas where ferns and grasses dominate the ground surface. MTC understands the development will encompass the project site in full. The predominant majority of the site interior will be occupied by SFR lots and roadways, with a dedicated open tract for stormwater facilities on the northern end of the property.

Photo A: Looking south from north-center part of property at the central interior of the site. Test pit TP-3 being excavated in photo.

Photo B: Looking to south from the northern boundary of the property. Test pit TP-4 in progress. The heavily forested and low gradient northern portion of the site near stormwater tract.

3.2 AREA GEOLOGY

The *Preliminary geologic map of the Clear Lake NW quadrangle, Skagit County, Washington 1: 24,000 scale* (Whetten et al., 1980) published by the US. Geological Survey indicates that site surface geology is mapped as Tertiary-age Chuckanut Formation Sandstone and Siltstone bedrock (Tc), with Quaternary Vashon till (Qvt) mapped to the immediate surrounding vicinity of the prominent ridge. The Chuckanut Formation bedrock unit is described as poorly indurated coarse sand with thin sand, silt, clay and, tephra interbeds. The unit is primarily deposited in a fluvial environment with some sub-members originating in alluvial fans, lacustrine environments, and mixed with volcanic flows. Glacial till deposits of the Vashon Stade of the Fraser Glaciation are dated at 12,000 to 18,000 years old, and are generally described as a compact, poorly sorted unit composed of varying percentages of silt, sand and subrounded to well-rounded gravel that was glacially transported and deposited under the advancing ice. Bedrock is confirmed as present at varying depths below glacial till deposits throughout the site and observed in local outcrops on the bedrock supported slopes on the southwest and northeast sides of the development area.

The USDA NRCS *Web Soil Survey* maps the majority of the prominent ridge and project site as *Dystric Xerochrepts-Rock outcrop complex* and a small portion of the southeast corner of the site as *Tokul gravelly medial* loam. *Dystric Xerochrepts-Rock outcrop complex* (65 to 90 percent slopes) soils are described as having a parent material of colluvium from sandstone and glacial drift and are typically formed on dip slopes. The typical profile for these soils consist of very gravelly silt loam to 2 inches depth, becoming very gravelly loam to 45 inches upon reaching unweathered bedrock. The map unit is will drained with greater than 80 inches to the groundwater table and approximately 20 to 70 inches to lithic bedrock. The *Tokul gravelly medial loam* (0 to 8 percent slopes) are reported to be formed on till plains and hillslopes with parent deposits derived from volcanic ash mixed with loess over glacial till. Below 2 inches of decomposing plant material, the typical profile consists of gravelly medial loam to 24 inches, followed by gravelly medial fine sandy loam to 33 inches, underlain by cemented material (glacial till) to 62 inches or greater. The map unit is moderately well drained, and is expected to have a very low to moderately low capacity to transmit water (Ksat – 0.0 to 0.06 inches/hour). The depth to the seasonal perched water table is listed as 18 to 36 inches, with a restrictive, cemented horizon at 20 to 39 inches.

Native soil conditions encountered in the field consist primarily of weathered and unweathered versions of native glacial till with silty sand to sandy silt with gravel components, overlying bedrock at depths ranging from 1.5 to 5.8 feet below present grade. Soils observed are interpreted to correlate closely with available geologic map and soil map resources for the project vicinity.

3.3 SOIL CONDITIONS

Subsurface soil conditions were observed and catalogued during test pit excavations. This section summarizes our general understanding of site soil conditions gained from completing field explorations and laboratory analyses.

Subsurface conditions observed throughout the site were generally consistent at all test locations with some variability in horizon depths. Identified typical units are summarized below, in order of increasing depth below the surface:

- **Topsoil – Silty Sand, Sandy Silt (SM, ML):**
  Topsoil deposits were encountered at all test pit locations to a depth of approximately 0.4 to 0.8 feet BPG. Topsoil consisted typically of dark brown sandy silt to silty sand w and high organic content, damp, and soft or loose in consistency. Topsoil typically had some to minor amounts of gravel up to 1-inch in diameter. Organic content included roots with grass and blackberry surfacing and in some areas included tree roots. At test pit TP-1, a thin layer (approximately 1.5 feet) of reworked native soil was observed directly below native topsoil. This was the only area where reworked soils or uncontrolled grade fill was observed.

- **Weathered Glacial Till Deposits – Silty Sand to Sandy Silt (SM-ML):**
  Soils interpreted as weathered glacial till deposits were found at all test pit locations beneath shallow topsoil, extending to approximately 1.5 to 3.2 feet BPG. These soils were typically composed of silty sand to sandy silt with some gravel, and trace to minor organic content. Upper soils were light brown to gray in color with moderate orange mottling observed, medium dense or stiff in consistency and generally damp in moisture content. Gravel contents typically ranged from 1.5 to 3 inches in size and clasts were subrounded. Local occurrences of cobbles and boulders were observed within weather till horizons throughout the site.

- **Unweathered Glacial Till Deposits – Silty Sand to Sandy Silt (SM-ML):**
  Predominantly fine-grained and unsorted native glacial deposits interpreted as intact glacial till were encountered in the majority of test pit locations beginning as shallow as 1.8 feet at TP-10 and as deep as 3.2 feet BPG at TP-1, with an average occurrence at 2.5 feet BPG and continuing to maximum depths explored. Unweathered glacial till deposits were not observed at the locations of TP-3, TP-7, and TP-8, where weathered horizons were observed to directly observed shallow bedrock surfaces. Unweathered soils below were typically uniform gray silty sand to sandy silt, containing some gravel, damp to dry with depth and with a very stiff to hard consistency resembling hardpan increasing with depth. The unweathered glacial till soil did not exhibit oxidation or mottling alteration in contrast to the overlying weathered section, except at near the upper contact in local test pit locations where faint discoloration was observed.

- **Bedrock – Chuckanut Sandstone/Siltstone to Argillite/Metasiltstone (BR):**
  Bedrock was encountered at all test pit locations underlying mantled glacial till deposits and was observed at the surface in local areas among the upper crest and throughout sloping terrain on the surrounding boundaries of the project site. Depths to bedrock ranged from as shallow as 1.5 feet BPG at TP-7 near the center of the site to as deep as 5.8 feet BPG at TP-9 near the southeast portion of the site. Depths to bedrock varied throughout the site without obvious control on depths but greater depths were generally observed in the southeastern corner of the site (TP-1, TP-2, TP-9). Bedrock character was also observed to vary throughout the site with Chuckanut Sandstone to Siltstone observed in the southeast at the deeper locations while Argillite or Metasiltstone bedrock was observed throughout the central and northern majority of the site. Bedrock in all locations was slightly fractured near the surface becoming resistant and high strength within less than 1 foot.

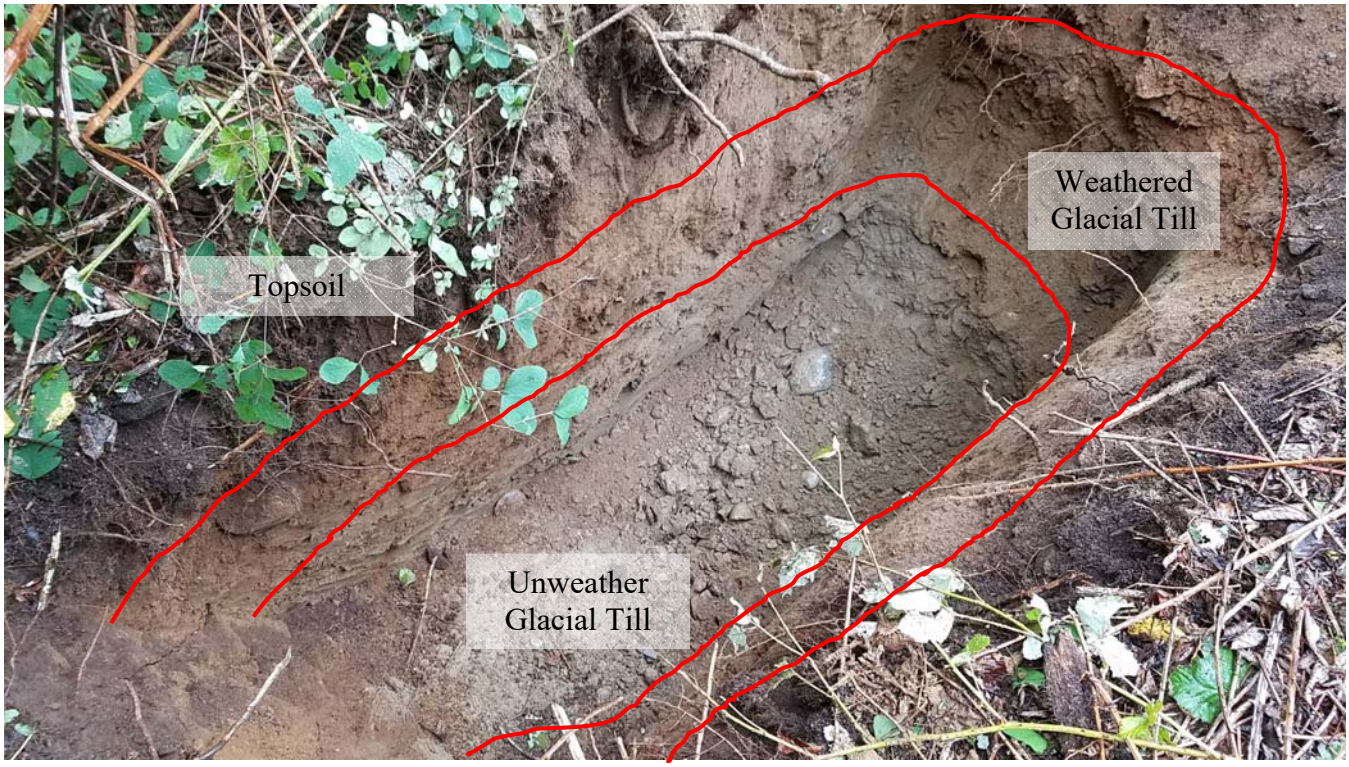


Photo C: General soil stratigraphy as observed at Test Pit TP-6. Typical profile includes topsoil to depths of 0.4 to 0.8 feet BPG, then shallow weathered glacial till deposits to an average depth of approximately 2.5 feet BPG. Weathered deposits are underlain by unweathered "hardpan" till deposits and bedrock at varying depths up to 5.8 feet BPG throughout the project.

3.4 SURFACE WATER AND GROUNDWATER CONDITIONS

No surface water features were observed on site or in the close vicinity of the project location, and no seasonal channels or runoff zones were observed on the property during the late-fall field visit. Surface conditions were typically damp with no obvious signs of saturated soils or seasonal water features. The nearest major surface water feature to the site is Big Lake, approximately 1.5 miles to the east. We understand some permanent or seasonal ponds and wetland features are present locally in the general site vicinity, however none are mapped within the site and no obvious indications of wetlands were observed.

A pervasive groundwater table was not encountered at any test pit location within the project site at the time of the explorations in the early summer season. No active water seepage or significant evidence of perched or shallow water was observed at any of the test pit locations at the time of the visit. Based on the time of this investigation, during the early summer season, it is likely that observed conditions represent a seasonally reduced condition of water occurrence which is most indicative of dry season conditions. Cursory review of available well data from the project vicinity indicates the regional water table resides at greater than 150 feet in depth, and outside of the scope of this study.

We observed for signs of seasonal saturation and perched water presence in the shallow soil column in order to estimate wet season conditions relating to a perched water table phenomenon which is known to be common in the site vicinity. Moderate oxidation and mottling was observed scattered within the weathered till soil profile within the upper 1.5 to 3 feet of the subsurface, as well as visible along the upper margin of the intact glacial soils in local areas. These patterns are interpreted to indicate interaction with meteoric waters from the surface during wet season conditions and storm events from surface infiltration and transient flow process above a relatively impermeable till or bedrock surface. No heavy mottling or color banding was observed, suggesting a pervasive perched water table does not fully develop in the winter season within the upper soils. It is likely that the sloping site gradient descending to the southwest and northeast prevents trapping of shallow water required to develop a true perched water table. Therefore, we interpret the restrictive till or bedrock horizons are also roughly the typical depth to full inundation in winter months due to temporary water migration down-gradient along this limiting boundary. Soil wetness and saturation may occur more shallowly due to the temporary effects of capillary action and migratory water retention.

MTC's scope of investigation did not include direct determination or term monitoring of seasonal groundwater elevation variations, conclusive measurement of groundwater elevations at the time of exploration, or deep explorations that may have encountered the regional groundwater table at greater depths past the extent of concern for the proposed construction.

3.5 CRITICAL AREA SLOPE CONDITIONS

MTC understands the proposed development is in proximity to critical area slopes of typically moderate grade descending to lower elevation golf course grounds on the southwest and northeast boundaries of the property. The site is within the Mount Vernon City permitting jurisdiction and subject to Mount Vernon Municipal Code (MVMC) 15.40 covering development in proximity to designated Critical Areas. Potentially geologically hazardous conditions related to slopes include erosional and landslide hazards. According to MVMC 15.40.070.B.2 defining geologic hazards, landslide hazards are considered where slopes exceed 40 percent or greater with a vertical relief of 10 feet or more. Erosion hazards are defined in MVMC 15.40.070.B.1 as areas containing soils that have severe or very severe erosion hazard potential and areas sloping greater than 30 percent.

MTC's site reconnaissance performed in conjunction with field explorations observed slopes bounding the southwest and northeast boundaries of the property. As noted above, the subject slopes descend from the prominent ridge that comprised the subject site down to lower elevation golf course grounds below. In addition, we traversed the property and observed slope face surface conditions to assess for visible signs such as headscarps, oversteepened soil walls and natural exposures hummocky areas, or sloughing or translational failures representing present-day activity or suspected historical instability. We included in our traverse evaluation of bedrock exposures that were found on both slope faces bounding the property. No obvious visual evidence of slope instability was observed within or adjacent to the property slopes among the southwest and northeast sides of the property, where accessible.

The larger slopes on the southwestern boundary of the site measure a total elevation relief of 150 feet from the top of the subject slope at the project boundary, terminating on lower elevation golf course grounds to the southwest. Due to steeper grades and unsafe bedrock conditions, we did not traverse this slope in total. Surface gradients on the accessible slope face were measured at 30 to 35 degrees with no obvious changes in slope morphology. Near the crest of the slope, we measured a lower gradient zone of approximately 50 feet with gradients of 10 to 15 degrees before reaching the flat interior of the project site. Vegetation on the southwest facing slope contained localized groves of tree growth and understory of grass and blackberry brambles. Denser vegetation was absent in areas where bedrock was observed or apparently close to the surface restricting vegetation development. No obvious areas of slope instability or soil/vegetation failure were observed along the slope face, where accessible.

Slopes observed among the northeastern boundary of the site were observed to be generally lower gradient along the southern edge with steeper rock outcrop slopes observed on the northern end. In the northern area, the rock outcrops were up to 20 feet in height with gradients up to 70 degrees. Vegetation was observed as very dense in all areas along this boundary, excepting where rock outcrops restricted growth. Exposed bedrock was observed as massive and very-strength quality.

Although the slopes bounding the site are considered as geologically hazardous slopes by local code definitions, we do not consider the subject site to be at increased risk to erosion, landslide, or seismic hazard due to development. With the presence of shallow bedrock throughout the project site, we anticipate foundations placed directly on and structurally connected to bedrock would reduce risks of sliding or failure. In addition, we observed that both slopes bounding the site area bedrock supported limiting the risks of slope failure throughout the site. A slope stability review and analysis were not considered feasible, nor necessary with the presence of bedrock supported building areas and slopes in the site vicinity. The recommendations in Section 5 of this report are intended to address development in the vicinity of a geologically hazardous area, and for best management practice also incorporate requirements typical for but not limited to landslide, erosion, or seismic hazard zones.

Photo D: View of southwest-facing slope face from near the slope crest. Dense vegetation observed in areas were bedrock not exposed at the surface.

4.0 KEY GEOTECHNICAL CONSIDERATIONS

This section discusses significant geotechnical issues that must be addressed in project planning and design and forms the basis for the geotechnical engineering design recommendations presented in Section 5.0 and construction recommendations presented in Section 6.0.

4.1 GENERAL SITE SOIL CONDITIONS

The results of MTC's investigation indicate organic-rich topsoil deposits are present to between 0.4 and 0.8 feet thickness at the site surface. Locally within the western portion of the project site, known uncontrolled grade fills cap native conditions for about 1.0-foot thickness residing over buried topsoil (TP-10 area). Shallow soil conditions at the proposed building and road areas throughout the site consist of relatively fine-grained outwash-derived deposits, composed typically of medium dense silty sand with local stiff sandy silt extending to 2.5 feet depth BPG on average (maximum of 4.2 feet BPG observed at TP-5). Lower deposits of predominantly medium dense to dense sands with variable gravel content and some to minor fines were encountered at all locations below the upper soil stratigraphy to maximum depths explored, correlating closely with regionally mapped coarse-grained outwash deposits.

Cover soils were typically soft or loose, organic-rich topsoils and local thin surface gravel fills near the southeast site entrance and in the vicinity of existing developments, as well as uncontrolled grade fills in one area of the west part of the site. Depth to medium dense sandy subgrade was typically around 1.0 feet BPG at most locations. However, locally loose conditions were also encountered intermittently or locally in the upper subsurface to a few feet depth.

The relatively shallow depth of topsoils and loose subsoils on the site, lack of significant uncontrolled fills, and general absence of unsuitably loose or soft soils at anticipated subgrade levels indicates that traditional shallow preparation and construction methods are generally feasible for the proposed project and site conditions for road and building site development. On-site infiltration appears to be infeasible through traditional methods, with shallow restrictive glacial till soils and bedrock as well as site proximity to critical area slopes. Preliminary plans indicate detention and dispersion of stormwater, which appear to be suitable given careful design and layout.

4.2 SCOPE OF SITE GRADING

A final grading plan was not available to MTC at the time of this report. Based on preliminary grading plans, this study assumes finished site grade will typically approximate current grade, with only minor cut and fill activities required. Therefore, the depths referred to in this report are considered roughly equivalent to final depths. The primary exception is near the northeastern col-du-sac at the end of the access roadway where additional fills are shown to accommodate sloping terrain. Along this area, a structural retaining wall is considered to retain native soils and grade fill with design pending.

4.3 TEMPORARY EXCAVATION CUT SLOPES, SHORING, AND DEWATERING

Plans for excavation including temporary cut slopes and proposed shoring methods were not available to MTC at the time of report production. Based on the client's project descriptions, general excavations for buildings and exterior constructions are anticipated to be shallow. If deeper excavations are left open and require worker entry, repealed cut slopes and/or shoring will likely be needed due to the non-cohesive nature of site soils. Section 6.3 of this report provides general recommendations for treatment of temporary excavations. MTC can provide further consultation, design, and evaluation services for cut slopes if desired prior to and during construction. If shoring is required beyond typical OSHA standards, MTC can provide geotechnical engineering services for shoring design upon request.

Dewatering is not anticipated to be a major component of site construction yet is considered of importance if construction occurs during winter or wet season months. Transient perched groundwater may develop during wet seasons within 1 to 2 feet from the surface based on shallow glacial till mottling patterns and local observations of bedrock near the surface. Summer conditions are anticipated to be dry. If earthwork is conducted in the winter season, it is plausible that some amount of dewatering will be needed to abate local water influx to confined excavations from surface runoff or as a result of seepage from restrictive horizons if encountered. General recommendations for site preparation and wet weather construction are addressed in section 6.1.3 of this report. However, it should be noted that this study did not include a hydrogeologic evaluation necessary for accurate appraisal of wet season groundwater conditions and is only generally suitable for planning and design of dewatering methods.

5.0 DESIGN RECOMMENDATIONS

5.1 FOUNDATION FEASIBILITY

Two requirements must be fulfilled in the design of foundations. First, the load must be less than the ultimate bearing capacity of the foundation soils to maintain stability; and secondly, the differential settlement must not exceed an amount that will produce adverse behavior of the structure. The allowable settlement is usually exceeded before bearing capacity considerations become important; thus, the allowable bearing pressure is normally controlled by settlement considerations including differential settlement. Excess settlement due to adverse soil conditions may be a result of shallow or deep soils, or a combination of both.

Considering the native glacial till deposits overlying bedrock found at all test pit locations as well as the scale of proposed improvements, the site does not appear susceptible to potential deep settlement from loose or soft soils or liquefaction-induced settlement after development. Therefore, MTC has not recommended further scope of exploration work and analysis towards deep settlement potential or liquefaction hazard at this time.

Surface soil conditions at the site consist of organic-rich topsoil and local thin fills (southwest corner of site at TP-1) underlain shallowly by silty sand to sandy silt glacial till deposits, varying depths to shallow bedrock below. Native soils appear generally suitable for bearing support of roadways, flatworks, and slab construction, utilizing design criteria cited in Section 5.2 below. For building foundation elements near the critical area slopes of the southwestern and northeastern project site boundaries, we recommend footing be placed on and anchored into bedrock to ensure building stability. We recommend avoiding placing footings and slabs within or over existing topsoil (present to about 1.0 feet BPG on average), or above uncontrolled fills or disturbed native soils as encountered locally, due to the potential for subgrade variability and risk of settlement. All organic-rich topsoil and unsuitably loose or soft upper soils should be removed down to firm native subgrade prior to placement of foundation elements.

Foundation design specifications were not available at the time of this report. MTC assumes that the single-family residences will employ continuous perimeter and/or spread footings and a slab-on-grade or elevated floor. Finished grade is assumed to be similar to existing grade; therefore, shallow conditions of the existing site soil are relevant to slab-on-grade construction. Observed bedrock conditions appear generally suitable for bearing support of shallow foundation elements. Locally soft silty soils may be present at specific foundation locations and depths, based on variations observed; therefore, some site preparation efforts toward recompaction or overexcavation and replacement of unsuitable subgrade with structural fill should be anticipated.

Topography within the building footprints among the ridge interior were observed to be flat to gently

sloping in the realm of 10 to 15 degrees maximum. We observed that the planned building areas to not overlap steeper sloping areas on the southwest and northeast margins of the site. Given the bedrock outcropping on the sloping terrain and shallow occurrences throughout the project site, we recommend a *minimum structural setback of 10 feet horizontal* be maintained from the outer edge of slopeward footings to slopes exceeding 40% grade. This assumes foundations lines and isolated elements will be excavated to and anchored to intact bedrock. If necessary, excavation depth can be increased for foundations to adhere to this minimum setback criteria.

It is the opinion of MTC that a shallow foundation is suitable for use assuming the recommendations provided below are followed for foundation design, site preparations, and construction methods. MTC recommends that we be contacted to review plans relating to foundation design and site preparations, to ensure they are consistent with the content and intent of recommendations provided herein.

5.2 FOUNDATION RECOMMENDATIONS

Surficial or buried organic soils, uncontrolled fills or disturbed native soils, and loose or soft subgrades are not suitable to remain below building elements due to shallow settlement concerns, and shall be excavated at footing locations and alignments prior to preparing footing subgrades or placing structural fills. MTC recommends building foundations be placed on suitably intact bedrock, or on imported structural fill installed over native soils where raising grade or local overexcavation is required. Since the native soils may be locally loose at shallow depths or disturbed during excavations and grading, MTC recommends recompacting exposed subgrade at structural footing locations to a uniformly medium dense condition after preparation to proposed subgrade level but prior to fill placement or proceeding with footings and slab-on-grade construction.

For general foundation design considerations, MTC recommends referring to guidelines and parameters of the International Building Code (IBC, 2015; or most recent edition at the time of construction). Per the assumed foundation design, MTC anticipates foundations will be placed on bedrock which is present near surface over the majority of locations throughout the site. Unweathered bedrock is assumed to be present typically within 1.5 to 5.8 feet BPG, deepest near the southeast corner of the site. Upon reaching intact rock, foundation alignments should be benched flat by mechanical removal. Blasting is expressly not recommended. Foundations should be stepped to accommodate gradual sloping grade. We recommend maximum steps of 18 inches with spacing of at least 5 feet, unless specified otherwise by the design engineer.

All portions of the foundation should be placed wholly on intact rock, as the variability in subgrade support between rock and adjacent loose soil may result in differential settlement. If required, lean concrete may be used as leveling material to address local variability in the bedrock profile. However, all efforts should be made to level the foundation subgrade prior to using leveling concrete. No foundation elements or leveling mixtures shall be placed on sloping rock surfaces or loose rock.

Shallow foundation elements should be anchored into bedrock using rock nails, epoxied dowels, or similar fastening components placed into competent bedrock where the structure is required to counteract lateral or uplift forces and adequate burial or backfill of foundation elements is not feasible. We also recommend a minimum embedment depth of 12 inches into competent bedrock when utilizing anchoring components. Isolated footings may require anchoring or structural tie-ins for lateral support when placed on shallow rock. Anchoring should be considered by the building designer, who may recommend alternative methods be employed. MTC may be contacted to consult on foundation placement options and review or provide additional recommendations for proposed construction specifications including anchoring.

Assuming site preparation is completed as described above, we recommend the following:

- **Allowable Soil Bearing Capacity:**
  2,500 pounds per square foot (psf) for foundation elements placed directly on suitably dense, intact glacial till deposits within the site interior, or on compacted structural fill placed over these soils per the recommendations presented herein for *Structural Fill Materials and Compaction*. Soils must be verified as suitably firm and free of organic material at subgrade level.

  For foundation elements and building footings encroaching on critical area slopes, up to *3,000 pounds per square foot (psf)* is allowed for footings placed directly on intact and competent bedrock. Bedrock must be verified as competent, unfractured and in favorable condition.

  A lower bearing capacity may be preferable for use to lessen or avoid requirements for inspection that can accompany application of bearing values exceeding those typically assumed for residential construction.

  The allowable bearing capacity may be increased by 1/3 for transient loading due to wind and seismic events.

- **Minimum Footing Depth:**
  For a shallow perimeter and spread footing system, all exterior footings shall be embedded a minimum of 18 inches and all interior footings shall be embedded a minimum of 12 inches below the lowest adjacent finished grade, but not less than the depth required by design. However, all footings must penetrate to the prescribed bearing stratum cited above, and no footing should be founded in or above organic or loose soils.

- **Minimum Footing Width:**
  Footings should be proportioned to meet the stated bearing capacity and/or the IBC 2012/2015 (or current) minimum requirements, whichever is greater. For a shallow foundation system, continuous strip footings should be a minimum of 16 inches wide and interior or isolated column footings should be a minimum of 24 inches wide.

- **Estimated Settlements:**

  We estimate that the maximum settlements from shallow bearing considerations will be on the order of 1 inch, or less, with a differential settlement of ½ inch, or less, over 50 linear feet. Settlement is anticipated to occur primarily when the load is applied during construction.

- **Lateral Load Resistance:**

  Lateral loads can be resisted by passive pressure against buried portions of the foundation elements and sliding resistance along its base. We recommend an allowable lateral pressure equal to that generated by a fluid with an equivalent unit weight of 200 pcf EFW. This value assumes foundations are backfilled with structural fill and includes a factor of safety of two. Alternatively, for elements placed directly against firm native soils, we recommend the allowable lateral pressure be reduced to 125 pcf EFW. The upper 18 inches of soil should be ignored unless the area is paved or covered with concrete, due to soil softening associated with freeze/thaw.

  Sliding resistance between the native silty sand to sand subgrade and concrete foundation base should be evaluated using an allowable coefficient of friction of 0.25 multiplied by the dead load. This value assumes concrete placed directly on the subgrade and includes a factor of safety of 1.5. Alternatively, where structural fill is planned to be placed beneath footings, an allowable coefficient of friction of up to 0.35 may be applied.

- **Footing Drains:**

  MTC recommends exterior foundations employ footing drains to help maintain an unsaturated subgrade. Footing drains should employ 4-inch minimum perforated pipe backfilled with free-draining material (as specified below for wall drainage) wrapped in filter fabric. Footing drains should be tightlined separately from roof drains to a catch basin system or to a suitable permanent discharge point at least 10 feet from the structure. A schematic illustration of a typical footing drain is shown below.

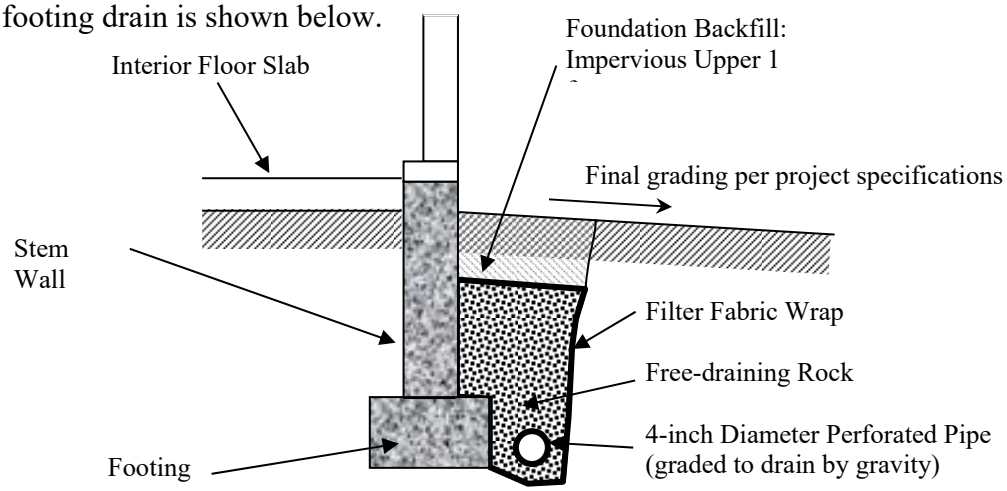


Illustration A. Footing Drain Schematic Profile

5.3 SLAB-ON-GRADE FLOOR CONSTRUCTION

Slab-on-grade floors may be used for building interiors and garages assuming typical residential construction practices. Floors are assumed to be subject to light live loading, with garages designed for small vehicle loading. After stripping of organic soils and removal of unsuitably soft or loose native sensitive soils, if present, shallow site conditions at building areas are anticipated to be silty sand to sandy silt of medium dense to dense or stiff to very stiff quality recompacted to a uniform condition. For traffic-loaded slabs, design and construction of the slab including reinforcement should counteract the potential for differential settlement due to soil variability at shallow depths.

We recommend the following activities and parameters for slab-on-grade design and construction intended to provide reinforcement against shallow soil variations and potential adverse effects of differential settlement. For the purpose of this report, we assume finished slab grade will be similar to present grade for the below recommendations. If floor grades are planned to be substantially raised or lowered from existing grade, MTC should be contacted to confirm or provide revised or alternative recommendations based on a greater extent of site preparations.

The below activities and parameters are recommended for slab-on-grade floor construction:

- **Subgrade Preparation and Base Pad:**
  After stripping to subgrade level, exposed soils should be evaluated by visual inspection and probing. Any excessively soft or loose soils should be overexcavated as needed and replaced with structural fill. We recommend slab subgrade be recompacted to assure an even, undisturbed subgrade for pad construction.

  A 12-inch minimum section of structural fill base is recommended to be installed beneath all floor slabs. Base pad material may consist of gravel borrow, as recommended herein for general structural fill application, or a similar material of equivalent function as approved by the geotechnical engineer. As noted below, capillary break material can account for a portion of the base fill section if composed of compacted angular material approved as structural fill.

- **Subgrade Modulus:**
  A bulk Subgrade Modulus (k) of 125 pci is recommended for use in design of slab-on-grade floors constructed on the minimum-thickness base pad as recommended above placed over native subgrade of suitably firm quality.

  A Subgrade Modulus (k) of 200 pci is allowed for use in design of slab-on-grade floors constructed over imported and compacted granular structural fills of at minimum 24 inches thickness (including angular capillary break) if applicable.

- **Proof Roll:**

Prior to placement of capillary break material and slab construction, the proposed slab subgrade shall be proof-rolled to confirm no soft or deflecting areas are present. This is to ensure the existing base is evenly prepared and adequate for support of the slab. MTC recommends that we be contacted for observation of the proof roll and final visual confirmation of prepared base suitability. Areas of excessive rutting, pumping, or yielding shall be excavated and backfilled with new structural fill as described herein.

- **Capillary Break:**
  A capillary break is recommended to help maintain a dry slab floor and reduce the potential for floor damage resulting from shallow water inundation. To provide a capillary moisture break, a 6-inch thick, properly compacted granular mat consisting of open-graded, free-draining angular aggregate is recommended below floor slabs. To provide additional slab structural support, or to substitute for a structural fill base pad where specified, MTC recommends the capillary break should consist of crushed rock all passing the 1-inch sieve and no more than 3 percent (by weight) passing the U.S. No. #4 sieve, compacted in accordance with Section 6.2.2 below.

- **Vapor Barrier:**
  A vapor retarding membrane such as 10 mil polyethylene film should be placed beneath all floor slabs to prevent transmission of moisture through the slab where floor coverings may be affected. Care should be taken during construction not to puncture or damage the vapor retarding membrane. To protect the membrane, a layer of sand no more than 2 inches thick may be placed over the membrane if desired.

- **Structural Design Considerations:**
  For slabs subject to vehicle loading, we recommend designing for increased rigidity and self-support in order to help counteract the higher potential for differential settlement under concentrated loading. MTC suggests at least a minimum unreinforced concrete structural section of 6.0 inches be employed, or as specified by the project structural engineer or architect. It is generally recommended that floor slabs and exterior concrete paving subject to vehicular loading be designed to incorporate reinforcing to help span localized areas of variable soils and eliminate potential cracking. In addition, these areas may call for additional structural fill sections to be placed beneath rigid pavements, depending on final grades. Slab design and specifications for structural or traffic loading should be assessed by the project engineer or building designer.

5.4 RETAINING WALL DESIGN

Structural retaining wall are planned to facilitate road construction general grading on the northeast sloping portion site and potentially within foundation areas where sloping terrain increases around the

perimeter of the site. Walls may retain either undisturbed native cut soils or structural backfills depending on final design. All walls are assumed to be founded on suitably firm intact native soil/bedrock, or on structural fill base pads, in accordance with recommendations for foundation design presented in Section 5.2.

The below recommendations pertain to the design of rigid, laterally loaded retaining structures. Values assume walls are backfilled with approved drainage fill and granular material, and retaining a level slope. These values are not universally applicable to exceedingly sloping backfills, backfills composed of non-granular soil materials, braced or tied-back walls, structurally or traffic-loaded walls, or for walls greater than 10 feet in height. MTC expressly recommends that we review final plans and specifications for retaining walls to ensure consistency with the recommendations presented herein and to provide additional geotechnical consultation and recommendations as needed for final design and construction.

- **Wall Drainage:**
  To preclude build-up of hydrostatic pressure, we recommend a minimum width of 1 foot of clean, granular, free-draining material extend from the footing drain at the base of the wall to the ground surface immediately behind the wall. Native soils are not considered suitable as drainage material. Imported wall drain aggregate should conform to WSDOT Standard Specification 9-03.12(4) Gravel Backfill for Drains or 9-03.12(5) Gravel Backfill for Drywells. A filter fabric suitable for use in soil separation and water transmission should be placed against the retained soil cut behind the wall to limit migration of fines into the drain corridor.

- **Backfill Soil – Structural Fill:**
  Where structural backfill is called for, soils used for wall backfill should be relatively granular with less than 5 percent fines (material passing the U.S. No. 200 sieve). Native site soils are not suitable for use as wall backfill. Wall backfill is considered Structural Fill, and additionally should conform to WSDOT Standard Specification 9-03.12(2) Gravel Backfill for Walls.

- **Backfill Compaction:**
  To prevent build-up of excess lateral pressures, over-compaction of structural fill behind walls if installed should be avoided. However, a lesser degree of compaction may permit excessive post-construction settlements. In order to limit wall pressures resulting from over-compaction of wall backfill, we recommend that backfill within 5 feet of a wall be compacted by small, hand-operated compaction equipment placed in 6- to 8-inch maximum loose lifts. Compaction efforts should begin along the fill edge closest to the wall and progress away from the structure.

- **Active and At-rest Pressures:**
  Yielding (cantilever) retaining walls should be designed to withstand an appropriate active lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate at-rest lateral earth pressure. The at-rest case is applicable where retaining wall

movement is confined to less than 0.005 H, where H is the wall height. If greater movement is possible, the active case applies. A wall movement of about 0.02 H will be required to develop full active and passive pressures. These pressures act over the entire back of the wall and vary with the backslope inclination.

For retaining walls up to 10 feet effective height (including backslope) and retaining native soils or imported structural fills, we recommend using the parameters for active and at-rest earth pressures (given as equivalent fluid unit weights) provided in Table 1.

Note: For undrained wall scenarios, if required, design loads should be compensated to account for saturated soil conditions and hydrostatic pressures per IBC. In this event, MTC should be contacted for further consultation.

Table 1. Recommended Parameters & Earth Pressures for Foundation Design

SOIL TYPE (ASTM)	VERTICAL BEARING CAPACITY	LATERAL BEARING PRESSURE	FRICTION ANGLE	FRICTION COEFFICIENT	ACTIVE PRESSURE*	AT-REST PRESSURE*
Weathered Glacial Till (SM – ML)	2,000	200	34	0.25	35	55
Unweather Glacial Till (SM – ML)	2,500	280	40	0.35	27	45
Structural Fill (GW)**	2,500	220	36	0.35	30	50

* Values in equivalent fluid pressure, based on depth below grade. Units of psf per foot. Assumes non-saturated conditions.
^ Assumed to be negligible compared to retained soil contribution.
** Design values for structural fill requires Gravel Borrow or 1 ¼”-minus crushed stone fill or equivalent structural materials.

5.5 SEISMIC DESIGN PARAMETERS AND LIQUEFACTION POTENTIAL

According to the *Liquefaction Susceptibility Map of Snohomish County, Washington* and the accompanying *Seismic Site Class Map* (Palmer et al., 2004), the site vicinity is identified as having a very *low* liquefaction susceptibility. Liquefaction is a phenomenon associated with a subsurface profile of relatively loose, cohesionless soils saturated by groundwater. Under seismic shaking the pore pressure can exceed the soil’s shear resistance and the soil ‘liquefies’, which may result in excessive settlements that are damaging to structures and disruptive to exterior improvements. The accompanying Seismic Site Class Map (Palmer et al., 2004) classifies the project area as Site Class C, representing a relatively low to moderate potential for increased amplitude of ground shaking during a seismic event. Based on the results of explorations, MTC also interprets the site to have a very low risk of liquefaction due to the mapped bedrock and till deposits in the site vicinity and absence of groundwater.

The *USGS Seismic Design Map Tool* was used to determine site-specific seismic design coefficients and spectral response accelerations for the project site assuming design Site Class C, representing a subsurface profile (upper 100 feet) of very dense soil or soft rock conditions. Parameters in Table 1 were calculated using 2008 USGS hazard data and 2012/2015 International Building Code standards:

Table 1. Seismic Design Parameters – Site Class C

Mapped Acceleration Parameters (MCE horizontal)	S_S	1.079 g
	S_1	0.420 g
Site Coefficient Values	F_a	1.000
	F_v	1.5380
Calculated Peak SRA	S_{MS}	1.079 g
	S_{M1}	0.579 g
Design Peak SRA (2/3 of peak)	S_{DS}	0.719 g
	S_{D1}	0.386 g
Seismic Design Category – Short Period (0.2 Second) Acceleration		D
Seismic Design Category – 1-Second Period Acceleration		D

5.6 STORMWATER CONTROL DISCUSSION

Site conditions present limitations for use of traditional infiltration stormwater controls per the Department of Ecology SMMWW guidelines. Field explorations yielded soil stratigraphy typically consisting of 0.8 feet of organic-rich topsoils, overlying restrictive native glacial till deposits and bedrock. The upper, weathered glacial drift soils showed a consistently moderate orange oxidation and mottling alteration indicating regular interaction with perched water conditions. Although our field investigation during the summer season did not encounter any seepage or primary signs of perched water, the high fines in the weathered soils and the consistent mottling patterns suggest that a perched water table likely develops within this horizon during wet, winter months or storm events.

Due to presence of shallow, restrictive glacial till soils bedrock conditions and the potential for elevated perched groundwater conditions, the site is considered infeasible for traditional infiltration design. We understand that a preliminary drainage plans are designed for the collection of all stormwater to be routed to a detention and dispersion system located at the northern portion of the project site. Plans indicate that a dispersion trench is to be located to outfall near the northeastern corner of this facility near steep bedrock slopes. We recommend avoiding dispersion within this area as discharge of water within areas of high gradients and shallow cover soils over bedrock may increase the risk for erosion in this area. During our field investigation we observed a lower gradient flow path that exits the northwest corner of the stormwater tract that would be more suitable for dispersion per DoE SMMWW

regulations. MTC can be contacted to review final stormwater drainage plans to verify final placement of dispersion outfall and drainage paths.

5.7 GEOTECHNICAL COMMENTARY FOR ROAD DEVELOPMENT

Based on the results of our targeted soil survey utilizing test pits along the proposed road alignment, the site appears generally suitable for final roadway construction to meet local municipal standards as depicted on the provided preliminary plans and City of Mount Vernon Standard Plans. As part of this scope, MTC was asked to provide commentary on road construction suitability in support of final civil design. This section addresses primary design considerations and general geotechnical recommendations for site preparation in light of the findings of our field explorations conducted to date. MTC can be contacted for additional analysis, review, and recommendations if required for final design and approval.

Existing Soil Conditions – Road Alignment

The soil profile at test pits TP-5, TP-7, and TP-9 along the proposed extension of existing is laterally consistent and generally correlative with other test pit locations on the property in terms of native stratigraphy. Below thin topsoils, native subgrades were stiff or medium dense sandy silty to silty sand weathered glacial till deposits appearing generally suitable as road subgrade, being firm and unyielding. All topsoils and other locally loose soils should be stripped prior to the placement of any road section gravel fill materials.

Proposed Pavement Section

Based on the provided site plans by the project designer and the City of Mount Vernon Standard Plans, we understand that the extension of the existing access road through the central interior of the project site as a public roadway is proposed to consist of the following pavement section:

4” Minimum Class ½” HMA
2” Minimum Crushed Surfacing Top Coarse (CSTC)
12” Minimum Gravel Borrow or Equivalent
Surface Stabilizing Fabric (as necessary depending on subgrade, construction season, etc.)

In our opinion, based on past experience and from a geotechnical perspective, this pavement section constructed over suitable subgrade as present at the project site appears sufficient for the intended use of the road. No conditions of obvious concern were encountered that would preclude use of a standard section on this project.

Road Improvement Recommendations

We anticipate the road improvements will be comprised of entirely new contruction road surfaces due to the lack of prior development or fills on the subject property and native conditions found in all test pit locations within the road alignment. Our recommendations for preparation are as follows:

1) Upon stripping, all organic materials should be verified as removed from the remaining road bed. The exposed road base material shall be inspected for suitability and recompacted.

2) New imported gravel base material meeting project specifications may then be applied and compacted to restore final base grade before placing CSTC and paving.

3) Final gravel base grade shall be compaction tested to verify suitable installation and/or recompaction is attained.

4) MTC recommends a proof roll shall be completed on all areas of the prepared roadway prior to placement of CSTC to assess for any localized soft or yielding areas remaining that require full removal and replacement of the base section. A proof roll prior to preparations may also be used to identify areas of concern to be overexcavated initially prior to other efforts. MTC recommends that we be contacted for geotechnical consultation and testing services towards documentation of road preparations and verification of the final road base conditions.

Site preparations and construction methods should follow typical local and industry standards. At minimum, this will include stripping of all topsoils and excessively loose or soft soils, and installation of approved structural fill materials as specified by the final civil design. All fills for pavement sections shall be installed in lifts and compacted to at least 95% of maximum dry density per modified proctor laboratory testing. Based on the native subgrade soil conditions observed in explorations in the mid-winter season, ground stabilization fabric does not appear to be necessary assuming the presence of suitably firm subgrade is verified in construction for all areas of new construction. Fabric may become necessary if locally poor conditions are encountered, or if work is performed during poor weather when moisture sensitive soils may become soft or unsuitable when exposed. MTC can be contacted for additional recommendations on an as needed basis prior to or during road construction.

5.8 CLEARING PLAN REVIEW AND DISCUSSION

MTC understands that project development involves clearing the majority of the site interior of existing vegetation and debris prior to construction. At the request of the City of Mt. Vernon, we have reviewed the clearing plan for the Eaglemont Phase III-C development for permitting purposes. In our opinion, the proposed clearing plan is suitable provided that the following recommendations are followed.

- No clearing activities should extend beyond silt fencing proposed around the perimeter of the site. This allows for suitable clearing setbacks from critical area slopes present along the western and eastern margins of the property.

- Implementing sturdy erosion control measures and practices during site preparations is necessary to limit the effects of construction on the bordering slope face, and protect existing nearby golf course property. The side-slope clearing limit barriers must be adequately established and reinforced to prevent soil and rockfall from occurring down the slope. It is the responsibility of the contractor to ensure that suitable protective measures are in place as needed throughout the project. Stockpiling of excavated tailings directly above or on slope faces is also prohibited.

- Source and runoff control BMPs should be implemented per civil design in order to reduce erosion within the site during construction. As stated in the clearing plan, mulching and hydroseeding should be employed within cleared areas that remain unworked for an extended period of time.

- Construction phase stormwater controls should follow stormwater recommendations outlined in Section 5.6 above. If construction activities occur during wet, winter months, appropriate construction stormwater discharge locations will be necessary to divert stormwater from critical area slope faces.

- Tree protection plans for trees to be preserved near the boundaries of the clearing limits appears to be adequate per the City of Mt. Vernon Land Clearing Permit Detail 06-08. Clearing near critical root zones of preserved trees must be conducted per the Mt. Vernon Municipal Code.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 EARTHWORK

6.1.1 Excavation

Excavations can generally be performed with conventional earthmoving equipment such as bulldozers, scrapers, and excavators.

Where possible, excavations made within about one foot of finished subgrade level should be performed with smooth edged buckets to minimize subgrade disturbance and the potential for softening to the greatest extent practical.

6.1.2 Subgrade Evaluation and Preparation

After excavations have been completed to the planned subgrade elevations, but before placing fill or structural elements, the exposed subgrade soils should be evaluated under the full-time observation and guidance of an MTC representative. Exposed bedrock at footing grades should be approved by an MTC representative following any benching and leveling procedures, but prior to placement of structural elements.

Where appropriate, the subgrade should be proof-rolled with a minimum of two passes with a fully loaded dump truck, water truck or scraper. In circumstances where this seems unfeasible, an MTC representative may use alternative methods for subgrade evaluation.

Any loose soil should be compacted to a firm and unyielding condition and at least to 95 percent of the modified Proctor maximum dry density per ASTM D1557. Any areas that are identified as being soft or yielding during subgrade evaluation should be over-excavated to a firm and unyielding condition or to the depth determined by the geotechnical engineer. Where over-excavation is performed below a structure, the over-excavation area should extend beyond the outside of the footing a distance equal to the depth of the over-excavation below the footing. The over-excavated areas should be backfilled with properly compacted structural fill.

6.1.3 Site Preparation, Erosion Control and Wet Weather Construction

The native shallow glacial till subgrade at presumed excavation depths may be moisture sensitive due to high fines content and could become loose or soft and difficult to compact or traverse with construction equipment when over optimal moisture content. During wet weather, the contractor should take measures to protect exposed subgrades and limit construction traffic during earthwork activities.

Once the geotechnical engineer has approved a subgrade, further measures should be implemented to prevent degradation or disturbance of the subgrade. These measures could include, but are not limited

to, placing a layer of crushed rock or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tarp and keeping construction traffic off the subgrade. Once subgrade has been approved, any disturbance because the subgrade was not protected should be repaired by the contractor at no cost to the owner.

During wet weather, earthen berms or other methods should be used to prevent runoff from draining into excavations. All runoff should be collected and disposed of properly. Measures may also be required to reduce the moisture content of on-site soils in the event of wet weather. These measures can include, but are not limited to, air drying and soil amendment, etc.

Since the native site soils may be difficult to work with during periods of wet weather due to elevated soil moisture content, and frozen soil is not suitable for use as structural fill, we recommend that earthwork activities generally take place in late spring, summer or early fall.

Dewatering efforts may be required locally if work occurs during the wet winter months or during heavy storm events, depending on actual soils encountered and weather conditions during earthwork. MTC recommends major earthwork activities take place during the dry season or shoulder seasons if possible to minimize the potential for stormwater inundation or seepage within excavations.

6.2 STRUCTURAL FILL MATERIALS AND COMPACTION

6.2.1 Materials

All material placed below structures or pavement areas should be considered structural fill. Structural fill material shall be free of deleterious material, have a maximum particle size of 4 inches, and be compactable to the required compaction level.

Excavated shallow native glacial till soils may be potentially suitable for limited re-use, such as for utility trench backfill outside of roadways and general non-structural site grading, depending on moisture conditions, season of use, and project specifications. Excavated native soils considered for re-use should be carefully removed and stockpiled to prevent sediment cross-contamination, visually confirmed prior to placement, properly moisture-conditioned and placed in accordance with the recommendations provided below for Placement and Compaction. During warm, dry weather, it will likely be necessary to add water to these soils after residing in stockpiles. The condition and suitability of stockpiled on-site materials should be verified prior to reuse as controlled fill. Material properties of re-used native soils shall meet project specifications for the intended use.

Imported material can be used as structural fill. We recommend imported structural fill material should conform to Section 9-03.14(1), Gravel Borrow, of the most recent edition (at the time of construction) of the State of Washington Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications).*

Controlled-density fill (CDF) or lean mix concrete can be used as an alternative to structural fill materials, except in areas where free-draining materials are required or specified.

Frozen soil is not suitable for use as structural fill. Fill material may not be placed on frozen soil.

The contractor should submit samples of each of the required earthwork materials to the geotechnical engineer for evaluation and approval prior to delivery to the site. The samples should be submitted at least 5 days prior to their delivery and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

6.2.2 Placement and Compaction

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill shall not exceed 12 inches in thickness; thinner lifts will be required for walk-behind or hand operated equipment.

All structural fill shall be compacted to a dense and unyielding condition and to a minimum percent compaction based on its modified Proctor maximum dry density as determined per ASTM D1557. Structural fill placed beneath each of the following shall be compacted to the indicated percent compaction:

Foundation and Floor Slab Subgrades:	95 Percent
Pavement Subgrades (upper 2 feet):	95 Percent
Pavement Subgrades (below 2 feet):	90 Percent
Utility Trenches (upper 4 feet):	95 Percent
Utility Trenches (below 4 feet):	90 Percent

We recommend that fill placed on slopes steeper than 3:1 (H:V) be 'benched' in accordance with hillside terraces entry of section 2-03.3(14) of the WSDOT Standard Specifications.

We recommend structural fill placement and compaction be observed on a full-time basis by an MTC representative. A sufficient number of tests shall be performed to verify compaction of each lift. The number of tests required will vary depending on the fill material, its moisture condition and the equipment being used. Initially, more frequent tests will be required while the contractor establishes the means and methods required to achieve proper compaction.

6.3 TEMPORARY EXCAVATIONS AND SLOPES

All excavations and slopes must comply with applicable local, state, and federal safety regulations. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type

information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that MTC is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

Temporary excavation slopes in the native silty and sandy soils should be inclined no steeper than 2H:1V, although locally steeper grades may be approvable upon review by the geotechnical engineer or their representative depending on actual conditions encountered, season of construction, and the depth of excavation. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of any excavation. Where the stability of adjoining walls or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Earth retention, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Washington.

Temporary excavations and slopes should be protected from the elements by covering with plastic sheeting or some other similar impermeable material. Sheeting sections should overlap by at least 12 inches and be tightly secured with sandbags, tires, staking, or other means to prevent wind from exposing the soils under the sheeting.

6.4 PERMANENT SLOPES

MTC recommends that new areas of permanent slopes including fill embankments be inclined no greater than 3H:1V. Permanent slopes should be planted with a deep-rooted, rapid-growth vegetative cover as soon as possible after completion of slope construction. Alternatively, the slope should be covered with plastic, straw, etc. until it can be landscaped.

6.5 UTILITY TRENCHES AND EXCAVATIONS

The contractor shall be responsible for the safety of personnel working in utility trenches. Given that steep excavations in native soils may be prone to caving, we recommend all utility trenches, but particularly those greater than 4 feet in depth, be supported in accordance with state and federal safety regulations.

Pipe bedding material should conform to the manufacturer's recommendations and be worked around the pipe to provide uniform support. Cobbles or boulders, if encountered, exposed in the bottom of utility excavations should be covered with pipe bedding or removed to avoid inducing concentrated stresses on the pipe.

Trench backfill should be placed and compacted as structural fill as recommended in Section 6.2. Particular care should be taken to insure bedding or fill material is properly compacted to provide

adequate support to the pipe. Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

7.0 ADDITIONAL RECOMMENDED SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Geotechnical plan review and engineering consultation as needed prior to construction phase,
- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement,
- Consultation on temporary excavation cutslopes and shoring if needed,
- Testing and inspection of any concrete or masonry included in the final construction plans, and
- Geotechnical Consultation as may be required during construction.

We strongly recommend that MTC be retained for the construction of this project to provide these and other services. Our knowledge of the project site and the design recommendations contained herein will be of benefit in the event that difficulties arise and either modifications or additional geotechnical engineering recommendations are required or desired. We can also, in a timely fashion observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

We further recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations.

Also, MTC retains fully accredited, WABO-certified laboratory and inspection personnel, and is available for this project's testing, observation and inspection needs. Information concerning the scope and cost for these services can be obtained from our office.

8.0 LIMITATIONS

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, our field observations and exploration and our laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that vary or differ from those described herein, we should be notified immediately in order that a review may be made and supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed.

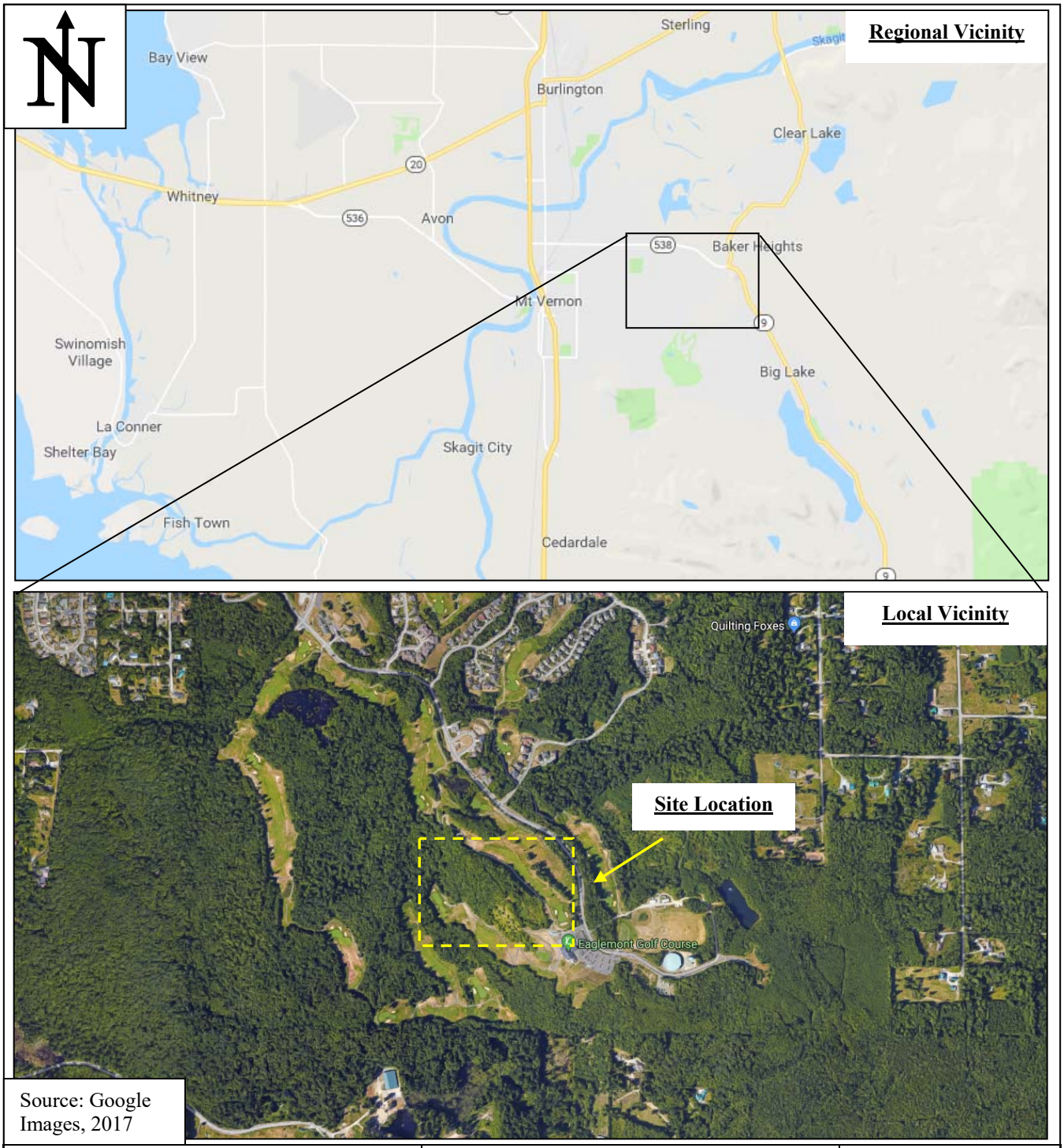
We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty, express or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by MTC during the construction phase in order to evaluate compliance with our recommendations. Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the author of this report, are only mentioned in the given standard; they are not incorporated into it or "included by referenced", as that latter term is used relative to contracts or other matters of law.

This report may be used only by Mr. Ed Young and his design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. Note that if another firm assumes Geotechnical Engineer of Record responsibilities they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation under the guidance of a professional engineer registered in the State of Washington. The recommendations of this report are based on the assumption that the Geotechnical Engineer of Record has reviewed and agrees with the findings, conclusion and recommendations of this report.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report, MTC may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by Mr. Young or anyone else will release MTC from any liability resulting from the use of this report by any unauthorized party and Mr. Young agrees to defend, indemnify, and hold harmless MTC from any claim or liability associated with such unauthorized use or non-compliance. We recommend that MTC be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

The scope of work for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

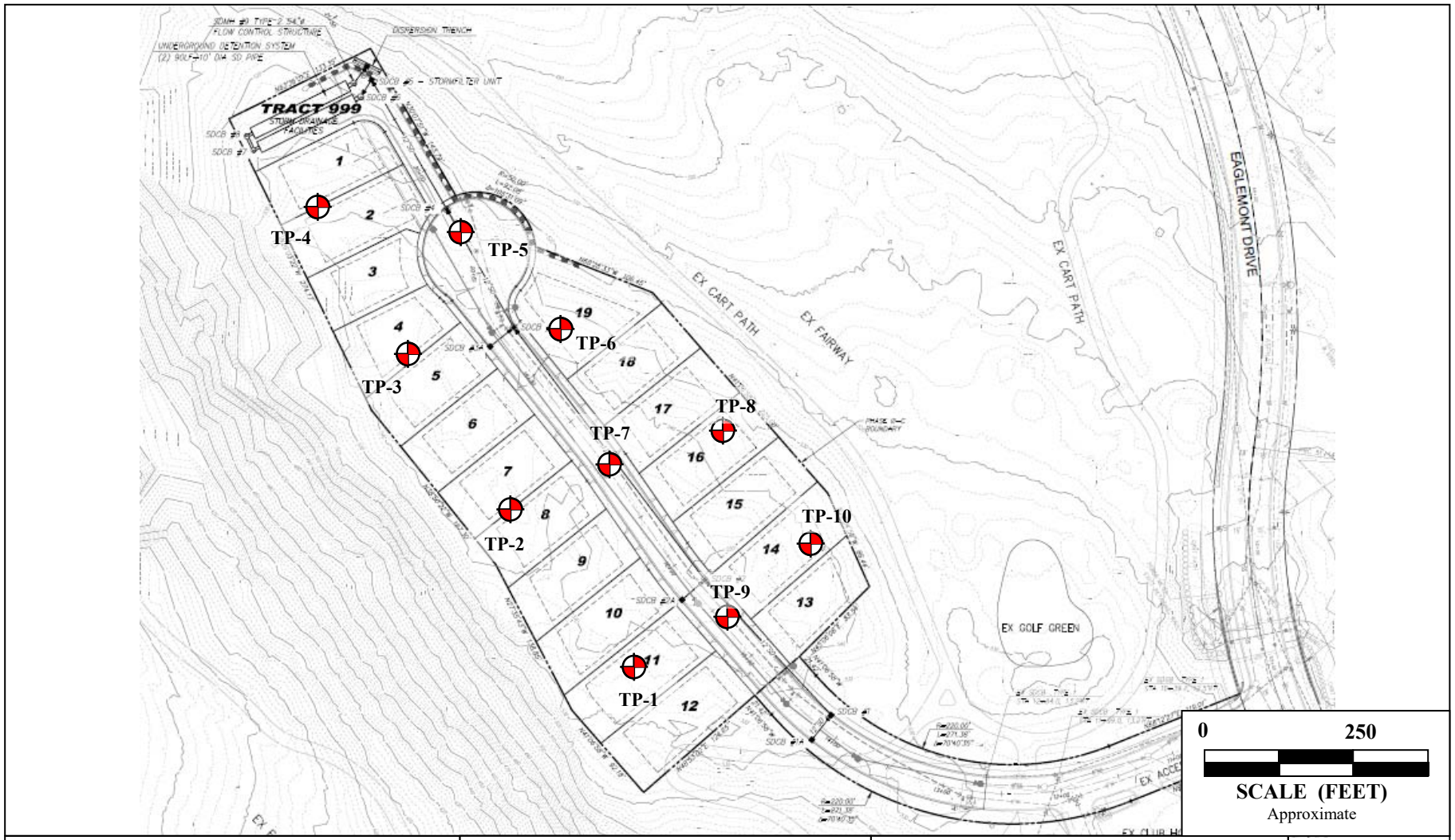
Appendix A. SITE LOCATION AND VICINITY



Source: Google Images, 2017

Materials Testing & Consulting, Inc. 777 Chrysler Drive Burlington, WA 98226	**Regional Site Vicinity Maps** Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	**FIGURE** **1**

Appendix B. SITE MAP AND EXPLORATION LOCATIONS



Materials Testing & Consulting, Inc. 777 Chrysler Drive Burlington, WA 98233	**Site Plan & Exploration Locations** Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	Base Map: Preliminary Subdivision Plan Drawn & Provided By: DEA Engineering Modified by MTC: 6/28/18 NOT INTENDED FOR CONSTRUCTION **NOT TO SCALE – Shown is Approximate**	**FIGURE** **2**

Appendix C. EXPLORATION LOGS

Grab soil samples were collected from each exploration location by our field geologist during test pit excavation. Soil samples collected during the field exploration were classified in accordance with ASTM D2487. All samples were placed in plastic bags to limit moisture loss, labeled, and returned to our laboratory for further examination and testing.

Exploration logs are shown in full in Appendix C. The explorations were monitored by MTC personnel who examined and classified the materials encountered in accordance with the Unified Soil Classification System (USCS), obtained representative soil samples, and recorded pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence. Upon completion test pits were backfilled with existing soils tailings.

The stratification lines shown on the individual logs represent the approximate boundaries between soil types; actual transitions may be either more gradual or more severe. The conditions depicted are for the date and location indicated only, and it should not necessarily be expected that they are representative of conditions at other locations and times.

Unified Soil Classification System Chart

Major Divisions			Graph	USCS	Typical Description
Coarse Grained Soils	Gravel	Clean Gravels		GW	Well-graded Gravels, Gravel-Sand Mixtures
	More Than 50% of Coarse Fraction Retained On No. 4 Sieve			GP	Poorly-Graded Gravels, Gravel-Sand Mixtures
More Than 50% Retained On No. 200 Sieve		Gravels With Fines		GM	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sand	Clean Sands		SW	Well-graded Sands, Gravelly Sands
	More Than 50% of Coarse Fraction Passing No. 4 Sieve			SP	Poorly-Graded Sands, Gravelly Sands
		Sands With Fines		SM	Silty Sands, Sand-Silt Mixtures
				SC	Clayey Sands, Clay Mixtures
Fine Grained Soils	Silts & Clays	Liquid Limit Less Than 50		ML	Inorganic Silts, rock Flour, Clayey Silts With Low Plasticity
More Than 50% Passing The No. 200 Sieve				CL	Inorganic Clays of Low To Medium Plasticity
				OL	Organic Silts and Organic Silty Clays of Low Plasticity
	Silts & Clays	Liquid Limit Greater Than 50		MH	Inorganic Silts of Moderate Plasticity
				CH	Inorganic Clays of High Plasticity
				OH	Organic Clays And Silts of Medium to High Plasticity
Highly Organic Soils				PT	Peat, Humus, Soils with Predominantly Organic Content

Sampler Symbol Description

- Standard Penetration Test (SPT)
- Shelby Tube
- Grab or Bulk
- California (3.0" O.D.)
- Modified California (2.5" O.D.)

Stratigraphic Contact

- Distinct Stratigraphic Contact Between Soil Strata
- Gradual Change Between Soil Strata
- Approximate location of stratagraphic change

- Groundwater observed at time of exploration
- Measured groundwater level in exploration, well or piezometer
- Perched water observed at time of exploration

Modifiers

Description	%
Trace	>5
Some	5-12
With	>12

Soil Consistency

Granular Soils		Fine-grained Soils	
Density	*SPT Blowcount*	*Consistency*	*SPT Blowcount*
Very Loose	0-4	Very Soft	0-2
Loose	4-10	Soft	2-4
Medium Dense	10-30	Firm	4-8
Dense	30-50	Stiff	8-15
Very Dense	> 50	Very Stiff	15-30
		Hard	> 30

Grain Size

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		> 12"	> 12"	Larger than a basketball
Cobbles		3 - 12"	3 - 12"	Fist to basketball
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb to fist
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea to thumb
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock salt to pea
	Medium	#40 - #10	0.017 - 0.079"	Sugar to rock salt
	Fine	#200 - #40	0.0029 - 0.017"	Flour to Sugar
Fines		Passing #200	< 0.0029"	Flour and smaller

Materials Testing & Consulting, Inc. 777 Chrysler Drive Burlington, WA 98233	**Exploration Log Key** Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	**FIGURE** **3**

Matertials Testing & Consulting
Burlington, WA
Geotechnical and Environmental Engineering

Log of Test Pit TP-1

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : SW corner of Development- See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	SM-ML		SILTY SAND to SANDY SILT, some gravel up to 3/4", loose or soft, damp, heavy organics (roots, blackberry surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND WITH GRAVEL up to 2", some cobbles up to 8", dense, dry to damp, minor scattered organics. Light to Medium BROWN. **REWORKED NATIVE FILL**				
2	SM		SILTY SAND, some gravel up to 2", medium dense or stiff, damp. Light BROWN to GRAY, moderate orange mottling throughout **WEATHERED GLACIAL TILL**		X		
3	ML-SM		SANDY SILT to SILTY SAND, some gravel up to 2", very stiff to hard, damp. Light BROWN to GRAY, faint orange mottling at upper surface **UNWEATHERED GLACIAL TILL**		X	40.4	37.7
5	SS		Chuckanut Sandstone - Siltstone Bedrock. Well consolidated, dry to damp, fracutred blocks up to 8" angular. Light BROWN to GOLDEN-BROWN, faint oxidation/staining **FRACTURED BEDROCK**				

T.D. 5.2' BPG Terminated at refusal on bedrock.
Groundwater table not observed.

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Log of Test Pit TP-2

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~100 feet NW of TP-1- See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, some gravel up to 1", soft, damp, heavy organics (roots, grass surface). Dark BROWN. **TOPSOIL**				
1	SM-ML		SILTY SAND to SANDY SILT, some gravel up to 1.5", medium dense or stiff, damp, some organics (roots). Light BROWN to GRAY, moderate to strong orange mottling throughout **WEATHERED GLACIAL TILL**				
2	ML		SANDY SILT, some gravel up to 2", trace cobbles up to 6", very stiff to hard, damp to dry. Light GRAY, faint orange mottling at upper surface **UNWEATHERED GLACIAL TILL**				
3							
4							
5	SS		Chuckanut Sandstone - Siltstone Bedrock. Well consolidated, dry to damp, fracutred blocks up to 6" angular. Light BROWN to GOLDEN-BROWN, some oxidation/staining **FRACTURED BEDROCK**				
6			T.D. 5.5' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
7							
8							

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Geotechnical and Environmental Engineering

Log of Test Pit TP-3

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~100 feet NW of TP-2- See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML-SM		SANDY SILT to SILTY SAND, some gravel up to 2", soft or loose, damp, heavy organics (roots, grass surface). Dark BROWN. **TOPSOIL**				
1	ML		SANDY SILT WITH GRAVEL up to 3" (angular), stiff to very stiff, damp, some organics (roots). Light BROWN to GRAY, moderate to strong orange mottling throughout **WEATHERED GLACIAL TILL**		X		
2			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
3			T.D. 2.5' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
4							
5							
6							
7							
8							

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Geotechnical and Environmental Engineering

Log of Test Pit TP-5

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~100 feet E-SE of TP-4. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, trace gravel up to 1", soft or loose, damp, heavy organics (roots, fern surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND, some gravel up to 3", medium dense, damp, trace organics (roots). Light BROWN to GRAY, moderateorange mottling throughout **WEATHERED GLACIAL TILL**		X	37.0	16.5
2	SM-ML		SILTY SAND to SANDY SILT, some gravel up to 3", minor cobbles up to 6", dense or very stiff, damp. Light GRAY **UNWEATHERED GLACIAL TILL**		X	42.4	14.3
4			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
5			T.D. 4.2' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
6							
7							
8							

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Log of Test Pit TP-6

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~100 feet E of TP-3. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, trace gravel up to 1", soft or loose, damp, heavy organics (roots, tree-blackberry surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND, some gravel up to 3", minor cobbles up to 6", medium dense, damp, trace to minor organics (roots). Light BROWN to GRAY, moderate orange mottling throughout **WEATHERED GLACIAL TILL**				
2							
3	SM-ML		SILTY SAND to SANDY SILT, some gravel up to 3", trace cobbles up to 6", dense or very stiff, damp to dry. Light GRAY **UNWEATHERED GLACIAL TILL**				
4							
5			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
6			T.D. 5.5' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
7							
8							

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Burlington, WA
Geotechnical and Environmental Engineering

Log of Test Pit TP-7

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~60 feet E of TP-2. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, some gravel up to 2", soft or loose, damp, heavy organics (roots, blackberry surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND WITH GRAVEL up to 3" (angular), medium dense to dense, damp, some organics (roots). Light BROWN to GRAY, moderate to strong orange mottling throughout **WEATHERED GLACIAL TILL**				
2			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
3							
4							
5							
6							
7							
8							

T.D. 2.0' BPG Terminated at refusal on bedrock.
Groundwater table not observed.

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Log of Test Pit TP-8

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~75 feet E of TP-7. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, some gravel up to 1", soft or loose, damp, heavy organics (roots, blackberry surface). Dark BROWN. **TOPSOIL**				
1	SM-ML		SILTY SAND to SANDY SILT WITH GRAVEL up to 3", medium dense to dense or stiff to very stiff,damp, some organics (roots). Light BROWN to GRAY, moderate to strong orange mottling throughout **WEATHERED GLACIAL TILL**				
2							
3			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
4			T.D. 3.5' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
5							
6							
7							
8							

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Log of Test Pit TP-9

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~80 feet E of TP-1. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML-SM		SANDY SILT to SILTY SAND, minor gravel up to 1", soft, damp, heavy organics (roots, grass surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND, some gravel up to 2.5", trace boulders up to 2', medium dense to dense, damp, minor organics (roots). Light BROWN to GRAY, moderate to strongorange mottling throughout **WEATHERED GLACIAL TILL**		X	34.0	22.6
2	ML		SANDY SILT, some gravel up to 2", trace cobbles up to 6", very stiff to hard, damp to dry. Light GRAY, faint orange mottling at upper surface **UNWEATHERED GLACIAL TILL**		X		
3							
4							
5							
6	SS		Chuckanut Sandstone - Siltstone Bedrock. Well consolidated, dry to damp, fracutred blocks up to 6" angular. Light BROWN to GOLDEN-BROWN, some oxidation/staining **FRACTURED BEDROCK**				
7			T.D. 6.5' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
8							

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Burlington, WA
Geotechnical and Environmental Engineering

Log of Test Pit TP-10

Eaglemont Ph III-C Geotech
4800 Eaglemont Drive
Mount Vernon, Washington

MTC Project No. 18B177

Date Started : 6/13/2018
Date Completed : 6/13/2018
Sampling Method : Grab Samples
Location : ~80 feet E of TP-9. See Map
Logged By : CD

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Water Level	Sample	% Finer than #200	% Moisture
0	ML		SANDY SILT, trace gravel up to 1", soft or loose, damp, heavy organics (roots, tree-blackberry surface). Dark BROWN. **TOPSOIL**				
1	SM		SILTY SAND, some gravel up to 3", minor cobbles up to 6", medium dense, damp, trace to minor organics (roots). Light BROWN to GRAY, moderate orange mottling throughout **WEATHERED GLACIAL TILL**		X		
2	SM-ML		SILTY SAND to SANDY SILT, some gravel up to 3", trace cobbles up to 6", dense or very stiff, damp to dry. Light GRAY **UNWEATHERED GLACIAL TILL**		X		
3			Argillite - Metasiltstone Bedrock. Welded, very hard, sharp fracutred blocks up to 6" (angular). Dark BROWN to BLACK, some oxidation **FRACTURED BEDROCK**				
4			T.D. 3.8' BPG Terminated at refusal on bedrock. Groundwater table not observed.				
5							
6							
7							
8							

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Appendix D. LABORATORY TEST RESULTS

Laboratory tests were conducted on several representative soil samples to better identify the soil classification of the units encountered and to evaluate the material's general physical properties and engineering characteristics. A brief description of the tests performed for this study is provided below. The results of laboratory tests performed on specific samples are provided at the appropriate sample depths on the individual boring logs. However, it is important to note that these test results may not accurately represent in situ soil conditions. All of our recommendations are based on our interpretation of these test results and their use in guiding our engineering judgment. MTC cannot be responsible for the interpretation of these data by others.

Soil samples for this project will be retained for a period of 3 months following completion of this report, unless we are otherwise directed in writing.

SOIL CLASSIFICATION

Soil samples were visually examined in the field by our representative at the time they were obtained. They were subsequently packaged and returned to our laboratory where they were reexamined and the original description checked and verified or modified. With the help of information obtained from the other classification tests, described below, the samples were described in general accordance with ASTM Standard D2487. The resulting descriptions are provided at the appropriate locations on the individual exploration logs, located in Appendix C, and are qualitative only.

GRAIN-SIZE DISTRIBUTION

Grain-size distribution analyses were conducted in general accordance with ASTM Standard D422 on representative soil samples to determine the grain-size distribution of the on-site soil. The information gained from these analyses allows us to provide a description and classification of the in-place materials. In turn, this information helps us to understand engineering properties of the soil and thus how the in-place materials will react to conditions such as heavy seepage, traffic action, loading, potential liquefaction, infiltration potential and so forth. The results are presented in this Appendix.

Sieve Report

Project: Eaglemont Phase III-C Geotech
Project #: 18B177
Client: David Evans & Associates
Source: TP-1 @ 4.0'
Sample#: B18-0552

Date Received: 25-Jun-18
Sampled By: C. Dimitroff
Date Tested: 27-Jun-18
Tested By: A. Eifrig

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
Light Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

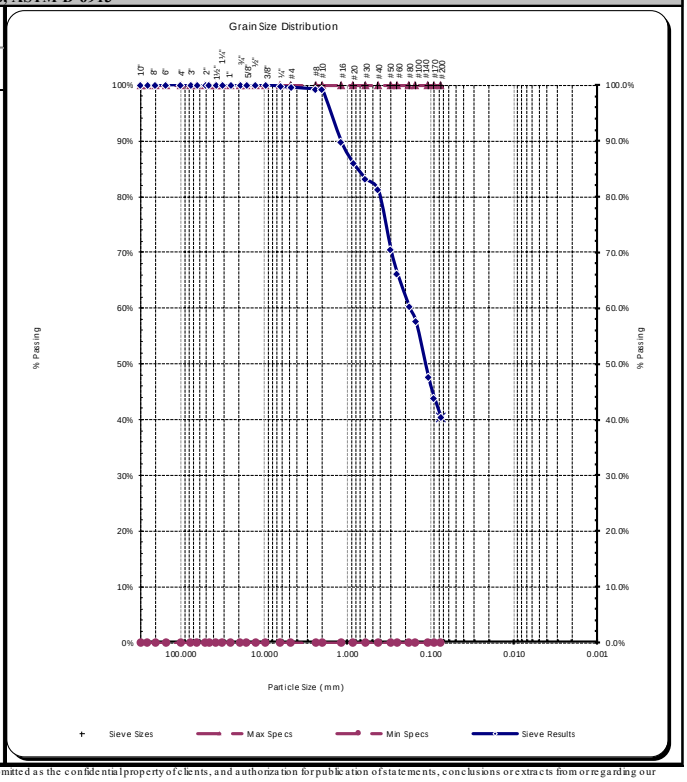
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.009 mm	% Gravel = 0.4%	Coeff. of Curvature, C_C = 0.94
$D_{(10)}$ = 0.019 mm	% Sand = 59.1%	Coeff. of Uniformity, C_U = 9.61
$D_{(15)}$ = 0.028 mm	% Silt & Clay = 40.4%	Fineness Modulus = 1.00
$D_{(30)}$ = 0.056 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.117 mm	Plasticity Index = n/a	Moisture %, as sampled = 37.7%
$D_{(60)}$ = 0.178 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 1.198 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 1/2	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		99%	100.0%	0.0%
#10	2.00	99%	99%	100.0%	0.0%
#16	1.18		90%	100.0%	0.0%
#20	0.850		86%	100.0%	0.0%
#30	0.600		83%	100.0%	0.0%
#40	0.425	81%	81%	100.0%	0.0%
#50	0.300		70%	100.0%	0.0%
#60	0.250		66%	100.0%	0.0%
#80	0.180		60%	100.0%	0.0%
#100	0.150	58%	58%	100.0%	0.0%
#140	0.106		48%	100.0%	0.0%
#170	0.090		44%	100.0%	0.0%
#200	0.075	40.4%	40.4%	100.0%	0.0%



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Comments: _____

Reviewed by: _____
Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc. 777 Chrysler Drive Burlington, WA 98233	**Lab Sample: TP-1 @ 4.0'** Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	**FIGURE** **4**

Sieve Report

Project: Eaglemont Phase III-C Geotech
Project #: 18B177
Client: David Evans & Associates
Source: TP-5 @ 1.5'
Sample#: B18-0553

Date Received: 25-Jun-18
Sampled By: C. Dimitroff
Date Tested: 27-Jun-18
Tested By: A. Eifrig

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand with Gravel
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.010 mm	% Gravel = 17.5%	Coeff. of Curvature, C_C = 0.26
$D_{(10)}$ = 0.020 mm	% Sand = 45.5%	Coeff. of Uniformity, C_U = 34.46
$D_{(15)}$ = 0.030 mm	% Silt & Clay = 37.0%	Fineness Modulus = 2.34
$D_{(30)}$ = 0.061 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.256 mm	Plasticity Index = n/a	Moisture %, as sampled = 16.5%
$D_{(60)}$ = 0.698 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 8.439 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 9/14	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	98%	98%	100.0%	0.0%
5/8"	16.00		97%	100.0%	0.0%
1/2"	12.50	97%	97%	100.0%	0.0%
3/8"	9.50	92%	92%	100.0%	0.0%
1/4"	6.30		86%	100.0%	0.0%
#4	4.75	83%	83%	100.0%	0.0%
#8	2.36		73%	100.0%	0.0%
#10	2.00	72%	72%	100.0%	0.0%
#16	1.18		64%	100.0%	0.0%
#20	0.850		61%	100.0%	0.0%
#30	0.600		59%	100.0%	0.0%
#40	0.425	58%	58%	100.0%	0.0%
#50	0.300		52%	100.0%	0.0%
#60	0.250		50%	100.0%	0.0%
#80	0.180		47%	100.0%	0.0%
#100	0.150	45%	45%	100.0%	0.0%
#140	0.106		40%	100.0%	0.0%
#170	0.090		39%	100.0%	0.0%
#200	0.075	37.0%	37.0%	100.0%	0.0%

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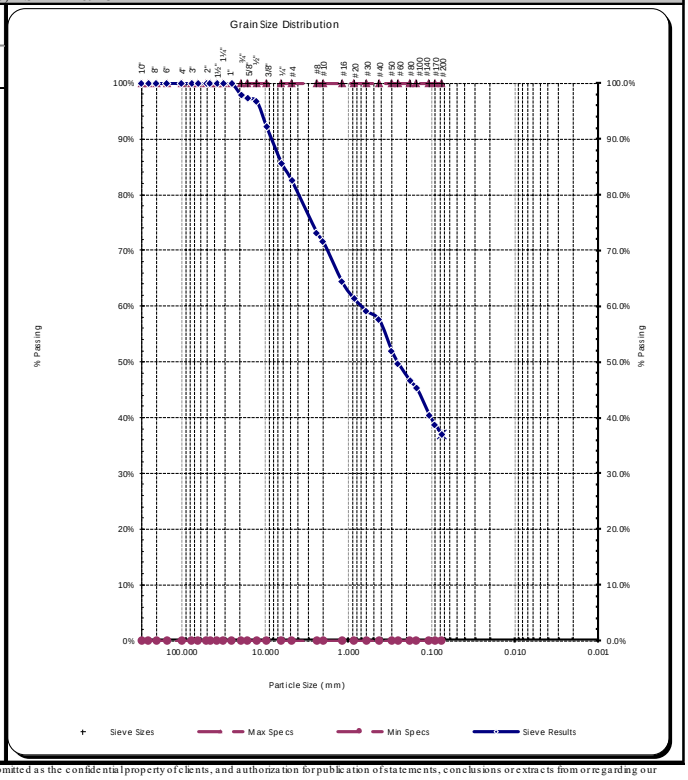


All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by: _____
Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.	Lab Sample: TP-5 @ 1.5'	FIGURE
777 Chrysler Drive Burlington, WA 98233	Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	5

Sieve Report

Project: Eaglemont Phase III-C Geotech
Project #: 18B177
Client: David Evans & Associates
Source: TP-5 @ 3.0'
Sample#: B18-0554

Date Received: 25-Jun-18
Sampled By: C. Dimitroff
Date Tested: 27-Jun-18
Tested By: A. Eifrig

ASTM D-2487 Unified Soils Classification System
ML, Sandy Silt with Gravel
Sample Color:
Gray-Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

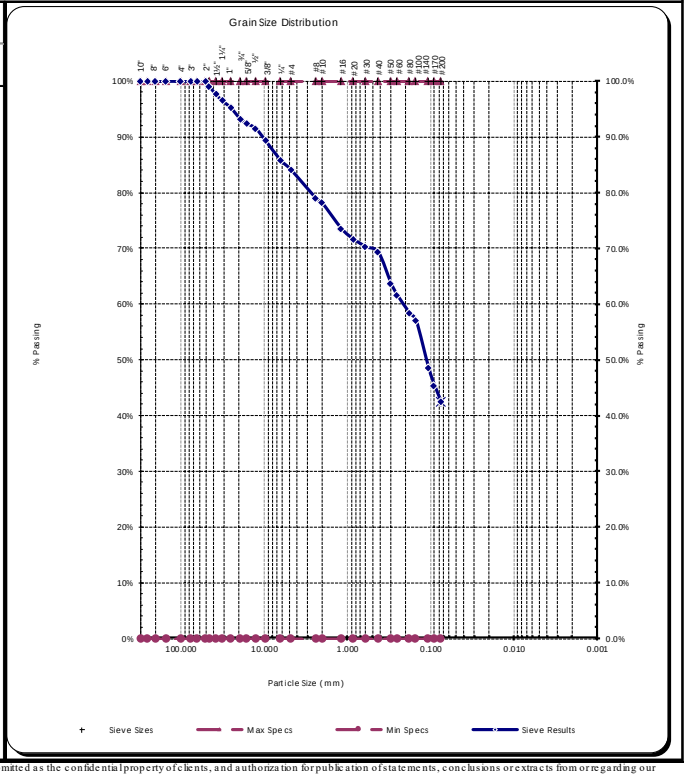
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.009 mm	% Gravel = 15.9%	Coeff. of Curvature, C_C = 0.73
$D_{(10)}$ = 0.018 mm	% Sand = 41.7%	Coeff. of Uniformity, C_U = 12.25
$D_{(15)}$ = 0.027 mm	% Silt & Clay = 42.4%	Fineness Modulus = 1.90
$D_{(30)}$ = 0.053 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.114 mm	Plasticity Index = n/a	Moisture %, as sampled = 14.3%
$D_{(60)}$ = 0.217 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 10.486 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 41/67	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		99%	100.0%	0.0%
1.50"	37.50		98%	100.0%	0.0%
1.25"	31.50		96%	100.0%	0.0%
1.00"	25.00	95%	95%	100.0%	0.0%
3/4"	19.00	93%	93%	100.0%	0.0%
5/8"	16.00		92%	100.0%	0.0%
1/2"	12.50	91%	91%	100.0%	0.0%
3/8"	9.50	89%	89%	100.0%	0.0%
1/4"	6.30		86%	100.0%	0.0%
#4	4.75	84%	84%	100.0%	0.0%
#8	2.36		79%	100.0%	0.0%
#10	2.00	78%	78%	100.0%	0.0%
#16	1.18		74%	100.0%	0.0%
#20	0.850		72%	100.0%	0.0%
#30	0.600		70%	100.0%	0.0%
#40	0.425	69%	69%	100.0%	0.0%
#50	0.300		64%	100.0%	0.0%
#60	0.250		61%	100.0%	0.0%
#80	0.180		58%	100.0%	0.0%
#100	0.150	57%	57%	100.0%	0.0%
#140	0.106		48%	100.0%	0.0%
#170	0.090		45%	100.0%	0.0%
#200	0.075	42.4%	42.4%	100.0%	0.0%



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Comments:

Reviewed by:
Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.	Lab Sample: TP-5 @ 3.0'	FIGURE
777 Chrysler Drive Burlington, WA 98233	Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	6

Sieve Report

Project: Eaglemont Phase III-C Geotech
Project #: 18B177
Client: David Evans & Associates
Source: TP-9 @ 1.5'
Sample#: B18-0555

Date Received: 25-Jun-18
Sampled By: C. Dimitroff
Date Tested: 27-Jun-18
Tested By: A. Eifrig

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand with Gravel
Sample Color:
Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

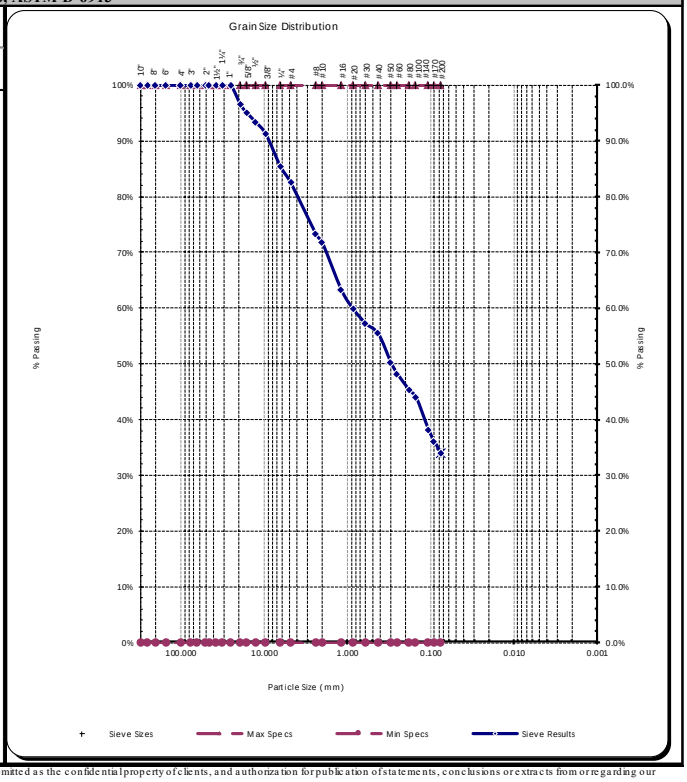
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

$D_{(5)}$ = 0.011 mm	% Gravel = 17.5%	Coeff. of Curvature, C_C = 0.23
$D_{(10)}$ = 0.022 mm	% Sand = 48.4%	Coeff. of Uniformity, C_U = 39.20
$D_{(15)}$ = 0.033 mm	% Silt & Clay = 34.0%	Fineness Modulus = 2.42
$D_{(30)}$ = 0.066 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 0.294 mm	Plasticity Index = n/a	Moisture %, as sampled = 22.6%
$D_{(60)}$ = 0.864 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 8.820 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
Dust Ratio = 35/57	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	96%	96%	100.0%	0.0%
5/8"	16.00		95%	100.0%	0.0%
1/2"	12.50	93%	93%	100.0%	0.0%
3/8"	9.50	91%	91%	100.0%	0.0%
1/4"	6.30		85%	100.0%	0.0%
#4	4.75	82%	82%	100.0%	0.0%
#8	2.36		73%	100.0%	0.0%
#10	2.00	72%	72%	100.0%	0.0%
#16	1.18		63%	100.0%	0.0%
#20	0.850		60%	100.0%	0.0%
#30	0.600		57%	100.0%	0.0%
#40	0.425	55%	55%	100.0%	0.0%
#50	0.300		50%	100.0%	0.0%
#60	0.250		48%	100.0%	0.0%
#80	0.180		45%	100.0%	0.0%
#100	0.150	44%	44%	100.0%	0.0%
#140	0.106		38%	100.0%	0.0%
#170	0.090		36%	100.0%	0.0%
#200	0.075	34.0%	34.0%	100.0%	0.0%



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Comments: _____

Reviewed by: _____
Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.	Lab Sample: TP-9 @ 1.5'	FIGURE
777 Chrysler Drive Burlington, WA 98233	Eaglemont Ph III-C 4800 Eaglemont Drive Mt. Vernon, WA	7

January 22, 2018

Polyield Summit, LLC
Attn: Ed Young
4800 Eaglemont Drive
Mount Vernon, WA 98274

Re: Critical Area Determination for Eaglemont – Phase IIIC (Parcel #P133779)

Mr. Young,

Wetland Resources, Inc. performed a site investigation on December 14, 2017, on the 3.7-acre Eaglemont Phase IIIC parcel referenced above (Section 27, Township 34N, Range 4E, W.M.). The purpose of the investigation was to determine the presence of regulated wetlands and/or streams on or near the subject property.

Access to this parcel is from the east via a driveway from Eaglemont Drive. The parcel is vacant forest land that lies between fairways of the Eaglemont Golf Course, northwest of the club house and main parking lot. A paved cart path travels along the northeast and south sides of the parcel.

Vegetation varies throughout the parcel, but is generally dominated by Western red cedar, big-leaf maple, red alder, vine maple, Himalayan blackberry, and swordfern. Site topography has a ridge in the center, sloping downward to the east and west. Underlying soils are mapped as Tokul gravelly-medial loam, 15 to 30 percent slopes, and Dystric Xerochrepts-Rock outcrop complex, 65 to 90 percent slopes. Soils inspected on site displayed a color of very dark grayish brown (10YR 3/2) in the upper four inches, underlain by dark yellowish brown (10YR 3/4) to 18 inches below the surface, consistent with the description for the Tokul series. The gravelly loam was dry throughout the profile at the time of inspection. No positive indicators for wetlands or streams were encountered on site.

No wetlands or streams are located within the property boundaries or within close proximity. A water feature associated with the golf course is located north of the subject property, but it is over 800 feet away.

Use of this Report

This Critical Area Reconnaissance Report is supplied to Polyield Summit, LLC, as a means of determining on-site critical area conditions. This report is based largely on readily observable conditions and, to a lesser extent, on readily ascertainable conditions. No attempt has been made to determine hidden or concealed conditions. Reports may be adversely affected due to

the physical condition of the site and the difficulty of access, which may lead to observation or probing difficulties.

The laws applicable to wetlands are subject to varying interpretations and may be changed at any time by the courts or legislative bodies. This report is intended to provide information deemed relevant in the applicant's attempt to comply with the laws now in effect.

The work for this report has conformed to the standard of care employed by wetland ecologists. No other representation or warranty is made concerning the work or this report and any implied representation or warranty is disclaimed.

Wetland Resources, Inc.

John Laufenberg
Principal Ecologist
Professional Wetland Scientist