civil & structural
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PLANNING

DRAINAGE REPORT

Cedar Urban Townhomes

225 Cedar Avenue
Snohomish, WA 98290

GREG GUILLEN
STATE OF WASHINGTON
25385
REGISTERED
PROFESSIONAL ENGINEER

07/07/2020

CG Project No.: 20043.20

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Section I – Project Overview

Section I Summary

Overview

Minimum Requirements

Overview

This drainage report has been written for a new two-building (two units each) townhouse development on a 0.18 ac lot located at 225 Cedar Ave in Snohomish, WA.

The project consists of site development and frontage improvements in the City's right-of-way (ROW). The site development will consist of clearing and grading the lot and the construction of the townhouse buildings along with their associated walkways and driveway. The frontage improvements consist of replacing the existing curb, gutter and sidewalk with new curb and gutter, a 4.5' wide grass amenity zone and a new 15' sidewalk consistent with Type B Access Street in Table III-2 of City of Snohomish Municipal Code. Existing residential developments border the site on the north and south, City of Snohomish Police Department borders the east and Cedar Ave borders the west.

The project will meet minimum requirements 1 through 9 of the 2014 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) because it will add approximately 7,327 sf of new/replaced impervious surfaces (including frontage improvements).

The site will utilize an infiltration trench that was designed for 100% infiltration for runoff from all impervious surfaces on-site. The trench was designed with an overflow pipe that is proposed to connect into the existing storm line in the east edge of Cedar Ave. According to City maps, the storm line conveys runoff to the north to 3rd St and then turns west to Swifty Creek (approximately 300 lineal feet from the site). From there, runoff travels SW to the Snohomish River (flow path approximately 1,600 lineal feet).

The proposed impervious areas on-site are as follows:

Impervious Areas	
Roof:	2,907 sf (0.067 ac)
Walkways:	426 sf (0.010 ac)
Grasscrete:	500 sf (0.011 ac)
Driveway:	2,433 sf (0.056 ac)
Total:	6,266 sf (0.144 ac)

The proposed impervious areas in the ROW are as follows:

Impervious Areas	
Sidewalk:	1,061 sf (0.024 ac)
Total:	1,061 sf (0.024 ac)

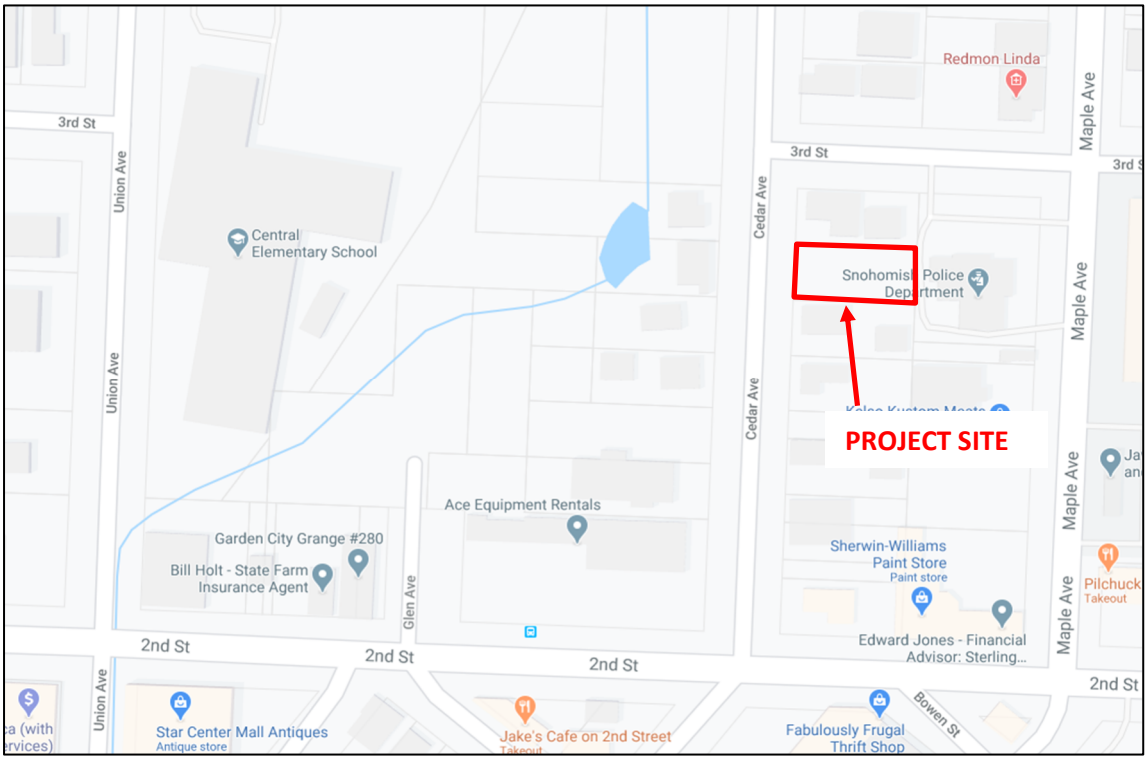

Figure I-1: Vicinity map (from Google Maps)

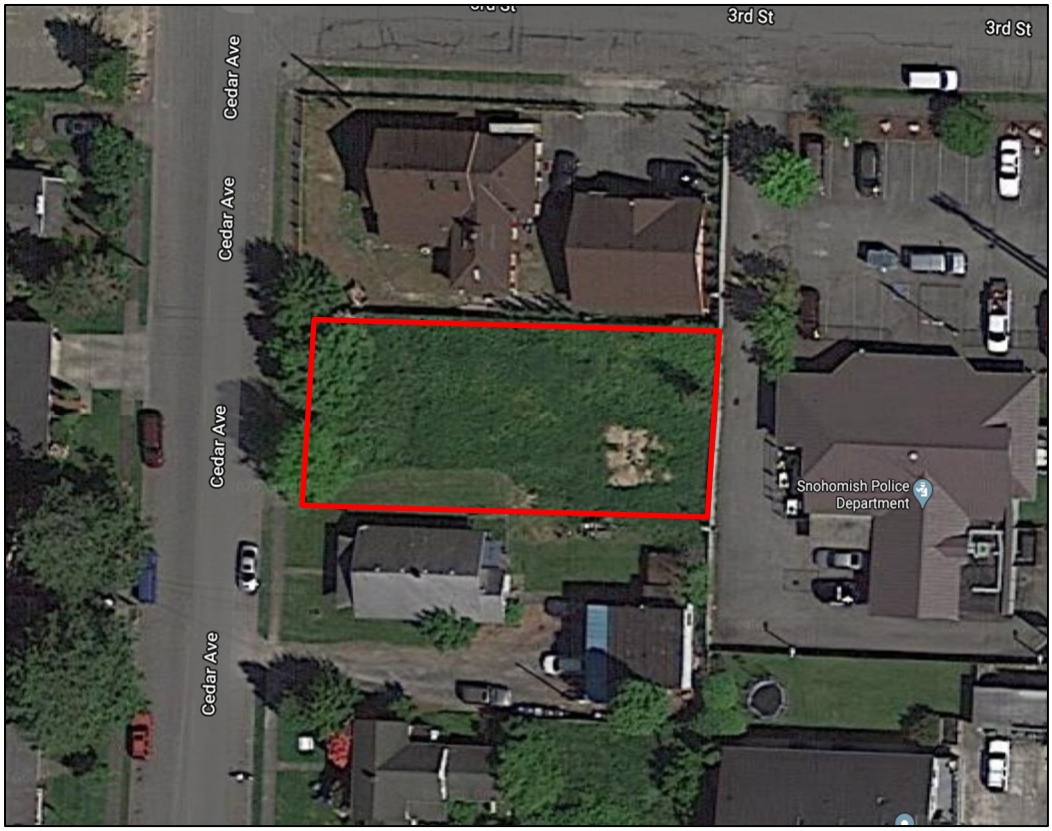

Figure I-2: Aerial image (from Google Maps)

Minimum Requirements

Stormwater requirements were determined per the 2014 Stormwater Management Manual for Western Washington by the Department of Ecology. This report is based on the steps recommended in Chapter 3.1.7 in Volume I of the SWMMWW. The project is classified as New Development and will comply with Minimum Requirements #1-9 (see Figure I-3 for development flow chart).

Minimum Requirement #1: Preparation of Stormwater Site Plans: The stormwater site plan consists of this report and the civil drawings, and is prepared in accordance with Chapter 3 of Volume 1 of the SWMMWW.

Minimum Requirement #2: **Construction Stormwater Pollution Prevention Plan (SWPPP)**: The SWPPP shall include a narrative and drawings. The SWPPP narrative shall include documentation that addresses the 13 elements of Construction Stormwater Pollution Prevention. See Section V of this report and the civil drawings. Please note that the full Department of Ecology SWPPP report typically associated with a Construction Stormwater General Permit is not required as land disturbance is expected to be less than an acre.

Minimum Requirement #3: Source Control of Pollution: All known, available and reasonable source control BMPs must be required for all projects approved by the City. All single-family residential projects shall, at a minimum, incorporate required BMPs from SWMMWW Volume IV, S411 – BMPs for Landscaping and Lawn/Vegetation Management. The Operation & Maintenance Manual found in Section VIII contains guide sheets for Lawn/Vegetation management.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls: Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and down gradient properties. All projects shall submit an off-site qualitative analysis. A qualitative analysis of the upstream and downstream system entering the site is presented in Section III.

Runoff will only leave the site through an overflow pipe from a proposed infiltration trench and through the buildings' footing drains which will be tied to a proposed catch basin over an existing storm line in the ROW that conveys runoff to the north.

Minimum Requirement #5: On-Site Stormwater Management: The project shall either use On-Site Stormwater Management BMPs from List #2 (per SWMMWW I-2.5.5) for all new plus replaced hard surfaces and land disturbed, or demonstrate compliance with the LID Performance Standard.

The project will use BMPs from List #2. See Section IV for feasibility review and WWHM report. Post-construction soil quality and depth in accordance with BMP T5.13 in Chapter 5 of Volume V of the SWMMWW will be used for all disturbed pervious areas. Runoff from the new and replaced impervious surfaces on-site will be routed to a fully-infiltrating gravel-filled trench.

Minimum Requirement #6: Runoff Treatment: The project meets the basic exemption from runoff treatment because it proposes less than 5,000 square feet of new/replaced pollution-generating hard surfaces (PGHS) and runoff treatment is not required. However, catch basins preceeding the infiltration trench and one before connecting into the ROW were designed with down-turned elbows (floatable material separators).

Minimum Requirement #7: Flow Control: Projects must provide flow control to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions. Flow control is required for projects in which the total of effective impervious surfaces is 10,000 sf or more in a threshold discharge area, convert ¾ acres or more of vegetation to lawn or landscape or cause a 0.15 cfs or more increase in the 100-year flow frequency between the existing and developed conditions.

The project will cause a 0.18 cfs increase in the 100-year flow frequency between the existing and developed conditions (see WWHM report in Section IV). Therefore, the project must provide flow control to be in compliance. The project proposes to fully infiltrate runoff from the new and replaced impervious surfaces on-site and the flow control requirement is considered to be met.

Minimum Requirement #8: Wetlands Protection: Projects shall comply with Guide Sheets #1 through #3 in Appendix I-D of the SWMMWW. The hydrologic analysis shall use the existing land cover condition to determine the existing hydrologic conditions unless directed otherwise by a regulatory agency with jurisdiction.

According to the City's stormwater map (see Figure III-1), the flow path through Swifty Creek is in a critical area. However, the majority of site runoff is not expected to be conveyed through this flow path except through an overflow and building footing drains. Therefore, this is not expected to be an issue wetlands protection measures should not be necessary.

Minimum Requirement #9: Operation and Maintenance: An Operation and Maintenance Manual that is consistent with the provisions in Volume V of the SWMMWW is required for proposed stormwater BMPs/facilities. The party (or parties) responsible for maintenance and operation shall be identified in the operation and maintenance manual. For private facilities approved by the City, a copy of the operation and maintenance manual shall be retained on-site or within reasonable access to the site, and shall be transferred with the property to the owner. For public facilities, a copy of the operation and maintenance manual shall be retained in the appropriate department. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection. See Appendix D.

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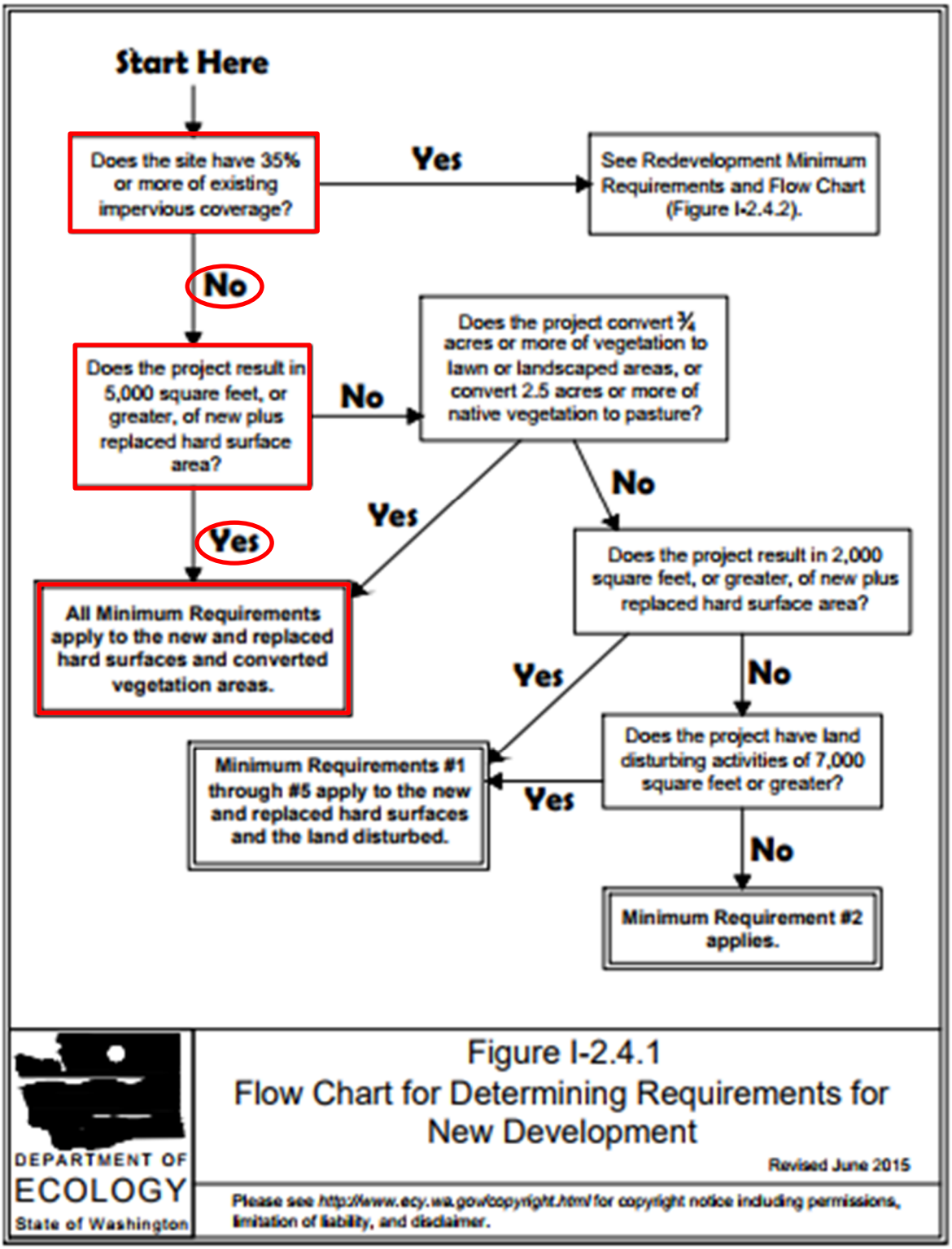

Figure I-3: Flow Chart for Determining Requirements for New Development (Figure I-2.4.1 in the 2014 SWMMWW)

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Section II – Existing Conditions Summary

Section II Summary

Narrative

Narrative

The site is currently mostly vacant with overgrown grass and shrubs and trailers parked on the property. The total area of the property is approximately 7,691 sf (0.18 ac).

Site topography is mostly flat, but there is a slight amount of slope descending east-to-west. According to the geotechnical engineer, the site is mapped as Older Alluvium with Recessional Outwash. The geotechnical explorations "encountered silty sand underlain by sandy gravel, consistent with the description of native older alluvium and recessional outwash…" More about the soils can be found in Section VI in the Stormwater Infiltration Evaluation.

On-site stormwater runoff either infiltrates through the lawn or sheet flows west to the street. The site does not appear to take on any significant upstream flows. Utilities are located in Cedar Ave and include sewer, water, and storm mains from the centerline, respectively.

The existing impervious areas on-site are as follows:

Impervious Areas	
Gravel Driveway:	139 sf (0.003 ac)
Total:	139 sf (0.003 ac)

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Section III – Off-Site Analysis Report

Section III Summary

Task 1 – Define and map the study area
Task 2 – Review all available information of the study area
Task 3 – Field inspect the area
Task 4 - Describe the drainage system, and its existing and predicted problems

Task 1 – Define and map the study area

An initial qualitative analysis shall document potential off-site impacts of stormwater discharges for each upstream drainage system entering a site, and each downstream drainage system leaving a site according to Section I-2.6.2 of the 2014 SWMMWW. The downstream analysis shall extend from the project site to the receiving water, or up to one-quarter mile, whichever is less.

For the purposes of the off-site analysis, the project's study area was considered to be from the site, up north on Cedar Ave to 3rd St. Runoff from the site is proposed to enter the City storm pipes in the east edge of Cedar Ave. Therefore, this analysis confirms the stormwater flow path from the site and documents the condition of the existing catch basins that will serve as junctions for runoff from the project site.

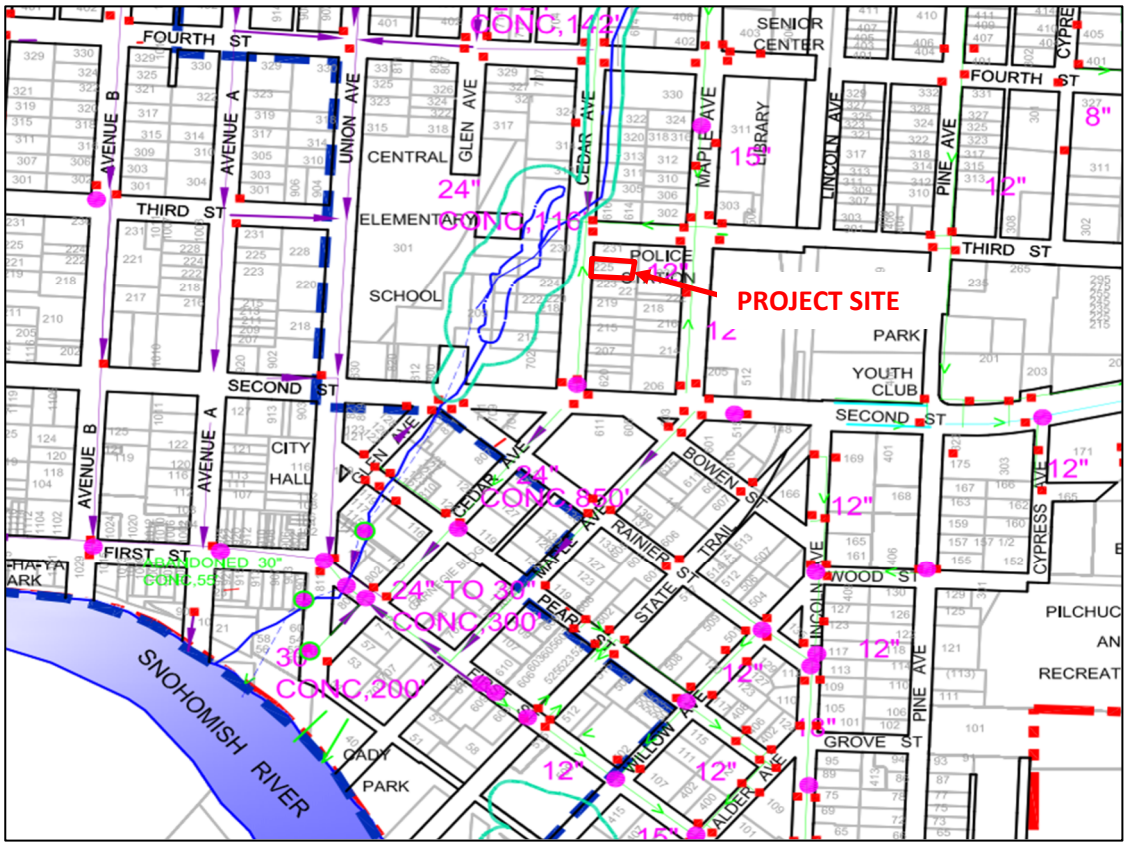

Figure III-1: Study Area (Reference City of Snohomish Stormwater Map)

Task 2 – Review all available information on the study area

Existing stormwater improvements were determined from the downstream walk and the City's stormwater map. A stormwater main runs from south to north in the east edge of Cedar Ave. The storm main conveys runoff to the north to 3rd St and then turns west to Swifty Creek (approximately 300 lineal feet from the site). From there, runoff travels SW through a critical area (according to the City stormwater map) to the Snohomish River (flow path approximately 1,600 lineal feet).

The Department of Ecology's online Water Quality Atlas Map was used to check contaminant levels of Swifty Creek. According to the map, Swifty Creek has a single Category 5 listing for bacteria.

Task 3 – Field inspect the study area

A site visit was done on the morning of July 1, 2020. The weather was cloudy and it was lightly raining. From evaluating surrounding conditions, the site does not appear to take on significant upstream runoff. The catch basins appeared to be working as expected and were free of problems. We were unable to document the outfall into Swifty Creek because the City storm pipe appears to cut through someone's house/private property. The following figures show pictures that were taken during the downstream walk.

Figure III-2: From Cedar Ave, facing east at subject property

Figure III-3: Near SW corner of site, facing NE

Figure III-4: Near SW corner of site, facing south

Figure III-5: Near SW corner of site, facing north

Figure III-6: From 3rd St, facing south

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Figure III-7: From sidewalk, NE corner of Cedar and 3rd, facing south. Painted storm lines on pavement

Figure III-8: From north edge of 3rd St, facing west. Painted storm lines on pavement

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Task 4 – Describe the drainage system, and its existing and predicted problems

Existing stormwater improvements were determined from the survey, site visit, and the City GIS map. This is described in Task 2.

The project proposes to route all runoff from target impervious surfaces of the site to a fully-infiltrating gravel trench. The infiltration trench was designed for 100% infiltration for the target impervious surfaces on-site as well as the new and replaced impervious surfaces in the ROW. The trench was designed to be conservative and include the area of the frontage improvements since no stormwater mitigation BMPs are proposed for the ROW area. With the over-sized trench, it is unlikely that the overflow from the system will get much use other than from the buildings' footing drains. Therefore, there are no problems anticipated with the proposed development of the project.

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Section IV – Permanent Stormwater Control Plan

Section IV Summary

Narrative
Calculations
WWHM2012 Report

Narrative

The project will meet minimum requirements #1-9 of the SWMMWW. This section specifically addresses Minimum Requirements #5-7.

On-site Stormwater Management (MR5)

The project must evaluate the feasibility of On-Site Stormwater Management BMPs from List #2 for all new plus replaced hard surfaces and land disturbed, or demonstrate compliance with the LID Performance Standard. This project will meet the LID Performance Standard and apply BMP T5.13 for all disturbed pervious areas.

The geotechnical engineer conducted a Small Pilot Infiltration Test (PIT) on the site and found infiltration to be feasible. The results of the PIT were analyzed and correction factors were applied to produce a design infiltration rate of 11.41 in/hr (see Geotech report in Section VI for more).

An infiltration trench was selected as the means of infiltrating stormwater for the project. The site was modeled in WWHM and includes the total area of the property as the basin (0.177 acres) and the areas of the proposed frontage improvements (an additional 1,061 sf of impervious surface) within the basin area to be conservative (see WWHM report in Attachment IV-2). The proposed basin was modeled with an infiltration trench using the design infiltration rate and running the model for 100% infiltration. The resulting infiltration trench was found to be 38'x8'x3'. This trench along with sections and details can be seen on the civil plans.

The trench was also designed with an overflow that is proposed to connect into existing storm infrastructure in Cedar Ave with a new catch basin. The proposed buildings' footing drains are also proposed to tie into the overflow from the trench.

Runoff Treatment (MR6)

Runoff Treatment per Minimum Requirement #6 is not required for this project as the proposed development meets the basic exemption from Runoff Treatment (< 5,000 sf PGHS).

Flow Control (MR7)

The project will cause a 0.18 cfs increase in the 100-year flow frequency between the existing and developed conditions (see WWHM report in Attachment IV-1). Therefore, the project must provide flow

control to be in compliance. The project proposes to fully infiltrate runoff from the new and replaced impervious surfaces on-site and the flow control requirement is considered to be met.

Attachment IV-1: WWHM Report for Flow Control Check

See attached pages.

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WWHM2012
PROJECT REPORT

Project Name: Cedar Urban Townhomes Flow Control Check
Site Name: Cedar Urban Townhomes
Site Address: 225 Cedar Avenue
City : Snohomish
Report Date: 6/25/2020
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
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 : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
A B, Pasture, Flat	.174
Pervious Total	0.174

Impervious Land Use	acre
DRIVEWAYS FLAT	0.003
Impervious Total	0.003
Basin Total	0.177 (lot area)

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
A B, Lawn, Flat	.039
Pervious Total	0.039

Impervious Land Use	acre	
ROOF TOPS FLAT	0.138	(total new/replaced impervious on-site)
Impervious Total	0.138	
Basin Total	0.177	

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS
Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.174
Total Impervious Area:0.003

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.039
Total Impervious Area:0.138

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001936
5 year	0.003248
10 year	0.00443
25 year	0.006363
50 year	0.008182
100 year	0.010383

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.07425
5 year	0.100403
10 year	0.119519
25 year	0.145802
50 year	0.166981
100 year	0.189577

Perlnd and Implnd Changes
No changes have been made.

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Attachment IV-2: WWHM Report for Infiltration Trench Design

See attached pages.

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WWHM2012
PROJECT REPORT

Project Name: Cedar Urban Townhomes Infiltration Trench Design
Site Name: Cedar Urban Townhomes
Site Address: 225 Cedar Avenue
City : Snohomish
Report Date: 6/26/2020
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
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 : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
A B, Forest, Flat	.177
Pervious Total	0.177

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.177 (lot area)

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
A B, Lawn, Flat	.017
Pervious Total	0.017

Impervious Land Use	acre

ROOF TOPS FLAT	**0.064**	
DRIVEWAYS FLAT	**0.068**	
SIDEWALKS FLAT	**0.028**	**(ROW sidewalk included)**
Impervious Total	**0.16**	
Basin Total	**0.177**	

Element Flows To:

Surface	**Interflow**	**Groundwater**
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 38.00 ft.
Bottom Width: 8.00 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 ft
Pour Space of material for first layer: 0.33
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: 11.41 in/hr
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 30.474
Total Volume Through Riser (ac-ft.): 0.001
Total Volume Through Facility (ac-ft.): 30.475
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 2.9 ft.
Riser Diameter: 8 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	0.007	0.000	0.000	0.000
0.0333	0.007	0.000	0.000	0.080
0.0667	0.007	0.000	0.000	0.080
0.1000	0.007	0.000	0.000	0.080
0.1333	0.007	0.000	0.000	0.080
0.1667	0.007	0.000	0.000	0.080
0.2000	0.007	0.000	0.000	0.080
0.2333	0.007	0.000	0.000	0.080
0.2667	0.007	0.000	0.000	0.080
0.3000	0.007	0.000	0.000	0.080
0.3333	0.007	0.000	0.000	0.080
0.3667	0.007	0.000	0.000	0.080

0.4000	0.007	0.000	0.000	0.080
0.4333	0.007	0.001	0.000	0.080
0.4667	0.007	0.001	0.000	0.080
0.5000	0.007	0.001	0.000	0.080
0.5333	0.007	0.001	0.000	0.080
0.5667	0.007	0.001	0.000	0.080
0.6000	0.007	0.001	0.000	0.080
0.6333	0.007	0.001	0.000	0.080
0.6667	0.007	0.001	0.000	0.080
0.7000	0.007	0.001	0.000	0.080
0.7333	0.007	0.001	0.000	0.080
0.7667	0.007	0.001	0.000	0.080
0.8000	0.007	0.001	0.000	0.080
0.8333	0.007	0.001	0.000	0.080
0.8667	0.007	0.002	0.000	0.080
0.9000	0.007	0.002	0.000	0.080
0.9333	0.007	0.002	0.000	0.080
0.9667	0.007	0.002	0.000	0.080
1.0000	0.007	0.002	0.000	0.080
1.0333	0.007	0.002	0.000	0.080
1.0667	0.007	0.002	0.000	0.080
1.1000	0.007	0.002	0.000	0.080
1.1333	0.007	0.002	0.000	0.080
1.1667	0.007	0.002	0.000	0.080
1.2000	0.007	0.002	0.000	0.080
1.2333	0.007	0.002	0.000	0.080
1.2667	0.007	0.002	0.000	0.080
1.3000	0.007	0.003	0.000	0.080
1.3333	0.007	0.003	0.000	0.080
1.3667	0.007	0.003	0.000	0.080
1.4000	0.007	0.003	0.000	0.080
1.4333	0.007	0.003	0.000	0.080
1.4667	0.007	0.003	0.000	0.080
1.5000	0.007	0.003	0.000	0.080
1.5333	0.007	0.003	0.000	0.080
1.5667	0.007	0.003	0.000	0.080
1.6000	0.007	0.003	0.000	0.080
1.6333	0.007	0.003	0.000	0.080
1.6667	0.007	0.003	0.000	0.080
1.7000	0.007	0.003	0.000	0.080
1.7333	0.007	0.004	0.000	0.080
1.7667	0.007	0.004	0.000	0.080
1.8000	0.007	0.004	0.000	0.080
1.8333	0.007	0.004	0.000	0.080
1.8667	0.007	0.004	0.000	0.080
1.9000	0.007	0.004	0.000	0.080
1.9333	0.007	0.004	0.000	0.080
1.9667	0.007	0.004	0.000	0.080
2.0000	0.007	0.004	0.000	0.080
2.0333	0.007	0.004	0.000	0.080
2.0667	0.007	0.004	0.000	0.080
2.1000	0.007	0.004	0.000	0.080
2.1333	0.007	0.004	0.000	0.080
2.1667	0.007	0.005	0.000	0.080
2.2000	0.007	0.005	0.000	0.080
2.2333	0.007	0.005	0.000	0.080
2.2667	0.007	0.005	0.000	0.080

2.3000	0.007	0.005	0.000	0.080
2.3333	0.007	0.005	0.000	0.080
2.3667	0.007	0.005	0.000	0.080
2.4000	0.007	0.005	0.000	0.080
2.4333	0.007	0.005	0.000	0.080
2.4667	0.007	0.005	0.000	0.080
2.5000	0.007	0.005	0.000	0.080
2.5333	0.007	0.005	0.000	0.080
2.5667	0.007	0.005	0.000	0.080
2.6000	0.007	0.006	0.000	0.080
2.6333	0.007	0.006	0.000	0.080
2.6667	0.007	0.006	0.000	0.080
2.7000	0.007	0.006	0.000	0.080
2.7333	0.007	0.006	0.000	0.080
2.7667	0.007	0.006	0.000	0.080
2.8000	0.007	0.006	0.000	0.080
2.8333	0.007	0.006	0.000	0.080
2.8667	0.007	0.006	0.000	0.080
2.9000	0.007	0.006	0.000	0.080
2.9333	0.007	0.006	0.043	0.080
2.9667	0.007	0.006	0.121	0.080
3.0000	0.007	0.006	0.219	0.080

ANALYSIS RESULTS
Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.177
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.017
Total Impervious Area:0.16

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000203
5 year	0.000441
10 year	0.000707
25 year	0.001234
50 year	0.001824
100 year	0.002646

Flow Frequency Return Periods for Mitigated. POC #1

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

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

Year	Predeveloped	Mitigated
1949	0.000	0.000
1950	0.000	0.000
1951	0.000	0.000
1952	0.000	0.000
1953	0.000	0.000
1954	0.001	0.000
1955	0.001	0.000
1956	0.000	0.000
1957	0.000	0.000
1958	0.000	0.000
1959	0.000	0.000
1960	0.000	0.000
1961	0.001	0.029
1962	0.000	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.000	0.000
1966	0.000	0.000
1967	0.000	0.000
1968	0.000	0.000
1969	0.000	0.000
1970	0.000	0.000
1971	0.001	0.000
1972	0.000	0.000
1973	0.000	0.000
1974	0.000	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.000	0.000
1981	0.000	0.000
1982	0.000	0.000
1983	0.000	0.000
1984	0.000	0.000
1985	0.000	0.000
1986	0.001	0.000
1987	0.001	0.000
1988	0.000	0.000
1989	0.000	0.000
1990	0.000	0.000
1991	0.000	0.000
1992	0.000	0.000
1993	0.000	0.000
1994	0.000	0.000
1995	0.000	0.000
1996	0.002	0.000
1997	0.004	0.000
1998	0.000	0.000
1999	0.000	0.000
2000	0.000	0.000
2001	0.000	0.000
2002	0.000	0.000

2003	0.000	0.000
2004	0.000	0.000
2005	0.000	0.000
2006	0.005	0.000
2007	0.000	0.000
2008	0.000	0.000
2009	0.000	0.000

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

Rank	Predeveloped	Mitigated
1	0.0047	0.0291
2	0.0044	0.0000
3	0.0016	0.0000
4	0.0012	0.0000
5	0.0010	0.0000
6	0.0008	0.0000
7	0.0007	0.0000
8	0.0007	0.0000
9	0.0007	0.0000
10	0.0005	0.0000
11	0.0004	0.0000
12	0.0004	0.0000
13	0.0003	0.0000
14	0.0003	0.0000
15	0.0003	0.0000
16	0.0003	0.0000
17	0.0003	0.0000
18	0.0003	0.0000
19	0.0003	0.0000
20	0.0002	0.0000
21	0.0002	0.0000
22	0.0002	0.0000
23	0.0002	0.0000
24	0.0001	0.0000
25	0.0001	0.0000
26	0.0001	0.0000
27	0.0001	0.0000
28	0.0001	0.0000
29	0.0001	0.0000
30	0.0001	0.0000
31	0.0001	0.0000
32	0.0001	0.0000
33	0.0001	0.0000
34	0.0001	0.0000
35	0.0001	0.0000
36	0.0001	0.0000
37	0.0001	0.0000
38	0.0001	0.0000
39	0.0001	0.0000
40	0.0001	0.0000
41	0.0001	0.0000
42	0.0001	0.0000
43	0.0001	0.0000
44	0.0001	0.0000
45	0.0001	0.0000

46	0.0001	0.0000
47	0.0001	0.0000
48	0.0001	0.0000
49	0.0001	0.0000
50	0.0001	0.0000
51	0.0001	0.0000
52	0.0001	0.0000
53	0.0001	0.0000
54	0.0001	0.0000
55	0.0001	0.0000
56	0.0001	0.0000
57	0.0001	0.0000
58	0.0001	0.0000
59	0.0001	0.0000
60	0.0001	0.0000
61	0.0001	0.0000

Stream Protection Duration
POC #1
The Facility PASSED
The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0001	0	0	0	Pass
0.0001	0	0	0	Pass
0.0001	0	0	0	Pass
0.0002	0	0	0	Pass
0.0002	0	0	0	Pass
0.0002	0	0	0	Pass
0.0002	0	0	0	Pass
0.0002	0	0	0	Pass
0.0002	0	0	0	Pass
0.0003	0	0	0	Pass
0.0003	0	0	0	Pass
0.0003	0	0	0	Pass
0.0003	0	0	0	Pass
0.0003	0	0	0	Pass
0.0003	0	0	0	Pass
0.0004	0	0	0	Pass
0.0004	0	0	0	Pass
0.0004	0	0	0	Pass
0.0004	0	0	0	Pass
0.0004	0	0	0	Pass
0.0004	0	0	0	Pass
0.0005	0	0	0	Pass
0.0005	0	0	0	Pass
0.0005	0	0	0	Pass
0.0005	0	0	0	Pass
0.0005	0	0	0	Pass
0.0006	0	0	0	Pass
0.0006	0	0	0	Pass
0.0006	0	0	0	Pass
0.0006	0	0	0	Pass
0.0006	0	0	0	Pass
0.0006	0	0	0	Pass
0.0007	0	0	0	Pass

0.0007	0	0	0	Pass
0.0007	0	0	0	Pass
0.0007	0	0	0	Pass
0.0007	0	0	0	Pass
0.0007	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0010	0	0	0	Pass
0.0010	0	0	0	Pass
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0.0011	0	0	0	Pass
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0.0012	0	0	0	Pass
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0.0013	0	0	0	Pass
0.0013	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
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0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0016	0	0	0	Pass
0.0016	0	0	0	Pass
0.0016	0	0	0	Pass
0.0016	0	0	0	Pass
0.0016	0	0	0	Pass
0.0017	0	0	0	Pass

0.0017	0	0	0	Pass
0.0017	0	0	0	Pass
0.0017	0	0	0	Pass
0.0017	0	0	0	Pass
0.0017	0	0	0	Pass
0.0018	0	0	0	Pass
0.0018	0	0	0	Pass
0.0018	0	0	0	Pass
0.0018	0	0	0	Pass
0.0018	0	0	0	Pass

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Water Quality	Percent Volume Infiltrated	Comment Water Quality Treated
Gravel Trench Bed 1 POC	N	27.73				N	100.00	
Total Volume Infiltrated		27.73	0.00	0.00			100.00	0.00
							0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

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Section V – Construction Stormwater Pollution Prevention Plan

Section V Summary:
Narrative
Construction SWPPP Elements
Source Controls

Erosion control details are provided consistent with the City of Snohomish guidelines. Erosion control plan sheets are provided in full size as a part of the civil drawing set.

For sites under one acre in area, the Department of Ecology does not require completion of the Construction SWPPP or the Construction Stormwater General Permit. Therefore, a full Construction SWPPP is not required for this project.

Construction SWPPP Elements

The elements for construction pollution prevention are discussed as follows:

Element 1: Mark Clearing Limits
To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Clearing limits will be to the extents of necessary land disturbance for the new townhouse buildings and associated driveway and walkways. The BMPs relevant to marking the clearing limits that will be applied for this project include:

High Visibility Plastic or Metal Fence (BMP C103)

Element 2: Establish Construction Access
Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads. A stabilized construction entrance is proposed in the area of the proposed driveway. The BMPs relevant to establishing construction access that will be applied for this project include:

Stabilized Construction Entrance (BMP C105)

Element 3: Control Flow Rates
The site is relatively small and mostly flat. As such, flow rates are not expected to be an issue during construction and a silt fence used for Element 4 should be sufficient.

Element 4: Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged. Silt fence has been proposed to be installed around the perimeter of the site. Pollution prevention facilities on the erosion control plan must be constructed prior to or in conjunction with all clearing and grading so as to ensure that the transport of sediment to surface waters and adjacent properties is minimized. The BMPs relevant to controlling sediment on this project include:

Silt Fence (BMP C233)

Element 5: Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

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)

Element 6: Protect Slopes

Exposed slopes shall be stabilized with BMPs found in Element 5.

Element 7: Protect Drain Inlets

Existing drain inlets along Cedar Ave and those that are made operable during construction must be protected from sedimentation. Stormwater shall not enter the conveyance system without first being filtered or treated to remove sediment. Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage (or as specified by the manufacturer). The specific BMPs to be used for protecting drain inlets are:

Storm Drain Inlet Protection (BMP C220)

Element 8: Stabilize Channels and Outlets

Conveyance channels are not located on or in the immediate vicinity of the site.

Element 9: Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The suggested BMPs are:

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

Element 10: Control Dewatering

De-watering is not anticipated since no groundwater was encountered during geotechnical explorations during the wet season.

Element 11: Maintain BMPs

All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Element 12: Manage the Project

- Phase development projects to the maximum degree practicable and take into account seasonal work limits.
- Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with the Construction Stormwater General Permit or local plan approval authority.
- Maintain an Updated Construction SWPPP
  - This SWPPP shall be retained on-site or within reasonable access to the site.
  - The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.
  - The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

Element 13: Protect Low Impact Development BMPs

The infiltration trench should be protected from compaction during construction so as not to reduce the infiltrative capacity of the soils.

Source Controls

This project should incorporate required BMPs from Volume IV of the DOE Manual: S407 – BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots; S411 – BMPs for Landscaping and Lawn/Vegetation Management; and S417 – BMPs for Maintenance of Stormwater Drainage and Treatment Systems. The Operation & Maintenance Manual found in Section VII contains guide sheets for the aforementioned BMPs.

Section VI – Special Reports and Studies

Section VI Summary:

Narrative

The following reports are included in this section:

1. Stormwater Infiltration Evaluation by Nelson Geotechnical Associates dated March 10, 2020.
2. Wetland and Stream Reconnaissance by Altmann Oliver Associates dated May 27, 2020.
3. Soil Resource Report from USDA's Web Soil Survey dated June 30, 2020.

NELSON GEOTECHNICAL
ASSOCIATES, INC.

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March 10, 2020

Mr. Dylan Muzzy
Muzzy Building Company
6065 – 126th Avenue NE
Kirkland, WA 98034
VIA Email: dylanmuzzy0@gmail.com

Stormwater Infiltration Evaluation - UPDATED
Muzzy Building Company Cedar Avenue Residence Development Infiltration
225 Cedar Avenue
Snohomish, Washington
NGA Project No. 1161020

Dear Mr. Muzzy:

This letter documents our explorations and provides our opinions and recommendations for the feasibility of stormwater infiltration at the property located at 225 Cedar Avenue in Snohomish, Washington, as shown on the Vicinity Map in Figure 1.

INTRODUCTION

The subject site is currently vacent and the ground surface within the site is relatively level. The property is covered in grass with a patch of blackberries occupiying the eastern section of the lot. We understand that the proposed development will consist of developing a new multi-family residence within the central portion of the property.

We understand that stormwater from the proposed residence will likely be directed into an on-site infiltration system, if feasible. The City of Snohomish uses the 2019 Department of Ecology (DOE) Stormwater Management in Western Washington to determine the design infiltration rate and overall system sizing. According to this manual, we understand that long-term design infiltration rates for this site are to be determined by performing on-site infiltration testing consisting of the Small Pilot Infiltration Test (PIT). In accordance with this manual, the soil explorations need to extend to a minimum of one foot below the base of the proposed infiltration system.

SCOPE

The purpose of this study is to explore and characterize the subsurface conditions within the site and to provide opinions and recommendations for stormwater infiltration. Specifically, our scope of services included the following:

1. Review available soil and geologic maps of the area.
2. Explored the subsurface soil and groundwater conditions within the site with trackhoe-excavated test pits. Trackhoe was provided by the client. Water for testing was arranged by the client.
3. Perform grain-size sieve analysis on soil samples, as necessary.
4. Provide long-term design infiltration rates based on on-site Small Pilot Infiltration Testing (PIT) per the 2019 Department of Ecology (DOE) Stormwater Management in Western Washington Manual.
5. Provide recommendations for infiltration system installation.
6. Document the results of our findings, conclusions, and recommendations in a written geotechnical letter.

SITE CONDITIONS

Surface Conditions

The site consists of a rectangular shaped parcel covering approximately 0.18 acres. The site is currently vacent and is relatively level. Vegetation throughout the site consists of grass and blackberry bushes with sparse trees. The site is bounded to the north, south, and east by existing residencial properties, and to the west by Cedar Avenue. We did not observe surface water on the site during our visit on February 13, 2020.

Subsurface Conditions

Geology: The site is mapped on the Geologic map of the Snohomish quadrangle, Washington, by James P. Minard (USGS, 1985). The site is mapped as Older Alluvium (Qoal) with Recessional Outwash (Qvr) mapped directly to the north and west of the subject site. Older Alluvium is typically described as mostly clay, silt, and very fine-grained sand. Recessional outwash is described as well-drained stratified outwash sand and gravel. Our explorations encountered silty sand underlain by sandy gravel, consistent with the description of native older alluvium and recessional outwash deposits at depth, respectively.

Explorations: The subsurface conditions within the site were explored on February 13, 2020 by excavating two test pit explorations with a mini trackhoe excavator. The approximate location of our exlorations are shown on the Site Plan in Figure 2. A geologist from Nelson Geotechnical Associates, Inc. (NGA) was present during the explorations, collected samples of the soils encountered, and maintained a log of the explorations. The soils were visually classified in general accordance with the Unified Soil Classification System, presented as Figure 3. The logs of our explorations are presented as Figure 4. We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the exploration logs should be reviewed.

At the surface of Infiltration Pit 1, and Test Pit 1, we encountered approximately one foot of loose, dark brown to brown silty fine to medium grain sand with gravel, and roots, that we interpreted as surficial topsoil and/or undocumented fill soils. Underlying the upper surficial soils, we encountered 3.0 to 5.3 feet of very stiff, light brown to brown-gray silt with fine to medium grain sand and gravel that we interpreted as native alluvium deposits. Underlying the alluvium in each of our test pits, we encountered medium dense to dense, gray, fine to coarse sand and gravel which we interpreted as native recessional outwash. Infiltration Pit 1 and Test Pit 1 were terminated within the native glacial recessional outwash soils at respective depths of approximately 7.4 amd 5.0 feet below the existing ground surface.

Hydrogeologic Conditions

We did not encounter groundwater within our explorations. If groundwater is encountered during construction we would interpret this water as perched groundwater. Perched water occurs when surface water infiltrates through less dense, more permeable soils, such as topsoil and the weathered horizon, and accumulates on top of a less permeable soil. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of groundwater to decrease during drier times of the year and increase during wetter periods.

INFILTRATION TESTING

The subsurface soils at depth within our explorations generally consisted of fine to coarse grain sand and gravel that we interpreted as native glacial recessional outwash soils to the depths explored. In accordance with the 2019 Department of Ecology (DOE) Stormwater Management in Western Washington Manual, we conducted a Small PIT within Infiltration Pit 1, as shown on the attached Site Plan in Figure 2. Infiltration Pit 1 measured 4.0-feet long by 3.0-feet wide by 7.5-feet deep. Infiltration Pit 1 was filled with approximately four inches of water and this level was maintained for six hours for the pre-soak period. Due to the granular nature of the recessional outwash soils and the maximum

ouput of the on-site water source of 7.5 gallons per minute, we were only able to maintain a water level of four inches at the base of the pit. At the end of the pre-soak period, the water flow rate into the hole was monitored with a Great Plains Industries (GPI) TM 075 water flow meter for one hour.

After the 6-hour soaking period was completed, the water level was maintained at approximately four inches for one hour for the steady-state period of the test. The flow rate for Infiltration Pit 1 stabilized at 7.50 gallons per minute (450.00 gallons per hour), which equates to an approximate infiltration rate of 60.16 inches per hour. The water was shut off after the steady-state period and the water level within the pit was monitored. After 8.52 minutes, the water level within the pit had completely dissipated, resulting in an infiltration rate of 28.17 inches per hour.

CONCLUSIONS

It is our opinion that the granular recessional outwash soils soils encountered at depth within the site are suitable for traditional stormwater infiltration. The granular recessional outwash soils were generally encountered at depths in the range of 4.0 to 6.3 feet below the existing ground surface. We have selected an overall measured field rate of 28.17 inches per hour obtained from the falling head portion of the test within Infiltration Pit 1 be utilized in determining the long-term design infiltration rate for the infiltration systems within the site. We referenced the equation in Chapter 5 (Page 736) of the 2019 Department of Ecology (DOE)_Stormwater Management in Western Washington Manual that applies correction factors to the field measured infiltration rate to generate a long-term design infiltration rate. Correction factors of 0.50, 0.90, and 0.90 were utilized in this equation for $F_{testing}$, $F_{geometry}$, $F_{plugging}$, respectively. Using these correction factors, we calculated a long-term design infiltration rate of 11.41 inches per hour to be utilized to design any on-site infiltration systems within the site, provided that the base of the system terminates within the native granular glacial outwash soils encountered at depth.

The storm water management systems should be designed and maintained in accordance with the 2019 Department of Ecology (DOE)_Stormwater Management in Western Washington Manual and the City of Snohomish standards. We recommend that any proposed infiltration systems be placed as to not negatively impact any proposed or existing nearby structures and also meet all required setbacks from existing property lines, structures, and sensitive areas as discussed in the drainage manual. In general, infiltration systems should not be located within proposed fill areas within the site (associated with site grading or retaining wall backfill) as such condition could lead to failures of the placed fills and/or retaining structures. We should be retained to review infiltration design and oversee installation.

The stormwater manual recommends a five-foot separation between the base of an infiltration system and any underlying bedrock, impermeable horizon, or groundwater. We did not encounter any groundwater to the depths explored throughout the site, and granular soils appear to extend at depth below the silty shallow layer.

USE OF THIS LETTER

This letter was prepared for Mr. Muzzy and his agents, for use in planning and budgeting the above-referenced project only. Our services included an evaluation of the infiltration capability of the site soils at specific locations, and should not be considered as an in-depth geotechnical study of the site or an evaluation of the overall site stability. This letter may be used for bidding and estimating purposes, but our letter, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions. The subsurface conditions between explorations may vary. A contingency for varying conditions should be incorporated into the project plans.

We recommend that NGA be retained to review the design plans and provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this letter was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

We appreciate the opportunity to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Austin Slabaugh
Staff Geologist

State of Washington
2883
Licensed Geologist
LEE S. BELLAH

Lee S. Bellah, LG
Project Geologist

MAHER A SHEBL
STATE OF WASHINGTON
33246
REGISTERED
PROFESSIONAL ENGINEER

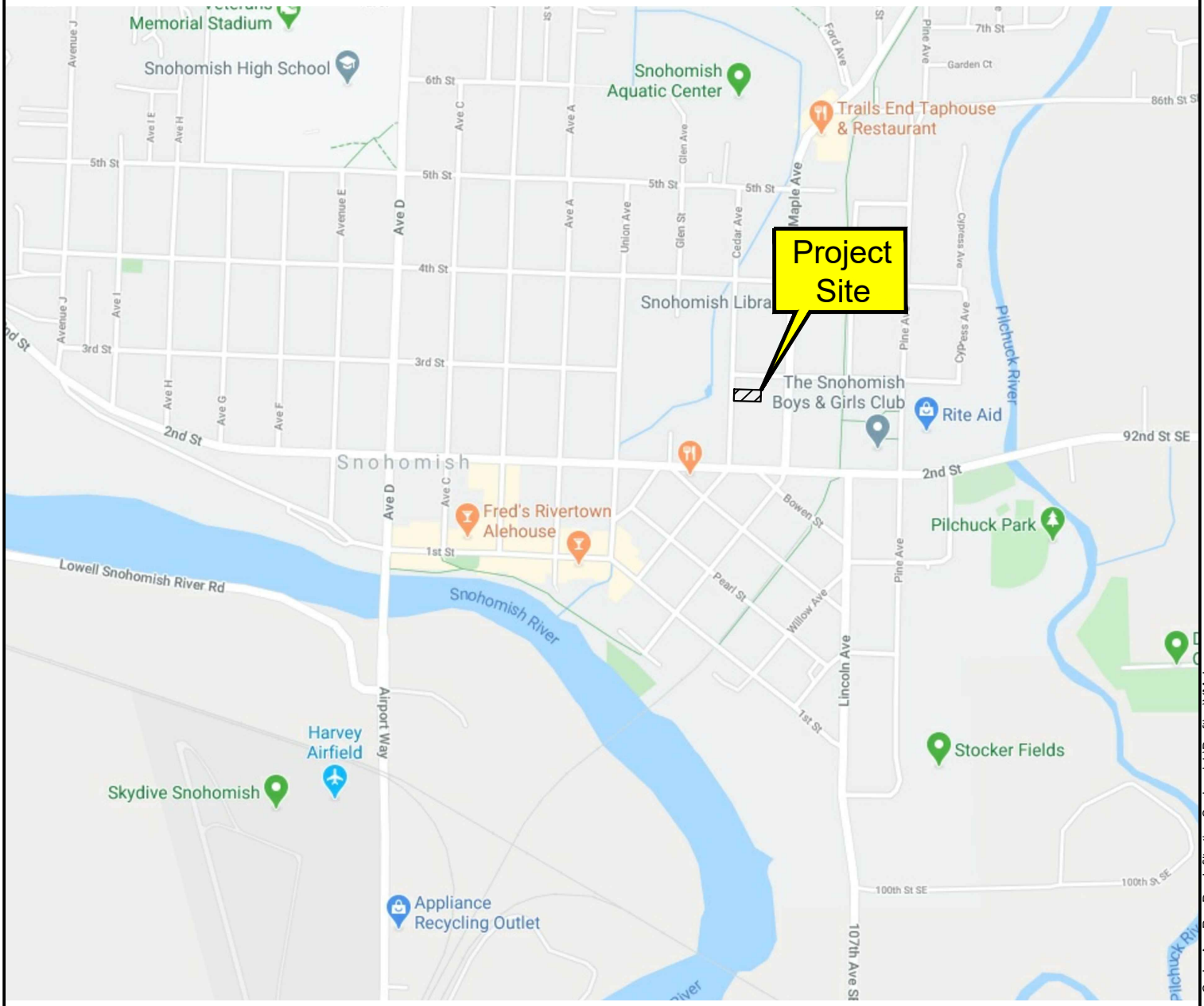
Maher A. Shebl, PhD, PE, M.ASCE
Senior Engineer

AJS:LSB:MAS:dy

Four Figures Attached

VICINITY MAP

Not to Scale

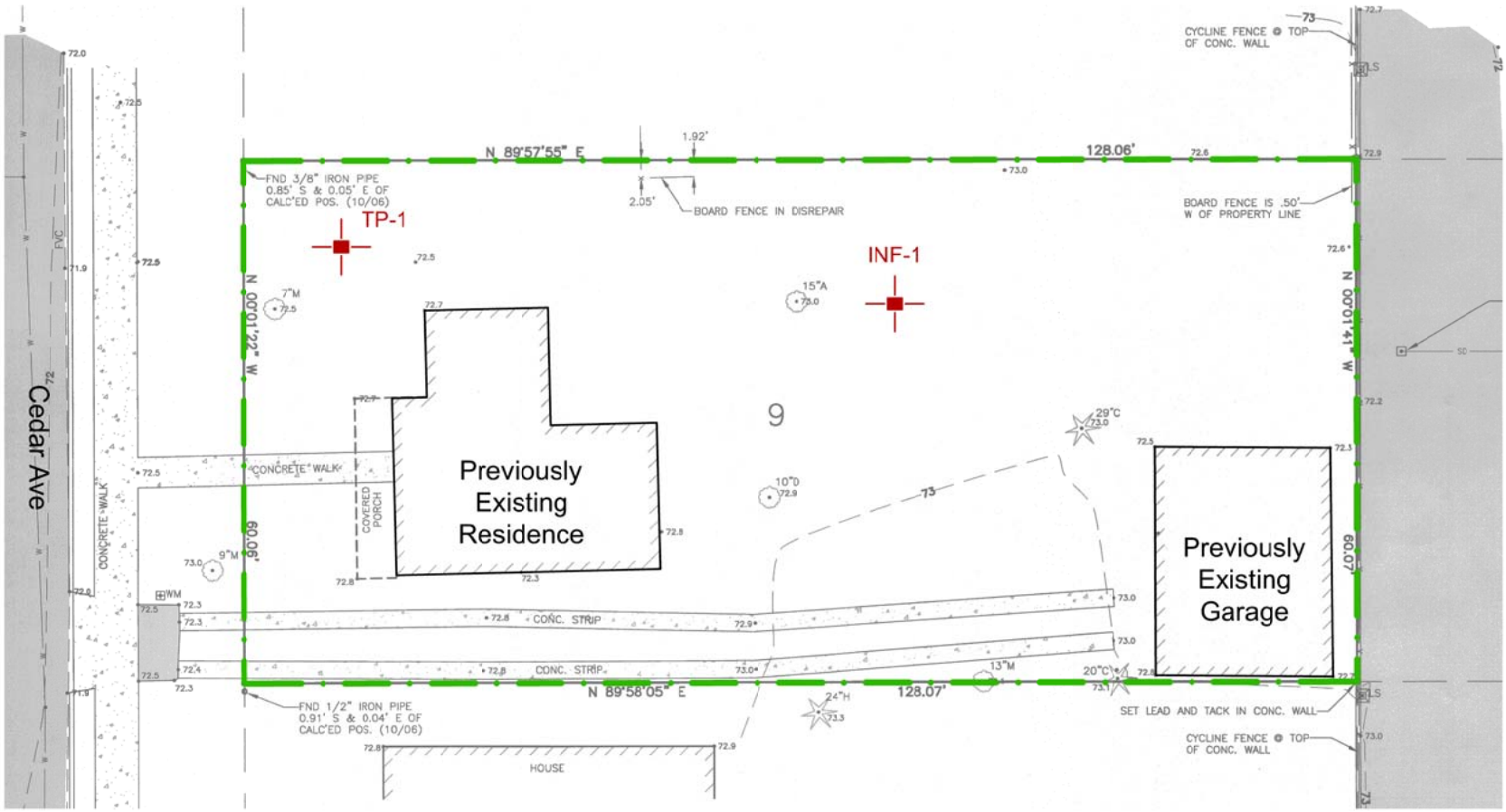


Snohomish, WA

Project Number 1161020	Muzzy Residence Development Infiltration Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC. GEOTECHNICAL ENGINEERS & GEOLOGISTS	No.	Date	Revision	By	CK
Figure 1		Woodinville Office: 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax: 481-2510 — East Wenatchee Office: 5526 Industry Lane, #2, East Wenatchee, WA 98802, (509) 665-7696 / Fax: 665-7692 — www.nelsongeotech.com	1	2/19/20	Original	DPN	AJS

\\HILL\company\2020 NGA Project Folders\11610-20 Muzzy Cedar Ave Res Dev Infiltration Snohomish\Drafting\VM.dwg

Site Plan



LEGEND

Property line

INF-1

Number and approximate location of infiltration test pit

TP-1

Number and approximate location of test pit

0 20 40

Scale: 1 inch = 20 feet

Reference: Site plan based on a plan dated November 1, 2006 titled "Cook," prepared by Mead Gilman & Assoc..

N:\2020 NGA Project Folders\11610-20 Muzzy Cedar Ave Res Dev Infiltration Snohomish\Drafting\SP.dwg

Project Number
1161020

Figure 2

Muzzy Residence
Development Infiltration
Site Plan

NELSON GEOTECHNICAL ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS & GEOLOGISTS
Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510
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www.nelsongeotech.com

No.	Date	Revision	By	CK
1	2/19/20	Original	DPN	AJS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.

2) Soil classification using laboratory tests is based on ASTM D 2488-93.

3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1161020	Muzzy Residence Development Infiltration Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC. GEOTECHNICAL ENGINEERS & GEOLOGISTS	No.	Date	Revision	By	CK
Figure 3			1	2/19/20	Original	DPN	AJS

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\\HILL\company\2020 NGA Project Folders\11610-20 Muzzy Cedar Ave Res Dev Infiltration Snohomish\Drafting\SC.dwg

LOG OF EXPLORATION

DEPTH (FEET)	USC	SOIL DESCRIPTION
INFILTRATION PIT ONE		
0.0 – 1.0		GRASS UNDERLAIN BY DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL, ROOTS, AND ORGANICS, (LOOSE, MOIST) (**UNDOCUMENTED FILL**)
1.0 – 6.3	ML	TAN TO GRAY SILT WITH FINE TO MEDIUM SAND AND IRON OXIDE STAINING, GRAVEL, AND ROOTS (VERY STIFF, MOIST)
6.3 – 7.4	SP	GRAY, FINE TO COARSE SAND WITH GRAVEL, (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED INFILTRATION PIT CAVING WAS NOT ENCOUNTERED INFILTRATION PIT WAS COMPLETED AT 7.4 FEET ON 2/13/2020
TEST PIT ONE		
0.0 – 1.0		GRASS UNDERLAIN BY DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, ORGANICS, AND GRAVEL (LOOSE, MOIST) (**UNDOCUMENTED FILL**)
1.0 – 4.0	ML	TAN TO GRAY, SILT WITH FINE TO MEDIUM SAND AND TRACE IRON OXIDE WEATHERING (MEDIUM DENSE TO DENSE, MOIST)
4.0 – 5.0	SP	GRAY, FINE TO COARSE SAND WITH GRAVEL, (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 5.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 5.0 FEET ON 2/13/2020

Altmann Oliver Associates, LLC

PO Box 578 Carnation, WA 98014 Office (425) 333-4535 Fax (425) 333-4509

AOA

Environmental Planning & Landscape Architecture

May 27, 2020

AOA-6227

Dylan Muzzy
Dylanmuzzy0@gmail.com

SUBJECT: **Wetland and Stream Reconnaissance for:**
225 Cedar Ave, Snohomish, WA
Parcel 00444000201000

Dear Dylan:

On May 26, 2020 I conducted a wetland and stream reconnaissance on the subject property utilizing the methodology outlined in the May 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0).* No wetlands or streams were identified on or adjacent to the property during the field investigation.

The site is currently undeveloped and consists of a relatively flat old yard area dominated by grasses, weeds, and patches of Himalayan blackberry (*Rubus armeniacus*). Common plant species included orchard grass (*Dactylis glomerata*), reed canarygrass (*Phalaris arundinacea*), Canada thistle (*Cirsium arvense*), vetch (*Vicia* sp.), dandelion (*Taraxacum officinale*), and red clover (*Trifolium pratense*). No hydrophytic plant communities were observed on or adjacent to the property.

Borings taken throughout the site revealed high chroma non-hydric soils and there was no evidence of ponding or prolonged soil saturation anywhere in the vicinity of the property.

Conclusion

No wetlands or streams were identified on or immediately adjacent the site. This determination is based on a field investigation during which no hydrophytic plant communities, hydric soils, or evidence of wetland hydrology or channels were observed.

If you have any questions regarding the reconnaissance, please give me a call.

Sincerely,

ALTMANN OLIVER ASSOCIATES, LLC

John Altmann
Ecologist

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 Snohomish County Area, Washington

Cedar Urban Townhomes

June 30, 2020

Custom Soil Resource Report
Soil Map

Map Scale: 1:220 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 3 6 12 18

Feet: 0 10 20 40 60

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: Snohomish County Area, Washington
Survey Area Data: Version 21, Sep 16, 2019

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

Date(s) aerial images were photographed: Sep 26, 2018—Oct 16, 2018

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
72	Tokul gravelly medial loam, 0 to 8 percent slopes	0.2	100.0%
Totals for Area of Interest		**0.2**	**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.

Snohomish County Area, Washington

72—Tokul gravelly medial loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t61k
Elevation: 160 to 1,150 feet
Mean annual precipitation: 45 to 70 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Tokul

Setting

Landform: Till plains, hillslopes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash mixed with loess over glacial till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 6 inches: gravelly medial loam
Bs1 - 6 to 9 inches: gravelly medial loam
Bs2 - 9 to 17 inches: gravelly medial loam
Bs3 - 17 to 24 inches: gravelly medial loam
BC - 24 to 33 inches: gravelly medial fine sandy loam
2Bsm - 33 to 62 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to cemented horizon; 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 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA)

Hydric soil rating: No

Minor Components

Pastik

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

Barneston

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

Norma

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

Mckenna

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

Section VII – Other Permits

Section VII Summary:

Narrative

The project is not expected to require permits beyond those from the City of Snohomish.

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

Section VIII – Bond Quantities, Declaration of Covenant, & Operation and Maintenance Manual

Section VIII Summary:

Narrative

The Bond Quantity Worksheet is a standalone document that can be provided for the site improvements and BMPs proposed if required for the site by the City of Snohomish.

The Declaration of Covenant is included in this section and will be recorded with the City prior to permit issuance.

The Operation and Maintenance Manual is a standalone document that will be given to the owners following the construction of the project.

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

RECORDING REQUESTED BY AND
WHEN RECORDED MAIL TO:

Snohomish City Clerk
116 Union Ave
Snohomish, 98290

DECLARATION OF COVENANT AND GRANT OF EASEMENT
For Stormwater Best Management Practices

Grantor(s): Dylan Muzzy
Grantee: City of Snohomish
Tax Parcel ID No.: 00444000201000
Property Address: 225 Cedar Avenue
Legal Description:

LOT 10, BLOCK 2, E.C. FERGUSON'S FIRST ADDITION TO SNOHOMISH, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 1 OF PLATS, PAGE 15, RECORDS OF SNOHOMISH COUNTY, WASHINGTON;

SITUATE IN THE COUNTY OF SNOHOMISH, STATE OF WASHINGTON

IN CONSIDERATION of the surface water improvements constructed under City of Snohomish Permit No. **_TBD_** relating to the real property described legally described above ("Property"), the Grantor, the owner in fee of the Property, hereby covenants with the Grantee, City of Snohomish, a political subdivision of the state of Washington ("City of Snohomish"), the he/she/they will observe, consent to, and abide by the conditions and obligations set forth herein with regard to the Property and hereby grants an access easement over the portions of the Property to the City of Snohomish for the purposes described herein.

THEREFORE, the Grantor hereby grants, covenant, and agree as follows:

1. The Grantor or his/her/their successor in interest and assigns shall at their own cost, operate, maintain, and keep in good repair the Property's stormwater facilities and/or best management practices ("BMPs") shown on the approved "SITE PLAN" for the property attached hereto as Exhibit A.

2. The City of Snohomish shall have a perpetual access easement over those portions of the Property for the sole purpose of performing inspection and/or monitoring of the stormwater facilities and BMPs and conducting any maintenance or repair activity specified in this Declaration of Covenant.

3. If the City of Snohomish determines that maintenance or repair work is required to be done to any of the stormwater facilities or BMPs, the Public Works Director for the City of Snohomish shall give written notice of the specific maintenance and/or repair work required. In this written

notice, the City shall set a reasonable time in which such work is to be completed by the Grantor(s). If the required work is not completed within the time set by the City, the City may perform the required work. Written notice will be sent to the Grantor stating the City's intention to perform the required work. Such notice shall state that the City will not commence any work until at least seven (7) days after mailing of the notice. If, within the sole discretion of the Public Works Director for the City of Snohomish, there exists an imminent or present danger to the public health, safety or welfare, or the environment, the Grantor hereby waive the seven (7) day notice period and the required work may begin immediately.

4. The Grantor shall assume all responsibility for the cost of any maintenance or repair work completed by the City. Such responsibility shall include reimbursement to the City within thirty (30) days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the prime rate at the time of the work plus two (2) percent as liquidated damages.

5. The Grantor is hereby required to obtain written approval from the Planning and Community Development Services Director of the City of Snohomish prior to performing any alterations or modifications to the stormwater facilities and/or BMPs, except for performance of routine landscape maintenance.

6. Any notice or consent required to be given or otherwise provided for by the provisions of this Declaration of Covenant and Grant of Easement shall be effective upon personal delivery, or three (3) days after mailing by Certified mail, return receipt requested, whichever occurs sooner.

7. This Declaration of Covenant and Grant of Easement is intended to promote the efficient and effective management of surface water drainage on the Property, and it shall inure to the benefit of all the citizens of Snohomish, its successors and assigns. This Declaration of Covenant and Grant of Easement shall run with the land and be binding upon Grantor, and Grantor's successors in interest and assigns.

8. This Declaration of Covenant and Grant of Easement may be terminated by execution of a written agreement by Grantor and the City of Snohomish expressing their mutual agreement to terminate this Declaration of Covenant and Grant of Easement.

IN WITNESS WHEREOF, this Declaration of Covenant and Grant of Easement is executed this

_____day of _____, 20___.

GRANTOR:

_____ _____

By _____ By _____

Its _____ Its _____

STATE OF WASHINGTON)
) ss.
COUNTY OF Snohomish)

I certify that I know or have satisfactory evidence that _____ is the person(s) who appeared before me, and acknowledged that he/she/they signed and delivered this instrument as his/her/their free and voluntary act for the uses and purposes set forth.

Dated this _____ day of _____, 20___ .

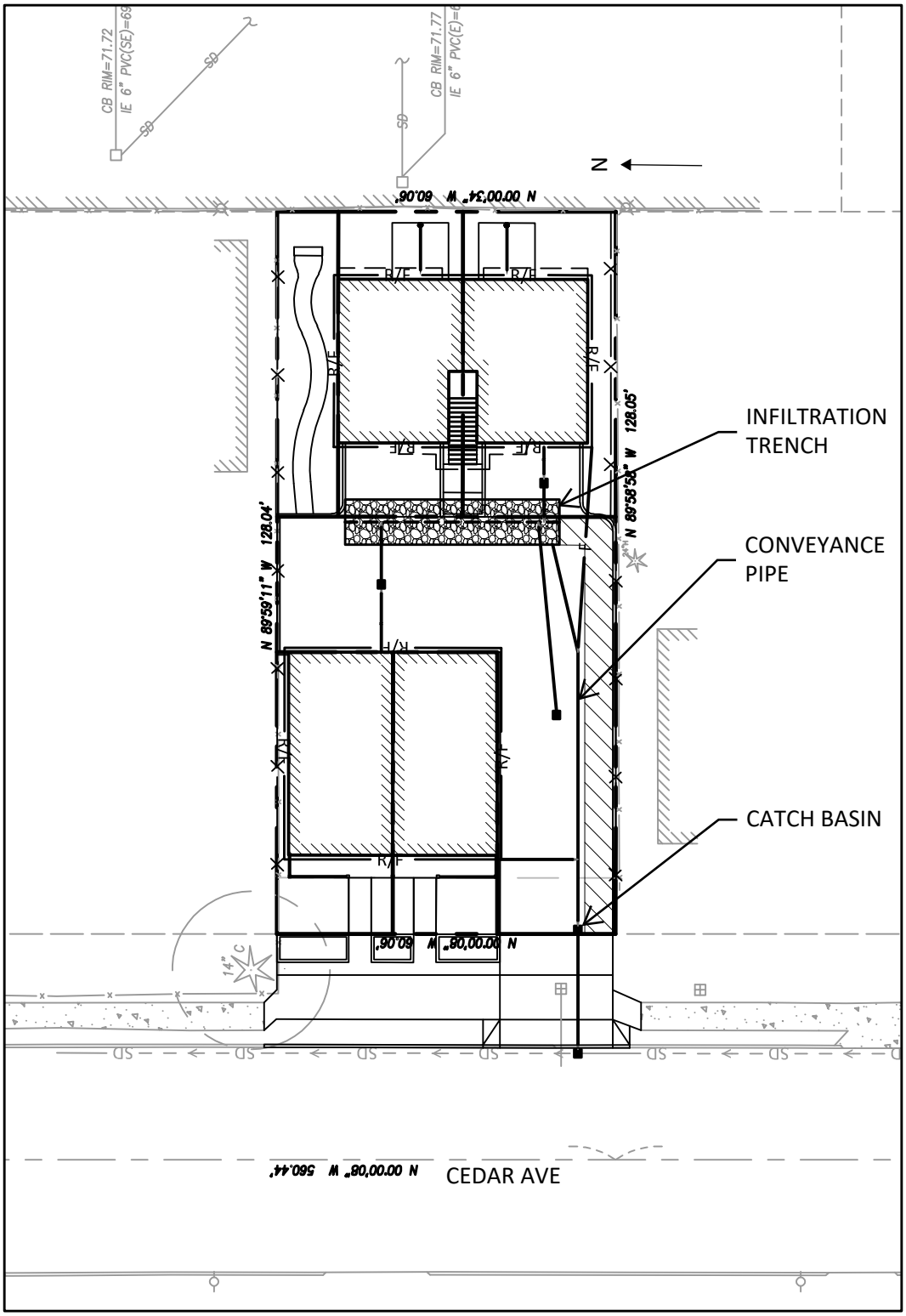
_____

Notary Public in and for the State of Washington,

Residing at _____

My commission expires _____

Exhibit A


INFILTRATION TRENCH
CONVEYANCE PIPE
CATCH BASIN
CEDAR AVE
N
CB RIM=71.72
IE 6" PVC(SE)=69
CB RIM=71.77
IE 6" PVC(E)=6
N 00°00'34" W 60.06'
N 89°58'58" W 128.05'
N 89°59'11" W 128.04'
N 00°00'08" W 560.44'
R/F
SD

Cedar Urban Townhomes
225 Cedar Avenue
Snohomish, WA 98290

OPERATION AND MAINTENANCE MANUAL

Date: July 2020

ENGINEERING

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

Operation and Maintenance Manual

This Operation and Maintenance Manual has been created for the Cedar Urban Townhomes, a two-building, four total units townhouse development on a 0.18 acre lot.

The proposed storm system consists of catch basins, conveyance pipes and an infiltration trench. Included in this Operation and Maintenance Manual is an 11" x 17" grading and drainage plan sheet showing the location of the system. Please note that this map 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 contractor will be responsible for the maintenance and operation of all stormwater structures and BMPs requiring maintenance during construction and, after construction, responsibility will pass to the property owner. An aerial image of the project area can be seen on the following page in Figure VIII-1.

Included in this manual are maintenance sheets taken from the 2014 Stormwater Management Manual for Western Washington for the following facilities/activities:

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

Infiltration Trenches: Gravel-filled trenches designed to meet Department of Ecology standards for managing stormwater on the site.

Vegetation Management: 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.

Facilities shall be inspected for defects listed in the following facility sheets.

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. The facility sheets list the potential conditions warranting maintenance and the expected result following any maintenance. Several engineer's notes for specific tasks are provided within the facility sheets. **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.**

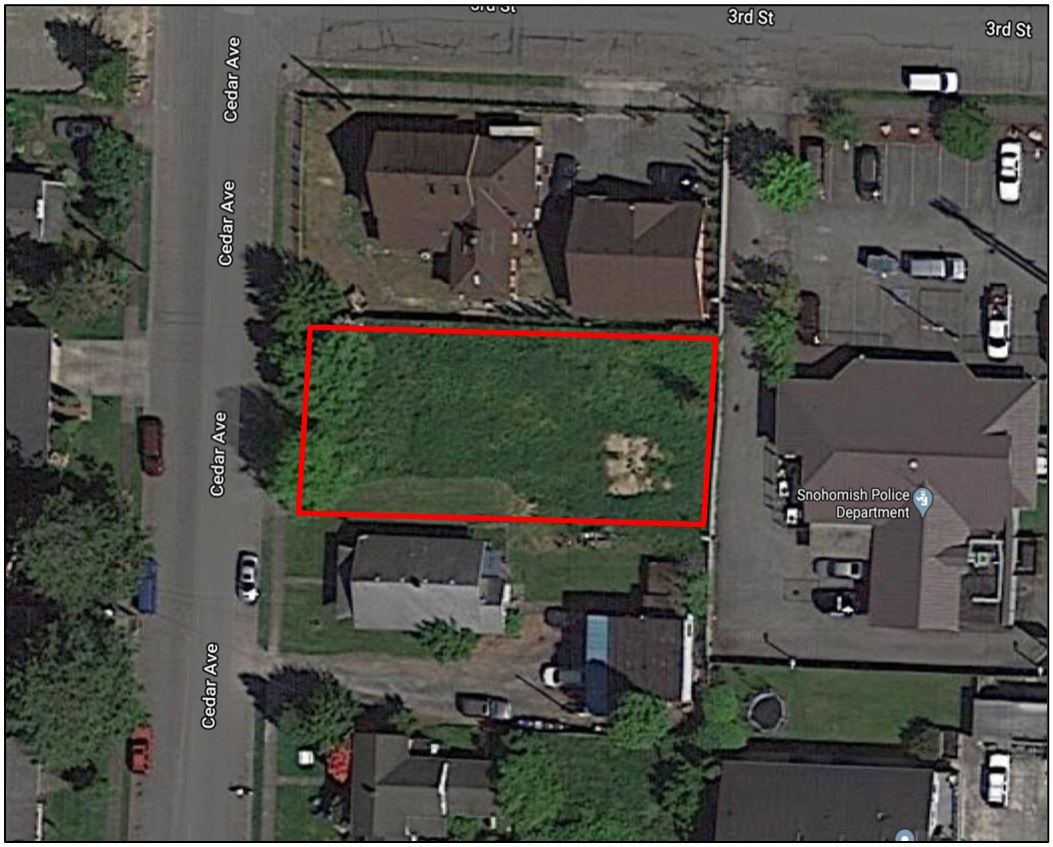
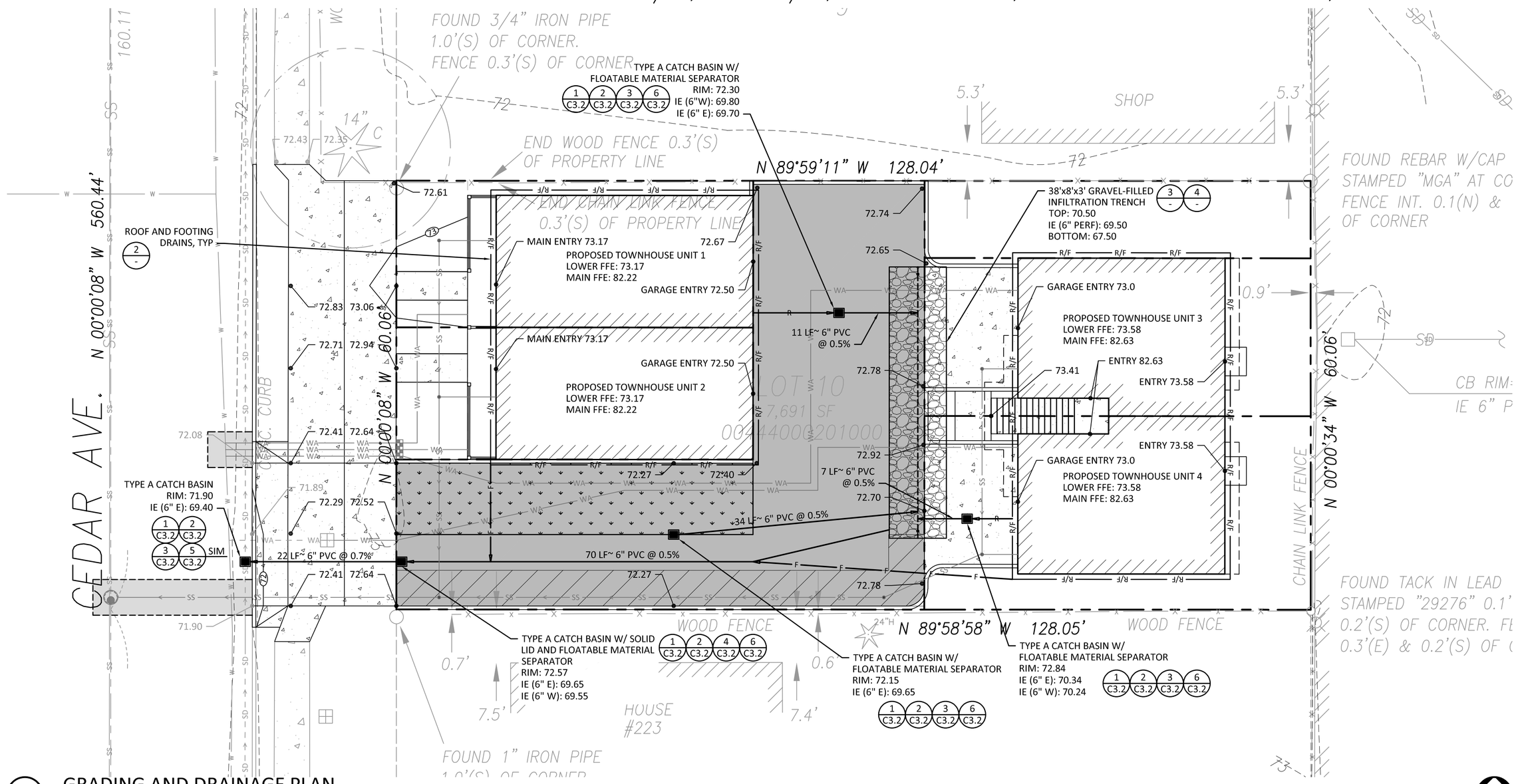


Figure VIII-1: Map of project area (from Google Maps)

SW 1/4, NW 1/4, SECTION 18, TOWNSHIP 28 NORTH, RANGE 6 EAST, W.M.



1 GRADING AND DRAINAGE PLAN

SCALE: 1" = 10'

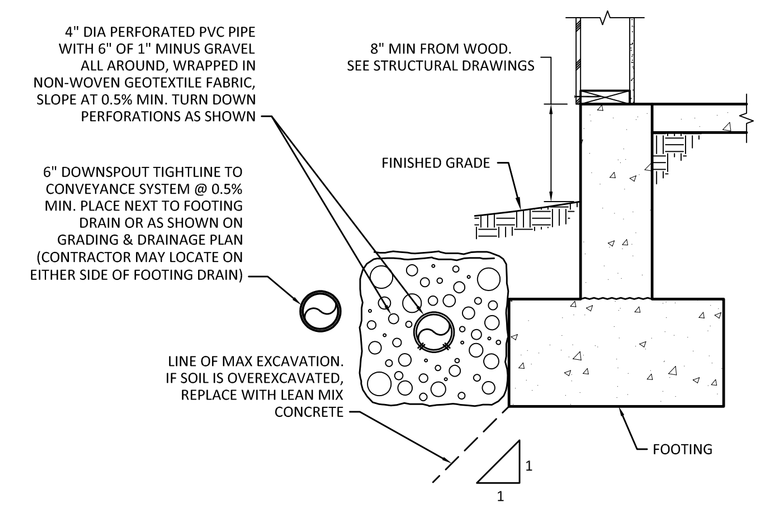
GRADING AND DRAINAGE PLAN NOTES:

1. SOILS REPORT
   REPORT NUMBER: 1161020
   PREPARED BY: NELSON GEOTECHNICAL ASSOCIATES
   DATED: MARCH 10, 2020
2. ALL DISTURBED AREAS ON AND OFF-SITE SHALL BE COMPOST-AMENDED PER THE REQUIREMENTS OF BMP T5.13 IN THE STOMWATER MANUAL VOLUME V, CHAPTER 5.
3. A MINIMUM OF 3' SEPARATION AND 1' VERTICAL SEPARATION IS REQUIRED BETWEEN THE DRY UTILITIES (POWER, GAS, PHONE, CABLE, ETC.) AND SEWER, WATER, AND STORM AND A MINIMUM OF 5' HORIZONTAL SEPARATION AND 1' VERTICAL SEPARATION FROM ANY CITY-OWNED LINES.
4. A TYPE II CATCH BASIN IS REQUIRED WHENEVER RIM TO INVERT EXCEEDS 5'.
5. A MINIMUM OF 2' OF COVER IS REQUIRED FOR ALL PIPES LOCATED UNDER DRIVEABLE SURFACES AND 1' OF COVER UNDER LANDSCAPE SURFACES.
6. EXISTING STORM MAIN LOCATION IN CEDAR AVE IS APPROXIMATE. CONTRACTOR SHALL POTHOLE THE MAIN TO VERIFY LOCATION, DEPTH, MATERIAL AND SIZE.
7. NEW/REPLACED IMPERVIOUS SURFACE (INCLUDING ROW): 7,017 SF
   -- BUILDING (ROOF AREA): 2,915 SF
   -- CONCRETE SIDEWALK/WALKWAYS: 1,169 SF
   -- ASPHALT DRIVEWAY: 2,433 SF
   -- GRASSCRETE: 500 SF

GRADING QUANTITIES

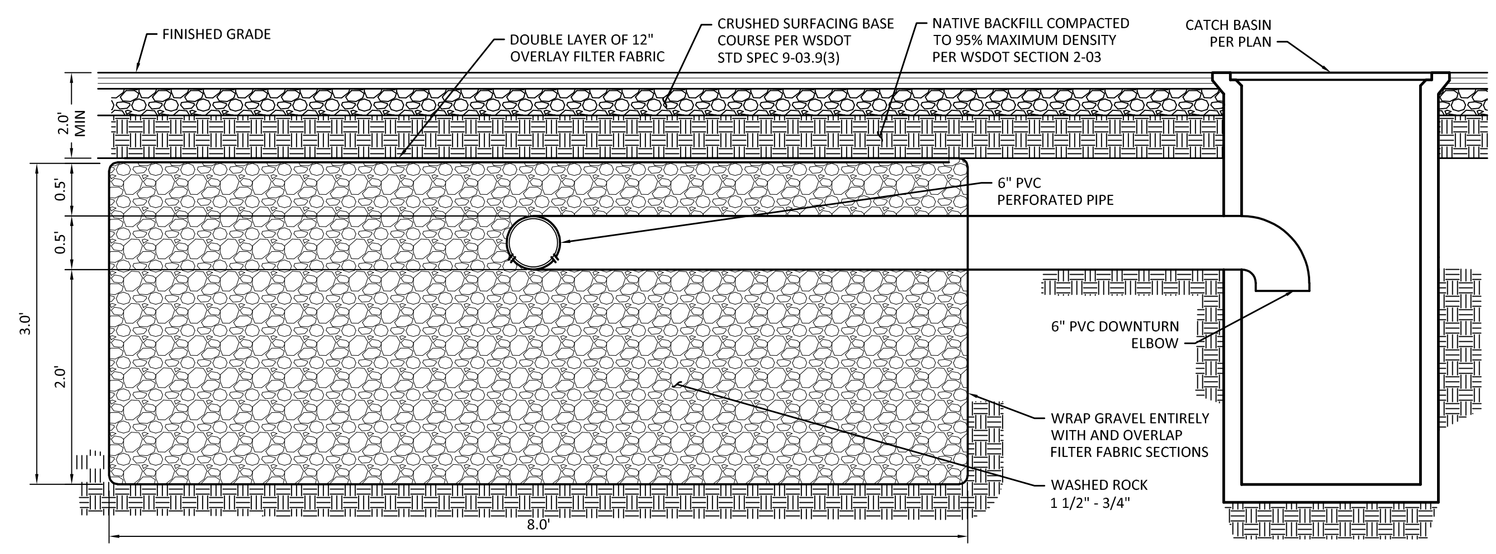
TOTAL EXCAVATION (CUT) -	10.0	CU YDS TOTAL
EMBANKMENT (FILL) -	60.0	CU YDS
TOTAL	70.0	CU YDS

THE QUANTITIES SHOWN ABOVE ARE FOR THE PERMIT PROCESS ONLY. THESE VALUES ARE APPROXIMATE. DO NOT USE FOR BIDDING, PAYMENT, OR ESTIMATING PURPOSES.



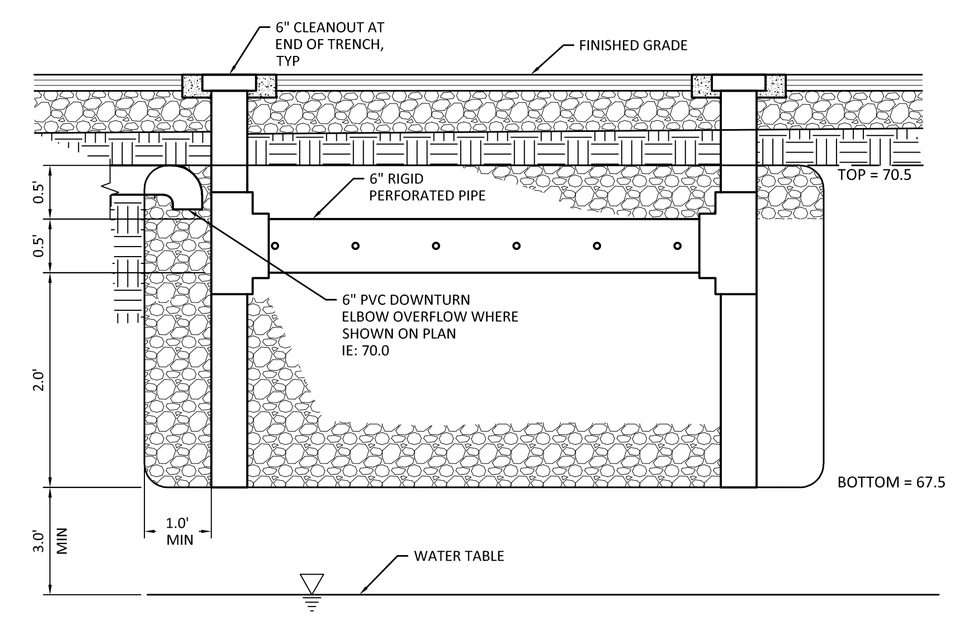
2 FOOTING AND ROOF DRAIN SECTION

SCALE: NTS



3 INFILTRATION TRENCH SECTION

SCALE: NTS



4 INFILTRATION TRENCH

SCALE: NTS

CG ENGINEERING
250 4TH AVE. S., SUITE 200
EDMONDS, WASHINGTON 98020
PHONE (425) 778-8500
FAX (425) 778-5536

FOR REPORT USE ONLY NOT FOR CONSTRUCTION

MARK	DATE	DESCRIPTION
	07/02/20	PERMIT SUBMITTAL

DESIGN:	
DRAWN:	ATD
CHECK:	JPU
JOB NO:	20043.24
DATE:	07/02/2020

CEDAR URBAN TOWNHOMES
225 CEDAR AVE.
SNOHOMISH, WA 98290

GRADING AND DRAINAGE PLAN AND DETAILS

FILE NAME:

SHEET:

C3.1

SAMPLE ACTIVITY LOG

DATE	FACILITY	MAINTENANCE PERFORMED	RESULTS / NOTES

No. 2 – Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		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 the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.

No. 5 – Catch Basins

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

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 18 – Catchbasin Inserts

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

S406 BMPs for Streets/ Highways

Applicable BMPs:

- Select de and anti-icers that cause the least adverse environmental impact. Apply only as needed using minimum quantities.
- Where practicable use roadway deicers, such as calcium magnesium acetate, potassium acetate, or similar materials, that cause less adverse environmental impact than urea, and sodium chloride.
- Store and transfer de and anti-icing materials on an impervious containment pad in accordance with *BMP Storage or Transfer (Outside) of Solid Raw Materials, By-Products, or Finished Products* in this volume.
- Sweep/clean up accumulated de and anti-icing materials and grit from roads as soon as possible after the road surface clears.

Recommended Additional BMPs

- Intensify roadway cleaning in early spring to help remove particulates from road surfaces.
- Include limits on toxic metals in the specifications for de/anti-icers.

S407 BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots

Description of Pollutant Sources: Dust can cause air and water pollution problems particularly at demolition sites and in arid areas where reduced rainfall exposes soil particles to transport by air.

Pollutant Control Approach: Minimize dust generation and apply environmentally friendly and government approved dust suppressant chemicals, if necessary.

Applicable Operational BMPs:

- Sprinkle or wet down soil or dust with water as long as it does not result in a wastewater discharge.
- Use only local and/or state government approved dust suppressant chemicals such as those listed in Ecology Publication #96-433, *Techniques for Dust Prevention and Suppression*.
- Avoid excessive and repeated applications of dust suppressant chemicals. Time the application of dust suppressants to avoid or minimize their wash-off by rainfall or human activity such as irrigation.
- Apply stormwater containment to prevent the conveyance of sediment into storm drains or receiving waters.

- Ecology prohibits the use of motor oil for dust control. Take care when using lignin derivatives and other high BOD chemicals in areas susceptible to contaminating surface water or ground water.
- Consult with Ecology and the local permitting authority on discharge permit requirements if the dust suppression process results in a wastewater discharge to the ground, ground water, storm drain, or surface water.

Recommended Additional Operational BMPs for Roadways and Other Trafficked Areas:

- Consider limiting use of off-road recreational vehicles on dust generating land.
- Consider graveling or paving unpaved permanent roads and other trafficked areas at municipal, commercial, and industrial areas.
- Consider paving or stabilizing shoulders of paved roads with gravel, vegetation, or local government approved chemicals.
- Encourage use of alternate paved routes, if available.
- Vacuum sweep fine dirt and skid control materials from paved roads soon after winter weather ends or when needed.
- Consider using pre-washed traction sand to reduce dust emissions.

Additional Recommended Operational BMPs for Dust Generating Areas:

- Prepare a dust control plan. Helpful references include: Control of Open Fugitive Dust Sources (EPA-450/3-88-088), and Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures (EPA-450/2-92-004).
- Limit exposure of soil (dust source) as much as feasible.
- Stabilize dust-generating soil by growing and maintaining vegetation, mulching, topsoiling, and/or applying stone, sand, or gravel.
- Apply windbreaks in the soil such as trees, board fences, tarp curtains, bales of hay, etc.

S408 BMPs for Dust Control at Manufacturing Areas

Description of Pollutant Sources: Industrial material handling activities can generate considerable amounts of dust that is typically removed using exhaust systems. Mixing cement and concrete products and handling powdered materials can also generate dust. Particulate materials that can cause air pollution include grain dust, sawdust, coal, gravel, crushed rock, cement, and boiler fly ash. Air emissions can contaminate stormwater. The objective of this BMP is to reduce the stormwater pollutants caused by dust generation and control.

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

Recommended Treatment BMPs:

Install biofiltration swales and filter strips – (See Chapter 9, Volume V) to treat roadside runoff wherever practicable and use engineered topsoils wherever necessary to maintain adequate vegetation. These systems can improve infiltration and stormwater pollutant control upstream of roadside ditches.

S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Description of Pollutant Sources: Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil/water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in Volume V. Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

Pollutant Control Approach: Provide maintenance and cleaning of debris, sediments, and oil from stormwater collection, conveyance, and treatment systems to obtain proper operation.

Applicable Operational BMPs:

Maintain stormwater treatment facilities per the operations and maintenance (O&M) procedures presented in Section 4.6 of Volume V in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O&M improvements.
- Promptly repair any deterioration threatening the structural integrity of stormwater facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure adequacy of storm sewer capacities and prevent heavy sediment discharges to the sewer system.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to an appropriate local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT Type 1L basins) may have as little as 12 inches sediment storage below the invert. These catch basins need frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system

owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.

- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catchbasin.
- Post warning signs; "Dump No Waste - Drains to Ground Water," "Streams," "Lakes," or emboss on or adjacent to all storm drain inlets *where possible*.
- Disposal of sediments and liquids from the catch basins must comply with "Recommendations for Management of Street Wastes" described in Appendix IV-G of this volume.

Additional Applicable BMPs: Select additional applicable BMPs from this chapter depending on the pollutant sources and activities conducted at the facility. Those BMPs include:

- S425 BMPs for Soil Erosion and Sediment Control at Industrial Sites
- S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers
- S406 BMPs for Spills of Oil and Hazardous Substances
- S410 BMPs for Illicit Connections to Storm Drains
- S430 BMPs for Urban Streets

S418 BMPs for Manufacturing Activities - Outside

Description of Pollutant Sources: Manufacturing pollutant sources include outside process areas, stack emissions, and areas where manufacturing activity has taken place in the past and significant exposed pollutant materials remain.

Pollution Control Approach: Cover and contain outside manufacturing and prevent stormwater run-on and contamination, where feasible.

Applicable Operational BMP:

- Sweep paved areas regularly, as needed, to prevent contamination of stormwater.
- Alter the activity by eliminating or minimizing the contamination of stormwater.
- **Applicable Structural Source Control BMPs:** Enclose the activity (see Figure 2.2.6). If possible, enclose the manufacturing activity in a building.
- Cover the activity and connect floor drains to a sanitary sewer, if approved by the local sewer authority. Berm or slope the floor as needed to prevent drainage of pollutants to outside areas. (Figure 2.2.7)