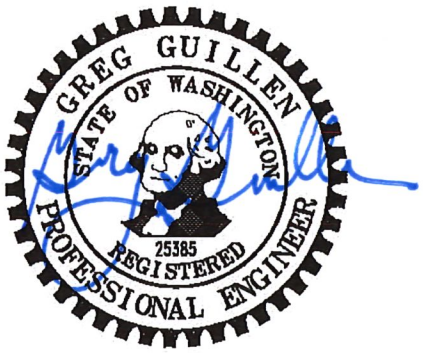
civil & structural
engineering & planning

TECHNICAL INFORMATION REPORT

Island Center Homes

9914 SW 188th St
Vashon Island, WA 98070



01/17/2020

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CG Project No. 19310.20

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5. Soils (attachment)

The proposed development is a multi-unit housing site with five buildings, associated parking, walkways and a rainwater cistern on a site 1.32-acre site made up of two parcels within the R-8-P Residential Zone. The project will add more than 2,000 square feet of impervious surfaces and so must meet the Full Drainage Review requirements from the 2016 King County Surface Water Design Manual (KCSWDM).

Address: 9914 SW 188th St Vashon Island, WA 98070
Tax Parcel Number: 312303-9138, 312303-9108

Predeveloped Condition

The proposed project site is currently developed with an existing house and associated walkways and driveway. Adjacent areas are similar with single family residences within the R-1 zone except for a church northwest of the site. See Figure 3 for an aerial photograph. The site has an average slope of 6% towards the east, where a drainage ditch running south to north conveys stormwater north. Following the natural grade the downstream path appears to connect to Ellisport Creek. From consulting King County's iMap tool, the project is within the East Vashon drainage basin and no flooding areas exist near the site. A drainage complaint has been filed for the northern parcel, to do with water quality and which has been resolved March 2015. Upstream runoff to the site seems to be insignificant as there are mostly residential and forested areas upstream of the site.

The existing land coverage is as follows:

Pervious Areas	
Trees and Vegetation:	48,228 sf (1.107 ac)
Total:	48,228 sf (1.107 ac)
Impervious Areas	
Existing House:	2,889 sf (0.066 ac)
Existing Gravel Driveway:	5,612 sf (0.129 ac)
Existing Concrete Walkways:	771 sf (0.018 ac)
Total:	9,272 sf (0.213 ac)

Developed Condition

In the proposed condition, there will be five new two-story buildings with 8 units each, a garden shed, a covered bike/trash enclosure and associated walkways and parking area with two driveways off 188th St. The four of the five buildings will have roof and footing drains which will be routed first towards a rainwater cistern and then towards a 4' deep gravel filled infiltration trench at the northeast corner of the site. Roof drains from building A along with the runoff collected from gradual slope at the west side of the site and the proposed gravel driveway will all be routed towards two 3' deep gravel infiltration trenches located within the gravel parking lot. Overflow from the trench will connect to existing stormwater infrastructure within Vashon Hwy SW, either directly tied to an existing catch basin or the exiting ditch along the west side of Vashon Hwy. The infiltration flow control BMP is discussed in Section IV.

The proposed land coverage is as follows:

Pervious Areas	
Total:	34,607 sf (0.794 ac)
Impervious Areas	
Roof:	12,301 sf (0.282 ac)
Walkways:	2,557 sf (0.059 ac)
Gravel Parking/Driveway:	8,512 sf (0.195 ac)
Total:	23,370 sf (0.536 ac)

Flow control per Core Requirement #3 is required as the site adds and/or replaces more than 5,000 square feet of impervious surface.

Flow Control Best Management Practices (BMPs) were evaluated per Core Requirement #9 to mitigate stormwater runoff impacts because the site adds and/or replaces more than 2,000 square feet of impervious surface.

Figure I-1: Technical Information Report (TIR) Worksheet

See following attached pages.

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Figure I-2: Site Location

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: Vashon Household
Phone: 206.463.6454
Address: PO Box 413
Vashon Island, WA 98070
Project Engineer: Greg Guillen
Company: CG Engineering
Phone: 425.778.8500

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: Island Center Homes
DPER Permit #:
Location Township: 23 N
Range: 3 E
Section: 31
Site Address: 9914 SW 188th Street
Vashon, WA 98070

Part 3 TYPE OF PERMIT APPLICATION

- ☐ Landuse (e.g.,Subdivision / Short Subd. / UPD)
- ☒ Building (e.g.,M/F / Commercial / SFR)
- ☒ Clearing and Grading
- ☐ Right-of-Way Use
- ☐ Other _____

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other _____
- ☐ Shoreline Management
- ☐ Structural Rockery/Vault/_____
- ☐ ESA Section 7

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report

Type of Drainage Review (check one):
- ☒ Full
- ☐ Targeted
- ☐ Simplified
- ☐ Large Project
- ☐ Directed

Date (include revision dates): 1/21/2020
Date of Final:

Site Improvement Plan (Engr. Plans)

Plan Type (check one):
- ☒ Full
- ☐ Modified
- ☐ Simplified

Date (include revision dates): 1/21/20
Date of Final:

Part 6 SWDM ADJUSTMENT APPROVALS

Type (circle one): Standard / Experimental / Blanket

Description: (include conditions in TIR Section 2)

N/A

Approved Adjustment No. _____ Date of Approval: _____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / (No)

Start Date: _____

Completion Date: _____

Describe: _____

_____

_____

Re: KCSWDM Adjustment No. _____

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : N/A

Special District Overlays: N/A

Drainage Basin: East Vashon

Stormwater Requirements: Full Drainage Review

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- ☐ River/Stream _____
- ☐ Lake _____
- ☐ Wetlands _____
- ☐ Closed Depression _____
- ☐ Floodplain _____
- ☐ Other _____

_____

- ☐ Steep Slope _____
- ☐ Erosion Hazard _____
- ☐ Landslide Hazard _____
- ☐ Coal Mine Hazard _____
- ☐ Seismic Hazard _____
- ☐ Habitat Protection _____
- ☐ _____

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
Alderwood	1-15%	Low

- ☐ High Groundwater Table (within 5 feet)
- ☐ Other _____
- ☐ Sole Source Aquifer
- ☐ Seeps/Springs

☐ Additional Sheets Attached

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 11 DRAINAGE DESIGN LIMITATIONS

REFERENCE	LIMITATION / SITE CONSTRAINT
☐ Core 2 – Offsite Analysis	
☐ Sensitive/Critical Areas	
☐ SEPA	
☐ LID Infeasibility	
☐ Other	
☐	

☐ Additional Sheets Attached

Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area)

Threshold Discharge Area:
(name or description)

Core Requirements (all 8 apply):

Discharge at Natural Location	Number of Natural Discharge Locations: 1
Offsite Analysis	Level: (1) / 2 / 3 dated:
Flow Control (include facility summary sheet)	Level: 1 / (2) / 3 or Exemption Number Flow Control BMPs Full Infiltration (Trenches)
Conveyance System	Spill containment located at: Sediment Trap
Erosion and Sediment Control / Construction Stormwater Pollution Prevention	CSWPP/CESCL/ESC Site Supervisor: TBD Contact Phone: After Hours Phone:
Maintenance and Operation	Responsibility (circle one): (Private) / Public If Private, Maintenance Log Required: (Yes) / No
Financial Guarantees and Liability	Provided: (Yes) / No
Water Quality (include facility summary sheet)	Type (circle one): Basic / Sens. Lake / (Enhanced Basic) / Bog or Exemption No. Landscape Management Plan: (Yes) / No

Special Requirements (as applicable):

Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac. / (None) Name:
Floodplain/Floodway Delineation	Type (circle one): Major / Minor / Exemption / (None) 100-year Base Flood Elevation (or range): Datum:
Flood Protection Facilities	Describe:

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 12 TIR SUMMARY SHEET	(provide one TIR Summary Sheet per Threshold Discharge Area)
Source Control (commercial / industrial land use)	Describe land use: New homes Describe any structural controls:
Oil Control	High-use Site: Yes / No (No) Treatment BMP: _____ Maintenance Agreement: Yes / No (No) with whom? _____
Other Drainage Structures	
Describe:	

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☒ Clearing Limits	☒ Stabilize exposed surfaces
☒ Cover Measures	☒ Remove and restore Temporary ESC Facilities
☒ Perimeter Protection	☒ Clean and remove all silt and debris, ensure operation of Permanent Facilities, restore operation of Flow Control BMP Facilities as necessary
☐ Traffic Area Stabilization	☐ Flag limits of SAO and open space preservation areas
☒ Sediment Retention	☐ Other _____
☒ Surface Water Collection	
☐ Dewatering Control	
☒ Dust Control	
☐ Flow Control	
☒ Protection of Flow Control BMP Facilities (existing and proposed)	
☒ Maintain BMPs / Manage Project	

Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch)

Flow Control	Type/Description	Water Quality	Type/Description
☐ Detention	_____	☐ Vegetated Flowpath	_____
☒ Infiltration	Three trenches	☐ Wetpool	_____
☐ Regional Facility	_____	☐ Filtration	_____
☐ Shared Facility	_____	☐ Oil Control	_____
☐ Flow Control BMPs	_____	☐ Spill Control	_____
☐ Other	_____	☒ Flow Control BMPs	Infiltration Trenches
		☐ Other	_____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 15 EASEMENTS/TRACTS		Part 16 STRUCTURAL ANALYSIS
☐ Drainage Easement		☐ Cast in Place Vault
☐ Covenant		☐ Retaining Wall
☐ Native Growth Protection Covenant		☐ Rockery > 4' High
☐ Tract		☐ Structural on Steep Slope
☐ Other _____		☐ Other _____

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER

I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate.

Greg J. Guillen 1/17/20

Signed/Date

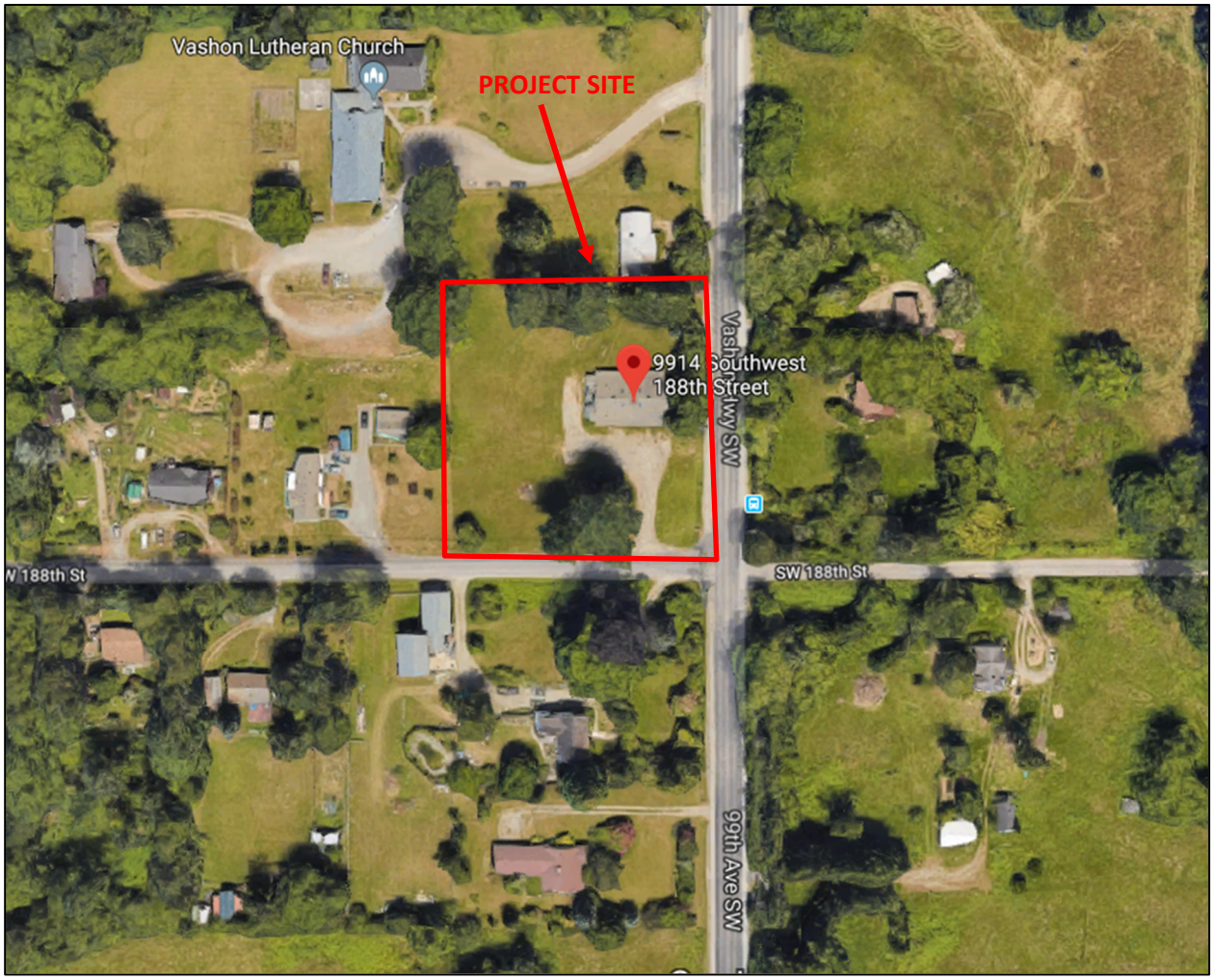

Figure I-3: Aerial Photograph

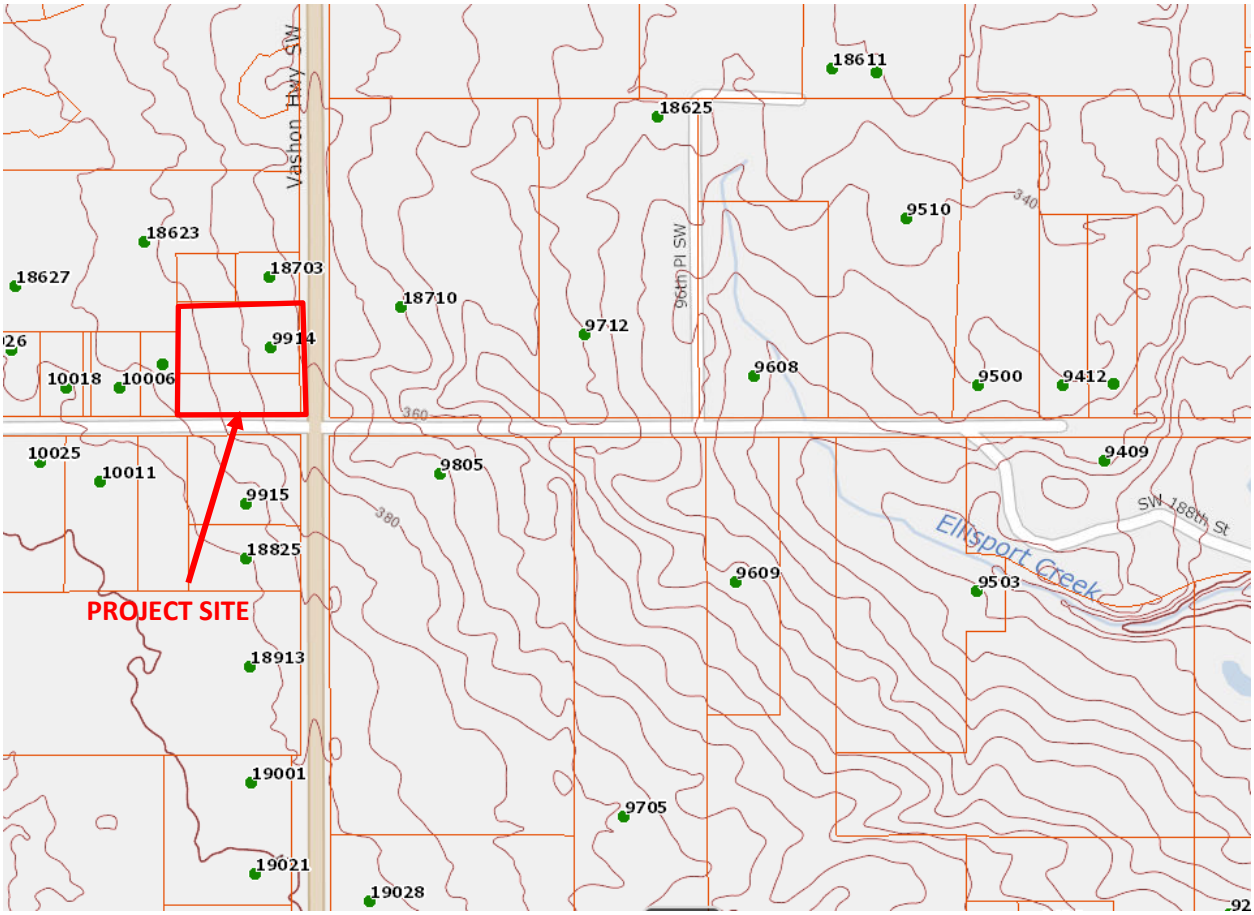

Figure I-4: Drainage Basin Map

Figure I-5: Soils
Underlying soils were determined using the Natural Resources Conservation Service soil survey tool. The site contains Alderwood gravelly sandy loam ashy coarse sandy loam, 8 to 15% slopes, corresponding to hydrologic soil group "B."

See attached pages.

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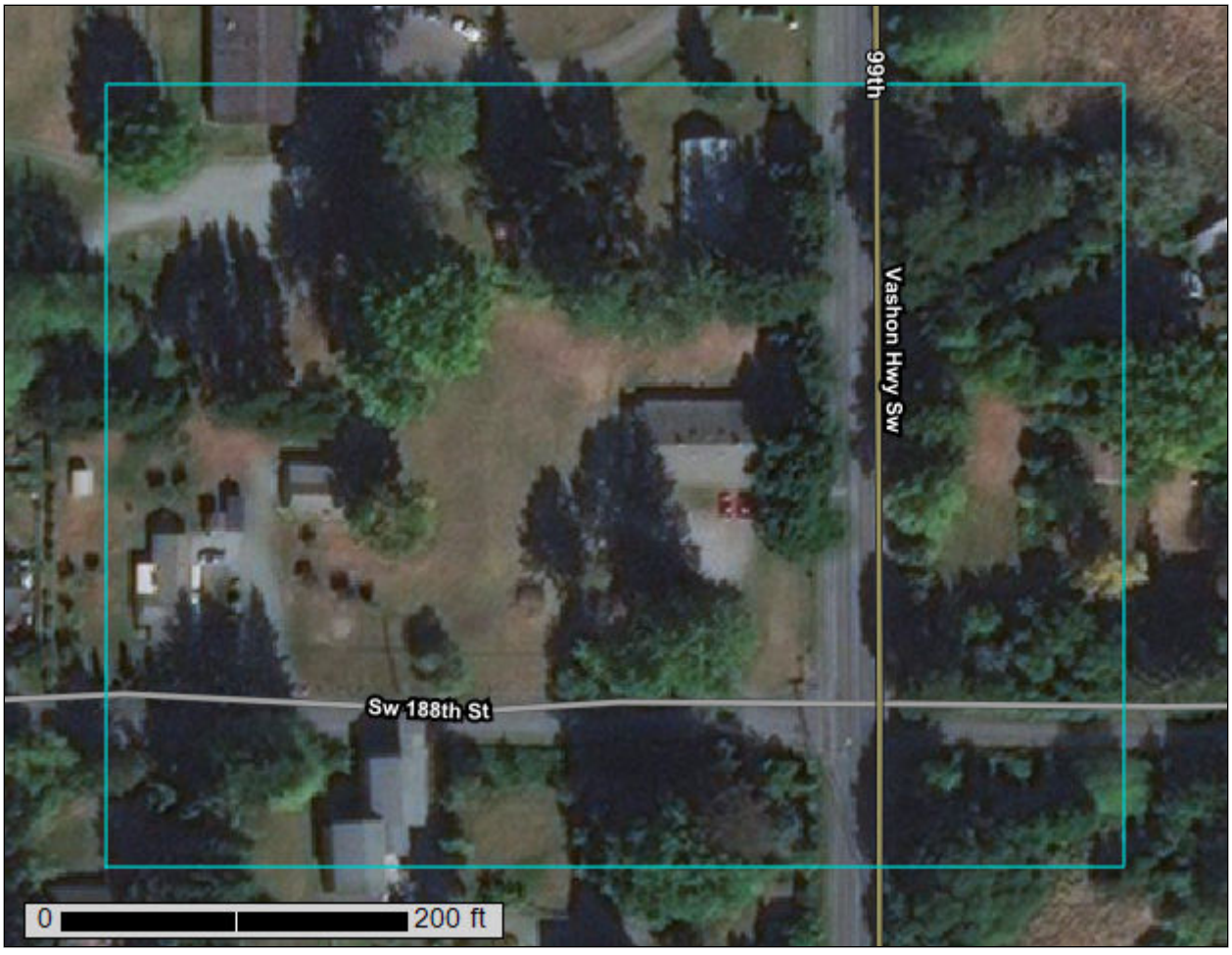
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for King County Area, Washington



August 15, 2019

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,160 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2016—Sep 27, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgB	Alderwood gravelly sandy loam, 0 to 8 percent slopes	0.0	0.5%
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	6.0	99.5%
Totals for Area of Interest		**6.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Minor Components

Everett

Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mckenna

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Shalcar

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

AgC—Alderwood gravelly sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t626
Elevation: 50 to 800 feet
Mean annual precipitation: 20 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Everett

Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 5 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Shalcar

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

TIR Section II – Conditions and Requirements Summary

TIR Section II Summary

Core Requirements

The proposed project will comply with the 2016 King County Surface Water Design Manual (2016 KCSWDM). The project is being submitted for a Full Drainage Review because it proposes to add over 2,000 square feet of impervious area. The project must comply with all 9 Core Requirements and all 5 Special Requirements. Therefore, the following conditions are required as specified by the KCSWDM.

Core Requirements

Core Requirement #1: Discharge at the Natural Location: The natural discharge location is maintained as the storm system along the west side of Vashon Hwy, which outfalls into Ellisport Creek.

Core Requirement #2: Offsite Analysis: Compliance with this requirement is indicated in Section 3.

Core Requirement #3: Flow Control: The project will add and/or replace more than 5,000 square feet of impervious surface and therefore must provide Flow Control for the project site. Gravel infiltration trenches will be utilized to infiltrate 100% of the runoff created by the newly created impervious surfaces. Overflows are provided for the site system tying into the public system within Vashon Hwy.

Core Requirement #4: Conveyance System: New pipe systems are proposed and have been designed to meet the 25-year peak flow capacity.

Core Requirement #5: Erosion & Sediment Control: A Construction Stormwater Pollution Prevention Plan (CSWPPP) and narrative has been prepared. See Section 8. More than 1 acre of land will be disturbed and therefore the Department of Ecology SWPPP and Construction Stormwater General Permit is required.

Core Requirement #6: Maintenance & Operations: Maintenance requirements are provided in Section 10 for the flow control BMP.

Core Requirement #7: Financial Guarantees & Liabilities: Not applicable. Drainage facilities will be privately maintained and will not serve 2 or more lots.

Core Requirement #8: Water Quality: The project will add and/or replace more than 5,000 square feet of pollution generating impervious surface and will add less than ¾ acres of new pollution generating pervious surface. Therefore, this requirement must be met for the runoff generated by the gravel parking lot and driveway. See Section IV for more detail of how this requirement is met.

Core Requirement #9: Flow Control BMPs: This is discussed in Section IV. Infiltration is proposed to meet the Flow Control Duration standard as the trenches infiltrate 100%, therefore no other BMPs are proposed for the project site.

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Special Requirements

Special Requirement #1: Other Adopted Requirements: Not applicable.

Special Requirement #2: Flood Hazard Area Delineation: Not applicable.

Special Requirement #3: Flood Protection Facilities: Flooding concerns do not appear to be applicable for this project.

Special Requirement #4: Source Control: Not applicable.

Special Requirement #5: Oil Control: Not applicable.

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TIR Section III – Off Site Analysis

TIR Section III Summary

Narrative

A Level 1 downstream analysis is presented in this section per Section 2.3.1.1 "Technical Information Report (TIR)" of the 2016 KCSWDM. The predeveloped conditions are discussed in Section I of this report.

Task 1: Study Area Definition and Maps

The study area is defined as the project site and the area one mile downstream (minimum flow path distance) from the proposed discharge location for the purposes of Task 2, and is defined as the project site and a minimum of one-quarter mile downstream from the proposed discharge location for the purposes of Tasks 3, 4, and 5.

The drainage basin map can be found in Figure 4 of Section 1. Runoff flows towards the east through the site and then to the north along Vashon Hwy steep slopes. The site appears to be in the East Vashon drainage basin. Which outlets at the east side of Vashon Island.

Task 2: Resource Review

Drainage and water quality problems and complaints were investigated using the King County iMap website. The only drainage complain within the range of the required downstream analysis was for the northern parcel for water quality concerns, this complaint was resolved in March of 2015.

Using the King County iMap, it doesn't appear that floodplains, wetlands, or water quality problems are applicable to this project. According to the Water Quality Atlas Map Yarrow Creek does not have any category 5-303d listings but is has listing for water quality standards as the stream is listed as a core summer salmonid habitat. The purple lines on the appear to represent Water Quality Standards for open streams. (Figure III-1).

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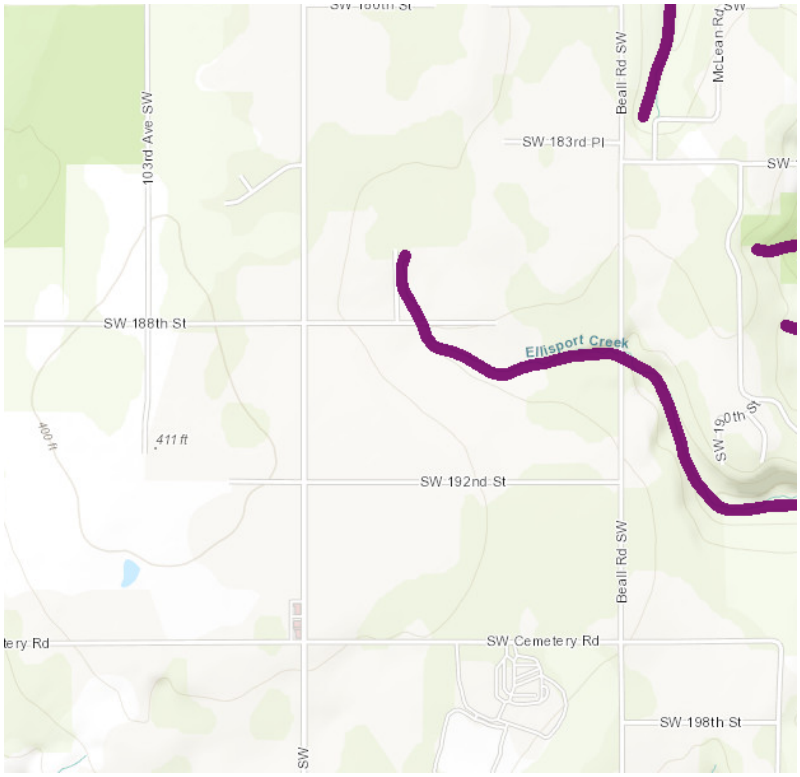

Figure III-1 DOE's Water Quality Atlas Map

Task 3: Field Inspection

A site was done the afternoon of 12/09/19. It was a cloudy day and it had rained the day before. The upstream and downstream paths were walked, the King County iMap and the survey were both referenced during the site visit. The ditch along Vashon Hwy was walked towards the north as the contours on both the survey and iMap slope towards the north. The neighboring property to the west has a HDPE pipe stretched towards the ditch, Figure III-5.

The stormwater runoff path was traced using the King County iMap tool using elevation contours. Runoff flows north along Vashon Hwy and then crosses the street through a 24" culvert towards the east into heavy brush, about 200 feet north of the church. From here it appears that the flow continues through heavy brush for about 900 feet before entering Ellisport Creek east of 96th Pl SW. Figures 2 – 12 depict the downstream walk done during the site visit.

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Figure III-2 SW 188th St Rd looking west (proposed site towards north). Shallow ditch flows to CB in Figure III-3

Figure III-3 Vashon Hwy looking east at intersection of Vashon Hwy and 188th. CB on west site of street picks up half of runoff off 188th.

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Figure III-4 Vashon Hwy looking north, CB picks up north half of runoff of 188th (proposed site towards west).

Figure III-5 Site frontage along Vashon Hwy, start of ditch flowing north.

Figure III-6 Culvert at neighboring driveway (looking south towards site), neighbors HDPE pipe connecting to ditch.

Figure III-7 Ditch and culvert system flowing north along Vashon Hwy.

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Figure III-8 Ditch line along Vashon HWY, looking south.

Figure III-9 24" Culvert within ditch line crossing Vashon Hwy, looking east.

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Figure III-10 Outfall of culvert in Figure III-8, heavy brush on east side of Vashon Hwy north of the site.

Figure III-11 Assumed location of Ellisport Creek, east of the project site looking north from 188th.

Figure III-12 Ellisport Creek crossing 188th St, east of site.

Task 4: Drainage System Description and Problem Descriptions

Currently a catch basin and ditch with culvert system is to the east of the site along the west side of Vashon Hwy, flowing north. No drainage problems are expected. Runoff is expected to fully infiltrate onsite. Overflow from the infiltration trench within the parking area is directed towards an existing catch basin at the intersection of 188th St and Vashon Hwy. The overflow from the trench at the northeast corner of the site is directed towards the existing ditch along Vashon Hwy(part of the same ditch culvert system which the existing catch basin mentioned previously).

Task 5: Mitigation of Existing or Potential Problems

Although the ditch system is deep and has culverts for every driveway it crosses, and water appears to flow through the system without any issues. It is recommended that the ditch system be cleaned out as there is lots of overgrown vegetation and a few of the culverts have accumulated sediment.

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TIR Section IV – Flow Control and Water Quality Facility Analysis and Design

TIR Section IV Summary:

Narrative
PART A: Existing Site Hydrology
PART B: Developed Site Hydrology
PART C: Performance Standards
PART D: Flow Control System
PART E: Water Quality System
WWHM 2012 Report (attachment)

Flow control per Core Requirement #3 is required as the site adds and/or replaces more than 5,000 square feet of impervious surface.

Flow Control Best Management Practices (BMPs) were evaluated per Core Requirement #9 to mitigate stormwater runoff impacts because the site adds and/or replaces more than 2,000 square feet of impervious surface. Per Section 1.2.9.2.3 "Large Rural Lot BMP Requirements," the site must meet the LID Performance Standard because it is located on a lot over 5 acres and is located outside of the Urban Growth Area (UGA).

The LID Performance Standard is achieved with three large infiltration trenches on the site. The infiltration trenches were modeled with WWHM 2012.

PART A: EXISTING SITE HYDROLOGY

The proposed project site is currently developed with an existing house and associated walkways and driveway. The site has an average slope of 6% towards the east, where a drainage ditch running south to north conveys stormwater north along Vashon Highway. Following the natural grade the downstream path appears to connect to Ellisport Creek. From consulting King County's iMap tool, the project is within the East Vashon drainage basin and no flooding areas exist near the site. A drainage complaint has been filed for the northern parcel, to do with water quality and which has been resolved March 2015. Upstream runoff to the site seems to be insignificant as there are mostly residential and forested areas upstream of the site.

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The existing land coverage is as follows:

Pervious Areas	
Trees and Vegetation:	48,228 sf (1.107 ac)
Total:	48,228 sf (1.107 ac)
Impervious Areas	
Existing House:	2,889 sf (0.066 ac)
Existing Gravel Driveway:	5,612 sf (0.129 ac)
Existing Concrete Walkways:	771 sf (0.018 ac)
Total:	9,272 sf (0.213 ac)

PART B: DEVELOPED SITE HYDROLOGY

In the proposed condition, there will be five new two-story buildings with 8 units each, a garden shed, a covered bike/trash enclosure and associated walkways and parking area with two driveways off 188th St.

Three infiltration trenches have been sized using WWHM 2012 with an infiltration rate of 0.5in/hr. Four of the five buildings will be routed first towards a rainwater cistern and then towards a 4' deep gravel filled infiltration trench at the northeast corner of the site. Roof drains from building "A" along with the runoff collected from gradual slope at the west side of the site and the proposed gravel driveway will all be routed towards two 3' deep gravel infiltration trenches located within the gravel parking lot. Overflow from the trenches will connect to existing stormwater infrastructure within Vashon Hwy SW, either directly tied to an existing catch basin or the exiting ditch along the west side of Vashon Hwy.

The proposed land coverage is broken into two sub-basins as follows:

Parking Sub-Basin: Drains to Trenches 101 and 102

Pervious Areas	
Lawn, AB, Flat	12,102 sf (0.278 ac)
Total:	12,102 sf (0.278 ac)
Impervious Areas	
Roof:	2,663 sf (0.061 ac)
Sidewalk, Flat:	1,053 sf (0.024 ac)
Parking, Flat:	8,512 sf (0.195 ac)
Total:	12,228 sf (0.281 ac)

Homes Sub-Basin: Drains to Trench 103

Pervious Areas	
Lawn, AB, Mod	4,032 sf (0.093 ac)
Lawn, AB, Flat	18,473 sf (0.424 ac)
Total:	22,505 sf (0.517 ac)
Impervious Areas	
Roof:	9,638 sf (0.221 ac)

Sidewalk, Flat:	1,504 sf (0.035ac)
Total:	12,228 sf (0.256 ac)

Flow Control Best Management Practices (BMPs) were evaluated per Core Requirement #9 to mitigate stormwater runoff impacts because the site adds and/or replaces more than 2,000 square feet of impervious surface. Per Section 1.2.9.2.3 "Large Rural Lot BMP Requirements," the site must meet the LID Performance Standard because it is located on a lot over 5 acres and is located outside of the Urban Growth Area (UGA). By meeting 100% infiltration for the Flow Control, Low Impact Development Standard is also met.

The WWHM report is included in the end of this Section.

PART C: PERFORMANCE STANDARDS

LID Performance Standard per Section 1.2.9.1 of the 2016 KCSWDM:

> *For the target surfaces subject to Core Requirement #9, Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow. Assume historic site conditions as the predeveloped condition.*

The LID Performance Standard is met by using a gravel filled infiltration trench. The trench is modeled in WWHM 2012 and the WWHM report is attached in this section.

PART D: FLOW CONTROL SYSTEM

Refer to plan sheet C3.1 for the placement and details of the flow control BMP.

Infiltration using a gravel-filled trench will be used to manage runoff to meet the LID duration standard from the site. A 45 ft long by 5 ft wide by 5 ft deep infiltration trench is proposed in the gravel driveway. The trench was designed to meet the LID Performance Standard using WWHM 2012 and the report is attached in this section. The design infiltration rate was found per Section 5.2.1 of the 2016 KCSWDM and the report can be found in Section VI.

PART E: WATER QUALITY SYSTEM

The site will add more than 5,000 square feet of pollution generating impervious surfaces and therefore will require water quality treatment. Water quality will be met using the cation exchange capacity of the underlying soil.

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WWHM2012
PROJECT REPORT

Project Name: Site Infiltration for Flow Control and LID Permformance
Site Name: Island Center Homes
Site Address: 9914 SW 188th ST
City : Vashon Island
Report Date: 1/16/2020
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.17
Version Date: 2018/10/10
Version : 4.2.16

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Entire Site: Basin 1 and 2
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Flat	.341
A B, Forest, Mod	.99
Pervious Total	1.331

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.331

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1:parking sub-basin

Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Lawn, Flat	.278
Pervious Total	0.278

Impervious Land Use	acre
ROOF TOPS FLAT	0.061
SIDEWALKS FLAT	0.024
PARKING FLAT	0.195
Impervious Total	0.28
Basin Total	0.558

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1 - Trenches 101 & 102
Bottom Length: 143.00 ft.
Bottom Width: 25.00 ft.
Trench bottom slope 1: 0 To 1
Trench Left side slope 0: 0 To 1
Trench right side slope 2: 0 To 1
Material thickness of first layer: 3
Pour Space of material for first layer: 0.35
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 0.5
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 53.06
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 53.06
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 2.9 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.082	0.000	0.000	0.000
0.0333	0.082	0.001	0.000	0.041
0.0667	0.082	0.001	0.000	0.041
0.1000	0.082	0.002	0.000	0.041
0.1333	0.082	0.003	0.000	0.041
0.1667	0.082	0.004	0.000	0.041
0.2000	0.082	0.005	0.000	0.041
0.2333	0.082	0.006	0.000	0.041
0.2667	0.082	0.007	0.000	0.041
0.3000	0.082	0.008	0.000	0.041
0.3333	0.082	0.009	0.000	0.041
0.3667	0.082	0.010	0.000	0.041
0.4000	0.082	0.011	0.000	0.041
0.4333	0.082	0.012	0.000	0.041
0.4667	0.082	0.013	0.000	0.041
0.5000	0.082	0.014	0.000	0.041
0.5333	0.082	0.015	0.000	0.041
0.5667	0.082	0.016	0.000	0.041
0.6000	0.082	0.017	0.000	0.041
0.6333	0.082	0.018	0.000	0.041
0.6667	0.082	0.019	0.000	0.041
0.7000	0.082	0.020	0.000	0.041
0.7333	0.082	0.021	0.000	0.041
0.7667	0.082	0.022	0.000	0.041
0.8000	0.082	0.023	0.000	0.041
0.8333	0.082	0.023	0.000	0.041
0.8667	0.082	0.024	0.000	0.041
0.9000	0.082	0.025	0.000	0.041
0.9333	0.082	0.026	0.000	0.041
0.9667	0.082	0.027	0.000	0.041
1.0000	0.082	0.028	0.000	0.041
1.0333	0.082	0.029	0.000	0.041
1.0667	0.082	0.030	0.000	0.041
1.1000	0.082	0.031	0.000	0.041
1.1333	0.082	0.032	0.000	0.041
1.1667	0.082	0.033	0.000	0.041
1.2000	0.082	0.034	0.000	0.041
1.2333	0.082	0.035	0.000	0.041
1.2667	0.082	0.036	0.000	0.041
1.3000	0.082	0.037	0.000	0.041
1.3333	0.082	0.038	0.000	0.041
1.3667	0.082	0.039	0.000	0.041
1.4000	0.082	0.040	0.000	0.041
1.4333	0.082	0.041	0.000	0.041
1.4667	0.082	0.042	0.000	0.041
1.5000	0.082	0.043	0.000	0.041
1.5333	0.082	0.044	0.000	0.041
1.5667	0.082	0.045	0.000	0.041
1.6000	0.082	0.046	0.000	0.041
1.6333	0.082	0.046	0.000	0.041
1.6667	0.082	0.047	0.000	0.041
1.7000	0.082	0.048	0.000	0.041

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1.7333	0.082	0.049	0.000	0.041
1.7667	0.082	0.050	0.000	0.041
1.8000	0.082	0.051	0.000	0.041
1.8333	0.082	0.052	0.000	0.041
1.8667	0.082	0.053	0.000	0.041
1.9000	0.082	0.054	0.000	0.041
1.9333	0.082	0.055	0.000	0.041
1.9667	0.082	0.056	0.000	0.041
2.0000	0.082	0.057	0.000	0.041
2.0333	0.082	0.058	0.000	0.041
2.0667	0.082	0.059	0.000	0.041
2.1000	0.082	0.060	0.000	0.041
2.1333	0.082	0.061	0.000	0.041
2.1667	0.082	0.062	0.000	0.041
2.2000	0.082	0.063	0.000	0.041
2.2333	0.082	0.064	0.000	0.041
2.2667	0.082	0.065	0.000	0.041
2.3000	0.082	0.066	0.000	0.041
2.3333	0.082	0.067	0.000	0.041
2.3667	0.082	0.068	0.000	0.041
2.4000	0.082	0.068	0.000	0.041
2.4333	0.082	0.069	0.000	0.041
2.4667	0.082	0.070	0.000	0.041
2.5000	0.082	0.071	0.000	0.041
2.5333	0.082	0.072	0.000	0.041
2.5667	0.082	0.073	0.000	0.041
2.6000	0.082	0.074	0.000	0.041
2.6333	0.082	0.075	0.000	0.041
2.6667	0.082	0.076	0.000	0.041
2.7000	0.082	0.077	0.000	0.041
2.7333	0.082	0.078	0.000	0.041
2.7667	0.082	0.079	0.000	0.041
2.8000	0.082	0.080	0.000	0.041
2.8333	0.082	0.081	0.000	0.041
2.8667	0.082	0.082	0.000	0.041
2.9000	0.082	0.083	0.000	0.041
2.9333	0.082	0.084	0.064	0.041
2.9667	0.082	0.085	0.182	0.041
3.0000	0.082	0.086	0.333	0.041

Name : Basin 2: Homes sub-basin
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
A B, Lawn, Flat	**.424**
A B, Lawn, Mod	**.093**
Pervious Total	**0.517**

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.221**
SIDEWALKS FLAT	**0.035**

Impervious Total **0.256**

Basin Total **0.773**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Gravel Trench Bed 2	Gravel Trench Bed 2	

Name : Gravel Trench Bed 2 - Trench 103
Bottom Length: 103.00 ft.
Bottom Width: 25.00 ft.
Trench bottom slope 1: 0 To 1
Trench Left side slope 0: 0 To 1
Trench right side slope 2: 0 To 1
Material thickness of first layer: 4
Pour Space of material for first layer: 0.35
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 0.5
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 48.803
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 48.803
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 3.9 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	**Outlet 2**

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.059	0.000	0.000	0.000
0.0444	0.059	0.000	0.000	0.029
0.0889	0.059	0.001	0.000	0.029
0.1333	0.059	0.002	0.000	0.029
0.1778	0.059	0.003	0.000	0.029
0.2222	0.059	0.004	0.000	0.029
0.2667	0.059	0.005	0.000	0.029
0.3111	0.059	0.006	0.000	0.029
0.3556	0.059	0.007	0.000	0.029
0.4000	0.059	0.008	0.000	0.029

0.4444	0.059	0.009	0.000	0.029
0.4889	0.059	0.010	0.000	0.029
0.5333	0.059	0.011	0.000	0.029
0.5778	0.059	0.012	0.000	0.029
0.6222	0.059	0.012	0.000	0.029
0.6667	0.059	0.013	0.000	0.029
0.7111	0.059	0.014	0.000	0.029
0.7556	0.059	0.015	0.000	0.029
0.8000	0.059	0.016	0.000	0.029
0.8444	0.059	0.017	0.000	0.029
0.8889	0.059	0.018	0.000	0.029
0.9333	0.059	0.019	0.000	0.029
0.9778	0.059	0.020	0.000	0.029
1.0222	0.059	0.021	0.000	0.029
1.0667	0.059	0.022	0.000	0.029
1.1111	0.059	0.023	0.000	0.029
1.1556	0.059	0.023	0.000	0.029
1.2000	0.059	0.024	0.000	0.029
1.2444	0.059	0.025	0.000	0.029
1.2889	0.059	0.026	0.000	0.029
1.3333	0.059	0.027	0.000	0.029
1.3778	0.059	0.028	0.000	0.029
1.4222	0.059	0.029	0.000	0.029
1.4667	0.059	0.030	0.000	0.029
1.5111	0.059	0.031	0.000	0.029
1.5556	0.059	0.032	0.000	0.029
1.6000	0.059	0.033	0.000	0.029
1.6444	0.059	0.034	0.000	0.029
1.6889	0.059	0.034	0.000	0.029
1.7333	0.059	0.035	0.000	0.029
1.7778	0.059	0.036	0.000	0.029
1.8222	0.059	0.037	0.000	0.029
1.8667	0.059	0.038	0.000	0.029
1.9111	0.059	0.039	0.000	0.029
1.9556	0.059	0.040	0.000	0.029
2.0000	0.059	0.041	0.000	0.029
2.0444	0.059	0.042	0.000	0.029
2.0889	0.059	0.043	0.000	0.029
2.1333	0.059	0.044	0.000	0.029
2.1778	0.059	0.045	0.000	0.029
2.2222	0.059	0.046	0.000	0.029
2.2667	0.059	0.046	0.000	0.029
2.3111	0.059	0.047	0.000	0.029
2.3556	0.059	0.048	0.000	0.029
2.4000	0.059	0.049	0.000	0.029
2.4444	0.059	0.050	0.000	0.029
2.4889	0.059	0.051	0.000	0.029
2.5333	0.059	0.052	0.000	0.029
2.5778	0.059	0.053	0.000	0.029
2.6222	0.059	0.054	0.000	0.029
2.6667	0.059	0.055	0.000	0.029
2.7111	0.059	0.056	0.000	0.029
2.7556	0.059	0.057	0.000	0.029
2.8000	0.059	0.057	0.000	0.029
2.8444	0.059	0.058	0.000	0.029
2.8889	0.059	0.059	0.000	0.029

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2.9333	0.059	0.060	0.000	0.029
2.9778	0.059	0.061	0.000	0.029
3.0222	0.059	0.062	0.000	0.029
3.0667	0.059	0.063	0.000	0.029
3.1111	0.059	0.064	0.000	0.029
3.1556	0.059	0.065	0.000	0.029
3.2000	0.059	0.066	0.000	0.029
3.2444	0.059	0.067	0.000	0.029
3.2889	0.059	0.068	0.000	0.029
3.3333	0.059	0.069	0.000	0.029
3.3778	0.059	0.069	0.000	0.029
3.4222	0.059	0.070	0.000	0.029
3.4667	0.059	0.071	0.000	0.029
3.5111	0.059	0.072	0.000	0.029
3.5556	0.059	0.073	0.000	0.029
3.6000	0.059	0.074	0.000	0.029
3.6444	0.059	0.075	0.000	0.029
3.6889	0.059	0.076	0.000	0.029
3.7333	0.059	0.077	0.000	0.029
3.7778	0.059	0.078	0.000	0.029
3.8222	0.059	0.079	0.000	0.029
3.8667	0.059	0.080	0.000	0.029
3.9111	0.059	0.080	0.012	0.029
3.9556	0.059	0.081	0.138	0.029
4.0000	0.059	0.082	0.333	0.029

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.331
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.795
Total Impervious Area:0.536

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001787
5 year	0.004739
10 year	0.008594
25 year	0.017347
50 year	0.028368
100 year	0.045319

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)

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2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0009	1909	0	0	Pass
0.0012	244	0	0	Pass
0.0014	195	0	0	Pass
0.0017	171	0	0	Pass
0.0020	148	0	0	Pass
0.0023	128	0	0	Pass
0.0026	108	0	0	Pass
0.0028	95	0	0	Pass
0.0031	83	0	0	Pass
0.0034	75	0	0	Pass
0.0037	69	0	0	Pass
0.0039	65	0	0	Pass
0.0042	60	0	0	Pass
0.0045	53	0	0	Pass
0.0048	48	0	0	Pass
0.0051	46	0	0	Pass
0.0053	44	0	0	Pass
0.0056	41	0	0	Pass
0.0059	38	0	0	Pass
0.0062	34	0	0	Pass
0.0064	34	0	0	Pass
0.0067	32	0	0	Pass
0.0070	30	0	0	Pass
0.0073	28	0	0	Pass
0.0076	25	0	0	Pass
0.0078	25	0	0	Pass
0.0081	23	0	0	Pass
0.0084	22	0	0	Pass
0.0087	20	0	0	Pass
0.0089	18	0	0	Pass
0.0092	18	0	0	Pass
0.0095	17	0	0	Pass
0.0098	16	0	0	Pass
0.0101	14	0	0	Pass
0.0103	14	0	0	Pass
0.0106	14	0	0	Pass
0.0109	13	0	0	Pass
0.0112	12	0	0	Pass
0.0114	12	0	0	Pass
0.0117	12	0	0	Pass
0.0120	11	0	0	Pass
0.0123	11	0	0	Pass

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0.0125	11	0	0	Pass
0.0128	11	0	0	Pass
0.0131	11	0	0	Pass
0.0134	11	0	0	Pass
0.0137	11	0	0	Pass
0.0139	11	0	0	Pass
0.0142	11	0	0	Pass
0.0145	11	0	0	Pass
0.0148	11	0	0	Pass
0.0150	10	0	0	Pass
0.0153	10	0	0	Pass
0.0156	10	0	0	Pass
0.0159	10	0	0	Pass
0.0162	9	0	0	Pass
0.0164	9	0	0	Pass
0.0167	9	0	0	Pass
0.0170	9	0	0	Pass
0.0173	9	0	0	Pass
0.0175	9	0	0	Pass
0.0178	9	0	0	Pass
0.0181	9	0	0	Pass
0.0184	9	0	0	Pass
0.0187	9	0	0	Pass
0.0189	9	0	0	Pass
0.0192	7	0	0	Pass
0.0195	7	0	0	Pass
0.0198	7	0	0	Pass
0.0200	7	0	0	Pass
0.0203	7	0	0	Pass
0.0206	7	0	0	Pass
0.0209	7	0	0	Pass
0.0212	7	0	0	Pass
0.0214	7	0	0	Pass
0.0217	7	0	0	Pass
0.0220	7	0	0	Pass
0.0223	7	0	0	Pass
0.0225	7	0	0	Pass
0.0228	7	0	0	Pass
0.0231	7	0	0	Pass
0.0234	7	0	0	Pass
0.0237	6	0	0	Pass
0.0239	6	0	0	Pass
0.0242	6	0	0	Pass
0.0245	6	0	0	Pass
0.0248	6	0	0	Pass
0.0250	6	0	0	Pass
0.0253	6	0	0	Pass
0.0256	6	0	0	Pass
0.0259	6	0	0	Pass
0.0261	6	0	0	Pass
0.0264	6	0	0	Pass
0.0267	6	0	0	Pass
0.0270	6	0	0	Pass
0.0273	6	0	0	Pass
0.0275	6	0	0	Pass
0.0278	6	0	0	Pass

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0.0281	6	0	0	Pass
0.0284	5	0	0	Pass

TIR Section V – Conveyance System Analysis and Design

TIR Section V Summary:

Narrative

Per Core Requirement #4, new pipe systems shall be designed with sufficient capacity to convey and contain (at minimum) the 25-year peak flow.

Pipe calculations are provided for the 8" PVC pipe conveying surface runoff to the infiltration trench. Assuming no significant upstream flows, Using the Rational Method the 25-year peak flow for the entire site is expected to be 1.430 cfs. The conveyance capacity of the pipe was calculated using Manning's equation and assuming a 1.5% slope. There is enough conveyance capacity to meet the 25-year peak flow.

Pipe	25-Year Peak Flow (cfs)	Conveyance Capacity (cfs)
8" PVC Pipe	1.43	1.50

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Rational Method - Developed Conditions
for: Island Center Homes

$Q = C_{avg}iA$

Tc = 6.30 (assumed, since all pipe flow)

	Area (ac)	C
Dense Forest		0.10
Light Forest		0.15
Pasture		0.20
Lawns		0.25
Gravel	0.20	0.80
Pavement & Roofs	0.350	0.90
Open Water		1.00
Other		0.00

C_{avg} = 0.86

Total Area (A) = 0.545 acres

i = (Pr)(ir) Pr= total precipitation at the project site for 24-hr duration storm
ir= unit peak rainfall intensity factor

ir= (ar)(Tc)^(-br) ar, br= coefficients from Table 3.2.1.B of KCSWDM

$(ir)_2$=	0.54	i_2=	1.276755	Q_2=	0.60
$(ir)_{10}$=	0.75	i_{10}=	2.441716	Q_{10}=	1.15
$(ir)_{25}$=	0.80	i_{25}=	3.0395	Q_{25}=	**1.43**
$(ir)_{100}$=	0.82	i_{100}=	3.724495	Q_{100}=	1.75

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Rational Method	By DLL	Date 1/17/2020
	Developed Conditions	Chkd	Date
		Scale N.T.S.	Sheet No.
	Island Center Homes	Job No. 19310.20	

Figure V-1. Rational Method calculations.

Rational Method - Developed Conditions
for: Island Center Homes

Manning's n= **0.013** PVC pipe (King County Surface Water Design Manual)

Conveyance Capacity					
	4-inch	6-inch	8-inch	10-inch	12-inch
Slope (ft/ft)					
0.005	0.13	0.40	0.87	1.55	2.52
0.010	0.19	0.56	1.23	2.20	3.57
0.015	0.23	0.69	**1.50**	2.69	4.37
0.020	0.27	0.79	1.74	3.11	5.05
0.025	0.30	0.89	1.94	3.47	5.65
0.030	0.33	0.97	2.13	3.81	6.18
0.035	0.36	1.05	2.30	4.11	6.68
0.040	0.38	1.12	2.46	4.39	7.14
0.045	0.40	1.19	2.60	4.66	7.57
0.050	0.43	1.26	2.75	4.91	7.98
0.055	0.45	1.32	2.88	5.15	8.37
0.060	0.47	1.38	3.01	5.38	8.75
0.065	0.49	1.43	3.13	5.60	9.10
0.070	0.50	1.49	3.25	5.81	9.45
0.075	0.52	1.54	3.36	6.02	9.78
0.080	0.54	1.59	3.47	6.21	10.10
0.085	0.56	1.64	3.58	6.40	10.41
0.090	0.57	1.68	3.68	6.59	10.71
0.095	0.59	1.73	3.78	6.77	11.01
0.100	0.60	1.78	3.88	6.95	11.29

ENGINEERING Edmonds, WA 98020	Rational Method Developed Conditions	By DLL	Date 1/17/2020
		Chkd	Date
		Scale N.T.S.	Sheet No. 1/1
	Island Center Homes	Job No. 19310.20	

Figure V-2. Conveyance Capacity

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TIR Section VI – Special Reports and Studies

TIR Section VI Summary:

Narrative

The following reports are attached for reference:

1. Geotechnical Engineering Study by dated October 19, 2019.
2. Infiltration Considerations by Geotech Consultants dated December 11, 2019.

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October 29, 2019

JN 19401

Vashon Household
P.O. Box 413
Vashon, Washington 98070

Attention: Chris Szala
via email: chris@vashonhousehold.org

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Residential Project
9914 Southwest 188th Street
Vashon, Washington

Dear Mr. Szala:

Attached to this transmittal letter is our geotechnical engineering report for the residential project to be constructed in Vashon, Washington. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design considerations for foundations, retaining walls, subsurface drainage, and temporary excavations.

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

D. Robert Ward, P.E.
Principal

cc: **Form + Function Architecture** – Judy Tucker
via email: jtuckerarch@peoplepc.com

DRW:kg

GEOTECHNICAL ENGINEERING STUDY
Residential Project
9914 Southwest 188th Street
Vashon, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed residential project to be located at 9914 Southwest 188th Street, Vashon.

We were provided with a site for the site and also a topography map. The site plan was developed by Form+Function Architecture dated January 27, 2019. Terrane developed the topography map, which is dated June 7, 2019. Based on the plans, we understand that five residence buildings will be placed throughout the property, with the exception of a gravel parking lot on the southwestern portion of the property. The lowest floor of the buildings, which will be on slabs, will have a grade similar to the existing grade.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site in the central, upland area of Vashon Island. The rectangular site has 250 feet of frontage on its southern side along Southwest 188th Street and 230 feet of frontage on its eastern side along Vashon Highway Southwest. The property, and the adjacent sites to the west, north, and east, slope gently downward to the east/northeast; the subject site has an overall inclination of about 5 percent (from about elevation 389 feet down to 375 feet). However, there is a very small, but steeper break in the topography around elevation 381/382 feet. A building and gravel parking lot on located on the eastern/southeastern portion of the property that are on the downslope side of this small break. Much of the property outside of the building and parking lot is grass-covered, although there are some large scattered trees; this are mostly around the perimeter of the site.

Large residential properties border the western and northern sides of the site. There are some residences on these properties that are within about 17 feet of the adjoining property lines.

SUBSURFACE

The subsurface conditions were explored by excavating 10 test pits at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The test pits were excavated on October 11 and 24 with a rubber-tired backhoe and a mini-excavator, respectively. A geotechnical engineer from our staff observed the excavation process, logged the test pits, and obtained representative samples of the soil encountered. "Grab" samples

of selected subsurface soil were collected from the backhoe bucket. The Test Pit Logs are attached to this report as Plates 3 through **7**.

Soil Conditions

Half of the test pits revealed about 2 to 5 feet of loose fill at the ground surface; these test pits were generally on the upslope, western portion of the site. Below the fill, and generally at the ground surface in the other test pits, some topsoil and native, slightly silty sand was revealed. The sand was generally loose at first, but became medium-dense to dense at depths ranging from about 6 inches to 8 feet.

Groundwater Conditions

No groundwater seepage was observed in the test pits, but there were some indications based on soil coloring (rust) that some minor, seasonal perched water likely occurs just above the medium-dense to dense soil. The wetter season, late fall through early spring, is the probable time of the perched groundwater.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the test pit logs are interpretive descriptions based on the conditions observed during excavation.

The compaction of test pit backfill was not in the scope of our services. The test pits were backfilled with excavated soil that was lightly tamped into place. Loose soil will therefore be found in the area of the test pits. If this presents a problem, the backfill will need to be removed and replaced with structural fill during construction.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test pits conducted for this study ultimately encountered medium-dense or dense, native, slightly silty sand soil. Generally, on the eastern portion of the site, east of approximately elevation 381 – 382 feet, this competent soil was revealed at relatively shallow depths. However, fill soils were revealed at the ground surface in many of the test pits on the central and western portion of the site, and the competent native soil was not revealed until deeper depths. We have noted on the Site Exploration Plan, Plate 2, the depths to the competent bearing soil at each test pit location, which range from about 6 inches to 8 feet. Where the competent bearing soil is shallow to relatively shallow, using conventional footing foundations could be very suitable for the new buildings; the footings will need to bear directly on the competent soil or on structural fill placed on the competent soil. Where the depth to competent soil is deeper, footings can still be used if a deeper over-excavation down to competent soil is done and structural fill placed above the competent soil. However, if the deeper overexcavation is not desirable, driven pipe piles could be used as

foundations in order to limit excavations. We have provided recommendations for both footing foundations and driven pipe pile foundations in this report. However, we recommend that only one foundation type be used per building. Thus, some overexcavation may be needed on portions of some of the buildings if a footing foundation is used where the depth to the competent soil is variable (for instance, the southeasternmost building is a possibility for this).

The onsite native soil that is currently in a medium-dense to dense condition is suitable to be used as structural fill provided its moisture is near optimum. The upper fill, topsoil, and loose native soil is not suitable to use as structural fill. However, since only minor excavations are planned for this project, it is unlikely that the suitable soil will be available to use as structural fill.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, the access roads should follow the alignment of planned pavements. Trucks should not be allowed to drive off of the rock-covered areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking, cleaning, and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a build up of excessive water vapor within the planned structure.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type C (Very Dense Soil. As noted in the USGS website,

the mapped spectral acceleration value for a 0.2 second (S_s) and 1.0 second period (S_1) equals 1.50g and 0.57g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.62g. The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature and/or the absence of near-surface groundwater.

Sections 1803.5 of the IBC and 11.8 of ASCE 7 require that other seismic-related geotechnical design parameters (seismic surcharge for retaining wall design and slope stability) include the potential effects of the Design Earthquake. The peak ground acceleration for the Design Earthquake is defined in Section 11.2 of ASCE 7 as two-thirds (2/3) of the MCE peak ground acceleration, or 0.42g.

CONVENTIONAL FOUNDATIONS

The proposed structure can be supported on conventional continuous and spread footings bearing on undisturbed, medium-dense or denser, native silty sand soil, or on structural fill placed above this competent native soil. See the section entitled ***General Earthwork and Structural Fill*** for recommendations regarding the placement and compaction of structural fill beneath structures. Adequate compaction of structural fill should be verified with frequent density testing during fill placement. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer to document that adequate bearing soils have been exposed.

We recommend that continuous and individual spread footings have minimum widths of 16 and 24 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand

An allowable bearing pressure of 3,000 pounds per square foot (psf) is appropriate for footings supported on competent native soil. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, or on structural fill up to 5 feet in thickness, will be about 3/4-inch, with differential settlements on the order of 1/2-inch in a distance of 40 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill.

We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.50
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

Thickened slabs are often used to support interior walls in multifamily and commercial structures. It is important to remember that thickened slab areas support building loads, just like conventional footings do. For this reason, the subgrade below thickened slabs must be prepared in the same way as for conventional footings. All unsuitable soils have to be removed and any structural fill compacted in accordance with the recommendations of this report. We recommend against the use of thickened slabs for most projects, particularly single-family residential, as it is difficult to ensure that the subgrades have been appropriately prepared. Also, the compacted slab fill has to be protected from disturbance by the earthwork, foundation, and utility contractors.

PIPE PILES

Different pipe pile sizes are possible for this project. We have discussed several sizes below, as well as other general pipe pile recommendations.

A 2-inch-diameter pipe pile driven with a minimum 90-pound jackhammer or a 140-pound Rhino hammer to a final penetration rate of 1-inch or less for one minute of continuous driving may be assigned an allowable compressive load of 3 tons. Extra-strong steel pipe should be used. The site soils are not highly organic, and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard "black" pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles.

Three- or 4-inch-diameter pipe piles are also possible. As a minimum, Schedule 40 pipe should be used. Because the site soils are not highly organic and not located near salt water. standard "black" pipe can be used. These piles driven with a 850- or 1,100- or 2,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (850-pound hammer)	FINAL DRIVING RATE (1,100-pound hammer)	FINAL DRIVING RATE (2,000-pound hammer)	ALLOWABLE COMPRESSIVE CAPACITY
3 inches	10 sec/inch	6 sec/inch	2 sec/inch	6 tons
4 inches	16 sec/inch	10 sec/inch	4 sec/inch	10 tons

Note: The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on

the top of the pile during driving. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard-mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

Pile caps and grade beams should be used to transmit loads to the piles. Isolated pile caps should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. Subsequent pipe sections should be connected together using threaded or slip couplers, or by welding. If slip couplers are used, they must fit snugly into the ends of the pipes. This can require that shims or beads of welding flux be applied to the couplers. Pile caps and grade beams should be used to transmit loads to the piles.

Lateral loads may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or surrounded by level structural fill. We recommend using a passive earth pressure of 300 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. We recommend a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate passive value.

It is difficult to accurately estimate the length that the piles will need to be driven to achieve the recommended refusal rate. It is likely that the piles will extend at least 5 feet into the competent bearing soil noted on Plate 2.

If lateral resistance from fill placed against the foundations is required for this project, the structural engineer should indicate this requirement on the plans for the general and earthwork contractor's information. Compacted fill placed against the foundations can consist of on-site that is tamped into place using the backhoe or is compacted using a jumping jack compactor. It is necessary for the fill to be compacted to a firm condition, but it does not need to reach even 90 percent relative compaction to develop the passive resistance recommended above.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	35 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.50
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Active and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure. This applies only to walls with level backfill.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired.

The passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 7**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated

water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The recommended wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

The ***General***, ***Slabs-On-Grade***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop firm, non-organic soils or on structural fill. The subgrade soil must be in a firm, non-yielding condition at the time of slab construction or underslab fill placement; thus, compaction of the slab subgrade soils will very likely be necessary. Any soft areas encountered should be excavated and replaced with select, imported structural fill.

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content

(percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI recommends a minimum 10-mil thickness vapor retarder for better durability and long term performance than is provided by 6-mil plastic sheeting that has historically been used. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection.

If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material.

The ***General***, ***Permanent Foundation and Retaining Walls***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

EXCAVATIONS AND SLOPES

No significant excavated slopes are anticipated other than for utility trenches. Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Temporary cuts to a maximum overall depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. Based upon Washington Administrative Code (WAC) 296, Part N, the soil at the upper soils at the subject site would generally be classified as Type B. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 1:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These

recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

All permanent cuts into native soil should be inclined no steeper than 2:1 (H:V). Compacted fill slopes should not be constructed with an inclination greater than 2:1 (H:V). To reduce the potential for shallow sloughing, fill must be compacted to the face of these slopes. This can be accomplished by overbuilding the compacted fill and then trimming it back to its final inclination. Adequate compaction of the slope face is important for long-term stability and is necessary to prevent excessive settlement of patios, slabs, foundations, or other improvements that may be placed near the edge of the slope.

Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

DRAINAGE CONSIDERATIONS

Footing drains are only needed where: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or, (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the ***Slabs-On-Grade*** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Providing a few inches of free draining gravel underneath the vapor retarder is also prudent to limit the potential for seepage to build up on top of the vapor retarder.

No groundwater was observed during our field work. However, if seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to buildings should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the ***Foundation and Retaining Walls*** section.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. It is important that existing foundations be removed before site development. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process. A discussion regarding the re-use of onsite soils is given in the earlier ***General*** section of this study.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches, but should be thinner if small, hand-operated compactors are used. We recommend testing structural fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended levels of relative compaction for compacted fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath footings, slabs or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking samples in test pits. Subsurface conditions can also vary between exploration locations. Such unexpected

conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Vashon Household and its representatives for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following plates are attached to complete this report:

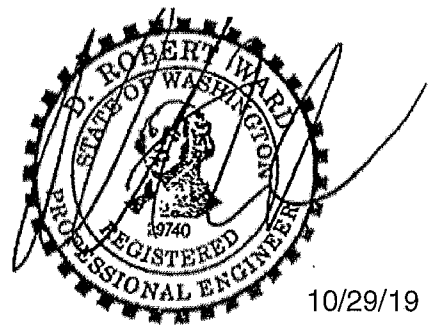
Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 7	Test Pit Logs

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

D. Robert Ward, P.E.
Principal



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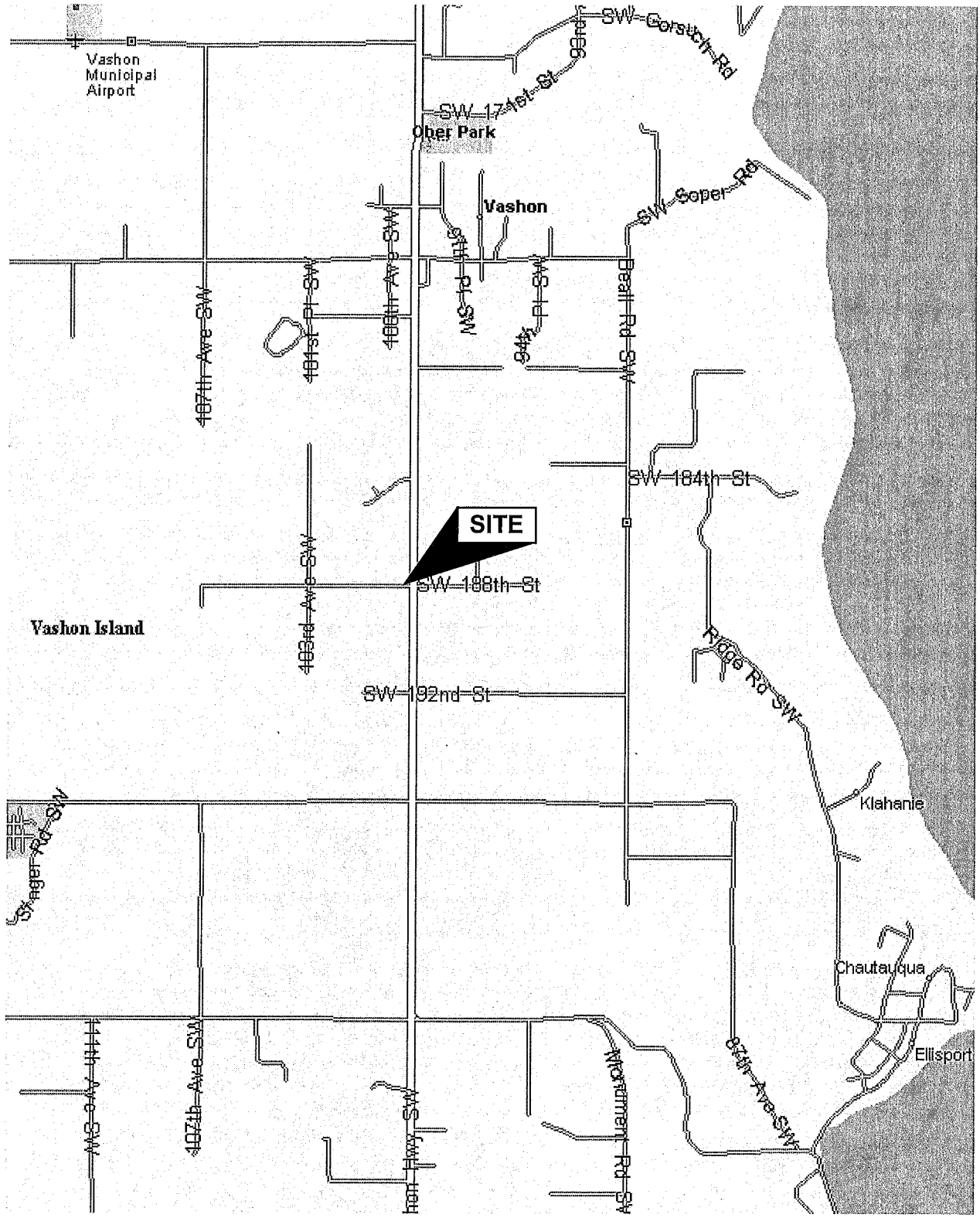

(Source: Microsoft MapPoint, 2013)

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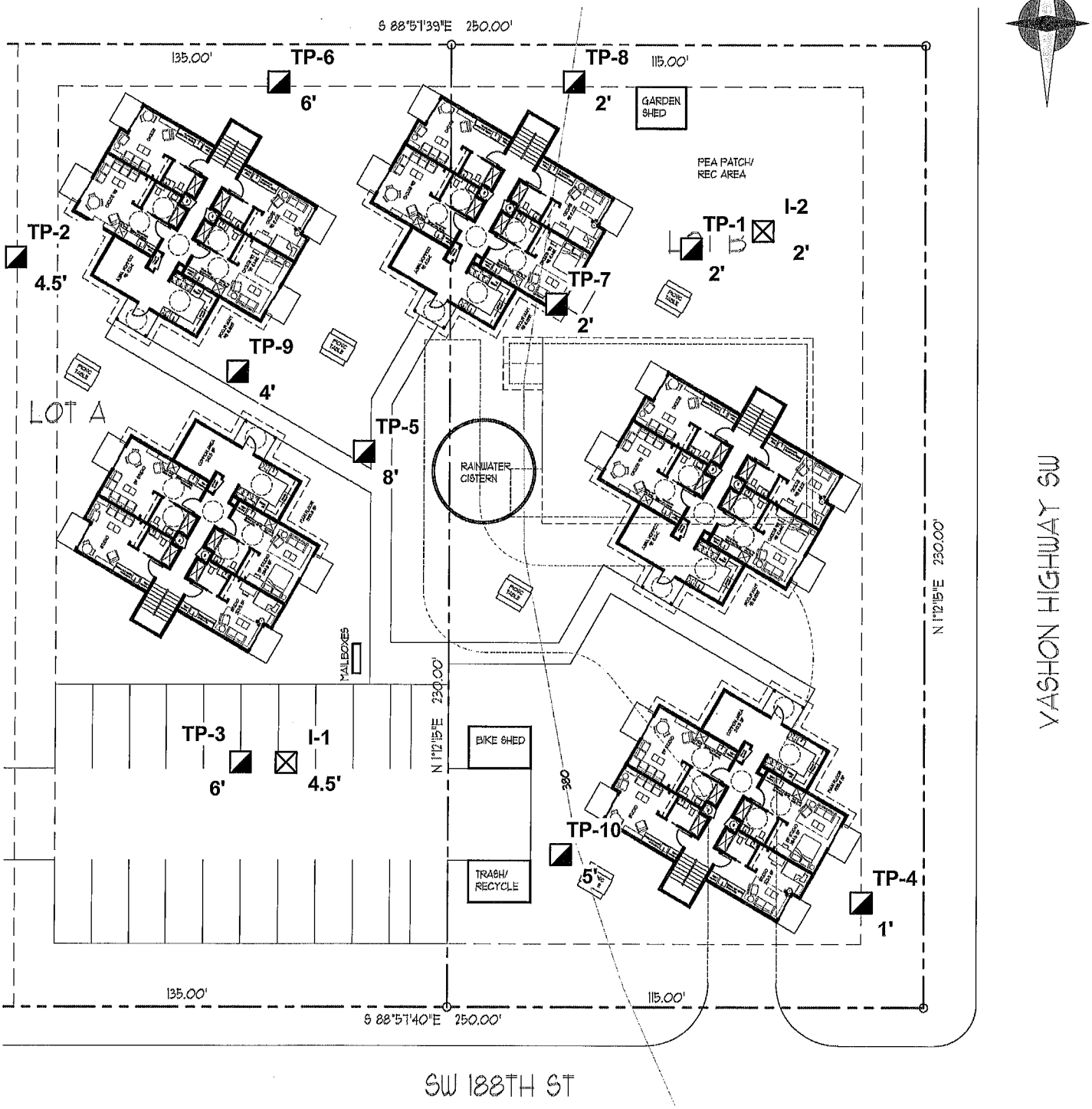
VICINITY MAP

9914 Southwest 188th Street
Vashon, Washington

Job No:	Date:		Plate:
19401	Oct. 2019		1



Legend:

Test Pit Location ☒ Infiltration Pit Location

Note: 6' Depth to Bearing Soil (TYP)

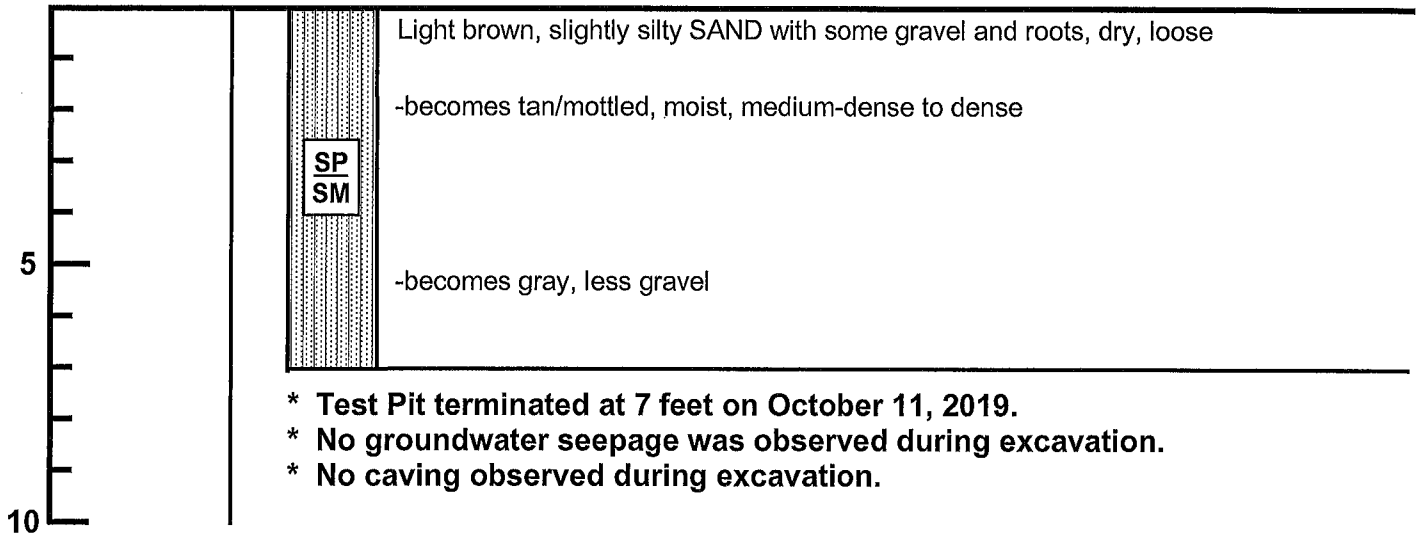
GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

9914 Southwest 188th Street
Vashon, Washington

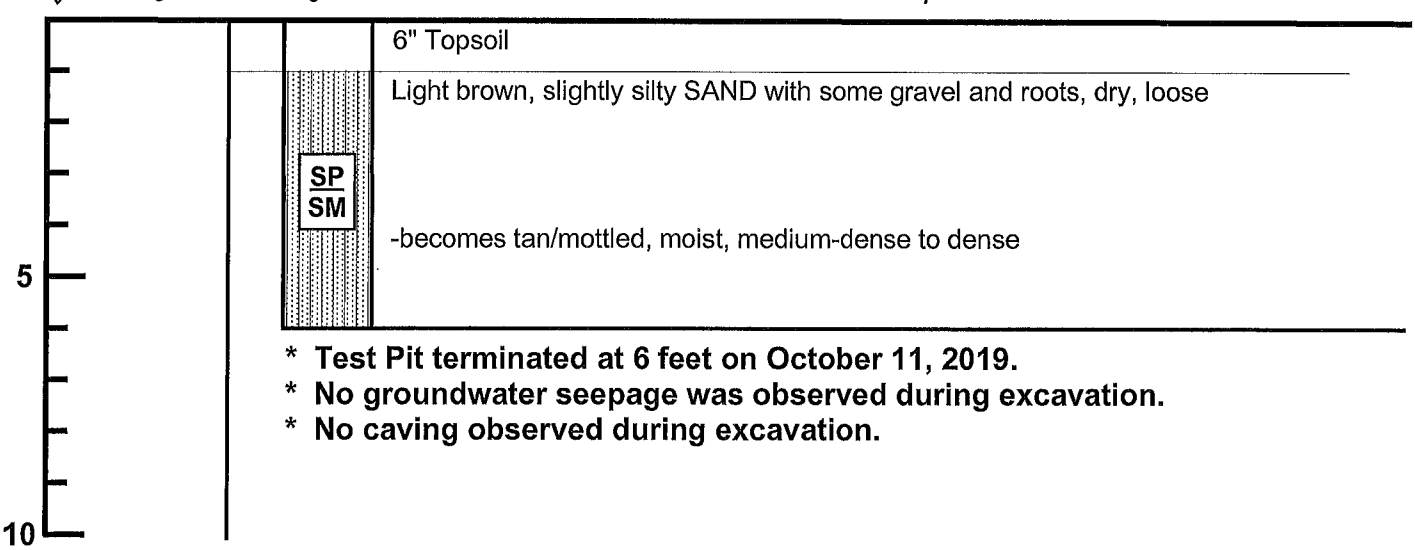
Job No:	Date:		Plate:
19401	Oct. 2019	No Scale	2

TEST PIT 1



* **Test Pit terminated at 7 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 2



* **Test Pit terminated at 6 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

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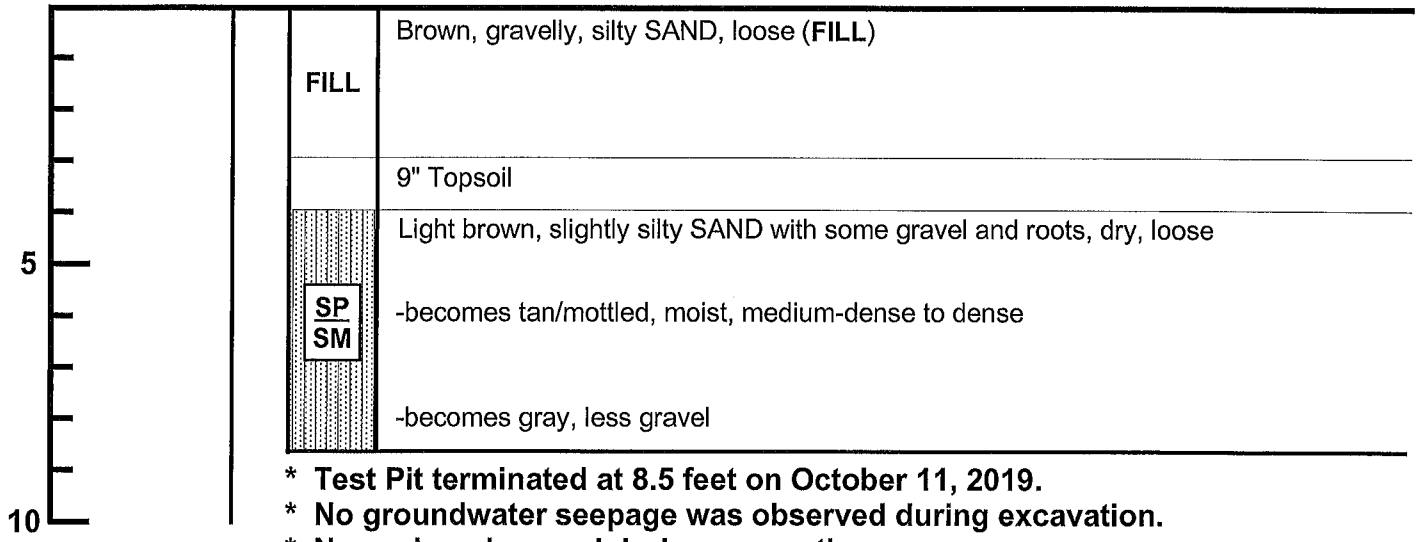
TEST PIT LOG

9914 Southwest 188th Street
Vashon, Washington

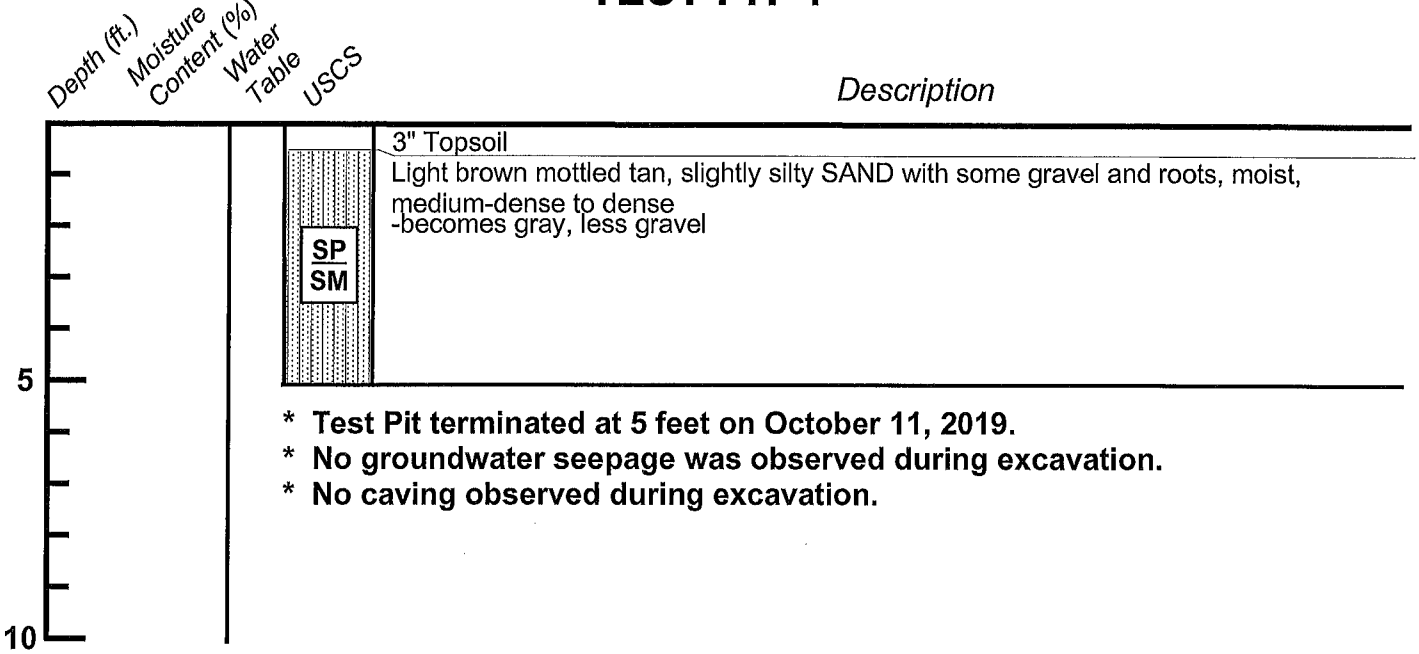
Job	Date:	Logged by:	Plate:
19401	Oct. 2019	DRW	3

TEST PIT 3



* **Test Pit terminated at 8.5 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 4



* **Test Pit terminated at 5 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

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TEST PIT LOG

9914 Southwest 188th Street
Vashon, Washington

Job	Date:	Logged by:	Plate:
19401	Oct. 2019	DRW	4

TEST PIT 5

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown, gravelly, silty SAND, loose (**FILL**)
5				9" Relic Topsoil
			SP SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose -becomes tan/mottled, moist, medium-dense to dense
10				

* **Test Pit terminated at 8.5 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 6

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown, gravelly, silty SAND, loose (**FILL**)
5			SP SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose -becomes tan/mottled, moist, medium-dense to dense
10				

* **Test Pit terminated at 7 feet on October 11, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

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TEST PIT LOG

9914 Southwest 188th Street
Vashon, Washington

Job	Date:	Logged by:	Plate:
19401	Oct. 2019	DRW	5

TEST PIT 7

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				3" Topsoil
			SP/SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose -becomes tan/mottled, moist, medium-dense to dense
5				* **Test Pit terminated at 4 feet on October 24, 2019.** * **No groundwater seepage was observed during excavation.** * **No caving observed during excavation.**
10				

TEST PIT 8

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				3" Topsoil
			SP/SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose -becomes tan/mottled, moist, medium-dense to dense
5				* **Test Pit terminated at 4 feet on October 24, 2019.** * **No groundwater seepage was observed during excavation.** * **No caving observed during excavation.**
10				

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TEST PIT LOG

9914 Southwest 188th Street
Vashon, Washington

Job	Date:	Logged by:	Plate:
19401	Oct. 2019	DRW	6

TEST PIT 9

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	2" Fill
				3" Relic Topsoil
			SP SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose
				-becomes tan/mottled, moist, medium-dense to dense
5				
10				

* **Test Pit terminated at 4.5 feet on October 24, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 10

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Fill
				3" Relic Topsoil
			SP SM	Light brown, slightly silty SAND with some gravel and roots, dry, loose
				-becomes tan/mottled, moist, medium-dense to dense
5				
10				

* **Test Pit terminated at 6 feet on October 24, 2019.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

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TEST PIT LOG

9914 Southwest 188th Street
Vashon, Washington

Job	Date:	Logged by:	Plate:
19401	Oct. 2019	DRW	7

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

December 11, 2019

JN 19401

Vashon Household
P.O. Box 413
Vashon, Washington 98070

Attention: Chris Szala
via email: chris@vashonhousehold.org

Subject: **Infiltration Considerations**
Proposed Residential Project
9914 Southwest 188th Street
Vashon, Washington

Reference: *Geotechnical Engineering Study* prepared by Geotech Consultants dated October 29, 2019.

Dear Mr. Szala:

We are pleased to present this report regarding infiltration considerations for the proposed residential development to be constructed at 9914 Southwest 188th Street, Vashon, Washington. In preparation for writing this report, we conducted two small-scale Pilot Infiltration Tests (PIT) where stormwater infiltration is being considered. This report summarizes the results of infiltration testing and provides recommendations related to on-site stormwater infiltration.

The two small-scale PIT's were conducted on October 24, 2019 in general accordance with the procedures outlined in Reference 6A of the 2016 King County Surface Water Design Manual (KCSWDM). These two infiltration tests, referred to as infiltration pit 1 (I-1) and infiltration pit 2 (I-2), were performed at the locations shown on Site Exploration Plan, Plate 2 of the referenced geotechnical report.

The infiltration test pits were excavated using a small rubber-tracked excavator until reaching depths of native sandy soils with a low silt-content. This resulted in bottom depths of about 4.5 and 3 feet at I-1 and I-2, respectively. Because of their lower silt content, these native soils are considered the most favorable for infiltration as compared to the brown silty SAND soils found closer to the ground surface. Apart from the varying depths where less silty native soils were revealed, the soil conditions were very similar in both test pits.

CONCLUSIONS AND RECOMMENDATIONS

Infiltration testing was performed as a Small Pilot Infiltration Test, with both test pits being excavation having a base area of at least 12 square feet. The pits were soaked with water for at least 4 hours. During the soaking period, approximately 12 inches water was maintained in the pit. The testing then consisted of measuring the rate of water flow needed to maintain a steady water level in the pits. The testing yielded a measured infiltration rate of 1.6 inches per hour, which was consistent between the two tests.

Per the procedures detailed in Kind County Stormwater Manual, KCSWDM 5.2.1, the design infiltration rate (I_{design}) needs to be less than the measured infiltration rate using correction factors. The calculation steps are summarized as follows:

$$I_{design} = I_{measured} \times F_{testing} \times F_{geometry} \times F_{plugging} \text{ (eq. 5-11 from KCSWDM)}$$

An explanation of each of correction factors $F_{testing}$, $F_{geometry}$, and $F_{plugging}$ is provided in Table 1 below.

Table 1: Correction Factors For Determination Of Design Infiltration Rate

Correction Factor	Value	Explanation
Testing Factor	$F_{testing} = 0.5$	For small-scale pilot infiltration test
Facility Geometry Factor	$F_{geometry} = 0.8$	A value of 0.8 was assumed for the facility geometry factor
Plugging Factor	$F_{plugging} = 0.8$	For fine sands and loamy sands

Plugging in the values of the correction factors listed in Table 1 above to eq. 5-11 yields:

$$I_{design} = (1.6\ inches/hr) \times (0.5) \times (0.8) \times (0.8)$$

$$I_{design} = 0.51\ inch/hr$$

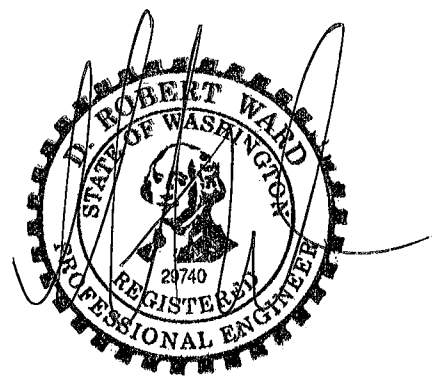
Therefore, we recommend a final design (long-term) infiltration rate of **0.5 inches per hour** to use for design of infiltration facilities at the site in the areas tested and to the depths tested.

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

David Crawford
Geotechnical Engineer



12/11/19
D. Robert Ward, P.E.
Principal

Attachment: Plate 2, Site Exploration Plan

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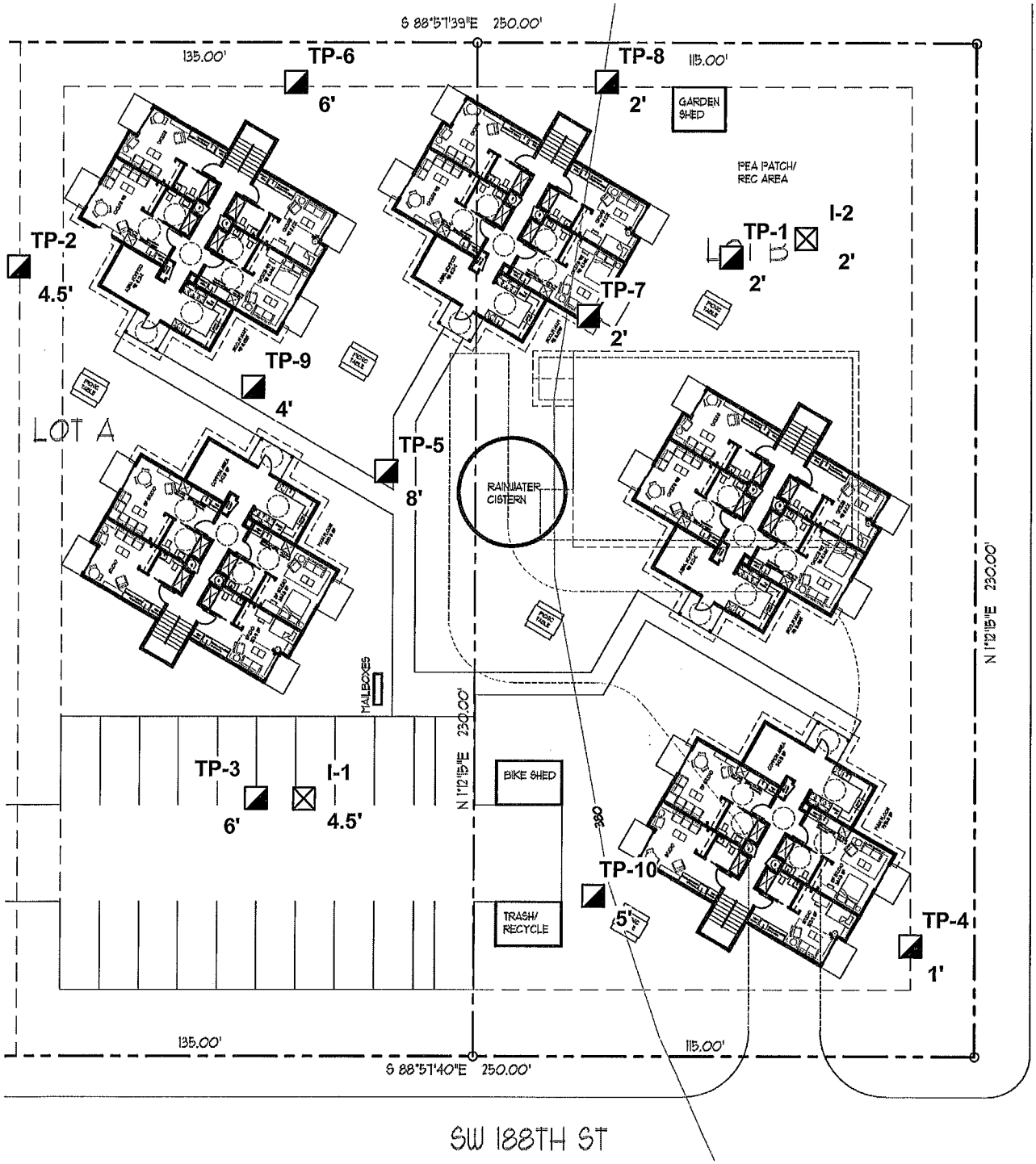

Legend:

Test Pit Location ☒ Infiltration Pit Location

Note: 6' Depth to Bearing Soil (TYP)

GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

9914 Southwest 188th Street
Vashon, Washington

Job No:	Date:		Plate:
19401	Oct. 2019	No Scale	2

TIR Section VII – Other Permits

TIR Section VII

Narrative

A NPDES General Permit for Construction (pursuant to the Washington State Department of Ecology's Construction Stormwater General Permit) is required for projects that will disturb one or more acres. See Narrative and attached SWPPP in Section VIII.

ENGINEERING
250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

TIR Section VIII – CSWPPP Analysis and Design

TIR Section VIII Summary

Narrative

DOE SWPPP

The Department of Ecology SWPPP and Construction Stormwater General Permit is required more than 1 acre of land will be disturbed and therefore. The SWPPP is attached.

ENGINEERING

250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Island Center Homes

Prepared for:

The Washington State Department of Ecology

Northwest Regional Office

Permittee / Owner	Developer	Operator / Contractor
Form & Function Architecture	Vashon Household	Robert Kruse Company

9914 188th SW St Vashon, WA 98070.

Tax Parcel Numbers: 312303-9138, 312303-9108

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Darina Litushko	CG Engineering	425.778.8500

SWPPP Preparation Date

January 2020

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction	July 2020 (Approx.)	May 2021 (Approx.)

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Appendix/Glossary

List of Acronyms and Abbreviations

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

1 Project Information

Project/Site Name: Island Center Homes
Street/Location: 9914 SW 188th ST
City: Vashon Island State: WA Zip code: 98070
Subdivision: N/A
Receiving waterbody: Ellisport Creek

1.1 Existing Conditions

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

Total acreage: 1.33 ac
Disturbed acreage: 1.25 ac
Existing structures: 0.066 ac building, 0.129 gravel driveway, and 0.018 concrete walkways
Landscape topography: 1.107 ac bushes, shrubs, small trees.
Drainage patterns: The site generally slopes downward from the west to east with a grade change of about 12 feet.
Existing Vegetation: Bushes, shrubs and a few trees. Site has been previously developed.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): NA

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

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity. N/A

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
Multi-family residential. The project will add 5 building totaling 40 apartment units.

Description of construction activities (example: site preparation, demolition, excavation):
Clearing, excavating, filling, and grading; utility installation, parking lot surfacing, and building construction.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
The site generally slopes downward from the west to the east and drainage in the developed condition is expected to flow in the same direction with the lowest point being at the northeast corner.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
Buildings, parking lots and driveways will cover about 40% of the site with the remaining 60% being landscaping.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
N/A

2 Construction Stormwater Best Management Practices (BMPs)

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

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

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

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

High Visibility Fence will be placed around the north, east and south property lines entire site. Trees near the proposed gravel driveway as well as the along the east property line, and near the northwest corner of the site will be protected.

List and describe BMPs:

- Preserving Natural Vegetation (BMP C101)
- High Visibility Fence (BMP C103)

Installation Schedules: Install BMPs prior to clearing and grading.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

2.1.2 Element 2: Establish Construction Access

Limit vehicle access to one route, if possible.

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, street cleaning, or wheel wash/tire baths may be necessary if the stabilized construction access is not effective. If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more necessary as needed. All wheel wash wastewater shall be controlled on-site and CANNOT be discharged into waters of the State.

A stabilized construction entrance will be added at the southwest corner of the site at the location of the proposed entrance to the site. This will help to prevent sediment tracking into the right of way.

List and describe BMPs:

- Stabilized Construction Entrance/Exit (BMP C105)

Installation Schedules: Install BMPs prior to clearing and grading.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

2.1.3 Element 3: Control Flow Rates

The project site has a gentle slope from west to east for most of the site (4-6%). Stormwater will be directed to a temporary sediment trap at the northeast corner of the site, and flow rates will be controlled per the BMPs listed below. The construction of the temporary sediment trap must be done as one of the first steps in grading.

Infitration facilities will be constructed for permanent stormwater control. Stormwater should not be directed to these facilities until the site has been stabilized. Protect Low Impact Development BMPs from compaction and sedimentation per Element 13. Flow rates around the rest of the site will be controlled by the silt fence that will be placed around the entire site.

Will you construct stormwater retention and/or detention facilities?
☒ Yes ☐ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?
☐ Yes ☒ No

List and describe BMPs:

- Temporary Sediment Trap (BMP C240)
- Check Dams (BMP C207)
- Interceptor Dike and Swale (BMP C200)
- Silt Fence (BMP C233)

Installation Schedules: Install BMPs prior to grading.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

2.1.4 Element 4: Install Sediment Controls

Stormwater must be filtered prior to being discharged to an infiltration system or leaving the construction site. Sediment control BMPs will be installed as one of the first steps of grading. These BMPs must be functional before other land-disturbing activities, especially grading and filling, take place.

A silt fence will be installed around the north, east and south property lines of the site. A temporary sediment trap will be installed at the northeast corner of the site where some sediment will be able to settle out prior to discharge to the public storm system.

If sediment controls are ineffective and turbid water is observed discharging from the site, additional energy dissipation BMPs and sediment control BMPs should be installed such as wattles. It may also be necessary to stabilize soils per Element 5 that are not being worked on.

List and describe BMPs:

- Silt Fence (BMP C233)
- Temporary Sediment Trap (BMP C240)

Installation Schedules: Install BMPs prior to clearing and grading.

Inspection and Maintenance plan: Repair sediment controls as needed. Remove sediment from pond as needed.

Responsible Staff: CESCL.

2.1.5 Element 5: Stabilize Soils

Stabilize exposed and unworked soils by the BMPs listed below to prevent erosion. Protect stockpiles with plastic covering or other approved sediment trapping measures. Stabilize exposed soils with Temporary and Permanent Seeding, Mulching, Sodding, Topsoiling/Compost, or Surface Roughening. Minimize soil compaction by applying gravel base early on areas to be paved.

The ESC Supervisor shall be familiar with BMPs for soil stabilization and dust control and implement these BMPs where needed on the proposed site.

West of the Cascade Mountains Crest

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

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

Anticipated project dates: Start date: March 2020 End date: May 2021

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

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Nets and Blankets (BMP C122)
- Plastic Covering (BMP C123)
- Sodding (BMP C124)
- Topsoiling/Composting (BMP C125)
- Surface Roughening (BMP C130)
- Dust Control (BMP C140)

Installation Schedules: As needed as soil is exposed.

Inspection and Maintenance plan: End of the shift before a holiday or weekend and prior to forecasted rain events.

Responsible Staff: CESCL.

2.1.6 Element 6: Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion. The interceptor swale and check dams will be located along the north and east edges of the site.

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

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Interceptor Dike and Swale (BMP C200)
- Check Dams (BMP C207)

Installation Schedules: Install BMPs prior to grading and as needed to minimize erosion.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided.

Storm Drain Inlet Protection will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.

Inlet protection should be provided as shown on the C2.1 Plan. Inlet protection devices will be cleaned (or removed and replaced), when sediment has filled the device by one third (1/3) or as specified by the manufacturer.

List and describe BMPs:

- Storm Drain Inlet Protection (BMP C220)

Installation Schedules: Before land disturbance for existing catch basins and as new catch basins are made operable.

Inspection and Maintenance plan: Inlets will be inspected weekly at a minimum and daily during storm events.

Responsible Staff: CESCL.

2.1.8 Element 8: Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion.

The project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used.

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

List and describe BMPs:

- Channel Lining (BMP C202)
- Check Dams (BMP C207)
- Outlet Protection (BMP C209)

Installation Schedules: Install BMPs prior to grading.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

2.1.9 Element 9: Control Pollutants

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

Table 2 – Pollutants

Pollutant (List pollutants and source, if applicable)
Concrete
Concrete process water
Concrete slurry
Asphalt materials
Utility Materials

List and describe BMPs:

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

Installation Schedules: As needed as pollutant source materials are used on-site.

Inspection and Maintenance plan: As needed.

Responsible Staff: CESCL.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?
☐ Yes ☒ No

Will wheel wash or tire bath system BMPs be used during construction?
☐ Yes ☒ No

Will pH-modifying sources be present on-site?
☒ Yes ☐ No

Table 3 – pH-Modifying Sources

☐	None
☒	Bulk cement
☒	Cement kiln dust
☒	Fly ash
☒	Other cementitious materials
☐	New concrete washing or curing waters
☐	Waste streams generated from concrete grinding and sawing
☒	Exposed aggregate processes
☐	Dewatering concrete vaults
☐	Concrete pumping and mixer washout waters

☐	Recycled concrete
☐	Recycled concrete stockpiles
☐	Other (i.e., calcium lignosulfate) [please describe:]

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

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

☐ Yes ☒ No

2.1.10 Element 10: Control Dewatering

Dewatering is not anticipated to be associated with this construction project.

If necessary, only clean, non-turbid dewatering water (such as well-point groundwater) may be discharged to systems tributary to, or directly into, surface waters of the State, provided the dewatering flow does not cause erosion or flooding of receiving waters.

Table 4 – Dewatering BMPs

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

List and describe BMPs: N/A.

Installation Schedules: N/A.

Inspection and Maintenance plan: N/A.

Responsible Staff: CESCL.

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

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

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

Table 5 – Management

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

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
Pre-construction	Preserving Natural Vegetation (BMP C101)	7/1/2020	Dry
Pre-construction	High Visibility Fence (BMP C103)	7/1/2020	Dry
Pre-construction	Silt Fence (BMP C233)	7/1/2020	Dry
Land disturbance	Stabilized Construction Entrance/Exit (BMP C105)	7/3/2020	Dry
Land disturbance	Temporary Sediment Pond (BMP C241)	7/5/2020	Dry
Land disturbance	Temporary and Permanent Seeding (BMP C120)	7/5/2020	Dry
Land disturbance	Mulching (BMP C121)	7/5/2020	Dry
Land disturbance	Nets and Blankets (BMP C122)	7/10/2020	Dry
Land disturbance	Plastic Covering (BMP C123)	7/10/2020	Dry
Land disturbance	Sodding (BMP C124)	7/10/2020	Dry
Land disturbance	Topsoiling/Composting (BMP C125)	7/10/2020	Dry
Land disturbance	Surface Roughening (BMP C130)	7/10/2020	Dry
Land disturbance	Dust Control (BMP C140)	7/15/2020	Dry
Land disturbance	Interceptor Dike and Swale (BMP C200)	7/15/2020	Dry
Land disturbance	Channel Lining (BMP C202)	7/20/2020	Dry
Land disturbance	Check Dams (BMP C207)	7/20/2020	Dry
Land disturbance	Outlet protection (BMP C209)	7/202020	Dry
Land disturbance	Storm Drain Inlet Protection (BMP C220)	7/1//2020	Dry
Construction	Concrete handling (BMP C151)	7/20/2020	Dry
Construction	Sawcutting and Surfacing Pollution Prevention (BMP C152)	7/20/2020	Dry
Construction	Material Delivery, Storage and Containment (BMP C153)	7/20/2020	Dry

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

Gravel Infiltration Trenches (SWMMWW Section 3.3.11) will be the primary means of stormwater detention for the roofs and other hard surfaces on this project. The infiltration trenches will need to be protected from compaction during construction. This can be done by placing orange protective fencing around the trenches as they are constructed in order to avoid compaction from vehicle traffic.

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	TBD
Resident Engineer	CG Engineering	425.778.8500
Emergency Ecology Contact	Noel Tamboer	360.407.7229
Emergency Permittee/ Owner Contact	Judy Tucker	206.372.9796
Non-Emergency Owner Contact	Judy Tucker	206.372.9796
Monitoring Personnel	TBD	TBD
Ecology Regional Office	Northwest Regional Office	425.649.7000

4 Monitoring and Sampling Requirements

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

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

File a blank form under Appendix D.

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

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

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

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

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

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

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

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

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

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

4.2.2 pH Sampling

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

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

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

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

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

Method for sampling pH:

Table 9 – pH Sampling Method

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

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

5.1 303(d) Listed Waterbodies

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

☐ Yes ☒ No

List the impairment(s): N/A

5.2 TMDL Waterbodies

Waste Load Allocation for CSWGP discharges: N/A

List and describe BMPs: N/A

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

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

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

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

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

6.1.2 Records Retention

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

Permit documentation to be retained on-site:

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

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

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

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

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

6.2 Reporting

6.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.

DMRs will be reported online through Ecology's WQWebDMR System.

6.2.2 Notification of Noncompliance

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

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

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

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

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results

5. Date / Time of call
6. Date / Time of sample
7. Project name

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

A. Site Map

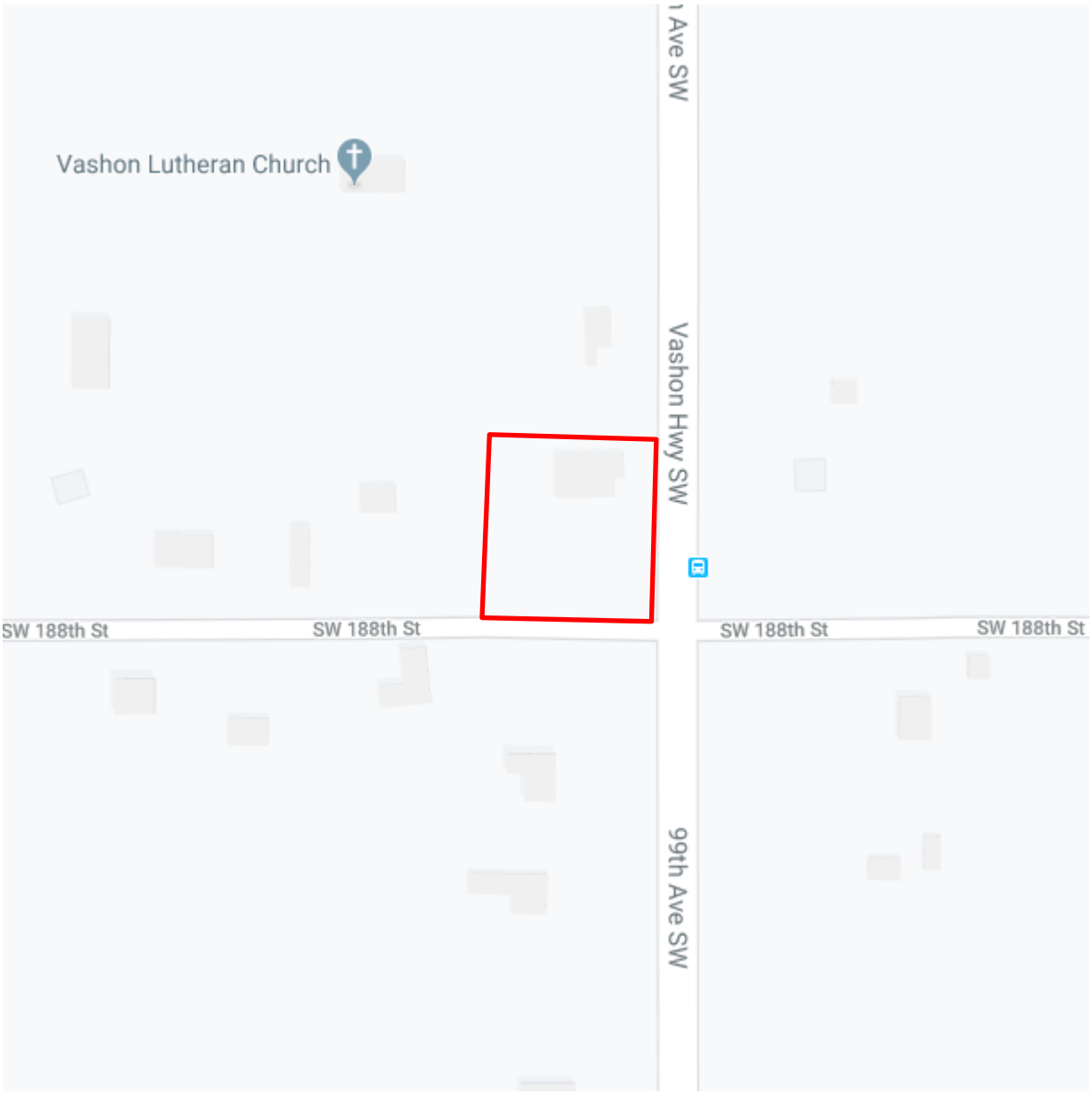

Figure A-1. Site map.

B. BMP Detail

BMP details are shown on the approved TESC plan. Additional/alternative BMPs are listed below and available for download from the Ecology Construction Stormwater website:

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

Element #1 - Mark Clearing Limits

- BMP C101: Preserving Natural Vegetation
- BMP C103: High Visibility Plastic or Metal Fence

Element #2 - Establish Construction Access

- BMP C105: Stabilized Construction Entrance/Exit

Element #3 - Control Flow Rates

- BMP C207: Check Dams
- BMP C240: Temporary Sediment Trap
- BMP C233: Silt Fence
- BMP C200: Interceptor Dike and Swale

Element #4 - Install Sediment Controls

- BMP C233: Silt Fence
- BMP C240: Temporary Sediment Pond

Element #5 - Stabilize Soils

- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP C122: Nets and Blankets
- BMP C123: Plastic Covering
- BMP C124: Sodding
- BMP C125: Topsoiling/Composting
- BMP C130: Surface Roughening
- BMP C140: Dust Control

Element #6 - Protect Slopes

- BMP C120: Temporary and Permanent Seeding
- BMP C200: Interceptor Dike and Swale
- BMP C207: Check Dams

Element #7 - Protect Drain Inlets

- BMP C220: Storm Drain Inlet Protection

Element #8 - Stabilize Channels and Outlets

- BMP C202: Channel Lining
- BMP C207: Check Dams
- BMP C209: Outlet Protection

Element #9 – Control Pollutants

- BMP C151: Concrete Handling

- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C153: Material Delivery, Storage and Containment

Element #10 - Control Dewatering

NA

Element #11: Maintain BMPs

- BMP C150: Materials On Hand
- BMP C160: Certified Erosion and Sediment Control Lead

Element #12: Manage the Project

- BMP C150: Materials On Hand
- BMP C160: Certified Erosion and Sediment Control Lead
- BMP C162: Scheduling

Element #13: Protect LID BMPs

- BMP C103: High Visibility Fence

C. Correspondence

D. Site Inspection Form

	Permit #	Inspection Date	Time
Project Name			

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

Print Name: _____

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

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

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

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

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

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

C. Questions:

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

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

_____

_____

_____

_____

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

Sampling Results:

Date: _____

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

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

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect						

	downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						
	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						

8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						
	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						

	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐

All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

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

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

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

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

Title/Qualification of Inspector: _____

E. Construction Stormwater General Permit (CSWGP)

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

G. Contaminated Site Information

H. Engineering Calculations

Sediment Trap Design Calculations
for: Island Center Homes

SA=FS(Q/Vs) Water surface area

FS=	2		Factor of Safety
Q2=	0.247	cfs	2-yr developed peak from WWHM
Q10=	0.398	cfs	10-yr developed peak from WWHM
Vs=	0.00096	ft/s	Settling Velocity
Side Slopes=	3	H:1V	
Depth=	3.5	ft	Minimum

2-year Trap Geometry

SA=	514	sf			
Min. Pond Dimensions=	23	by	23	ft	(Assumed square trap)
Incl. 1 ft Freeboard=	29	by	29	ft	

10-year Trap Geometry

SA=	829	sf			
Min. Pond Dimensions	29	by	29	ft	(Assumed square trap)
Incl. 1 ft Freeboard=	35	by	35	ft	

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Sediment Trap Calculations 2- and 10-year Storms **Island Center Homes** **Sediment Trap Calculations**	By DLL Chkd Scale N.T.S. Job No. 19310.20	Date 01/17/2020 Date Sheet No.

Figure H-1. Sediment trap surface area calculations.

BMP ACTIVITY WORKSHEET			
Activity Sheet #	Use this worksheet to identify the activities that you conduct. Interpret the categories broadly. Numbers A-1 – A-48 correspond to sheets located in Chapter 3.	Do you conduct this activity? If so, where?	
	TYPE OF ACTIVITY	**INDOORS**	**OUTDOORS**
STORAGE			
A-1	Required BMPs for All Properties with Commercial Activities		x
A-2	Outdoor Storage of Liquid Materials in Stationary Tanks		x
A-3	Storage of Liquid Materials in Portable Containers		
A-4	Storage of Soil, Sand, and Other Erodible Materials		
A-5	Storage of Dry Pesticides and Fertilizers		
A-6	Storage and Treatment of Contaminated Soils		
A-7	Outdoor Storage and Processing of Food Items		
A-8	Storage of Solid Wastes and Food Wastes (Including Cooking Grease)		
A-9	Storage of Scrap and Recycling Materials (Including Auto Recycling Facilities)		
A-10	Treatment, Storage, or Disposal of Dangerous Wastes		
A-31	Vehicle and Equipment Parking and Storage		
WASHING			
A-11	Cleaning or Washing of Tools and Equipment		
A-12	Cleaning or Washing of Food Service Areas and Equipment		
A-13	Vehicle Washing and Steam Cleaning		
A-14	Interior Washing Operations (Including Mobile Contractors)		
A-15	Pressure Washing of Buildings, Rooftops, and Other Large Objects		
A-32	Sidewalk Maintenance		
A-41	Wheel Wash and Tire Bath Operations		
TRANSFER OF LIQUID MATERIALS			
A-16	Truck or Rail Loading and Unloading of Liquid Materials		
A-17	Stationary Fueling Operations		
A-18	Engine Repair and Maintenance		
A-47	Older Stationary Fueling Operations		
A-48	Mobile Fueling Operations		

PRODUCTION AND APPLICATION			
A-19	Concrete and Asphalt Production at Stationary Sites		
A-20	Concrete and Asphalt at Temporary Sites		
A-21	Manufacturing and Post-Processing of Metal Products		
A-22	Painting, Finishing, and Coating of Vehicles, Products, and Equipment		
A-23	Wood Treatment and Preserving		
A-24	Commercial Composting		
A-25	Chemical Applications-Other than for Landscaping		
A-37	Mining and Quarrying of Sand, Gravel, and Other Materials		
A-39	Roof Vents and Fugitive Emissions (Including Dust)		
A-44	Dust Control and Soil Erosion and Sediment Control for Manufacturing and Other Commercial Operations		
LANDSCAPING			
A-26	Landscaping Activities		
CONSTRUCTION			
A-27	Clearing, Grading, and Preparation of Land for Small Construction Projects		x
A-28	Demolition of Buildings		x
A-29	Building Repair, Remodeling, and Construction		x
A-30	Boat Building, Maintenance, and Repair		
OTHER			
A-33	Swimming Pool and Spa Cleaning and Maintenance		
A-34	Keeping Animals in Controlled Areas		
A-35	Keeping Livestock in Stables, Pens, Pastures or Fields		
A-36	Logging and Log Yards		
A-38	Well, Directional and Geotechnical Drilling		
A-40	Street Deicing Operations		
A-42	Potable Water Line Flushing or Tank Maintenance		
A-45	Maintenance of Public and Private Utility Corridors and Facilities		
A-46	Color Events		

A-1 REQUIRED BEST MANAGEMENT PRACTICES FOR ALL PROPERTIES WITH COMMERCIAL ACTIVITIES

The following Best Management Practices (BMPs) are required for all commercial, industrial, agricultural, public, or residential properties with commercial activities in unincorporated King County.

Best Management Practices (BMPs) are required by King County Code 9.12. If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs:

Clean and Maintain Storm Drainage System

Evaluate the condition of the catch basin by checking the amount of sediment in the bottom of the sump. Catch basins must be cleaned out when the solids, trash, and debris in the sump reaches one-half of the depth between the bottom of the sump and the bottom of the lowest inflow or outflow pipe connected to the catch basin or is at least 6 inches below this point.

Hire a professional drainage contractor to inspect and maintain your system or clean the system yourself. If there is sediment or other debris in the drainage pipes, then a professional contractor must be hired to flush or jet out the pipes.

Small amounts of floating oil can be soaked up with oil absorbent pads, bagged and disposed of as solid waste.

Up to one cubic yard of nonhazardous solid material may be disposed of as solid waste in your regular garbage. If you exceed this threshold hire a professional drainage contractor. All of the solids and stagnant water collected from catch basin sumps must be disposed of properly. None of the sump contents can be flushed into the catch basin outflow pipe. Depending on the nature of the pollutants in the sump, and the associated types of activities taking place on the site, the sump contents may need to be handled as contaminated waste. Contractors who perform catch basin clean-out services are required to follow appropriate disposal requirements.

Clean and maintain catch basins annually. Sites with activities generating a lot of sediments and other debris will have to inspect and clean out their catch basins more often. Frequent sweeping of paved parking and storage areas will save time and money in maintaining the drainage system.

Other components of drainage systems such as ponds, tanks, and bioswales must also be maintained. If this maintenance is beyond your ability, contractors are available to complete this work.

Label All Storm Drain Inlets on your property

Stencil or apply storm drain markers adjacent to storm drains to help prevent the improper disposal of pollutants. If the storm drain grate is stamped with warnings against polluting, then additional marking may not be required if there is no evidence of pollutants being dumped or washed into the storm drain.

Eliminate Illicit Connections to the Storm Drainage System

Connections to the storm drainage system that convey substances other than stormwater are prohibited. Examples are connections from internal floor drains, HVAC systems, industrial processes, sinks, and toilets.

Illicit connections must be immediately removed, permanently plugged or re-plumbed

The discharge must be re-plumbed so that it goes to the sanitary sewer, a septic system, an on-site treatment system, or a holding tank for off-site disposal. There are restrictions on what can be disposed of to the sanitary sewer and septic systems. You may be required to do additional investigation to determine where all stormwater and non-stormwater discharges go. This may include smoke, dye, and chemical testing or closed circuit television inspection.

Additional Information:

- Drainage System Maintenance Contractors Information Sheet
- For stencils and instructions or to determine if you have an illicit connection, contact King County Stormwater Services at 206-477-4811 or kingcounty.gov/stormwater.

A-2 OUTDOOR STORAGE OF LIQUID MATERIALS IN STATIONARY TANKS

Best Management Practices (BMPs) are required by King County Code 9.12. If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs:

- Store and contain liquid materials so if the tank leaks, the contents will not get into the storm drainage system, surface waters, or groundwater. This requires secondary containment or using a double-walled tank.
- Place small, gravity-fed farm fuel tanks without secondary containment on flat and open ground so that a spill or leak will not run downhill toward creeks, ditches, tiles, or drains before it can be contained and cleaned up.
- Place tanks on secure bases and stable ground.
- Install a spill control device (such as an oil/water separator or down-turned elbow) in the catch basins that collect runoff from the storage tank area if the liquid is oil, gas, or other material that separates from and floats on water.
- Place drip pans or absorbent materials under taps and at all potential drip and spill locations during filling and unloading of tanks and properly dispose of collected liquids and absorbent materials. Turn over or remove empty drip pans when not in use.
- Have spill control materials/spill kit near the tanks and any liquid transfer areas.
- Post a spill control plan and keep contact information current.
- Train all employees on required spill response methods and procedures.

Required Routine Maintenance:

- Sweep and clean paved storage areas as needed. Do not hose down the area to a storm drain.
- Check tanks and sumps regularly for leaks and spills and replace if compromised. Collect and dispose of all spilled liquids.
- Inspect spill control devices regularly and remove floating oil and debris.
- Collect and properly dispose of stormwater that collects in containment areas.

This activity does not apply to underground storage tanks or to businesses permitted by the Washington State Department of Ecology to treat, store, or dispose of dangerous wastes. Storage of reactive, combustible, or flammable liquids must comply with the King County Fire Code Title 17.

Additional Information

- Containment Information Sheet
- Oil/water separators Information Sheet
- Disposal Information Sheet

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A-27 CLEARING AND GRADING OF LAND FOR SMALL CONSTRUCTION PROJECTS

Best Management Practices (BMPs) are required by King County Code 9.12. If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs:

Contact the King County Department of Design and Environmental Review (DPER) prior to clearing, grading, and preparation activities for construction sites greater than 2,000 square feet. Follow the procedures for construction site erosion and sediment control outlined in the ***King County Surface Water Design Manual, Appendix D Erosion and Sediment Control Standards***.

King County DPER coordinates the clearing, grading, and erosion control requirements on individual sites. The King County Surface Water Design Manual has requirements for erosion and sediment control measures. Appendix D (Erosion and Sediment Control Standards) outlines requirements that all sites must implement. The King County Surface Water Design Manual Appendix C (Small Project Drainage Requirements) addresses small project developments. Even if your site does not require a permit, erosion control measures are still required to prevent turbid water from entering drainage systems or surface waters.

For more information or assistance contact the King County Stormwater Services at 206-477-4811 and visit kingcounty.gov/stormwater.

A-29 BUILDING REPAIR, REMODELING, AND CONSTRUCTION

Best Management Practices (BMPs) are required by King County Code 9.12. If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs:

- Do not dump any substance, wash water or liquid waste on the pavement or ground.
- Use drop cloths when painting, scraping, and sandblasting and properly dispose of collected material daily.
- Use a drop cloth, drip pan, or tub for activities such as paint mixing and tool cleaning.
- Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal. Solvents may not be disposed of to the sanitary sewer. Never dispose of any wash water to a storm drain.
- Use a storm drain cover, filter fabric, or other runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area. Check runoff control mechanisms daily, and replace as necessary. Drain covers, filter fabric, and other containment devices are commercially available if effective runoff control cannot otherwise be provided.
- Cover trash bins and dumpsters and ensure they are not leaking.
- Follow Appendix D of the King County Surface Water Design Manual, "Erosion and Sediment Control Measures" for dewatering activities.

Required Routine Maintenance:

- Keep spill cleanup materials in a common location on-site. Ensure that employees are familiar with proper spill cleanup procedures.
- Sweep paved areas to collect loose particles for proper disposal. Wipe up spills with rags or other absorbent material immediately. Do not hose down the area to a storm drain.
- Store hazardous materials under cover, using items such as tarps or other temporary cover materials.

Supplemental BMPs:

- Recycle or reuse leftover materials.
- Install catch basin inserts to collect excess sediment and debris if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.
- Install temporary wheel wash facilities if track out occurs.

Additional Information:

- Concrete pouring - Activity Sheet A 20

- Catch Basin Insert Information Sheet
- See Activity Sheet A-41, “Wheel Wash and Tire Bath Operations.”

For more information or assistance contact the King County Stormwater Services at 206-477-4811 and visit kingcounty.gov/stormwater.

TIR Section IX – Bond Quantities, Facility Summaries, and Declaration of Covenant

TIR Section IX Summary:

Narrative

Facility Summary Sheet

A Declaration of Covenant is provided for the flow control BMPs.

A Facility Summary Sheet is provided for the infiltration trenches.

ENGINEERING

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Edmonds, WA 98020
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www.cgengineering.com

RECORDING REQUESTED BY AND
WHEN RECORDED MAIL TO:

_____

_____

_____

_____

DECLARATION OF COVENANT

FOR INSPECTION AND MAINTENANCE OF STORMWATER FACILITIES AND BMPS

Grantor: _____

Grantee: King County

Legal Description: _____

_____

_____

Additional Legal(s) on: See attached

Assessor's Tax Parcel ID#: 312303-9138, 312303-9108

IN CONSIDERATION of the approved King County _____ permit for application No. _____ relating to the real property ("Property") described above, the Grantor(s), the owner(s) in fee of that Property, hereby covenants(covenant) with King County, a political subdivision of the state of Washington and its municipal successors in interest and assigns ("King County" and "the County", or "its municipal successor"), that he/she(they) will observe, consent to, and abide by the conditions and obligations set forth and described in Paragraphs 1 through

10 below with regard to the Property, and hereby grants(grant) an easement as described in Paragraphs 2 and 3. Grantor(s) hereby grants(grant), covenants(covenant), and agrees(agree) as follows:

1. The Grantor(s) or his/her(their) successors in interest and assigns ("Owners") shall at their own cost, operate, maintain, and keep in good repair, the Property's stormwater facilities and best management practices ("BMPs") identified in the plans and specifications submitted to King County for the review and approval of permit(s) #: _____ . Stormwater facilities include pipes, swales, tanks, vaults, ponds, and other engineered structures designed to manage stormwater on the Property. Stormwater BMPs include dispersion and infiltration devices, native vegetated areas, permeable pavements, vegetated roofs, rainwater harvesting systems, reduced impervious surface coverage, and other measures designed to reduce the amount of stormwater runoff on the Property.

2. King County shall have the right to ingress and egress over those portions of the Property necessary to perform inspections of the stormwater facilities and BMPs and conduct other activities specified in this Declaration of Covenant and in accordance with King County Code ("KCC") 9.04.120 or relevant municipal successor's codes as applicable. This right of ingress and egress, right to inspect, and right to perform required maintenance or repair as provided for in Section 3 below, shall not extend over those portions of the Property shown in Exhibit "A."

3. If King County determines that maintenance or repair work is required to be done to any of the stormwater facilities or BMPs, the Director of the Water and Land Resources Division or its municipal successor in interest ("WLR") shall give notice of the specific maintenance and/or repair work required pursuant to KCC 9.04.120 or relevant municipal successor's codes as applicable. The Director shall also set a reasonable time in which such work is to be completed by the Owners. If the above required maintenance or repair is not completed within the time set by the Director, the County may perform the required maintenance or repair, and hereby is given access to the Property, subject to the exclusion in Paragraph 2 above, for such purposes. Written notice will be sent to the Owners stating the

County's intention to perform such work. This work will not commence until at least seven (7) days after such notice is mailed. If, within the sole discretion of the WLR Director, there exists an imminent or present danger, the seven (7) day notice period will be waived and maintenance and/or repair work will begin immediately.

4. If at any time King County reasonably determines that a stormwater facility or BMP on the Property creates any of the hazardous conditions listed in KCC 9.04.130 or relevant municipal successor's codes as applicable and herein incorporated by reference, the WLR Director or equivalent municipal successors official may take measures specified therein.

5. The Owners shall assume all responsibility for the cost of any maintenance or repair work completed by the County as described in Paragraph 3 or any measures taken by the County to address hazardous conditions as described in Paragraph 4. Such responsibility shall include reimbursement to the County within thirty (30) days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate as liquidated damages. If legal action ensues, the prevailing party is entitled to costs or fees.

6. The Owners are hereby required to obtain written approval from the King County WLR Director prior to filling, piping, cutting, or removing vegetation (except in routine landscape maintenance) in open vegetated stormwater facilities (such as swales, channels, ditches, ponds, etc.), or performing any alterations or modifications to the stormwater facilities and BMPs referenced in this Declaration of Covenant.

7. Any notice or consent required to be given or otherwise provided for by the provisions of this Agreement shall be effective upon personal delivery, or three (3) days after mailing by Certified Mail, return receipt requested.

8. With regard to the matters addressed herein, this agreement constitutes the entire agreement between the parties, and supersedes all prior discussions, negotiations, and all agreements whatsoever whether oral or written.

9. This Declaration of Covenant is intended to protect the value and desirability of the real property described above, and shall inure to the benefit of all the citizens of King County and its municipal successors and assigns. This Declaration of Covenant shall run with the land and be binding upon Grantor(s), and Grantor's(s') successors in interest, and assigns.

10. This Declaration of Covenant may be terminated by execution of a written agreement by the Owners and King County or the municipal successor that is recorded by King County in its real property records.

IN WITNESS WHEREOF, this Declaration of Covenant for the Inspection and Maintenance of Stormwater Facilities and BMPs is executed this _____ day of _____, 20_____.

_____
GRANTOR, owner of the Property

_____
GRANTOR, owner of the Property

STATE OF WASHINGTON)
COUNTY OF KING)ss.

On this day personally appeared before me:

_____, to me known to be the individual(s) described in and who executed the within and foregoing instrument and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein stated.

Given under my hand and official seal this _____ day of _____, 20_____.

_____

_____
Printed name
Notary Public in and for the State of Washington, residing at

_____

My appointment expires _____

LEGAL DESCRIPTIOION:
(PER STATUTORY WARRANTY DEED RECORDING# 20180430000949)

PARCEL A:

THE NORTH 145 FEET OF THE SOUTH 230 FEET OF THE FOLLOWING DESCRIBED PROPERTY:

THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 31, TOWNSHIP 23 NORTH, RANGE 3 EAST, W.M., IN KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS:
BEGINNING AT THE SOUTHEAST CORNER OF SAID SUBDIVISION;
THENCE SOUTH 89°49'00" WEST ALONG THE SOUTHERLY LINE THEREOF A DISTANCE OF 30 FEET;
THENCE NORTH, PARALLEL TO THE EAST LINE OF SAID SUBDIVISION A DISTANCE OF 20 FEET TO THE INTERSECTION OF THE NORTHERLY MARGIN OF THE COUNTY ROAD KNOWN AS SOUTHWEST 188TH STREET WITH THE WEST MARGIN OF THE COUNTY ROAD KNOWN AS 99TH AVENUE SOUTHWEST AND THE TRUE POINT OF BEGINNING OF THE TRACT HEREIN DESCRIBED;
THENCE CONTINUING NORTH, ALONG THE WEST MARGIN OF 99TH AVENUE SOUTHWEST, A DISTANCE OF 330 FEET;
THENCE SOUTH 89°49'00" WEST, PARALLEL TO THE SOUTHERLY LINE OF SAID SUBDIVISION, A DISTANCE OF 250 FEET;
THENCE SOUTH, PARALLEL TO THE WEST MARGIN OF 99TH AVENUE SOUTHWEST A DISTANCE OF 330 FEET TO THE NORTHERLY MARGIN OF SOUTHWEST 188TH STREET;
THENCE EASTERLY, ALONG SAID NORTHERLY MARGIN 250 FEET TO THE TRUE POINT OF BEGINNING.

PARCEL B:

THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 31, TOWNSHIP 23 NORTH, RANGE 3 EAST, W.M., IN KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS:
BEGINNING AT THE SOUTHEAST CORNER OF SAID SUBDIVISION;
THENCE SOUTH 89°49'00" WEST ALONG THE SOUTHERLY LINE THEREOF A DISTANCE OF 30 FEET;
THENCE NORTH PARALLEL TO THE EAST LINE OF SAID SUBDIVISION A DISTANCE OF 20 FEET TO THE INTERSECTION OF THE NORTHERLY MARGIN OF THE COUNTY ROAD, KNOWN AS SOUTHWEST 188TH STREET, WITH THE WEST MARGIN OF THE COUNTY ROAD KNOWN AS 99TH AVENUE SOUTHWEST AND THE TRUE POINT OF BEGINNING OF TRACT HEREIN DESCRIBED;
THENCE NORTH ALONG THE WEST MARGIN OF 99TH AVENUE SOUTHWEST A DISTANCE OF 85 FEET;
THENCE SOUTH 89°49'00" WEST PA

STORMWATER FACILITY SUMMARY SHEET

(provide one Stormwater Facility Summary Sheet per *Natural Discharge Location)*

DPER Permit No. _____
Date _____
NPDES Permit No. _____

OVERVIEW:

Project Name Island Center Homes

Project Location 9914 SW 188th St
Vashon, WA 98070

Parcel No. _____
Retired Parcel No. _____

Downstream Drainage Basins:

Major Basin Name Puget Sound

Immediate Basin Name Ellisport Creek

Project includes Landscape Management Plan? yes ☐
(include copy with TIR as Appendix) no ☒

Declarations of Covenant	Recording No.
Leachable Metals	
Impervious Surface Limit	
Flow Control BMPs	
Clearing Limit	
Drainage Facility	
Landscape Management Plan	

GENERAL FACILITY INFORMATION:

Detention		Infiltration		Water Quality		Flow Control Performance Std
Type	*# of*	*Type*	*# of*	*Type*	*# of facilities*	
Ponds	_____	Ponds	_____	Ponds	_____	☒ Basic
Vaults	_____	Tanks	_____	Vaults	_____	☐ Conservation
Tanks	_____	Trenches	2	Tanks	_____	☐ Flood Problem

If no flow control facility, check one:

- ☐ Project qualifies for KCSWDM Exemption (KCSWDM 1.2.3):
  - ☐ Basic Exemption
  - ☐ Impervious Surface Exemption for Transportation Redevelopment projects
  - ☐ Cost Exemption for Parcel Redevelopment projects
  - ☐ Direct Discharge Exemption
  - ☐ Other _____
- ☐ Project qualifies for 0.1 cfs Exception per KCSWDM 1.2.3
- ☐ No flow control required per approved KCSWDM Adjustment No. _____
- ☐ Flow control provided in regional/shared facility per approved approved KCSWDM Adjustment No. _____
  Shared Facility Name/Location: _____
- ☐ No flow control required (other, provide justification):
  _____

TREATMENT SUMMARY FOR TOTAL IMPERVIOUS SURFACES

(Applies to Commercial parcels only)	Area	% of Total
Total Acreage **(ac)**		-----
Total Impervious Acreage **(ac)**		
Total impervious surface served by flow control facility(ies) **(sq ft)**		
Impervious surface served by flow control facility(ies) designed 1990 or later **(sq ft)**		
Impervious surface served by pervious surface absorption **(sq ft)**		
Impervious surface served by approved water quality facility(ies) **(sq ft)**		

PROVIDE FACILITY DETAILS AND FACILITY SKETCH FOR EACH FACILITY ON REVERSE. USE ADDITIONAL SHEETS AS NEEDED FOR ADDITIONAL FACILITIES

STORMWATER FACILITY SUMMARY SHEET DPER Permit No. _____

(provide one Stormwater Facility Summary Sheet per *Natural Discharge Location)*

Project Name	Island Center Homes
Project Location	9914 SW 188th St Vashon, WA 98070

Downstream Drainage Basins:
Major Basin Name Puget Sound
Immediate Basin Name Ellisport Creek

FLOW CONTROL FACILITY: Basin:

Facility Name/Number Gravel Infil Trench ☒ New Facility ☐ Existing Facility
Facility Location Gravel Parking Area & NE corner
UIC? ☐ yes ☐ no **UIC Site ID:**

Live Storage Volume	☐ cu.ft. ☐ ac.ft.	Live Storage Depth (ft)	Volume Factor of Safety

Project Impervious Acres Served 54%
% of Total Project Impervious Acres Served 100%
No. of Lots Served 1

Control Structure location: _____
Type of Control Structure:
☐ Riser in vault
☐ Riser in Type II CB
☐ Weir in Type II CB

No. of Orifices/Restrictions _____
Size of Orifice/Restriction (in.) (numbered starting with lowest orifice): (inches in decimal format)
No.1 _____ No.2 _____ No.3 _____ No.4 _____

Dam Safety Regulations (WA State Dept of Ecology):

Reservoir Volume above natural grade		☐ cu.ft. ☐ ac.ft.
Depth of Reservoir above natural grade		(ft)

WATER QUALITY FACILITIES

Indicate no. of water quality facilities/BMPs for each type:

_____ Flow dispersion Gravel Infil Trench
_____ Filter strip Gravel Parking Area & NE corner
_____ Biofiltration swale ☐ *regular,* ☐ *wet or* ☐ *continuous inflow*
_____ Wetvault ☐ *combined w/detention*
_____ Wetpond ☐ *basic* ☐ *large* ☐ *combined w/detention*
_____ Pre-settling pond
_____ Stormwater wetland
_____ Sand filter ☐ *basic* ☐ *large* ☐ *regular* ☐ *linear* ☐ *vault* Sand bed depth (inches) _____
● Is facility lined? ☐ yes ☒ no If so, what marker is used above liner? _____

Design Information

Water Quality design flow (cfs)
Water Quality treated volume (sandfilter) (cu.ft.)
Water Quality storage volume (wetpool) (cu.ft.)
☐ **Landscape management plan** ☐ **Farm management plan**

_____ High flow bypass structure (e.g., flow-splitter catch basin)
_____ Oil/water separator ☐ *baffle* ☐ *coalescing plate*
_____ Storm filter
_____ Pre-settling structure (Manufacturer:_____)
_____ Catch basin inserts (Manufacturer:_____)
_____ Source controls_____

Facility Summary Sheet Sketch: All detention, infiltration and water quality facilities must include a detailed sketch (11"x17" reduced size plan sheets preferred).

TIR Section X – Operation and Maintenance Manual

TIR Section X Summary:
Narrative
Maintenance Sheets

The owner of the facility shall be responsible for the maintenance of the on-site stormwater system. The project contractor will be responsible for passing along the information in this maintenance manual to the owner. Upon request by King County, it shall be made available for their inspection.

A Declaration of Covenant to maintain the Flow Control BMP (gravel-filled infiltration trench) has been prepared and can be found in Section IX with a proposed Flow Control BMP site plan. Please note that the site plan is generated during the design phase and may not reflect all changes made in permitting and construction. CG Engineering may be contacted for an updated copy of this map once the as-built drawings are completed for the site.

The proposed storm system consists of catch basins that capture on site runoff and route it through conveyance pipes to either a gravel-filled infiltration trench underneath the gravel driveway or at the northeast corner of the site. Operation and maintenance sheets from Appendix A of the 2016 King County Surface Water Design Manual are provided in this section for the following stormwater system components:

Conveyance Pipes: 6" PVC conveyance pipes are found on the perimeter of the building to convey stormwater from the roofs. The owner will also be responsible for maintaining the 8" and 12" PVC pipes conveying stormwater between catch basins.

Catch Basins: Concrete structures with steel grates that collect stormwater runoff from the site and act as junctions for storm conveyance pipes.

Infiltration Trench: The infiltration trench is located below the gravel parking area and the northeast corner of the site. It is used to detain and infiltrate stormwater.

Landscaping: Landscaping throughout the site will require maintenance as indicated in the specification sheet.

Facilities shall be inspected for defects. The frequency of this should occur annually. Most maintenance tasks are generally reactionary to a defect being found, rather than a matter of constant upkeep. It is generally expected that few to none of these defects will be present upon the yearly inspection of each facility. Unless otherwise noted on the facility sheets the maintenance tasks should be performed on an "as needed" basis: (a) when the described defect is visible to whomever performs the yearly inspection, or (b) should any defect become apparent between inspections.

SAMPLE ACTIVITY LOG

DATE	FACILITY	MAINTENANCE PERFORMED	RESULTS / NOTES

250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

NO. 2 – INFILTRATION FACILITIES

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area	Sediment accumulation	If two inches or more sediment is present or a percolation test indicates facility is working at or less than 90% of design.	Facility infiltrates as designed.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
Infiltration Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Infiltration Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.

NO. 2 – INFILTRATION FACILITIES

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open manhole requires immediate maintenance.**	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Filter Bags	Plugged	Filter bag more than $^1/_2$ full.	Replace filter bag or redesign system.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Pre-settling Ponds and Vaults	Sediment accumulation	6" or more of sediment has accumulated.	Pre-settling occurs as designed
Infiltration Pond, Rock Filter	Plugged	High water level on upstream side of filter remains for extended period of time or little or no water flows through filter during heavy rain storms.	Rock filter replaced evaluate need for filter and remove if not necessary.
Infiltration Pond Emergency Overflow Spillway	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and is structurally sound.
		Cracks wider than ½ 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.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	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.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance**.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

NO. 11 – GROUNDS (LANDSCAPING)

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. **A hazard tree identified by a qualified arborist must be removed as soon as possible.**	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.

NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

NO. 24 – CATCH BASIN INSERT

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Media Insert	Visible Oil	Visible oil sheen passing through media	Media inset replaced.
	Insert does not fit catch basin properly	Flow gets into catch basin without going through media.	All flow goes through media.
	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
	Oil absorbent media saturated	Media oil saturated.	Oil absorbent media replaced.
	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Insert replaced.
	Service life exceeded	Regular interval replacement due to typical average life of media insert product, typically one month.	Media replaced at manufacturer's recommended interval.
	Seasonal maintenance	When storms occur and during the wet season.	Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval.

NO. 27 – GRAVEL FILLED DISPERSION TRENCH BMP

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Preventative	Blocking, obstructions	Debris or trash limiting flow to dispersion trench or preventing spreader function.	Dispersion trench able to receive full flow prior to and during wet season.
Site	Trash and debris	Trash or debris that could end up in the dispersion trench is evident.	No trash or debris that could get into the dispersion trench can be found.
Pipes	Inlet is plugged	The entrance to the pipe is restricted due to sediment, trash, or debris.	The entrance to the pipe is not restricted.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Plugged	Sediment or other material prevents free flow of water through the pipe.	Water flows freely through pipes.
	Broken joint or joint leaks.	Damage to the pipe or pipe joints allowing water to seep out.	Pipe does not allow water to exit other than at the outlet to the trench.
	Cleanout caps	Cleanout caps are broken, missing, or buried.	Cleanout caps are accessible and intact.
Structure	Flow not reaching trench	Flows are not getting into the trench as designed.	Water enters and exits trench as designed.
	Perforated pipe plugged	Flow not able to enter or properly exit from perforated pipe.	Water freely enters and exits perforated pipe.
	Flow not spreading evenly at outlet of trench	Outlet flows channelizing or not spreading evenly from trench.	Sheet flow occurs at the outlet of the trench.
	Cleanout/inspection access does not allow cleaning or inspection of perforated pipe	The cleanout/inspection access is not available.	Cleanout/inspection access is available.
Filter Media	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
Inspection	Frequency	Annually and prior to and following significant storms.	Inspect dispersion trench system for any defects of deficiencies.

NO. 28 – NATIVE VEGETATED SURFACE / NATIVE VEGETATED LANDSCAPE BMP

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Site	Trash and debris	Trash and debris accumulated on the native vegetated surface/native vegetated landscape site.	Native vegetated surface site free of any trash or debris.
Vegetation	Native vegetation type	Less than two species each of native trees, shrubs, and groundcover occur in the design area.	A minimum of two species each of native trees, shrubs, and groundcover is established and healthy.
	Native vegetated area	Less than 90% if the required vegetated area has healthy growth.	A minimum of 90% of the required vegetated area has healthy growth.
	Undesirable vegetation	Weeds, blackberry, and other undesirable plants are invading more than 10% of vegetated area.	Less than 10% undesirable vegetation occurs in the required native vegetated surface area.
Vegetated Area	Soil compaction	Soil in the native vegetation area compacted.	Less than 8% of native vegetation area is compacted.
	Insufficient area	Less than 3.5 square feet of native vegetation area for every 1 square foot of impervious surface.	A minimum of 3.5 square feet of native vegetation area for every 1 square foot of impervious surface.
	Excess slope	Slope of native vegetation area greater than 15%.	Slope of native growth area does not exceed 15%.
Inspection	Frequency	Annually	Inspect native vegetation area for any defects of deficiencies

NO. 29 – PERFORATED PIPE CONNECTIONS BMP

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Preventative	Blocking, obstructions	Debris or trash limiting flow into perforated pipe system or outfall of BMP is plugged or otherwise nonfunctioning.	Outfall of BMP is receiving designed flows from perforated pipe connection.
Inflow	Inflow impeded	Inflow into the perforated pipe is partially or fully blocked or altered to prevent flow from getting into the pipe.	Inflow to the perforated pipe is unimpeded.
Pipe Trench Area	Surface compacted	Ground surface over the perforated pipe trench is compacted or covered with impermeable material.	Ground surface over the perforated pipe is not compacted and free of any impervious cover.
Outflow	Outflow impeded	Outflow from the perforated pipe into the public drainage system is blocked.	Outflow to the public drainage system is unimpeded.
Outfall Area	Erosion or landslides	Existence of the perforated pipe is causing or exasperating erosion or landslides.	Perforated pipe system is sealed off and an alternative BMP is implemented.
Inspection	Frequency	Annually and prior to and following significant storms.	Perforated pipe system is operating as designed.

Applicable Operational BMPs:

- Eliminate unpermitted wastewater discharges to storm sewer, ground water, or surface water.
- Convey unpermitted discharges to a sanitary sewer if allowed by the local sewer authority, or to other approved treatment.
- Obtain appropriate state and local permits for these discharges.

Recommended Additional Operational BMPs: At commercial and industrial facilities, conduct a survey of wastewater discharge connections to storm drains and to surface water as follows:

- Conduct a field survey of buildings, particularly older buildings, and other industrial areas to locate storm drains from buildings and paved surfaces. Note where these join the public storm drain(s).
- During non-stormwater conditions inspect each storm drain for non-stormwater discharges. Record the locations of all non-stormwater discharges. Include all permitted discharges.
- If useful, prepare a map of each area. Show on the map the known location of storm sewers, sanitary sewers, and permitted and unpermitted discharges. Aerial photos may be useful. Check records such as piping schematics to identify known side sewer connections and show these on the map. Consider using smoke, dye, or chemical analysis tests to detect connections between two conveyance systems (e.g., process water and stormwater). If desirable, conduct TV inspections of the storm drains and record the footage on videotape.
- Compare the observed locations of connections with the information on the map and revise the map accordingly. Note suspect connections that are inconsistent with the field survey.
- Identify all connections to storm sewers or to surface water and take the actions specified above as applicable BMPs.

S411 BMPs for Landscaping and Lawn/ Vegetation Management

Description of Pollutant Sources: Landscaping can include grading, soil transfer, vegetation removal, pesticide and fertilizer applications, and watering. Stormwater contaminants include toxic organic compounds, heavy metals, oils, total suspended solids, coliform bacteria, fertilizers, and pesticides.

Lawn and vegetation management can include control of objectionable weeds, insects, mold, bacteria, and other pests with pesticides. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; sap stain and insect control on lumber and logs; rooftop moss removal; killing nuisance rodents; fungicide application to patio decks, and residential lawn/plant care. It is possible to

release toxic pesticides such as pentachlorophenol, carbamates, and organometallics to the environment by leaching and dripping from treated parts, container leaks, product misuse, and outside storage of pesticide contaminated materials and equipment. Poor management of the vegetation and poor application of pesticides or fertilizers can cause appreciable stormwater contamination.

Pollutant Control Approach: Control of fertilizer and pesticide applications, soil erosion, and site debris to prevent contamination of stormwater.

Develop and implement an Integrated Pest Management Plan (IPM) and use pesticides only as a last resort. Carefully apply pesticides/ herbicides, in accordance with label instructions. Maintain appropriate vegetation, with proper fertilizer application where practicable, to control erosion and the discharge of stormwater pollutants. Where practicable grow plant species appropriate for the site, or adjust the soil properties of the subject site to grow desired plant species.

Applicable Operational BMPs for Landscaping:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Do not dispose of collected vegetation into waterways or storm sewer systems.

Recommended Additional Operational BMPs for Landscaping:

- Conduct mulch-mowing whenever practicable
- Dispose of grass clippings, leaves, sticks, or other collected vegetation, by composting, if feasible.
- Use mulch or other erosion control measures on soils exposed for more than one week during the dry season or two days during the rainy season.
- Store and maintain appropriate oil and chemical spill cleanup materials in readily accessible locations when using oil or other chemicals. Ensure that employees are familiar with proper spill cleanup procedures.
- Till fertilizers into the soil rather than dumping or broadcasting onto the surface. Determine the proper fertilizer application rate for the types of soil and vegetation encountered.
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Use manual and/or mechanical methods of vegetation removal rather than applying herbicides, where practical.

Applicable Operational BMPs for the Use of Pesticides:

- Develop and implement an IPM (See section on IPM in *Applicable Operational BMPs for Vegetation Management*) and use pesticides only as a last resort.
- Implement a pesticide-use plan and include at a minimum: a list of selected pesticides and their specific uses; brands, formulations, application methods and quantities to be used; equipment use and maintenance procedures; safety, storage, and disposal methods; and monitoring, record keeping, and public notice procedures. All procedures shall conform to the requirements of Chapter 17.21 RCW and Chapter 16-228 WAC (Appendix IV-D R.7).
- Choose the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. The pesticide should readily degrade in the environment and/or have properties that strongly bind it to the soil. Conduct any pest control activity at the life stage when the pest is most vulnerable. For example, if it is necessary to use a Bacillus thuringiens application to control tent caterpillars, apply it to the material before the caterpillars cocoon or it will be ineffective. Any method used should be site-specific and not used wholesale over a wide area.
- Apply the pesticide according to label directions. Do not apply pesticides in quantities that exceed manufacturer's instructions.
- Mix the pesticides and clean the application equipment in an area where accidental spills will not enter surface or ground waters, and will not contaminate the soil.
- Store pesticides in enclosed areas or in covered impervious containment. Do not discharge pesticide contaminated stormwater or spills/leaks of pesticides to storm sewers. Do not hose down the paved areas to a storm sewer or conveyance ditch. Store and maintain appropriate spill cleanup materials in a location known to all near the storage area.
- Clean up any spilled pesticides. Keep pesticide contaminated waste materials in designated covered and contained areas.
- The pesticide application equipment must be capable of immediate shutoff in the event of an emergency.
- Spraying pesticides within 100 feet of open waters including wetlands, ponds, and rivers, streams, creeks, sloughs and any drainage ditch or channel that leads to open water may have additional regulatory requirements beyond just following the pesticide product label. Additional requirements may include:
    - Obtaining a discharge permit from Ecology.
    - Obtaining a permit from the local jurisdiction.
    - Using an aquatic labeled pesticide.

- Flag all sensitive areas including wells, creeks, and wetlands prior to spraying.
- Post notices and delineate the spray area prior to the application, as required by the local jurisdiction or by Ecology.
- Conduct spray applications during weather conditions as specified in the label direction and applicable local and state regulations. Do not apply during rain or immediately before expected rain.

Recommended Additional Operational BMPs for the use of pesticides:

- Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal.
- Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes. The following are three possible mechanisms for disease control by compost addition (USEPA Publication 530-F-9-044):
    1. Successful competition for nutrients by antibiotic production;
    2. Successful predation against pathogens by beneficial microorganism; and
    3. Activation of disease-resistant genes in plants by composts.

Installing an amended soil/landscape system can preserve both the plant system and the soil system more effectively. This type of approach provides a soil/landscape system with adequate depth, permeability, and organic matter to sustain itself and continue working as an effective stormwater infiltration system and a sustainable nutrient cycle.

- Once a pesticide is applied, evaluate its effectiveness for possible improvement. Records should be kept showing the effectiveness of the pesticides considered.
- Develop an annual evaluation procedure including a review of the effectiveness of pesticide applications, impact on buffers and sensitive areas (including potable wells), public concerns, and recent toxicological information on pesticides used/proposed for use. If individual or public potable wells are located in the proximity of commercial pesticide applications, contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary.
- Rinseate from equipment cleaning and/or triple-rinsing of pesticide containers should be used as product or recycled into product.

For more information, contact the Washington State University (WSU) Extension Home-Assist Program, (253) 445-4556, or Bio-Integral Resource Center (BIRC), P.O. Box 7414, Berkeley, CA.94707, or EPA to

obtain a publication entitled "Suspended, Canceled, and Restricted Pesticides" which lists all restricted pesticides and the specific uses that are allowed.

Applicable Operational BMPs for Vegetation Management:

- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can substantially improve the permeability of the soil, the disease and drought resistance of the vegetation, and reduce fertilizer demand. This reduces the demand for fertilizers, herbicides, and pesticides. Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. Return natural plant debris and mulch to the soil, to continue recycling nutrients indefinitely.
- Select the appropriate turfgrass mixture for the climate and soil type. Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects. However, they do not, repel root-feeding lawn pests such as Crane Fly larvae, and are toxic to ruminants such as cattle and sheep. The fungus causes no known adverse effects to the host plant or to humans. Endophytic grasses are commercially available; use them in areas such as parks or golf courses where grazing does not occur. Local agricultural or gardening resources such as Washington State University Extension office can offer advice on which types of grass are best suited to the area and soil type.
- Use the following seeding and planting BMPs, or equivalent BMPs to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: *Temporary and Permanent Seeding*, *Mulching*, *Plastic Covering*, and *Sodding* as described in Volume II.
- Adjusting the soil properties of the subject site can assist in selection of desired plant species. For example, design a constructed wetland to resist the invasion of reed canary grass by layering specific strata of organic matters (e.g., composted forest product residuals) and creating a mildly acidic pH and carbon-rich soil medium. Consult a soil restoration specialist for site-specific conditions.
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Conduct aeration while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than ¾-inch deep.

- Mowing is a stress-creating activity for turfgrass. Grass decreases its productivity when mown too short and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease prone and more reliant on outside means such as pesticides, fertilizers, and irrigation to remain healthy. Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.

Irrigation:

- The depth from which a plant normally extracts water depends on the rooting depth of the plant. Appropriately irrigated lawn grasses normally root in the top 6 to 12 inches of soil; lawns irrigated on a daily basis often root only in the top 1 inch of soil. Improper irrigation can encourage pest problems, leach nutrients, and make a lawn completely dependent on artificial watering. The amount of water applied depends on the normal rooting depth of the turfgrass species used, the available water holding capacity of the soil, and the efficiency of the irrigation system. Consult with the local water utility, Conservation District, or Cooperative Extension office to help determine optimum irrigation practices.

Fertilizer Management:

- Turfgrass is most responsive to nitrogen fertilization, followed by potassium and phosphorus. Fertilization needs vary by site depending on plant, soil, and climatic conditions. Evaluation of soil nutrient levels through regular testing ensures the best possible efficiency and economy of fertilization. For details on soils testing, contact the local Conservation District, a soils testing professional, or a Washington State University Extension office.
- Apply fertilizers in amounts appropriate for the target vegetation and at the time of year that minimizes losses to surface and ground waters. Do not fertilize when the soil is dry. Alternatively, do not apply fertilizers within three days prior to predicted rainfall. The longer the period between fertilizer application and either rainfall or irrigation, the less fertilizer runoff occurs.
- Use slow release fertilizers such as methylene urea, IDBU, or resin coated fertilizers when appropriate, generally in the spring. Use of slow release fertilizers is especially important in areas with sandy or gravelly soils.
- Time the fertilizer application to periods of maximum plant uptake. Ecology generally recommends application in the fall and spring, although Washington State University turf specialists recommend four fertilizer applications per year.

- Properly trained persons should apply all fertilizers. Apply no fertilizer at commercial and industrial facilities, to grass swales, filter strips, or buffer areas that drain to sensitive water bodies unless approved by the local jurisdiction.

Integrated Pest Management

An IPM program might consist of the following steps:

Step 1: Correctly identify problem pests and understand their life cycle

Step 2: Establish tolerance thresholds for pests.

Step 3: Monitor to detect and prevent pest problems.

Step 4: Modify the maintenance program to promote healthy plants and discourage pests.

Step 5: Use cultural, physical, mechanical or biological controls first if pests exceed the tolerance thresholds.

Step 6: Evaluate and record the effectiveness of the control and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

For an elaboration of these steps, refer to Appendix IV-F.

S412 BMPs for Loading and Unloading Areas for Liquid or Solid Material

Description of Pollutant Sources: Operators typically conduct loading/unloading of liquid and solid materials at industrial and commercial facilities at shipping and receiving, outside storage, fueling areas, etc. Materials transferred can include products, raw materials, intermediate products, waste materials, fuels, scrap metals, etc. Leaks and spills of fuels, oils, powders, organics, heavy metals, salts, acids, alkalis, etc. during transfer may cause stormwater contamination. Spills from hydraulic line breaks are a common problem at loading docks.

Pollutant Control Approach: Cover and contain the loading/unloading area where necessary to prevent run-on of stormwater and runoff of contaminated stormwater.

Applicable Operational BMPs:

At All Loading/ Unloading Areas:

- A significant amount of debris can accumulate at outside, uncovered loading/unloading areas. Sweep these surfaces frequently to remove loose material that could contaminate stormwater. Sweep areas temporarily covered after removal of the containers, logs, or other material covering the ground.
- Place drip pans, or other appropriate temporary containment device, at locations where leaks or spills may occur such as hose connections, hose reels and filler nozzles. Always use drip pans when making and