Preliminary
Drainage Report

Western Self Storage
RV Storage Parking Lot

Prepared for:
Western Self Storage
2008 East Valley Highway East
Sumner, Washington 98390

Contact: Dave Honeysett
Phone: (253) 294-4539

Prepared by:

Sitts & Hill Engineers, Inc.
4815 Center Street
Tacoma, Washington 98409

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Phone: (253) 474-9449

June 2024

Job Number 20,352

REVIEW #2
SEPA-2024-0003

Project Engineers Certification

I hereby state that this Drainage Report for the **Western Self Storage RV Storage Parking Lot** has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand the City of Sumner does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1 Project Overview

The project proposes a RV Storage Parking Lot in Sumner, Washington. Permits sought for the proposed project include a site development permit and NPDES permit. Specific proposed on-site improvements include asphalt paving and curbing; retaining walls under four feet tall, and stormwater management utilities.

This report is prepared in accordance with the 2019 Department of Ecology Stormwater Management Manual for Western Washington.

The site address is 1401 East Valley Highway E, Sumner, WA 98390. Please see the vicinity map included as Figure 1. The project site is situated on tax parcel numbers 052006-7001 (2.49 acres), 952000-0230 (0.95 acres), 952000-0235 (3.40 acres), and 952000-0236 (1.14 acres). The parcel is zoned Light Industrial.

The project includes 191,030 square feet (4.38 acres) of new and replaced impervious surfaces and 195,280 square feet (4.48 acres) of disturbed area.

Figure 1 - Vicinity Map

Google Earth, 2023 1417 East Valley Highway E, Sumner, WA 98390

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2 Existing Site Hydrology

2.1 Summary

The project site is developed with two active businesses: to the south is a self-storage facility and to the north is a topsoil business. The area has been cleared, graded, and filled with gravel since the 1980s, prior to the site's annexation to the City of Sumner from Pierce County. The last development on the site was in 2016 and included the construction of 5 additional self-storage buildings over a gravel parking storage lot.

The existing stormwater management system on the site consists of catch basins and underground conveyance piping, Stormfilter treatment cartridges, and a detention pond. There is conveyance piping from East Valley Highway East connected to the site's catch basins and underground conveyance piping: This conveyance piping from East Valley Highway East contains run-on from properties and a portion of East Valley Highway East from the east of the site. There is no other location of runoff entering the site. The downstream flowpath from the site includes discharge from the detention pond running under the adjacent railroads to the west and into a channel that flows south to the Dieringer Powerhouse Tailrace. The Dieringer Powerhouse Tailrace then discharges into the White River. See Figure 2 for a depiction of the existing site hydrology and downstream runoff.

2.2 Critical Areas

Pierce County's Public GIS and the City of Sumner Critical Area mapping identifies the site as located within a volcanic hazard area, aquifer recharge area, and a seismic hazard area. There are no flood hazards or wetlands on the site. There is a wetland adjacent to the north of the site.

A Technical Memorandum was prepared for the site by Grette Associates regarding the offsite wetland to the north of the site and is included in Appendix D. The Memorandum states that to the north of the site is a Type III wetland with a buffer of 60'. In accordance with SMC 16.46.150.M.2, the wetland buffer does not extend past any preexisting structure. There is an existing retaining wall along the northern boundary of the site, therefore; to remain outside of the wetland buffer it is proposed to limit all project disturbance to south of the existing retaining wall. No portion of the site south of the existing retaining wall drains to the wetland.

Upon reviewing Department of Natural Resource Mapping, it appears two streams are mapped as crossing through the site. The streams appear to be erroneously labeled and do not existing at the surface. We are currently in correspondence with WDFW to correct the stream mapping.

2.3 Soils

A Custom Soil Resource Report from the National Resources Conservation Service is included in Appendix D. The site has previously been filled and graded with gravel surfacing and underlying the gravel is Semiahmoo Muck, a hydric soil. Infiltration is considered infeasible.

Figure 2 - Site Hydrology Mapping

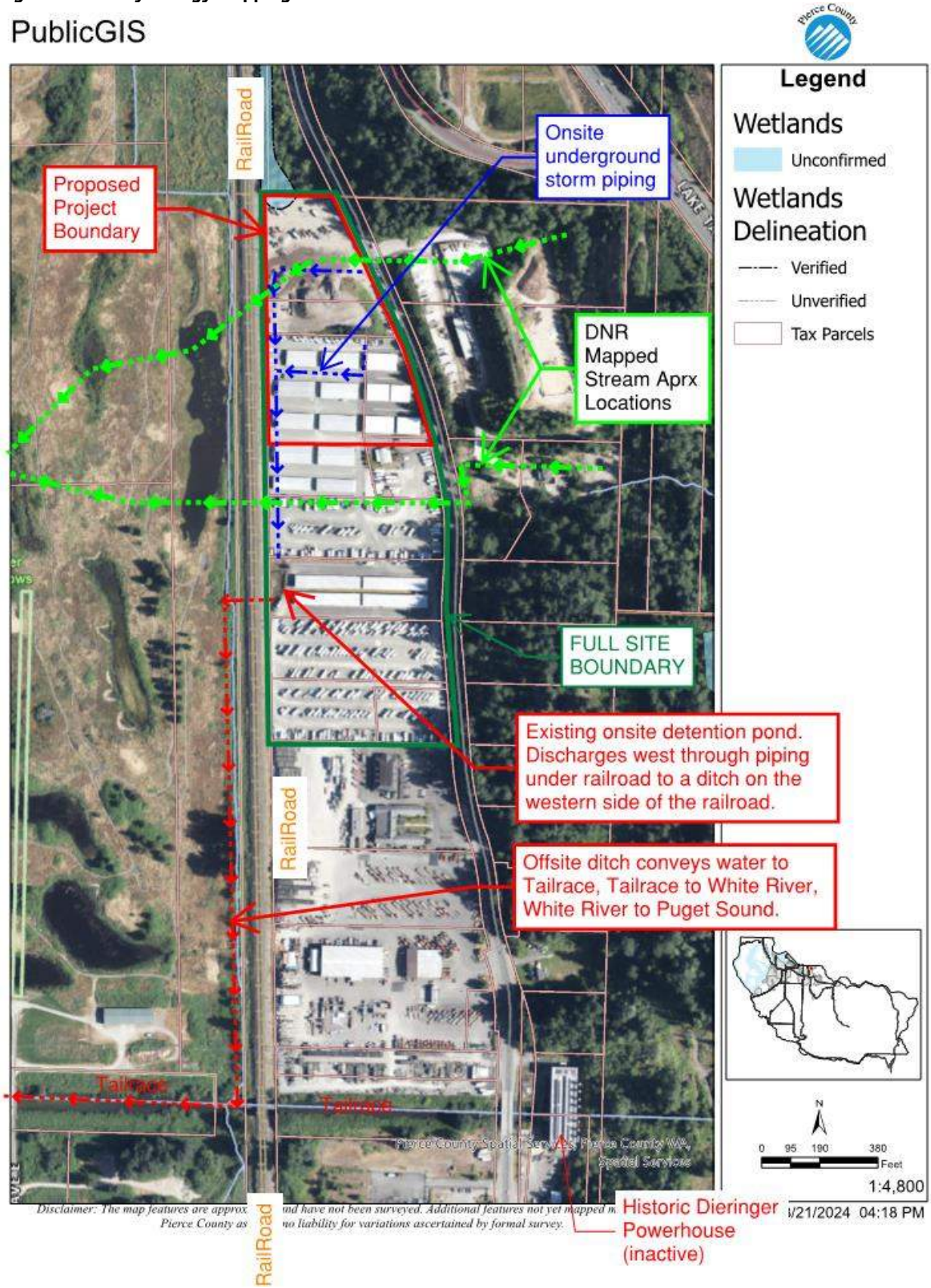
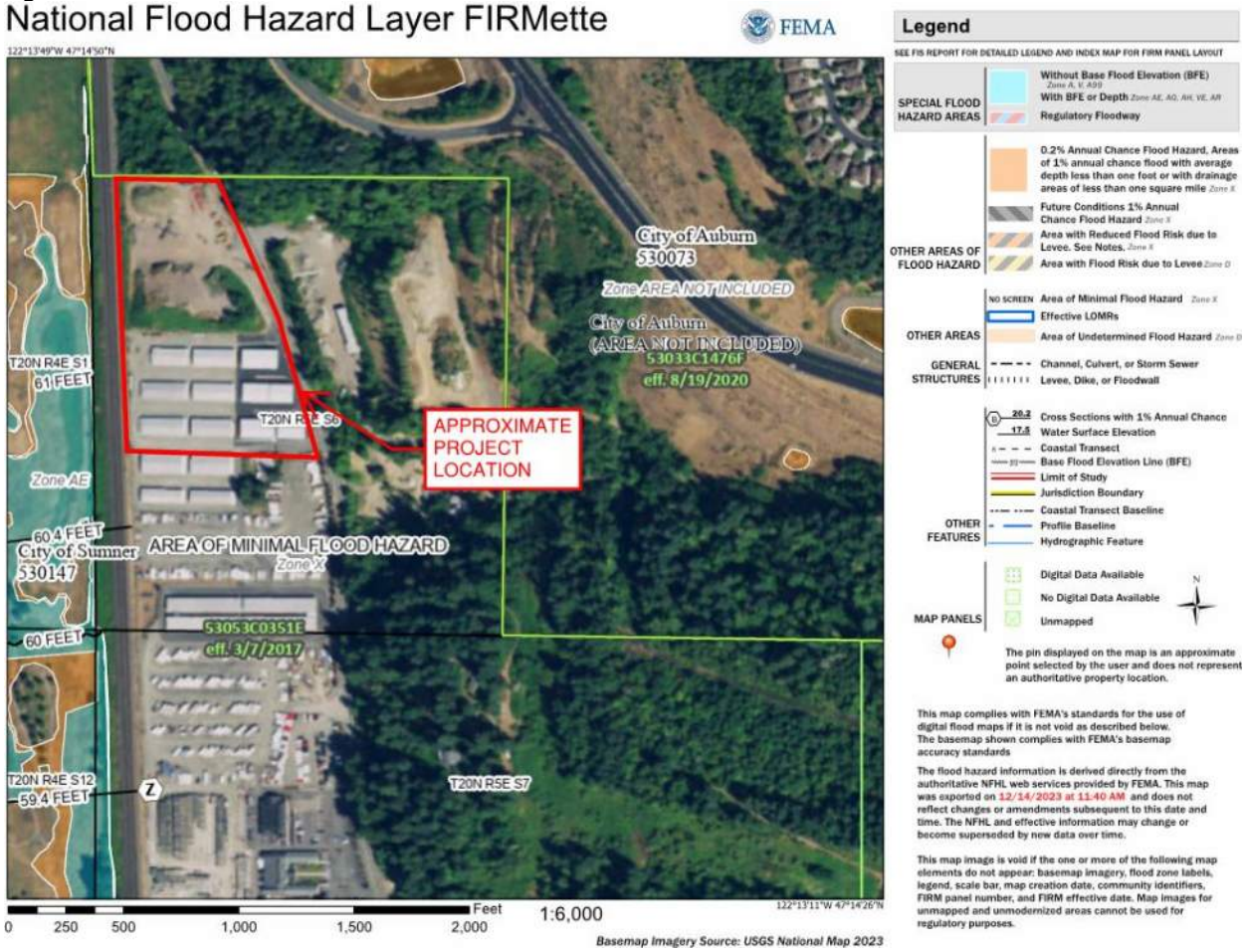


Figure 3 - Fema Flood Panel



3 Developed Site Hydrology

3.1 Summary

The project includes 195,280 square feet of disturbed area and 191,030 square feet of new and replaced impervious surfaces. Stormwater runoff will be collected, treated, and conveyed back into the existing stormwater conveyance system prior to discharging into the White River. The improvements include rerouting a portion of the existing conveyance piping, installing new catch basins and underground conveyance piping, an oil water separator, an Oldcastle Infrastructure BioPod™, and soil amendment in accordance with BMP T5.13.

3.2 Performance Standards and Goals

Please see the DOE Flow Chart, included as Figure 3 in this report, for determining the requirements for this project. Minimum Requirements #1-9 apply to the new and replaced hard surfaces and converted vegetation areas. The project discharges to the White River, a basic treatment and flow control exempt water body through man made conveyance elements: a culvert, a ditch that flows south along the western side of the railroad.

The following is a discussion to Minimum Requirements #1-9 as they apply to this proposal.

3.2.1 MR #1 – Preparation of Stormwater Site Plans
This report and the accompanying drawings satisfy this requirement.

3.2.2 MR #2 - Construction Stormwater Pollution Prevention
The Construction Stormwater Pollution Prevention Plan (CSWPPP), submitted as a separate document, was prepared in accordance with Section 2.2 in Volume II of the Manual and includes a discussion of the 13 required elements.

3.2.3 MR #3 - Source Control of Pollution
A discussion of Source Control BMPs is included in Section 3.4 of this report. Source control BMPs are also included in the Construction Stormwater Pollution Prevention Plan (CSWPPP) and project plans. These documents are bound under separate cover and included in the permit submittal package.

3.2.4 MR #4 - Preservation of Natural Drainage Systems and Outfalls
The project does not propose to change the existing drainage of the site, and will collect and convey all stormwater runoff to the existing conveyance system. There are no proposed outfalls.

3.2.5 MR #5 - On-site Stormwater Management
The project triggers Minimum Requirements #1-9 and is located inside the UGA. Therefore, in accordance with Table I-3.1, it is proposed to use List #2 to satisfy this requirement. Below is a discussion of the BMPs in List #2.

Lawn and Landscape Areas: Any disturbed areas to be lawn or landscaped will be amended in accordance with BMP T5.13 Post-Construction Soil Quality and Depth.
Roofs: No buildings or structures are proposed.
Other Hard Surfaces: The site does not have remaining native vegetation or sufficient vegetation for any dispersion and the soils underlying the site are not feasible for infiltration.

BMP T5.13 is proposed and the following BMPs are not feasible: Full Dispersion, Permeable Pavements, Bioretention, and Sheet Flow or Concentrated Flow Dispersion.

3.2.6 MR #6 – Runoff Treatment
The project has more than 5,000 square feet of new pollution generating hard surfaces (PGHS); therefore, runoff treatment is required. The Treatment Facility Selection Flow Chart, included as Figure 3, was used to determine the requirements for runoff treatment.

- Oil control is required for all areas that may store 25 vehicles or more that are over 10 tons gross weight. Oil control is not required for the other areas, as there are less than 300 total trip ends per day and vehicle washing and maintenance are not site uses.
- Phosphorous control is not required because the site does not discharge to a phosphorous sensitive water body.
- Enhanced treatment is required for all pollution generating hard surfaces in Sumner.

Oil control is required for the RV storage areas and enhanced treatment is required for all new and replaced pollution generating surfaces. An oil water separator will treat all proposed RV storage areas, and all new and replaced PGHS will be treated with an Oldcastle Infrastructure BioPod™, an enhanced treatment (metals) level technology with a Department of Ecology

General Use Level Designation. Calculations demonstrating adequate capacity in the Oil Water Separator and the Oldcastle Infrastructure BioPod™ are provided in Appendix B.

3.2.7 MR #7 – Flow Control

The project discharges to a flow control exempt water body through manmade conveyance elements, therefore; flow control is not required. The previous development on the site provided open water conveyance calculations demonstrating adequate capacity for the downstream flowpath and the 2015 Stormwater Report by Sitts & Hill Engineers, Inc. is included in Appendix G for reference. Backwater calculations for the downstream flowpath are provided in Appendix B.

The downstream flowpath through manmade conveyance elements include an offsite ditch flowing south adjacent to the west of the railroad, and the Dieringer Powerhouse Tailrace that discharges into the White River. Historic photos of the construction of the Dieringer Powerhouse and its tailrace are included in Appendix D. Capacity calculations are only provided for the ditch as the tailrace is much larger than the ditch and was built to serve the now inactive powerhouse.

The 2015 Stormwater Report (included as Appendix G of this report) calculated a peak demand flow rate of 76.67 cfs during the 24-hour, 100-year runoff event for the downstream ditch, and demonstrated the ditch conveys 76.67 cfs at a depth of 2.17 ft with an average available depth of 4 feet.

The peak demand flow rate includes drainage areas of 54.0 acres from the adjacent golf course (90% impervious at a future build-out), 74.2 acres from the east and north of the site (7% impervious), and 12.2 acres from onsite (100% impervious). These drainage areas and the percent impervious are conservative estimates and demonstrate the ditch has adequate capacity to convey the peak flow event to the tailrace.

3.2.8 MR #8 – Wetlands Protection

All disturbance will be limited to outside of the offsite wetland's buffer. Discharges from the site are to be kept to the existing hydrologic regime and are not permitted to go to the offsite wetland.

3.2.9 MR #9 – Operation and Maintenance

An Operation and Maintenance Manual, prepared in accordance with Volume V of the manual, is submitted as a separate document.

3.3 Low Impact Development Features

There are no existing or proposed Low Impact Development Features on the site.

3.4 Source Control

The following source control BMPs are applicable to the project site. Descriptions of each BMP listed can be found in Volume IV of the Manual.

Source Control BMPs Applicable to All Sites:
S410 BMPs for Correcting Illicit Discharges to Storm Drains
S453 BMPs for Formation of a Pollution Prevention Team

S454 BMPs for Preventive Maintenance / Good Housekeeping
S455 BMPs for Spill Prevention and Cleanup
S456 BMPs for Employee Training
S457 BMPs for Inspections
S458 BMPs for Record Keeping

Project Specific Source Control BMPs
S407 BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots
S411 BMPs for Landscaping and Lawn / Vegetation Maintenance
S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems
S421 BMPs for Parking and Storage of Vehicles and Equipment
S442 BMPs for Labeling Storm Drain Inlets on Your Property
S450 BMPs for Irrigation

3.5 Conveyance System Analysis and Design

The proposed on-site stormwater conveyance system consists of catch basins and storm drains and connects to the existing on-site conveyance system (at the south project limits) discharging to the regional ditch located on the west side of railroad tracks roughly 620 feet further to the south. The conveyance system (both proposed and existing) has been checked for adequacy during the 100-year, 24-hour event (for overtopping at CB rims) and during the 25-year, 24-hour event (for 0.5' between rim and HGL).

The initial tail-water elevation was set at 57.63, 2.17 feet above the bottom of the existing ditch at the discharge point, the 100-year peak water elevation calculated in the original 2015 Stormwater Report included as Appendix G of this report. Note that the peak water elevation at the ditch is still below the invert elevation of the existing 24-inch outfall pipe (57.87); therefore, the outfall condition is not submerged.

The offsite runoff from the area to the north and east of the site including forested area, mining operations and E Valley Hwy (identified as Basin 3 in the original report mentioned above) will bypass the new improvements but still remain tributary to the existing downstream conveyance system. The runoff from already developed areas located to the south of the project site (identified as Basin 2 in the original report mentioned above) were also included in the conveyance calculations.

There is an existing detention pond located in the middle of the existing Basin 2 (along western edge) that regulates the discharge from that basin; however, for the purpose of these conveyance calculations, the detention aspect of the system was omitted and non-mitigated runoff (worst case) was assumed to be tributary to the last stormwater structure on the east side of the railroad.

Santa Barbara UH hydrologic analysis using Autodesk® Storm and Sanitary Analysis software was used to analyze the on-site storm drainage system, assuming a Type 1A rainfall distribution. Refer to Appendix B, conveyance/backwater section, for detailed information.

Figure 4 - Flow Chart for Determining Requirements for Redevelopment

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment

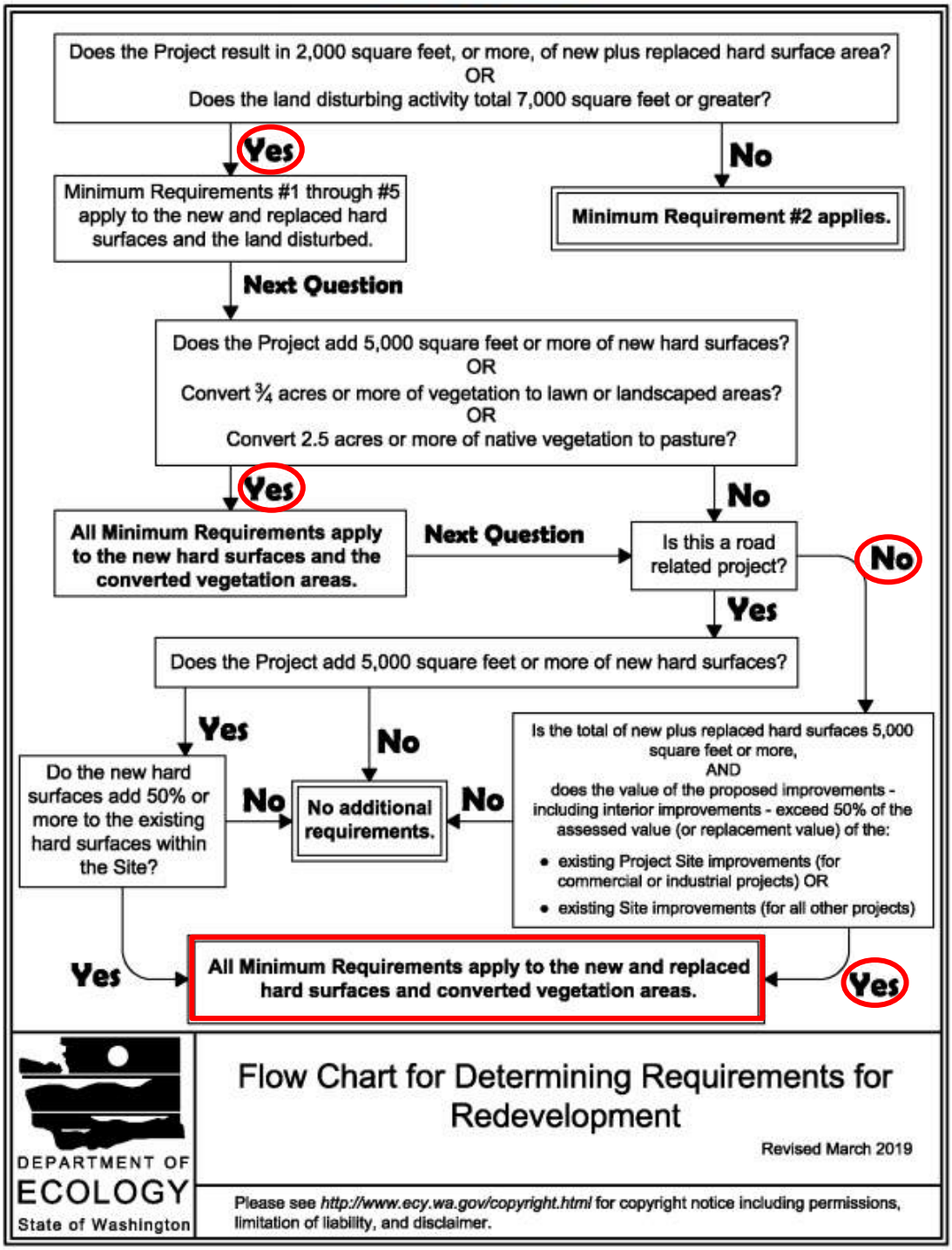
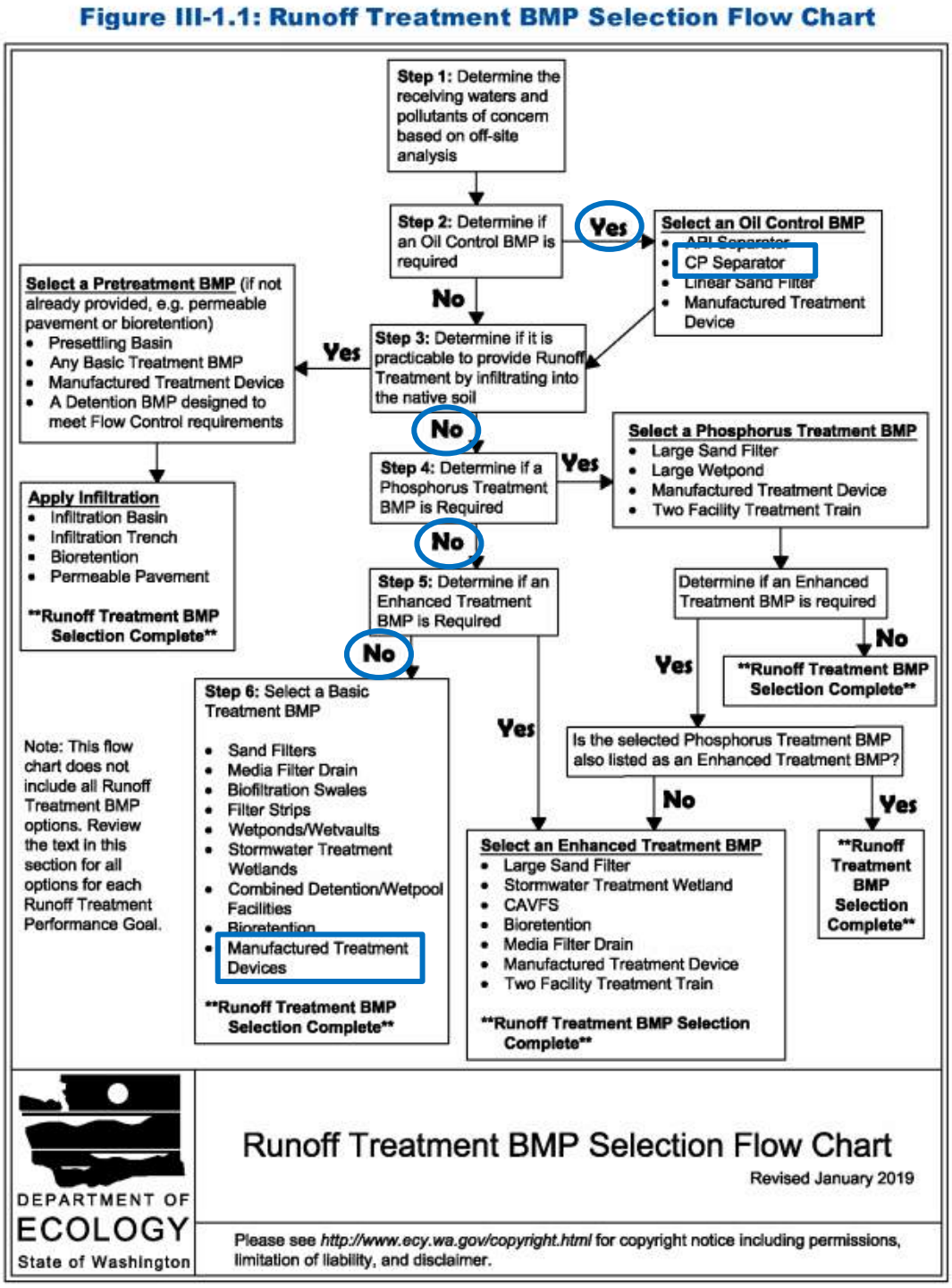
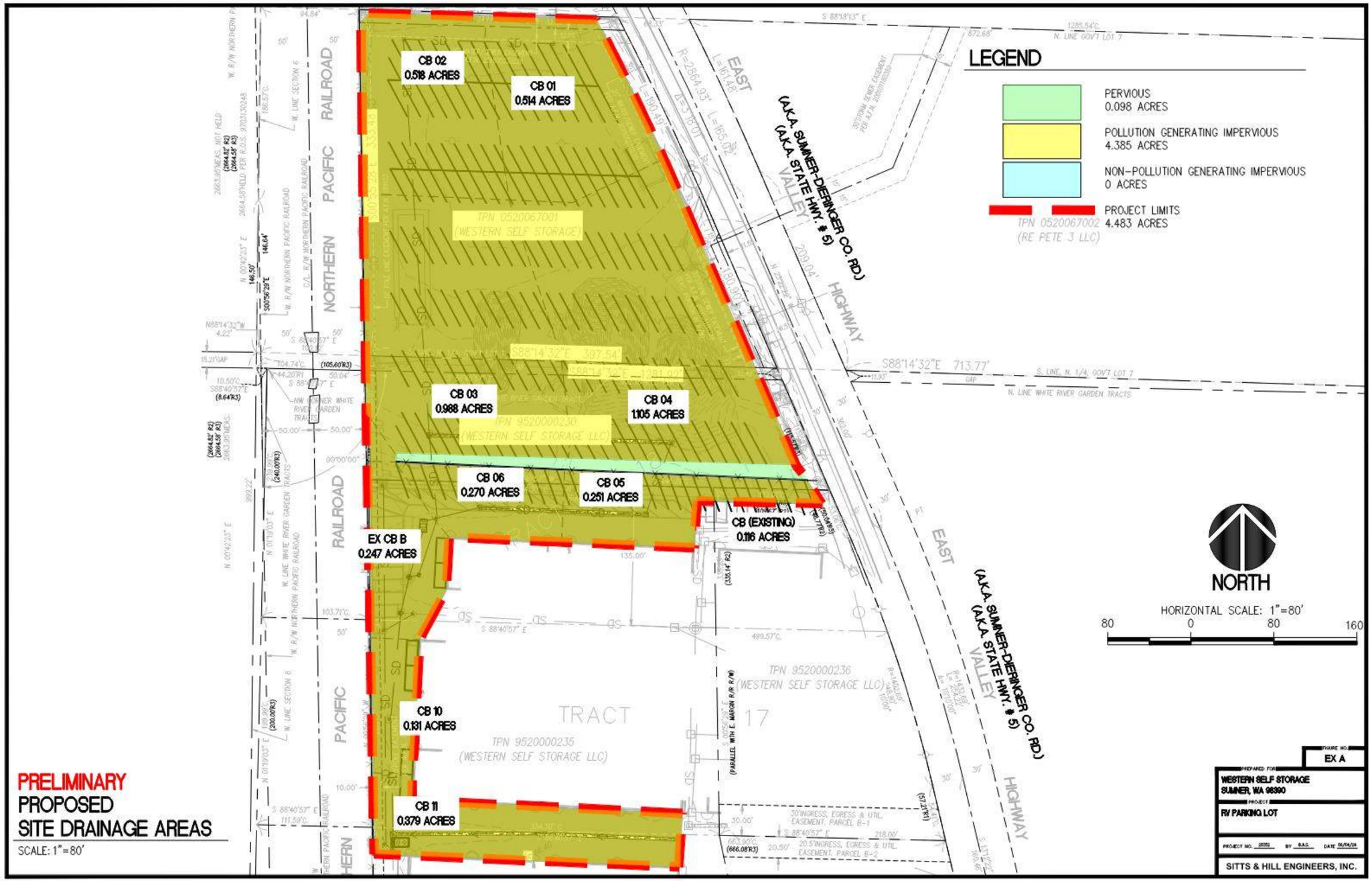


Figure 5 - Runoff Treatment BMP Selection Flow Chart



Appendix A Drainage Exhibit


CB 02
0.518 ACRES
CB 01
0.514 ACRES
CB 03
0.988 ACRES
CB 04
1.105 ACRES
CB 06
0.270 ACRES
CB 05
0.251 ACRES
CB (EXISTING)
0.116 ACRES
EX CB B
0.247 ACRES
CB 10
0.131 ACRES
CB 11
0.379 ACRES
LEGEND
PERVIOUS
0.098 ACRES
POLLUTION GENERATING IMPERVIOUS
4.385 ACRES
NON-POLLUTION GENERATING IMPERVIOUS
0 ACRES
PROJECT LIMITS
4.483 ACRES
TPN 0520067001
(WESTERN SELF STORAGE)
TPN 0520067002
(RE PETE 3 LLC)
TPN 9520000230
(WESTERN SELF STORAGE LLC)
TPN 9520000236
(WESTERN SELF STORAGE LLC)
TRACT 17
NORTHERN PACIFIC RAILROAD
EAST VALLEY HIGHWAY
(A.K.A. SUMNER-DIERINGER CO. RD.)
(A.K.A. STATE HWY. # 5)
S 88°14'32" E 713.77'
N. LINE GOV'T LOT 7
S. LINE, N. 1/4, GOV'T LOT 7
N. LINE WHITE RIVER GARDEN TRACTS
NORTH
HORIZONTAL SCALE: 1"=80'
80 0 80 160
PRELIMINARY
PROPOSED
SITE DRAINAGE AREAS
SCALE: 1"=80'
EX A
WESTERN SELF STORAGE
SUMNER, WA 98390
RV PARKING LOT
SITTS & HILL ENGINEERS, INC.

Appendix B Engineering Calculations

Calculations provided include demonstrating adequate capacity for the oil water separator, Oldcastle Infrastructure BioPod™, and conveyance elements. The demand for these calculations is driven by the contributing drainage area, as shown on the exhibits in Appendix A, and either the water quality treatment flow rate calculated by the Western Washington Hydrology Model (WWHM), a DOE approved continuous runoff hydrology model.

Oil Water Separator

The Oil Water Separator (BMP T11.11) treats runoff from CBs 01 through 07 and has a bypass for high flow events. The below calculations demonstrate adequate capacity in the proposed Oil Water Separator to treat the online water quality treatment flow rate.

Per 2019 DOE Stormwater management Manual for Western Washington, as adopted by the City of Sumner, the water quality flow rate for oil/water separator (OWS) is defined as 72% of the developed two-year peak flow rate, as determined using the WWHM model with 15-minute time steps calibrated to site conditions. See Appendix C for WWHM printout.

Tributary Basin: Ap = 0.07 ac, Ai = 3.57 ac
Water Quality Flow (off-line) Q_6 = 0.3142 cfs (141 GPM)

The design water quality flow (Q) used for the Oil Water Separator calculation is the 15-minute WQ flow determined by WWHM multiplied by (k) ratio indicated in Figure V-7.8 of the Manual. For the City of Sumner: 6-month, 24-hour precipitation (72% of 2-year) is 1.44 inches. Therefore, **k=3.5** – see Figure at the end of this chapter.

The required projected surface area for a coalescing plate device is given by the following equation.

$$A_h = \frac{Q}{Vt} = \frac{Q}{0.00386\left[\frac{S_w - S_o}{\mu}\right]}$$

where: Ah=required effective (horizontal) area of plate media (sf)
Vt=rise rate of oil droplet (ft/min)
Q= water quality design flow rate (cf/s) multiplied by k ratio
Sw=specific gravity of water (1.00)
So=specific gravity of oil (0.85)
μ=absolute viscosity of water (poises); use 0.015674 for temp=39°F

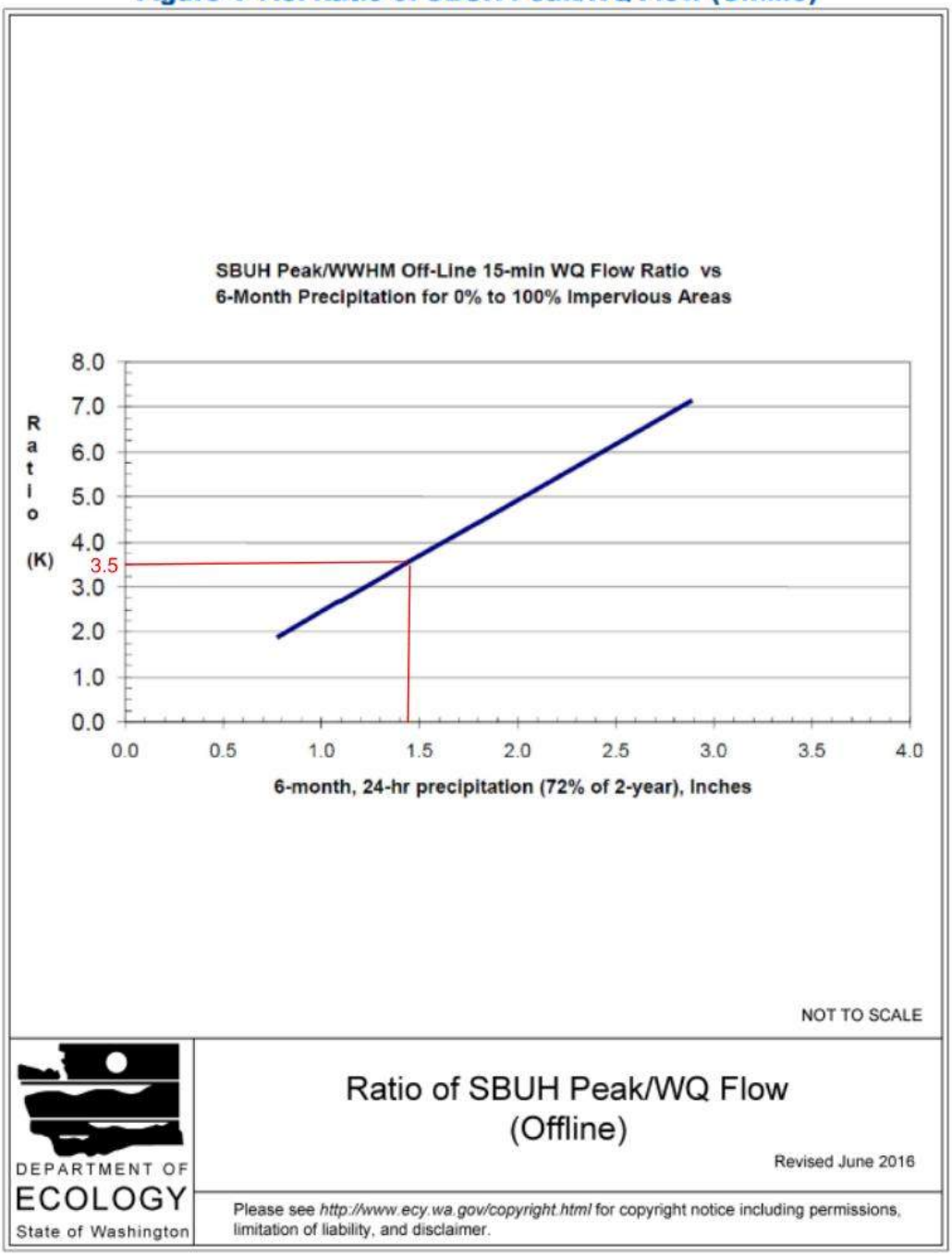
$$A_h = \frac{3.5 \times 60 x Q}{0.00386\left[\frac{1.00 - 0.85}{0.015674}\right]}$$

This equation gives a required minimum plate surface area value of **1,776 sf**.

Per DOE Manual, the plate spacing should be a minimum of ¾ inch, plate angle between 45 and 60 degrees, plate pack setback from bottom at least 6 inches, head space above plates at least 12 inches. The separator should contain forebay for floatables and afterbay for collection of effluent. An 18-inch tall baffle should separate forebay from plate stack. Access plates for ease of removal and maintenance should be provided.

The **Oldcastle Precast 612-2-CPS Oil Water Separator** is chosen to provide plate surface area of 1,776 sf and treatment rate of 438 GPM, matching the required minimum. The equivalent products may be provided that match or exceed the **design WQ flow rates**. They will be subject to verification and acceptance.

Figure V-7.8: Ratio of SBUH Peak/WQ Flow (Offline)

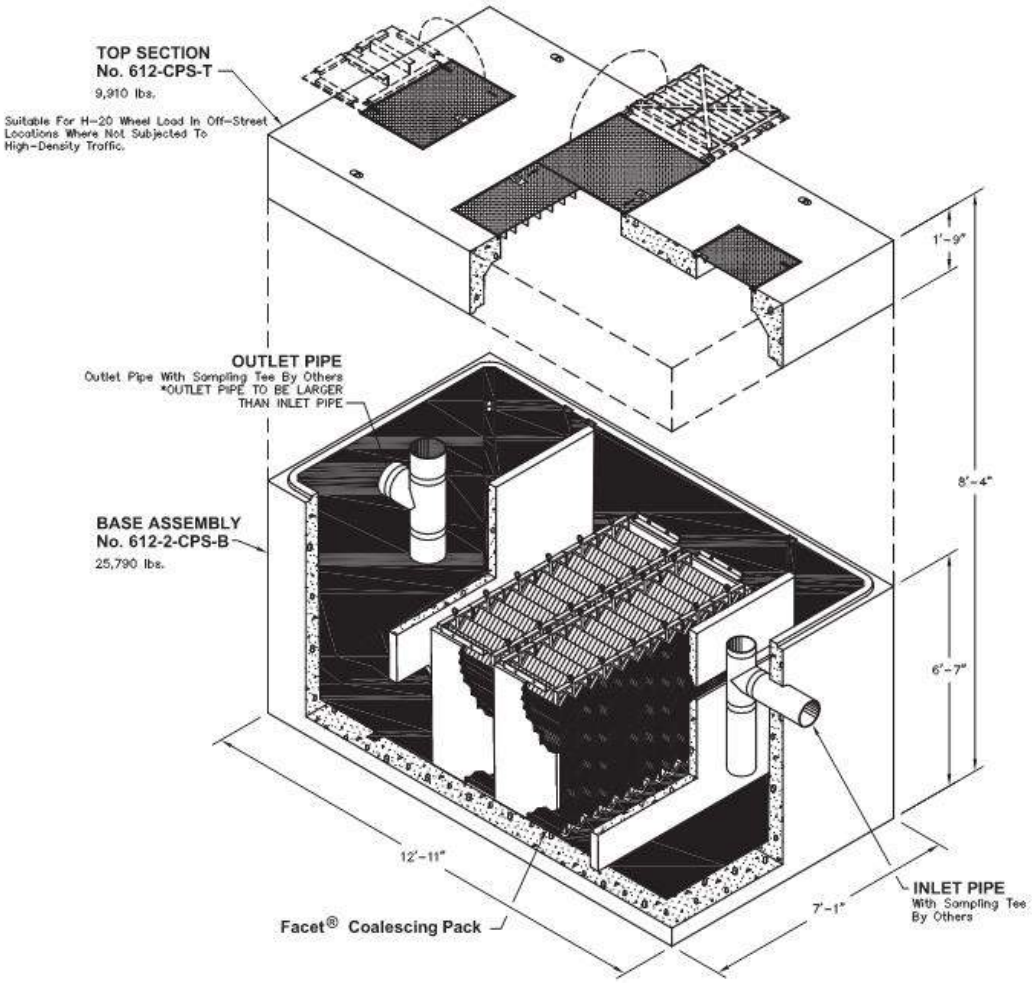


Oldcastle Precast® AUBURN

Delivering Reliability

612-2-CPS OIL WATER SEPARATOR

Project Plate Area = 1,776 Sq/ft
Maximum Process Flow = 830 GPM



FOR DETAILS, SEE REVERSE>>

Items Shown Are Subject To Change Without Notice
Issue Date: April 2016

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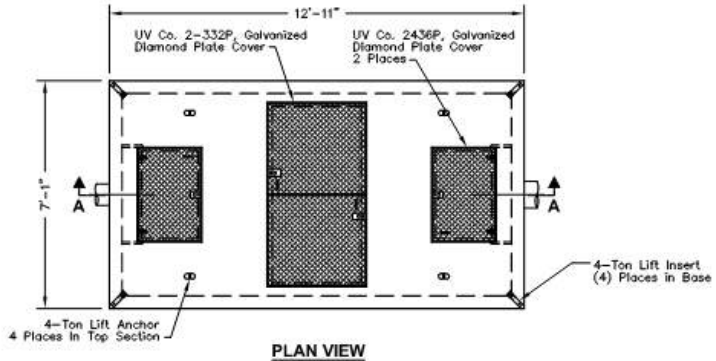
Oldcastle Precast®

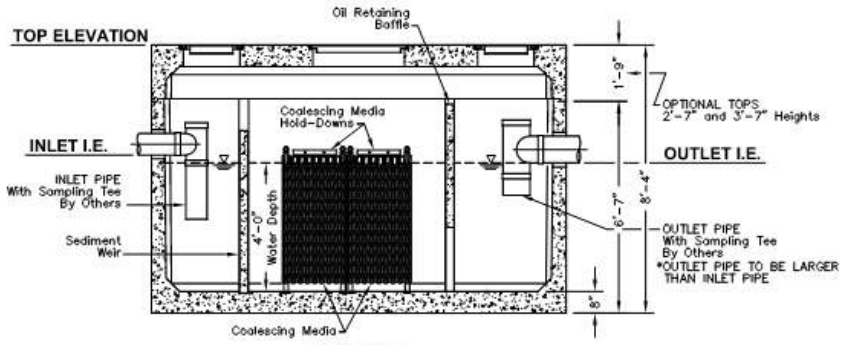
Delivering Reliability

612-2-CPS

Project Plate Area = 1,776 Sq/ft
Maximum Process Flow = 830 GPM



PLAN VIEW



SECTION AA

STRUCTURAL NOTES:
1. Concrete: 28 Day Compressive Strength f'c= 7000 psi
2. Rebar: ASTM A-615 Grade 60
3. Mesh: ASTM A-185 Grade 65
4. Design: ACI-318-05 Building Code
   ASTM C-890 "Minimum Structural Design Loading For Underground Precast Concrete Water and Wastewater Structures"
5. Loads: HS-20 Truck Wheel w/ 30% Impact Per AASHTO

GENERAL NOTES:
1. All Baffles and Weirs To Be Precast Concrete
2. Static Water Depth = 4'-0"
3. Contractor to:
   Supply and Install All Piping & Sampling Tees
   Grout In All Pipes
   Fill With Clean Water Prior To "Start-Up" Of System
   Verify All BLockout Sizes and Locations

INFORMATION NEEDED:
Top Of Separator Elevation:
Inlet Pipe Size:
Inlet Pipe Elevation:
Outlet Pipe Size:
Outlet Pipe Elevation:

BASIC DESIGN INFORMATION:
INFLUENT CHARACTERISTICS:
Oil Specific Gravity: 0.88
Operating Temperature: 50°
Influent Oil Concentration: 100 ppm
Mean oil Droplet Size: 130 Microns
0.033 ft/min Oil Rise Rate
Designed Per Washington State Department Of Ecology

FLOW RATE	EFFLUENT QUALITY	100% COLLECTED SIZE
438 GPM	10 ppm	60 Micron

145.1

opauburn.com

Oldcastle Infrastructure BioPod™

The Oldcastle Infrastructure BioPod™ treats CBs 01 through 11 and has an internal bypass for high flow events. The below calculations demonstrate adequate capacity in the proposed Oldcastle Infrastructure BioPod™ to treat the offline water quality treatment flow rate.

General Use Level Designation for Basic (TSS), Dissolved Metals (Enhanced), and Phosphorous Treatment has been issued by the Washington State Department of Ecology for the BioPod product. A copy of this approval document is included in Appendix E.

Per 2019 DOE Stormwater management Manual for Western Washington, as adopted by the City of Sumner, the water quality flow rate for BioPod is defined as 72% of the developed two-year peak flow rate, as determined using the WWHM model with 15-minute time steps calibrated to site conditions. See Appendix C for WWHM printout.

Tributary Basin: Ap = 0.07 ac, Ai = 4.33 ac
Water Quality Flow Rate (off-line) Q_6 = 0.3813 cfs

Off-line WQFR was used since the internal bypass in BioPod (6.5 cfs) is larger than 100-yr Flow Rate (3.88 cfs). Based on the project water quality design flow rate (0.3813 cfs) and the treatment flowrate of 1.6 cfs/sf of media surface area, **8' x 16' BioPod Biofilter vault** (BPU-816IB) is required able to treat up to 0.384 cfs.

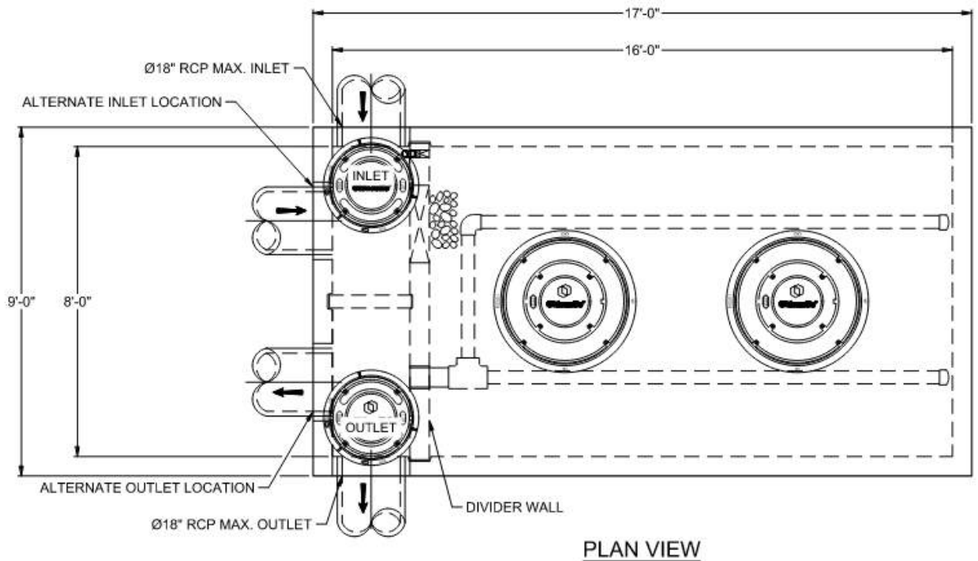
SITE SPECIFIC DATA	
Structure ID	ID
Treatment Flow Rate (cfs)	-
Peak Flow Rate (cfs)	-
Rim Elevation	-
Top of Vault Elevation	-

Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet	-	-	-	-
Outlet	-	-	-	-

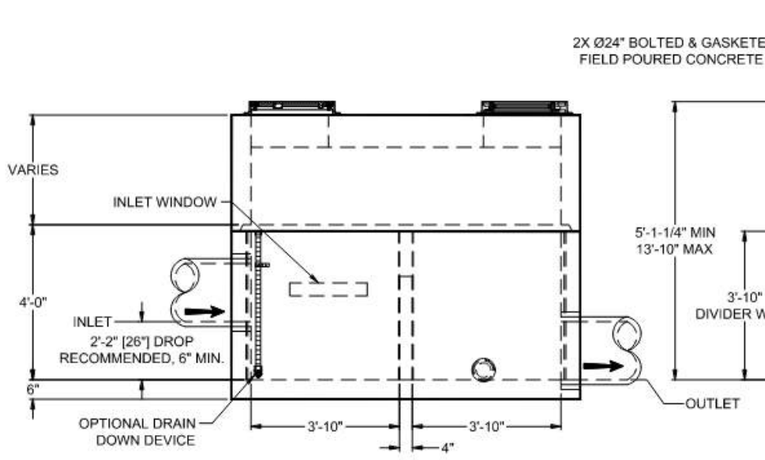
Notes:

PERFORMANCE SPECIFICATIONS	
Treatment Flow Capacities:*	
NJDEP 80% Removal, 75 micron	0.432 cfs
WA Ecology GULD - Basic, Enhanced & Phosphorus	0.384 cfs
Bypass Capacity	6.5 cfs

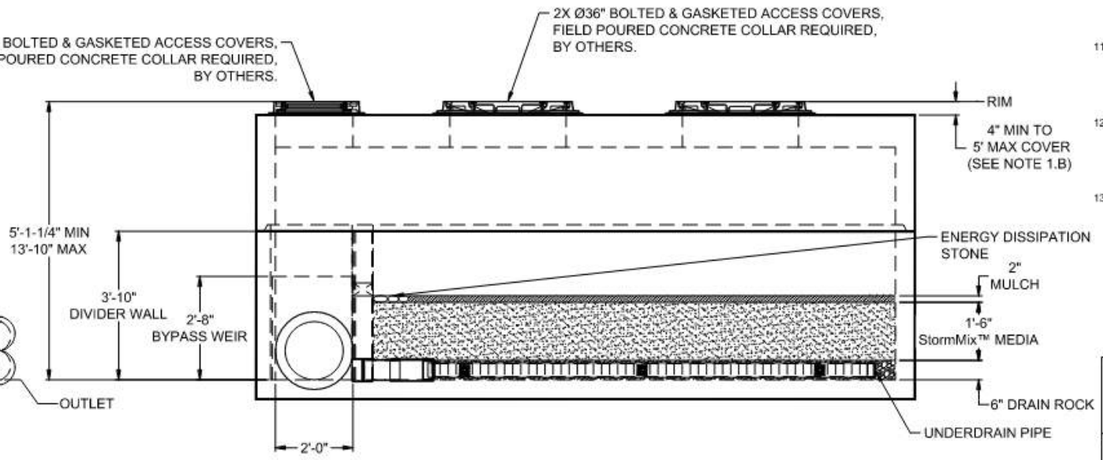
*Contact Oldcastle for alternative treatment flow capacities.



PLAN VIEW



LEFT END VIEW



ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY FY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW.
8. INLET AND OUTLET HOLES WILL BE FACTORY CORED/CAST PER PLANS AND CUSTOMER REQUIREMENTS. INLET AND OUTLET LOCATIONS CAN BE MIRRORED.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. MAXIMUM PICK WEIGHTS*:
    A. TOP: XX,XXX LBS
    B. BASE: XX,XXX LBS*
    (* COMBINED WEIGHT OF BASE INCLUDES BYPASS WEIR, DIVIDER WALL, ROCK & MEDIA)
13. INTERNALS SHALL CONSIST OF UNDERDRAIN PIPE, ROCK, STORMMIX™ MEDIA, MULCH, DIVIDER WALL, BYPASS WEIR AND OPTIONAL DRAIN DOWN.

Oldcastle Infrastructure
A CRH COMPANY

Ph: 800.579.8818 | www.oldcastleinfrastructure.com/stormwater

BioPod™ Biofilter System (STANDARD)
Underground Vault with Internal Bypass

CUSTOMER: -
PROJECT NAME: -

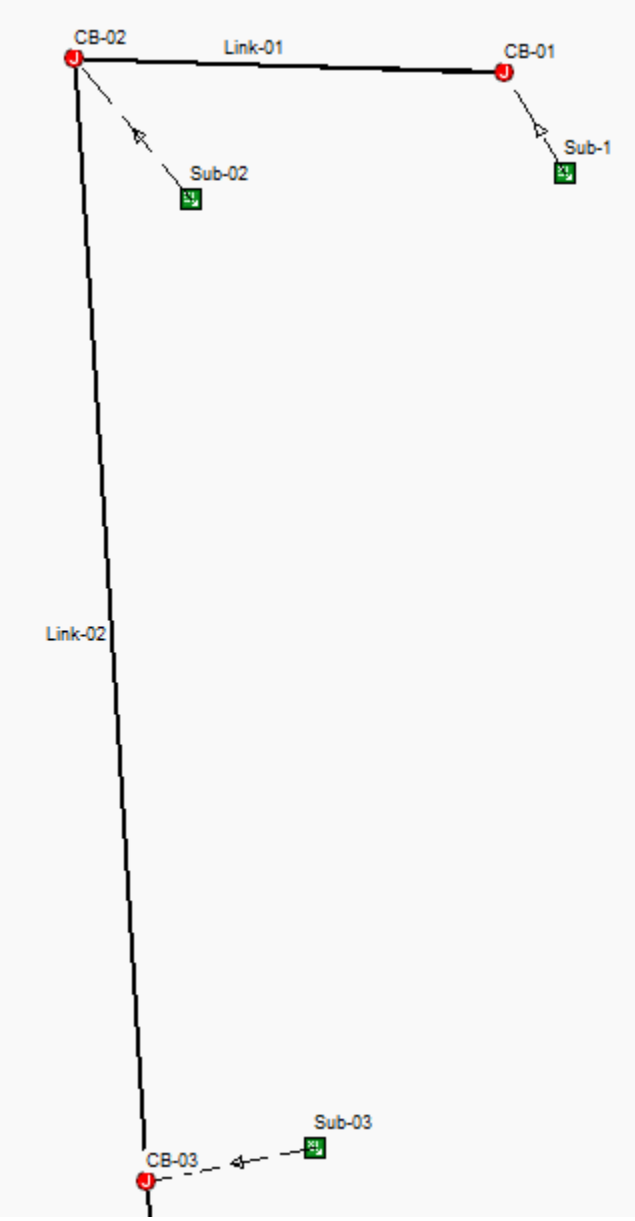
SHEET NAME	REVISION	SHEET
Specifier Drawing BPU-816IB	- REV DATE -	1 OF 1

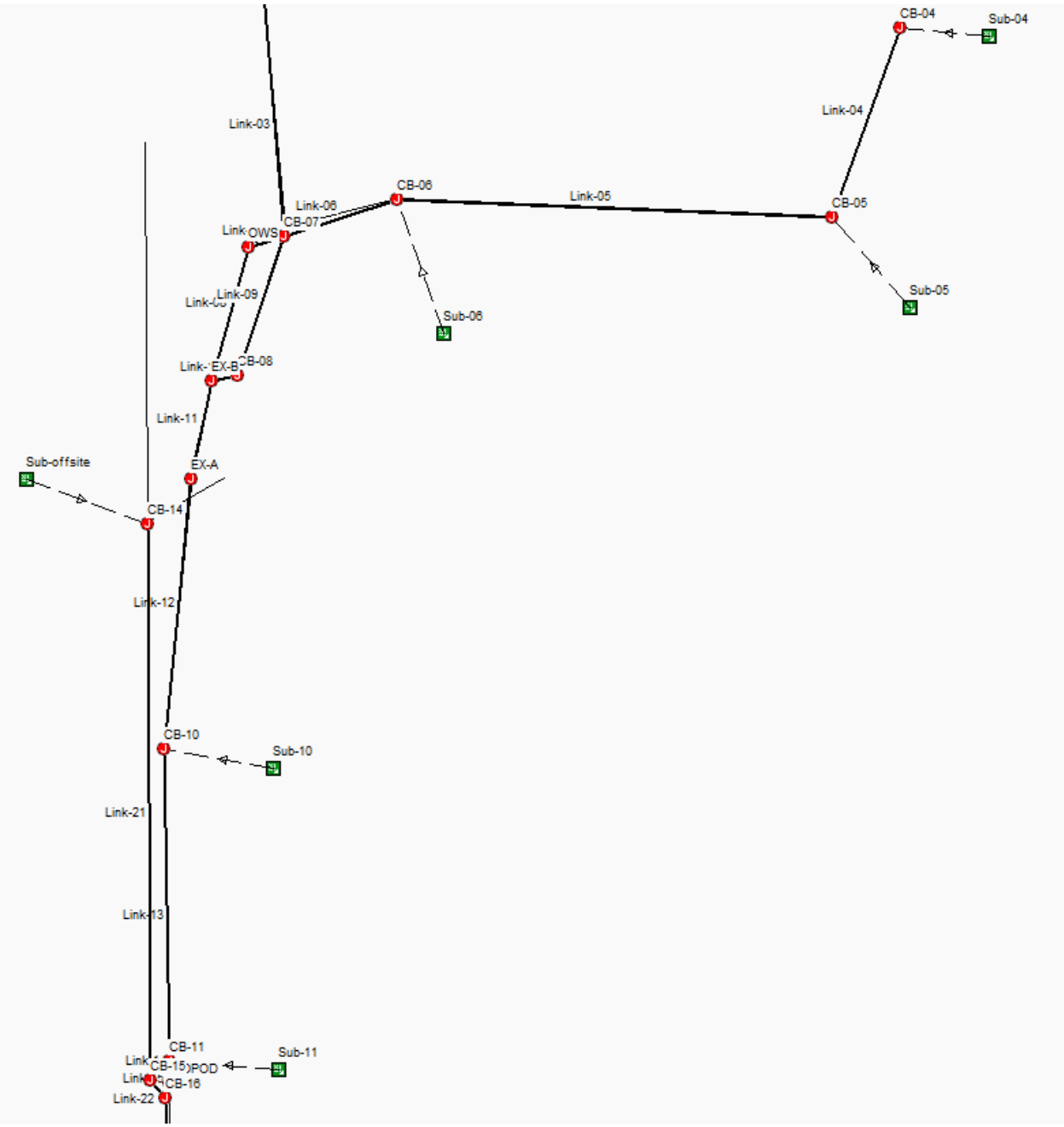
Bioretention/ Bioinfiltration

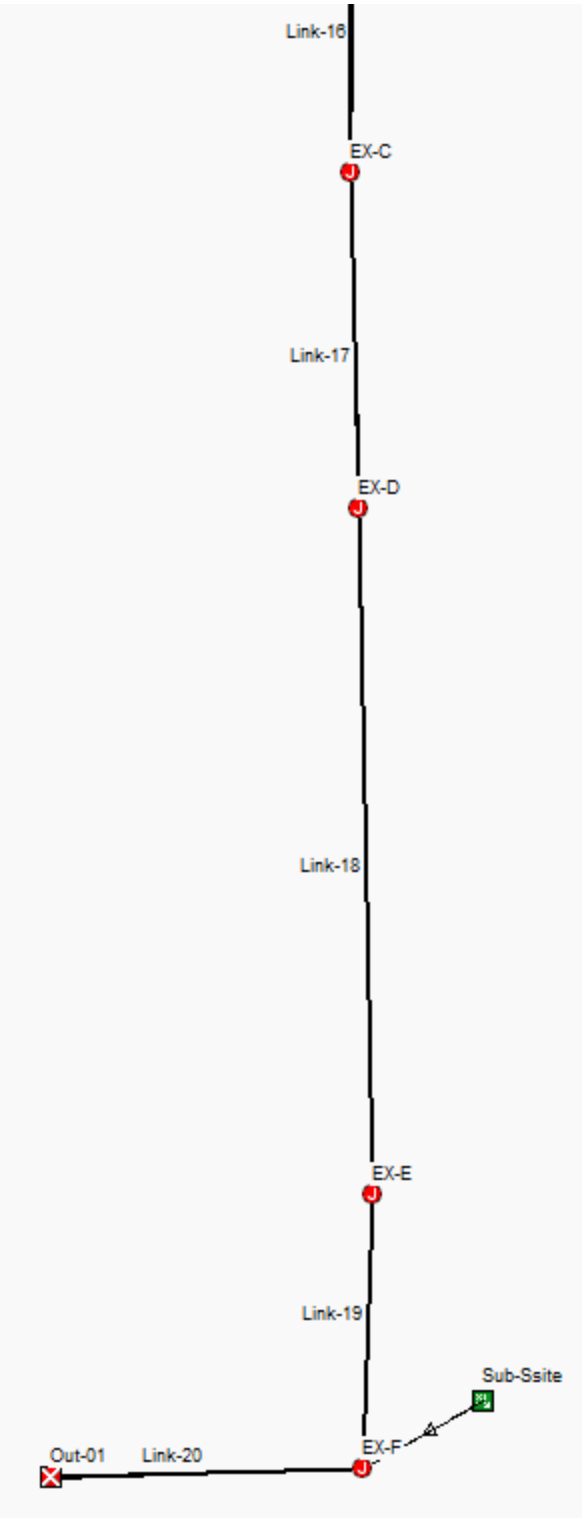
Conveyance and Backwater Calculations

Santa Barbara UH hydrologic analysis using Autodesk® Storm and Sanitary Analysis software and assuming a Type 1A rainfall distribution has been performed assuming tailwater elevation of 57.63 feet at regional drainage ditch.

Based on the calculation below, it was confirmed that there is at least 0.5' freeboard between proposed Rims and HGL during the 25-year, 24-hour event – see attached profiles with HGL marked in blue for visual presentation of the attached calculations. The calculations show that a short-time overtopping may occur during the 100-year, 24-hour event in few structures; however, the project area is already gravel, which is considered impervious (from stormwater runoff perspective), tributary to the same downstream conveyance system and no drainage capacity issues or overtopping was noted on the site.




CB-04
Sub-04
Link-04
Link-03
CB-06
Link-06
Link-05
CB-05
CB-07
Link-OWS
Sub-06
Sub-05
Link-09
CB-08
Link-11
Sub-offsite
EX-A
CB-14
Link-12
CB-10
Sub-10
Link-21
Link-13
CB-11
Sub-11
CB-16
Link-22


Link-16
EX-C
Link-17
EX-D
Link-18
EX-E
Link-19
Sub-Ssite
EX-F
Out-01
Link-20

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Autodesk® Storm and Sanitary Analysis 2016 - Version 13.0.94 (Build 0)
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*******************
Project Description
*******************
File Name ................. 20352 - SSA.SPF

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Analysis Options
****************
Flow Units ................. cfs
Subbasin Hydrograph Method. Santa Barbara UH
Time of Concentration...... SCS TR-55
Link Routing Method ....... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date ............. MAY-29-2024 00:00:00
Ending Date ............... MAY-30-2024 00:00:00
Report Time Step .......... 00:00:10
Time Series ID .......... 25-years
    Description ........... 25-year intensity storm for Pierce County, Washington, with a total rainfall
    amount of 3.5 in using a SCS Type IA 24-hr storm distribution.
*************
Element Count
*************
Number of rain gages ...... 0
Number of subbasins ....... 10
Number of nodes ........... 23
Number of links ........... 22

****************
Subbasin Summary
****************
Subbasin                 Total    Imperv.    Raingage
                          Area       Area
ID                       acres          %
--------------------------------------------------
Sub-02                    0.52     100.00    StormGage
Sub-03                    0.99     100.00    StormGage
Sub-04                    1.11     100.00    StormGage
Sub-05                    0.25      85.00    StormGage
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Sub-06	0.27	87.00	StormGage
Sub-1	0.51	100.00	StormGage
Sub-10	0.13	100.00	StormGage
Sub-11	0.38	100.00	StormGage
Sub-offsite	74.20	7.00	StormGage
Sub-Ssite	7.84	100.00	StormGage

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Node Summary
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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
BIOPOD	JUNCTION	60.46	65.56	0.00	
CB-01	JUNCTION	70.00	72.10	0.00	
CB-02	JUNCTION	69.28	71.50	0.00	
CB-03	JUNCTION	67.37	69.50	0.00	
CB-04	JUNCTION	67.60	69.70	0.00	
CB-05	JUNCTION	64.90	67.02	0.00	
CB-06	JUNCTION	64.10	67.02	0.00	
CB-07	JUNCTION	63.89	67.95	0.00	
CB-08	JUNCTION	63.50	67.48	0.00	
CB-10	JUNCTION	62.67	65.55	0.00	
CB-11	JUNCTION	62.11	65.32	0.00	
CB-14	JUNCTION	60.30	66.68	0.00	
CB-15	JUNCTION	60.10	65.52	0.00	
CB-16	JUNCTION	60.08	65.79	0.00	
EX-A	JUNCTION	63.18	66.22	0.00	
EX-B	JUNCTION	63.36	67.37	0.00	
EX-C	JUNCTION	59.75	65.10	0.00	
EX-D	JUNCTION	59.44	64.56	0.00	
EX-E	JUNCTION	58.57	68.00	0.00	
EX-F	JUNCTION	58.24	68.18	0.00	
OWS	JUNCTION	63.59	68.12	0.00	
Out-01	OUTFALL	57.87	59.87	0.00	

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Link Summary
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Link	From Node	To Node	Element	Length	Slope	Manning's

ID			Type	ft	%	Roughness
Link-01	CB-01	CB-02	CONDUIT	144.0	0.5000	0.0120
Link-02	CB-02	CB-03	CONDUIT	382.0	0.5000	0.0120
Link-03	CB-03	CB-07	CONDUIT	80.0	4.3500	0.0120
Link-04	CB-04	CB-05	CONDUIT	74.0	3.6486	0.0120
Link-05	CB-05	CB-06	CONDUIT	160.0	0.5000	0.0120
Link-06	CB-06	CB-07	CONDUIT	42.0	0.5000	0.0120
Link-07	CB-07	OWS	CONDUIT	10.0	0.5000	0.0120
Link-08	OWS	EX-B	CONDUIT	45.0	0.5111	0.0120
Link-09	CB-07	CB-08	CONDUIT	58.0	1.7241	0.0150
Link-10	CB-08	EX-B	CONDUIT	9.0	1.5556	0.0120
Link-11	EX-B	EX-A	CONDUIT	36.0	0.5000	0.0120
Link-12	EX-A	CB-10	CONDUIT	102.0	0.5000	0.0120
Link-13	CB-10	CB-11	CONDUIT	111.0	0.5045	0.0120
Link-14	CB-11	BIOPOD	CONDUIT	8.0	0.5000	0.0120
Link-15	BIOPOD	CB-16	CONDUIT	8.0	4.7500	0.0150
Link-16	CB-16	EX-C	CONDUIT	85.0	0.3882	0.0120
Link-17	EX-C	EX-D	CONDUIT	89.0	0.3483	0.0240
Link-18	EX-D	EX-E	CONDUIT	249.0	0.3494	0.0240
Link-19	EX-E	EX-F	CONDUIT	91.0	0.3626	0.0240
Link-20	EX-F	Out-01	CONDUIT	104.7	0.3535	0.0120
Link-21	CB-14	CB-15	CONDUIT	206.0	0.2000	0.0120
Link-22	CB-15	CB-16	CONDUIT	10.0	0.2000	0.0120

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Link-02	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Link-03	CIRCULAR	1.00	1.00	1	0.79	0.25	8.05
Link-04	CIRCULAR	1.00	1.00	1	0.79	0.25	7.37
Link-05	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Link-06	CIRCULAR	1.50	1.50	1	1.77	0.38	8.05
Link-07	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Link-08	CIRCULAR	1.25	1.25	1	1.23	0.31	5.00
Link-09	CIRCULAR	1.00	1.00	1	0.79	0.25	4.05
Link-10	CIRCULAR	1.00	1.00	1	0.79	0.25	4.81

Link-11	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Link-12	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Link-13	CIRCULAR	1.25	1.25	1	1.23	0.31	4.97
Link-14	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Link-15	CIRCULAR	1.50	1.50	1	1.77	0.38	19.84
Link-16	CIRCULAR	2.00	2.00	1	3.14	0.50	15.27
Link-17	CIRCULAR	2.00	2.00	1	3.14	0.50	7.23
Link-18	CIRCULAR	2.00	2.00	1	3.14	0.50	7.24
Link-19	CIRCULAR	2.00	2.00	1	3.14	0.50	7.38
Link-20	CIRCULAR	2.00	2.00	1	3.14	0.50	14.57
Link-21	CIRCULAR	2.00	2.00	1	3.14	0.50	10.96
Link-22	CIRCULAR	2.00	2.00	1	3.14	0.50	10.96

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	25.059	3.489
Surface Runoff	12.031	1.675
Continuity Error (%)	-0.000	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	11.991	3.908
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.038	0.012
Continuity Error (%)	0.000	

Composite Curve Number Computations Report

Subbasin Sub-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.52		98.00

Subbasin Sub-03

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.99		98.00

Subbasin Sub-04

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	1.11		98.00

Subbasin Sub-05

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.25		96.20

Subbasin Sub-06

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.27		96.44

Subbasin Sub-1

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.51		98.00

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Subbasin Sub-10
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                                                        Area           Soil
Soil/Surface Description                               (acres)         Group          CN
-------------------------------------------------------------------------------------
Composite Area & Weighted CN                             0.13                       98.00

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Subbasin Sub-11
------------------
                                                        Area           Soil
Soil/Surface Description                               (acres)         Group          CN
-------------------------------------------------------------------------------------
Composite Area & Weighted CN                             0.38                       98.00

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Subbasin Sub-offsite
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                                                        Area           Soil
Soil/Surface Description                               (acres)         Group          CN
-------------------------------------------------------------------------------------
Composite Area & Weighted CN                            74.20                       78.47

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Subbasin Sub-Ssite
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                                                        Area           Soil
Soil/Surface Description                               (acres)         Group          CN
-------------------------------------------------------------------------------------
Composite Area & Weighted CN                             7.84                       98.00


************************************************
SCS TR-55 Time of Concentration Computations Report
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Sheet Flow Equation
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        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))
```

```
        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
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        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
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        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
```

```
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness

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Subbasin Sub-02
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        User-Defined TOC override (minutes):      6.00

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Subbasin Sub-03
------------------

        User-Defined TOC override (minutes):      6.00

------------------
Subbasin Sub-04
------------------

        User-Defined TOC override (minutes):      6.00

------------------
Subbasin Sub-05
------------------

        User-Defined TOC override (minutes):      6.00

------------------
Subbasin Sub-06
------------------

        User-Defined TOC override (minutes):      6.00

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Subbasin Sub-1
-----------------

        User-Defined TOC override (minutes):      6.00
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Subbasin Sub-10
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        User-Defined TOC override (minutes):      6.00

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Subbasin Sub-11
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        User-Defined TOC override (minutes):      6.00

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Subbasin Sub-offsite
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        User-Defined TOC override (minutes):    139.47

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Subbasin Sub-Ssite
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        User-Defined TOC override (minutes):     18.29

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Subbasin Runoff Summary
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Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-02	3.49	3.26	0.42	98.000	0	00:06:00
Sub-03	3.49	3.26	0.80	98.000	0	00:06:00
Sub-04	3.49	3.26	0.90	98.000	0	00:06:00
Sub-05	3.49	3.08	0.19	96.200	0	00:06:00
Sub-06	3.49	3.11	0.21	96.440	0	00:06:00
Sub-1	3.49	3.26	0.42	98.000	0	00:06:00
Sub-10	3.49	3.26	0.11	98.000	0	00:06:00

Sub-11	3.49	3.26	0.31	98.000	0	00:06:00
Sub-offsite	3.49	1.42	8.44	78.470	0	02:19:28
Sub-Ssite	3.49	3.24	5.39	98.000	0	00:18:17

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Node Depth Summary
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Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
BIOPOD	1.09	3.31	63.77	0	08:08	0	0	0:00:00
CB-01	0.11	0.26	70.26	0	07:54	0	0	0:00:00
CB-02	0.16	0.40	69.68	0	07:55	0	0	0:00:00
CB-03	0.13	0.31	67.68	0	07:55	0	0	0:00:00
CB-04	0.10	0.24	67.84	0	07:54	0	0	0:00:00
CB-05	0.18	0.44	65.34	0	07:54	0	0	0:00:00
CB-06	0.19	0.67	64.77	0	07:56	0	0	0:00:00
CB-07	0.33	0.84	64.73	0	07:56	0	0	0:00:00
CB-08	0.17	0.86	64.36	0	08:06	0	0	0:00:00
CB-10	0.29	1.40	64.07	0	08:07	0	0	0:00:00
CB-11	0.41	1.75	63.86	0	08:07	0	0	0:00:00
CB-14	1.55	3.75	64.05	0	08:08	0	0	0:00:00
CB-15	1.51	3.70	63.80	0	08:08	0	0	0:00:00
CB-16	1.43	3.63	63.71	0	08:08	0	0	0:00:00
EX-A	0.29	1.06	64.24	0	08:07	0	0	0:00:00
EX-B	0.31	1.00	64.36	0	08:06	0	0	0:00:00
EX-C	1.59	3.68	63.43	0	08:08	0	0	0:00:00
EX-D	1.49	3.28	62.72	0	08:07	0	0	0:00:00
EX-E	1.38	2.43	61.00	0	08:06	0	0	0:00:00
EX-F	1.11	2.01	60.25	0	08:06	0	0	0:00:00
OWS	0.31	0.90	64.49	0	08:06	0	0	0:00:00
Out-01	0.90	1.39	59.26	0	08:06	0	0	0:00:00

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Node Flow Summary
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Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
BIOPOD	JUNCTION	0.00	3.31	0	07:55	0.00		
CB-01	JUNCTION	0.42	0.42	0	07:54	0.00		
CB-02	JUNCTION	0.42	0.84	0	07:54	0.00		
CB-03	JUNCTION	0.80	1.63	0	07:55	0.00		
CB-04	JUNCTION	0.90	0.90	0	07:54	0.00		
CB-05	JUNCTION	0.19	1.09	0	07:54	0.00		
CB-06	JUNCTION	0.21	1.30	0	07:54	0.00		
CB-07	JUNCTION	0.00	2.93	0	07:55	0.00		
CB-08	JUNCTION	0.00	0.47	0	07:56	0.00		
CB-10	JUNCTION	0.11	3.03	0	07:56	0.00		
CB-11	JUNCTION	0.31	3.33	0	07:55	0.00		
CB-14	JUNCTION	8.44	8.44	0	09:18	0.00		
CB-15	JUNCTION	0.00	8.44	0	09:18	0.00		
CB-16	JUNCTION	0.00	9.76	0	08:10	0.00		
EX-A	JUNCTION	0.00	2.92	0	07:56	0.00		
EX-B	JUNCTION	0.00	2.92	0	07:56	0.00		
EX-C	JUNCTION	0.00	9.76	0	08:10	0.00		
EX-D	JUNCTION	0.00	9.76	0	08:10	0.00		
EX-E	JUNCTION	0.00	9.76	0	08:10	0.00		
EX-F	JUNCTION	5.39	14.92	0	08:06	0.00		
OWS	JUNCTION	0.00	2.45	0	07:55	0.00		
Out-01	OUTFALL	0.00	14.92	0	08:06	0.00		

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Outfall Loading Summary
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Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-01	99.70	6.94	14.92

System 99.70 6.94 14.92

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Link Flow Summary
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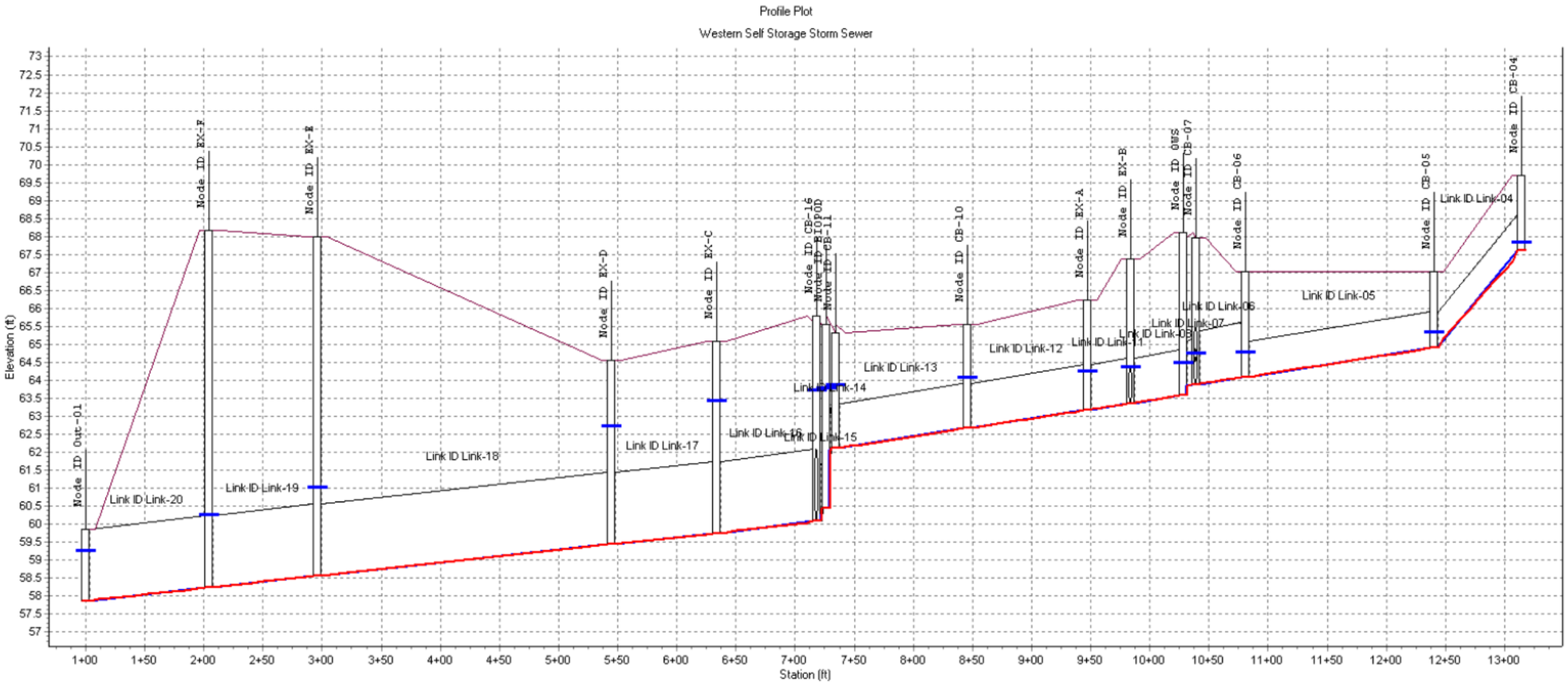
Link ID	Element Type	Time of Peak Flow Occurrence days	hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Link-01	CONDUIT	0	07:54	1.83	1.00	0.42	2.73	0.15	0.33	0	Calculated
Link-02	CONDUIT	0	07:55	3.36	1.00	0.83	2.73	0.31	0.35	0	Calculated
Link-03	CONDUIT	0	07:55	3.51	1.00	1.63	8.05	0.20	0.57	0	Calculated
Link-04	CONDUIT	0	07:54	3.85	1.00	0.90	7.37	0.12	0.34	0	Calculated
Link-05	CONDUIT	0	07:54	2.42	1.00	1.09	2.73	0.40	0.56	0	Calculated
Link-06	CONDUIT	0	07:55	1.45	1.00	1.29	8.05	0.16	0.51	0	Calculated
Link-07	CONDUIT	0	07:55	3.30	1.00	2.45	4.95	0.50	0.59	0	Calculated
Link-08	CONDUIT	0	07:55	2.73	1.00	2.45	5.00	0.49	0.76	0	Calculated
Link-09	CONDUIT	0	07:56	1.19	1.00	0.47	4.05	0.12	0.53	0	Calculated
Link-10	CONDUIT	0	07:56	0.67	1.00	0.47	4.81	0.10	0.93	0	Calculated
Link-11	CONDUIT	0	07:56	3.26	1.00	2.92	4.95	0.59	0.82	0	Calculated
Link-12	CONDUIT	0	07:56	3.46	1.00	2.92	4.95	0.59	0.92	0	Calculated
Link-13	CONDUIT	0	07:55	3.17	1.00	3.03	4.97	0.61	1.00	10	SURCHARGED
Link-14	CONDUIT	0	07:55	3.68	1.00	3.31	4.95	0.67	1.00	22	SURCHARGED
Link-15	CONDUIT	0	07:54	2.45	1.00	3.26	19.84	0.16	1.00	251	SURCHARGED
Link-16	CONDUIT	0	08:10	3.11	1.00	9.76	15.27	0.64	1.00	232	SURCHARGED
Link-17	CONDUIT	0	08:10	3.11	1.00	9.76	7.23	1.35	1.00	224	SURCHARGED
Link-18	CONDUIT	0	08:10	3.11	1.00	9.76	7.24	1.35	1.00	78	SURCHARGED
Link-19	CONDUIT	0	08:11	3.18	1.00	9.76	7.38	1.32	1.00	2	SURCHARGED
Link-20	CONDUIT	0	08:06	5.25	1.00	14.92	14.57	1.02	0.85	0	> CAPACITY
Link-21	CONDUIT	0	09:18	2.69	1.00	8.44	10.96	0.77	1.00	243	SURCHARGED
Link-22	CONDUIT	0	09:18	2.69	1.00	8.44	10.96	0.77	1.00	232	SURCHARGED

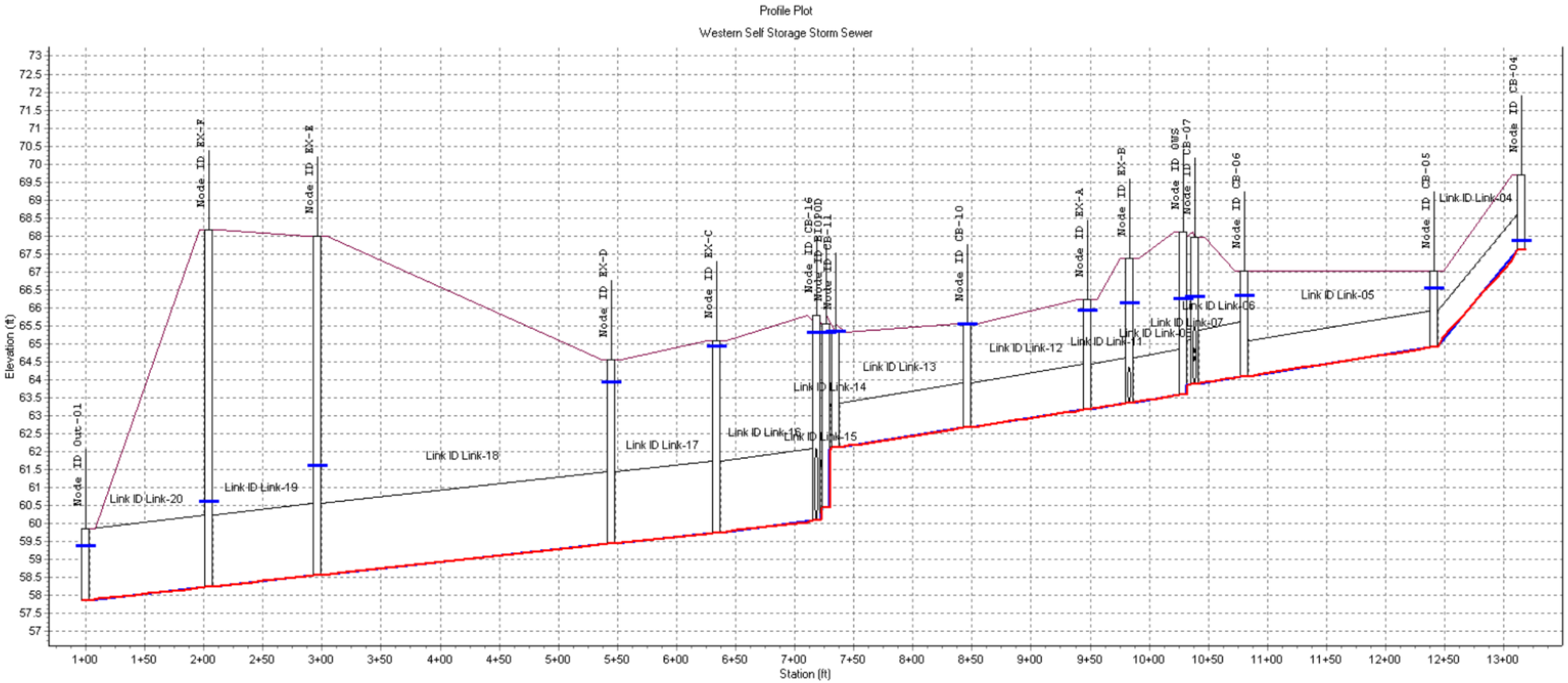
25-yr, 24-hr storm event - HGL elevations profile



Node ID:	Out-01	EX-F	EX-E	EX-D	EX-C	CB-16	CB-11	CB-10	EX-A	EX-B	OWS	CB-07	CB-06	CB-05	CB-04
Rim (ft):		68.18	68.00	64.56	65.10	65.55	65.55	65.55	66.22	67.37	68.32	67.95	67.02	67.02	69.70
Invert (ft):	57.87	58.24	58.57	59.44	59.75	60.08	60.31	62.67	63.18	63.36	63.59	63.89	64.10	64.90	67.60
Min Pipe Cover (ft):		7.94	7.43	3.12	3.35	3.72	3.24	1.63	1.79	2.76	3.03	3.45	1.42	1.12	1.10
Max HGL (ft):	59.26	60.25	61.00	62.72	63.43	63.86	63.86	64.07	64.24	64.36	64.46	64.73	64.77	65.34	67.84

Link ID:	Link-20	Link-19	Link-18	Link-17	Link-16	Link-15	Link-14	Link-13	Link-12	Link-11	Link-08	Link-07	Link-06	Link-05	Link-04
Length (ft):	104.67	91.00	249.00	89.00	85.00	8.00	8.00	111.00	102.00	36.00	45.00	10.00	42.00	160.00	74.00
Dia (ft):	2.00	2.00	2.00	2.00	2.00	1.50	1.25	1.25	1.25	1.25	1.25	1.25	1.50	1.00	1.00
Slope (ft/ft):	0.0035	0.0036	0.0035	0.0035	0.0039	0.0475	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0365
Up Invert (ft):	58.24	58.57	59.44	59.75	60.08	60.31	60.31	62.67	63.18	63.36	63.59	63.89	64.10	64.90	67.60
Dn Invert (ft):	57.87	58.24	58.57	59.44	59.75	60.08	60.17	62.11	62.67	63.18	63.36	63.84	63.89	64.10	64.90
Max Q (cfs):	14.92	9.76	9.76	9.76	9.76	3.03	3.01	3.03	2.92	2.92	2.45	2.45	1.29	1.09	0.90
Max Vel	3.18	3.11	3.11	3.11	3.11	2.46	3.68	3.17	3.46	3.26	2.73	3.30	1.45	2.42	3.85
Max Depth (ft):	1.70	2.00	2.00	2.00	2.00	1.50	1.25	1.25	1.15	1.03	0.95	0.74	0.76	0.56	0.34

100-yr, 24-hr storm event - HGL elevations profile



Node ID:	Out-01	EX-F	EX-E	EX-D	EX-C	CB-16	BIOPOD	CB-11	CB-10	EX-A	EX-B	OWS	CB-07	CB-06	CB-05	CB-04
Rim (ft):		68.18	68.00	64.56	65.10	65.52	65.52	65.52	65.55	66.22	67.37	68.67	67.95	67.02	67.02	69.70
Invert (ft):	57.87	58.24	58.57	59.44	59.75	60.08	60.08	60.51	62.67	63.18	63.36	63.59	63.89	64.10	64.90	67.60
Min Pipe Cover (ft):		7.94	7.43	3.12	3.35	3.40	3.40	3.46	1.63	1.79	2.76	3.04	3.45	1.42	1.12	1.10
Max HGL (ft):	59.38	60.59	61.61	63.93	64.91	65.52	65.52	65.52	65.55	65.91	66.12	66.68	66.30	66.32	66.67	67.86

Link ID:	Link-20	Link-19	Link-18	Link-17	Link-16	Link-15	Link-14	Link-13	Link-12	Link-11	Link-08	Link-07	Link-06	Link-05	Link-04
Length (ft):	104.67	91.00	249.00	89.00	85.00	8	0	111.00	102.00	36.00	45.00	10.00	42.00	160.00	74.00
Dia (ft):	2.00	2.00	2.00	2.00	2.00	1.5	1.25	1.25	1.25	1.25	1.25	1.25	1.50	1.00	1.00
Slope (ft/ft):	0.0035	0.0036	0.0035	0.0035	0.0039	0.04	0.0050	0.0050	0.0050	0.0050	0.0051	0.0050	0.0050	0.0050	0.0365
Up Invert (ft):	58.24	58.57	59.44	59.75	60.08	60.4	60.51	62.67	63.18	63.36	63.59	63.89	64.10	64.90	67.60
Dn Invert (ft):	57.87	58.24	58.57	59.44	59.75	60.0	60.4	62.11	62.67	63.18	63.36	63.84	63.89	64.10	64.90
Max Q (cfs):	17.55	12.00	12.00	11.99	11.99	3.3	3.19	3.19	3.42	3.42	2.54	2.56	1.51	1.27	1.06
Max Vel	3.87	3.82	3.82	3.82	3.82	2.4	3.17	3.17	3.48	3.31	2.73	3.31	1.49	2.50	3.99
Max Depth (ft):	1.75	2.00	2.00	2.00	2.00	1.5	1.25	1.25	1.25	1.25	1.25	1.25	1.50	1.00	0.63

Autodesk Storm and Sanitary Analysis

Appendix C WWHM Report

Two WWHM Reports are included for water quality treatment flow rates: the Oil Water Separator and the Oldcastle Infrastructure BioPod™.

Oil Water Separator

WWHM2012
PROJECT REPORT

Project Name: Oil Water Separator WQ
Site Name: Western Self Storage
Site Address:
City :
Report Date: 6/4/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2022/02/10
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

MITIGATED LAND USE
Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	.07
Pervious Total	0.07
Impervious Land Use	**acre**
PARKING FLAT	3.57
Impervious Total	3.57
Basin Total	3.64

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS
Stream Protection Duration

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.07
Total Impervious Area:3.57

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.28337
5 year	1.722588
10 year	2.041799
25 year	2.478665
50 year	2.829266
100 year	3.202125

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.3919 **acre-feet**
On-line facility target flow: 0.5413 **cfs.**
Adjusted for 15 min: 0.5413 **cfs.**
Off-line facility target flow: 0.3142 **cfs.**
Adjusted for 15 min: 0.3142 **cfs.**

Oldcastle Infrastructure BioPod™

WWHM2012
PROJECT REPORT

Project Name: BioPod WQ
Site Name: Western Self Storage
Site Address:
City :
Report Date: 6/4/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2022/02/10
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

MITIGATED LAND USE
Name : Basin 1
Bypass: No
GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	.07
Pervious Total	0.07
Impervious Land Use	**acre**
PARKING FLAT	4.33
Impervious Total	4.33
Basin Total	4.4

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS
Stream Protection Duration

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.07
Total Impervious Area:4.33

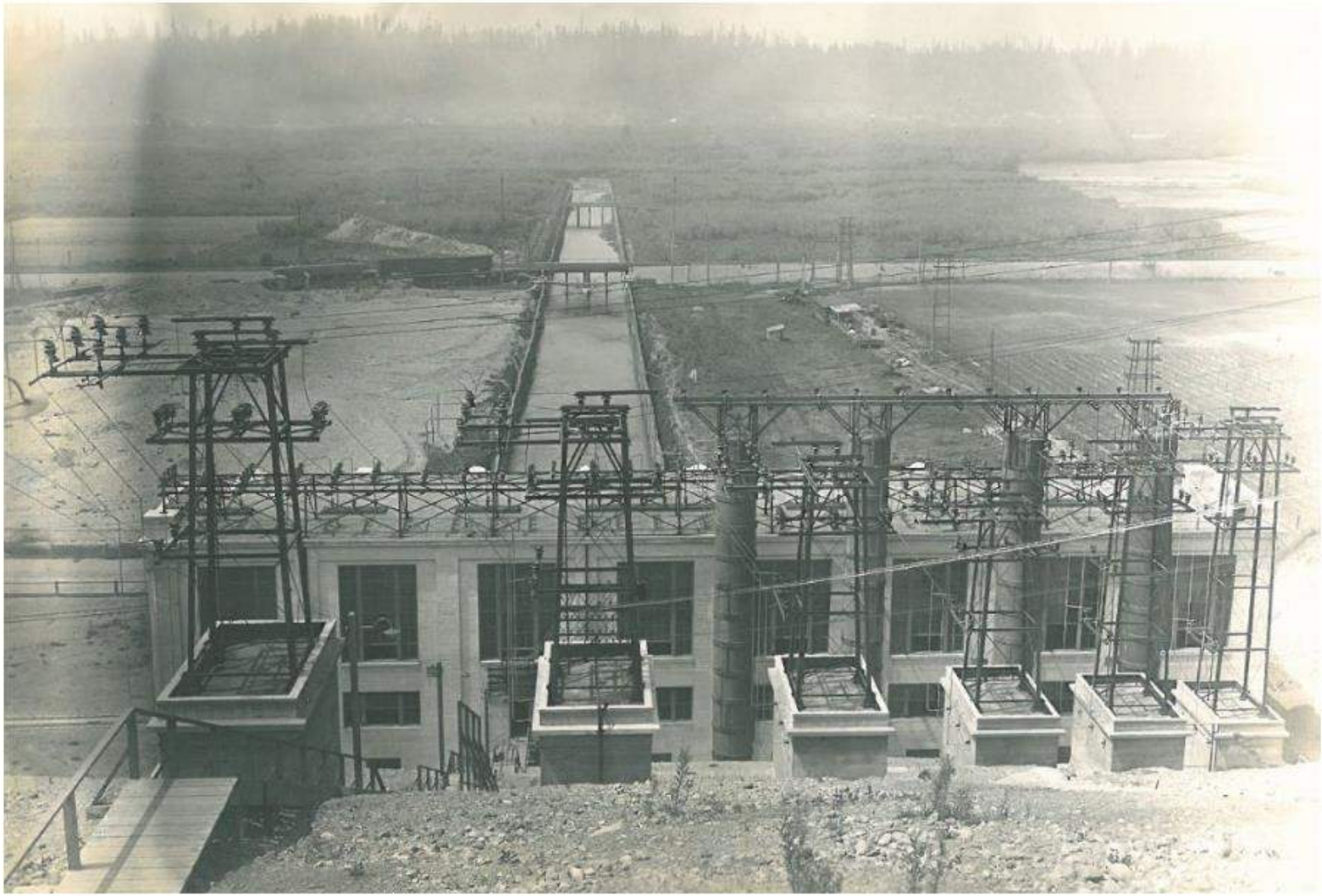
Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.555915
5 year	2.088195
10 year	2.475009
25 year	3.004362
50 year	3.429164
100 year	3.880914

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.4747 **acre-feet**
On-line facility target flow: 0.6567 **cfs.**
Adjusted for 15 min: 0.6567 **cfs.**
Off-line facility target flow: 0.3813 **cfs.**
Adjusted for 15 min: 0.3813 **cfs.**

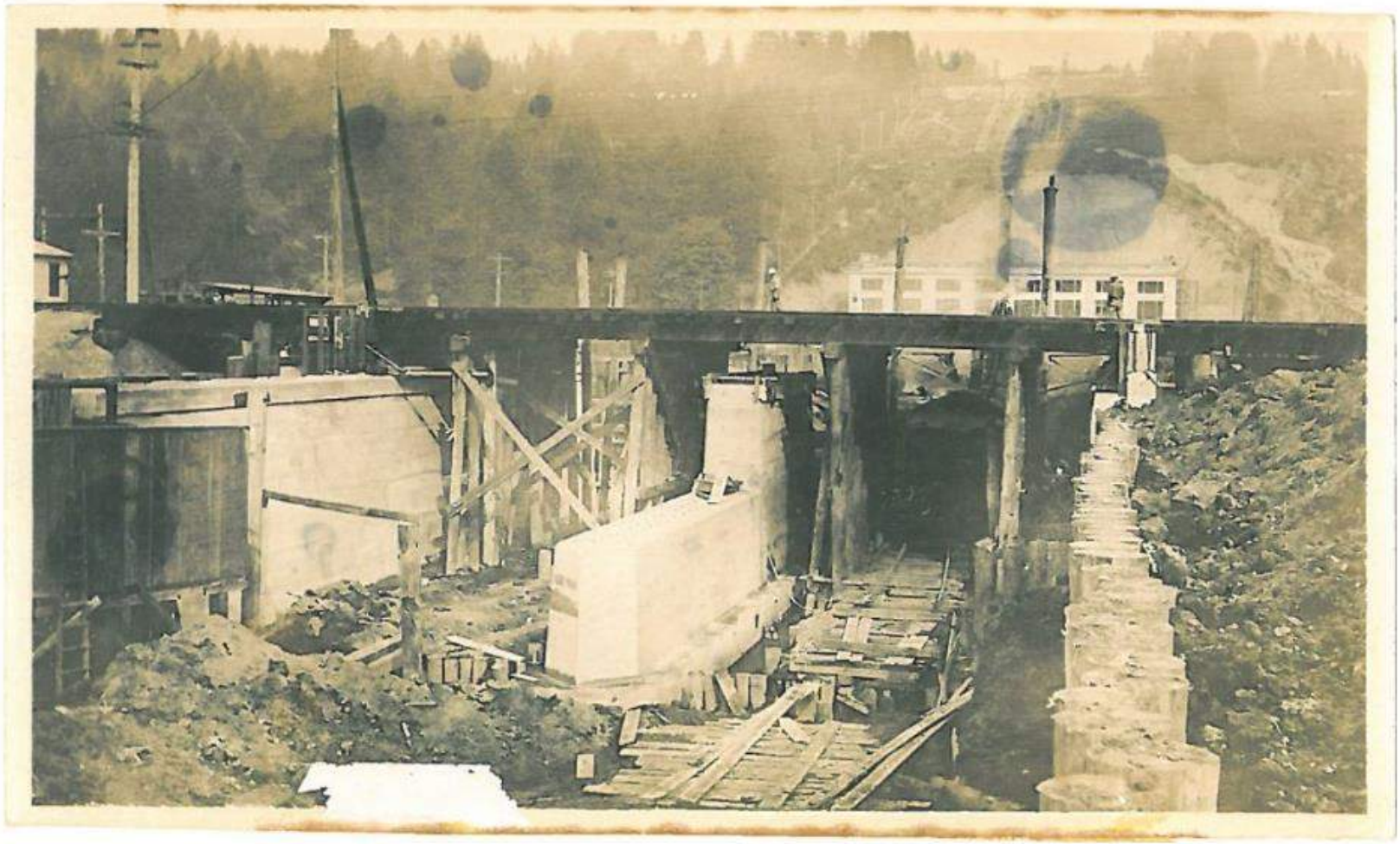
Appendix D Historic Photos of Dieringer Powerhouse Construction

View from back of Powerhouse and tailrace, Railroad Bridge and 148th Street bridge. Row of concrete buildings in foreground supported towers for power up the hillside; towers are now gone, but buildings are still there.



20

Concrete abutment to protect the railroad bridge from the water flow.



22

On Cottage Road, where 4-1 and 4-2 standpipes buildings were later built. Finished Tailrace channel filled with water in background.

23

Appendix E Oldcastle Infrastructure BioPod™ GULD

February 2024

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), METALS, AND PHOSPHORUS TREATMENT

For

Oldcastle Infrastructure, Inc.'s
The BioPod™ Biofilter
(Formerly the TreePod Biofilter)

Ecology's Decision

Based on Oldcastle Infrastructure, Inc. application submissions for The BioPod™ Biofilter (BioPod), Ecology hereby issues the following use level designation:

1) General Use Level Designation (GULD) for Basic, Metals, and Phosphorus Treatment:
   - Sized at a hydraulic loading rate of 1.6 gallons per minute (gpm) per square foot (sq ft) of media surface area.
   - Constructed with a minimum media thickness of 18-inches (1.5-feet)
2) Ecology approves the BioPod at the hydraulic loading rate listed above, to achieve the maximum water quality design flow rate. The water quality design flow rates are calculated using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology- approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3) For systems that have a drain down outlet, designers must increase the water quality design flow rate calculated in Item 2, above, to account for the water that will enter the initial bay but won't be treated by the engineered soil. Multiply the flow rate determined above by 1.05 to determine the required flowrate for the BioPod unit.

4) Oldcastle produces alternative configurations of the version tested for TAPE approval. The system tested is the named the BioPod Planter. Alternative configurations that are also approved for use through this GULD are the BioPod Surface, the BioPod Tree, and the BioPod Underground.
5) The GULD has no expiration date, but may be amended or revoked by Ecology.

Ecology's Conditions of Use

The BioPod shall comply with these conditions:

1) Applicants shall design, assemble, install, operate, and maintain the BioPod installations in accordance with Oldcastle Infrastructure Inc.'s applicable manuals and the Ecology Decision.
2) The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in Ecology Decision, Item 3, above) and the hydraulic loading rate (as identified in Ecology Decision, Item 1, above). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the hydraulic loading rate (converted to ft/sec) to obtain the required surface area (sq ft) of the BioPod unit.
3) BioPod media shall conform to the specifications submitted to and approved by Ecology.
4) The applicant tested the BioPod without plants. This GULD applies to the BioPod Stormwater Treatment System whether plants are included in the final product or not.
5) Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
    - The BioPod is designed for a target maintenance interval of 1 year. Maintenance includes replacing the mulch, assessing plant health, removal of trash, and raking the top few inches of engineered media.
    - The BioPod system initially tested at the Lake Union Ship Canal Test Facility in Seattle, WA required maintenance after 1.5 months, or 6.3% of a water year. Monitoring personnel observed similar maintenance issues with other systems evaluated at the Test Facility. Runoff from the Test Facility may be unusual and maintenance requirements of systems installed at the Test Facility may not be indicative of typical maintenance requirements. Because of this, the initial version of the GULD required Oldcastle to subsequently "conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest". Quarterly testing from a 15-month maintenance frequency assessment conducted on a BioPod system installed along a roadway in Des Moines, WA indicated the system was able to treat a full water year before requiring maintenance.
    - Test results provided to Ecology from a BioPod System evaluated in a lab following New Jersey Department of Environmental Protection Laboratory Protocol for Filtration MTDs have indicated the BioPod System is capable of longer maintenance intervals.

- Owners/operators must inspect BioPod systems for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.

6) Install the BioPod in such a manner that you bypass flows exceeding the maximum operating rate and you will not resuspend captured sediment.
7) Discharges from the BioPod shall not cause or contribute to water quality standard violations in receiving waters.

Approved Alternate Configurations

BioPod Internal Bypass

1) The BioPod Internal Bypass configuration may be combined with a Curb Inlet, Grated Inlet, and Piped-In Inlet. Water quality flows and peak flows are directed from the curb, overhead grate, or piped inlet to a contoured inlet rack. The inlet rack disperses water quality flows over the top surface of the biofiltration chamber. Excess flows are diverted over a curved bypass weir to the outlet area without passing through the treatment area. Both water quality flows and bypass flows are combined in the outlet area prior to being discharged out of the system.
2) To select a BioPod Internal Bypass unit, the designer must determine the size of the standard unit using the sizing guidance described above. Systems that have an internal bypass may use the off-line water quality design flow rate.
3) The internal bypass configuration has a maximum flow rate of 900 gallons per minute. Sites where the anticipated flow rate at the treatment device is larger than 900 gpm must use an external bypass, or size the treatment device for the on-line water quality design flow rate.

Applicant:	Oldcastle Infrastructure, Inc.
Applicant's Address:	7100 Longe St, Suite 100 Stockton, CA 95206

Application Documents:

BioPod™ Stormwater Filter Maintenance Frequency Assessment, Prepared for Oldcastle Infrastructure, Inc., Prepared by Herrera Environmental Consultants, Inc. February 2022

Technical Evaluation Report TreePod™ BioFilter System Performance Certification Project, Prepared for Oldcastle, Inc., Prepared by Herrera Environmental Consultants, Inc. February 2018

Technical Memorandum: Response to Board of External Reviewers' Comments on the Technical Evaluation Report for the TreePod™ Biofilter System Performance Certification Project, Oldcastle, Inc. and Herrera Environmental Consultants, Inc., February 2018

Technical Memorandum: Response to Board of External Reviewers' Comments on the Technical Evaluation Report for the TreePod™ Biofilter System Performance Certification Project, Oldcastle, Inc. and Herrera Environmental Consultants, Inc., January 2018

Application for Pilot Use Level Designation, TreePod™ Biofilter – Stormwater Treatment System, Oldcastle Stormwater Solutions, May 2016

Emerging Stormwater Treatment Technologies Application for Certification: The TreePod™ Biofilter, Oldcastle Stormwater Solutions, April 2016

Applicant's Use Level Request:

- General Use Level Designation as a Basic, Metals, and Phosphorus Treatment device in accordance with Ecology's *Stormwater Management Manual for Western Washington*

Applicant's Performance Claims:

Based on results from laboratory and field-testing, the applicant claims the BioPod™ Biofilter operating at a hydraulic loading rate of 153 inches per hour is able to remove:

- 80% of Total Suspended Solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 60% dissolved zinc for influent concentrations 0.02 to 0.3 mg/L.
- 30% dissolved copper for influent concentrations 0.005 to 0.02 mg/L.
- 50% or greater total phosphorus for influent concentrations 0.1 to 0.5 mg/L.

Ecology's Recommendations:

Ecology finds that:

- Oldcastle Infrastructure, Inc. has shown Ecology, through laboratory and field testing, that the BioPod™ Biofilter is capable of attaining Ecology's Basic, Total Phosphorus, and Metals treatment goals.

Findings of Fact:

Field Testing

- Herrera Environmental Consultants, Inc. conducted monitoring of the BioPod™ Biofilter at the Lake Union Ship Canal Test Facility in Seattle Washington between November 2016 and April 2018. Herrera collected flow-weight composite samples during 14 separate storm events and peak flow grab samples during 3 separate storm events. The system was sized at an infiltration rate of 153 inches per hour or a hydraulic loading rate of 1.6 gpm/ft^2.
  - The D_{50} of the influent PSD ranged from 3 to 292 microns, with an average D_{50} of 28 microns.
  - Influent TSS concentrations ranged from 17 mg/L to 666 mg/L, with a mean concentration of 98 mg/L. For all samples (influent concentrations above and below 100 mg/L) the bootstrap estimate of the lower 95 percent confidence limit (LCL 95) of the mean TSS reduction was 84% and the bootstrap estimate of the upper 95 percent confidence limit (UCL95) of the mean TSS effluent concentration was 8.2 mg/L.
  - Dissolved copper influent concentrations from the 17 events ranged from 9.0 µg/L to 21.1 µg/L. The 21.1 µg/L data point was reduced to 20.0 µg/L, the upper limit to the TAPE allowed influent concentration range, prior to calculating the pollutant removal. A bootstrap estimate of the LCL95 of the mean dissolved copper reduction was 35%.
  - Dissolved zinc influent concentrations from the 17 events ranged from 26.1 µg/L to 43.3 µg/L. A bootstrap estimate of the LCL95 of the mean dissolved zinc reduction was 71%.
  - Total phosphorus influent concentrations from the 17 events ranged from 0.064 mg/L to 1.56 mg/L. All influent data greater than 0.5 mg/L were reduced to 0.5 mg/L, the upper limit to the TAPE allowed influent concentration range, prior to calculating the pollutant removal. A bootstrap estimate of the LCL95 of the mean total phosphorus reduction was 64%.
  - The system experienced rapid sediment loading and needed to be maintained after 1.5 months. Monitoring personnel observed similar sediment loading issues with other systems evaluated at the Test Facility. The runoff from the Test Facility may not be indicative of maintenance requirements for all sites.
- Herrera Environmental Consultants, Inc. conducted a maintenance frequency assessment of the BioPod™ installed along a roadway in Des Moines, WA between September 2020 and January 2022.
  - Herrera collected influent grab samples during 10 storm events and paired effluent samples during 5 storm events. Influent concentrations ranged from 1 mg/L to 164 mg/L, with a median concentration of 23 mg/L. Effluent concentrations ranged from 1 mg/L to 19 mg/L, with a median of 5 mg/L.
  - Herrera collected influent PSD samples during 3 storm events. The D_{50} for the samples were 42, 1306, and 57 microns. The 1306 micron value was collected during an event with an influent TSS concentration of 1 mg/L. It is assumed this sample was atypical and that it contained a few grains of very coarse sand and almost no other particles.

- Herrera used a water truck to conduct flow testing 7 times to assess how long the system could filter at the design flow rate without bypass. Results show the system was able to treat up to a full water year before the system needed maintenance.

Laboratory Testing

- Good Harbour Laboratories (GHL) conducted laboratory testing at their site in Mississauga, Ontario in October 2017 following the New Jersey Department of Environmental Protection Laboratory Protocol for Filtration MTDs. The testing evaluated a 4-foot by 6-foot standard biofiltration chamber and inlet contour rack with bypass weir. The test sediment used during the testing was custom blended by GHL using various commercially available silica sands, which had an average d_{50} of 69 µm. Based on the lab test results:
  - GHL evaluated removal efficiency over 15 events at a Maximum Treatment Flow Rate (MTFR) of 37.6 gpm, which corresponds to a MTFR to effective filtration treatment area ratio of 1.80 gpm/ft^2. The system, operating at 100% of the MTFR with an average influent concentration of 201.3 mg/L, had an average removal efficiency of 99 percent.
  - GHL evaluated sediment mass loading capacity over an additional 16 events using an influent SSC concentration of 400 mg/L. The first 11 runs were evaluated at 100% of the MTFR. The BioPod began to bypass, so the remaining 5 runs were evaluated at 90% of the MTFR. The total mass of the sediment captured was 245.0 lbs and the cumulative mass removal efficiency was 96.3%.
- Herrera Environmental Consultants Inc. conducted laboratory testing in September 2014 at the Seattle University Engineering Laboratory. The testing evaluated the flushing characteristics, hydraulic conductivity, and pollutant removal ability of twelve different media blends. Based on this testing, Oldcastle Infrastructure, Inc. selected one media blend, Mix 8, for inclusion in their TAPE evaluation of the BioPod™ Biofilter.
  - Herrera evaluated Mix 8 in an 8-inch diameter by 36-inch tall polyvinyl chloride (PVC) column. The column contained 18-inches of Mix 8 on top of 6-inches of pea gravel. The BioPod will normally include a 3-inch mulch layer on top of the media layer; however, this was not included in the laboratory testing.
  - Mix 8 has a hydraulic conductivity of 218 inches per hour; however, evaluation of the pollutant removal ability of the media was based on an infiltration rate of 115 inches per hour. The media was tested at 75%, 100%, and 125% of the infiltration rate. Based on the lab test results:
    - The system was evaluated using natural stormwater. The dissolved copper and dissolved zinc concentrations in the natural stormwater were lower than the TAPE influent standards; therefore, the stormwater was spiked with 66.4 mL of 100 mg/L Cu solution and 113.6 mL of 1,000 mg/L Zn solution.
    - The BioPod removed an average of 81% of TSS, with a mean influent concentration of 48.4 mg/L and a mean effluent concentration of 9.8 mg/L.
    - The BioPod removed an average of 94% of dissolved copper, with a mean influent concentration of 10.6 µg/L and a mean effluent concentration of 0.6 µg/L.
    - The BioPod removed an average of 97% of dissolved zinc, with a mean influent concentration of 117 µg/L and a mean effluent concentration of 4 µg/L.

- The BioPod removed an average of 97% of total phosphorus, with a mean influent concentration of 2.52 mg/L and a mean effluent concentration of 0.066 mg/L. When total phosphorus influent concentrations were capped at the TAPE upper limit of 0.5 mg/L, calculations showed an average removal of 87%.

Other BioPod Related Issues to be Addressed by the Company:

1. None identified at this time.

Technology Description: Download at https://oldcastleprecast.com/stormwater/bioretention-biofiltration-applications/bioretention-biofiltration-solutions/

Contact Information:

Applicant:
Chris Demarest
Oldcastle Infrastructure, Inc.
(925)667-7100
Chris.demarest@oldcastle.com

Applicant website: https://oldcastleprecast.com/stormwater/

Ecology web link: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

Ecology:
Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 870-0983
douglas.howie@ecy.wa.gov

Revision History

Date	Revision
March 2018	GULD granted for Basic Treatment
March 2018	Provisional GULD granted for Enhanced and Phosphorus Treatment
June 2016	PULD Granted
April 2018	GULD for Basic and Provisional GULD for Enhanced and Phosphorus granted, changed name to BioPod from TreePod
July 2018	GULD for Enhanced and Phosphorus granted
September 2018	Changed Address for Oldcastle
December 2018	Added minimum media thickness requirement
May 2019	Changed language on who must Install and maintain the device from Oldcastle to Applicants
August 2019	Added text on sizing using infiltration rate and water quality design flow rate

October 2019	Added text describing ability to use off-line design water quality flow rate for sizing due to internal bypass
December 2021	Extended approval to installations without plants, added sizing adjustment when using facilities with a drawdown outlet
March 2022	Added results from the maintenance frequency assessment to the Ecology's Conditions of Use and the Findings of Fact sections
January 2024	Revised Dissolved Metals (Enhanced) to Metals
February 2024	Added manufacturers names for the tested unit and the three alternative configurations to the text.

Appendix F Technical Memorandum: Offsite Wetland Assessment

TECHNICAL MEMORANDUM

Prepared for: Kathy Hargrave
Sitts & Hill Engineers
4815 Center Street
Tacoma, WA 98409

November 16, 2023

Prepared by: Grette Associates[LLC]
2709 Jahn Ave, St. H-5
Gig Harbor, WA 98335

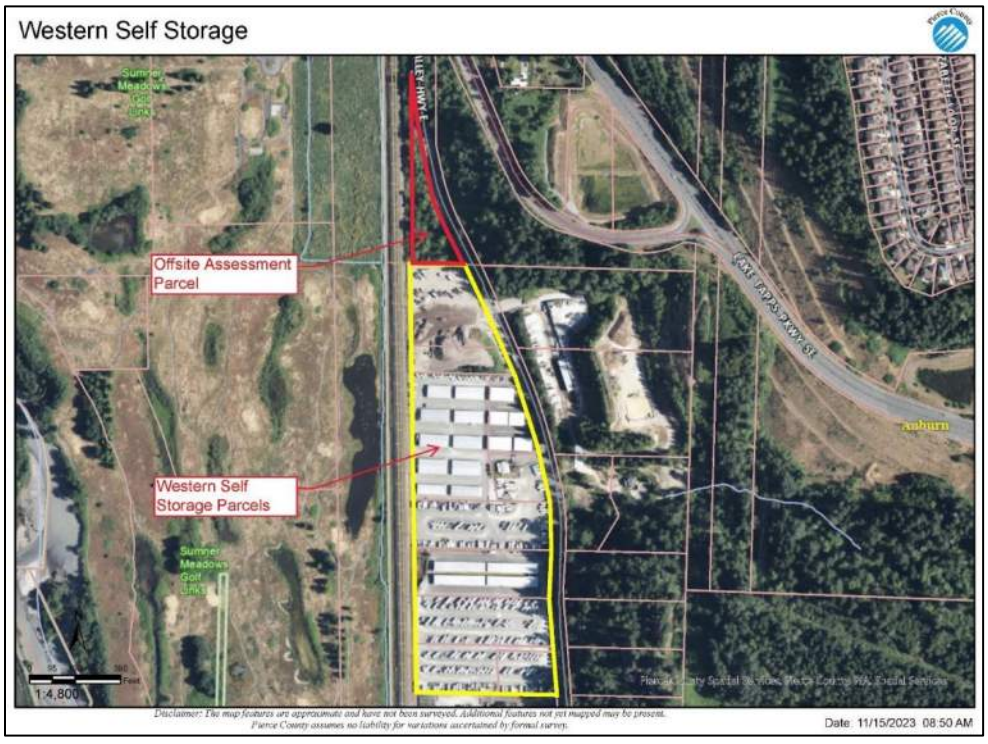
File No.: 402.032

Re: Western Self Storage: E Valley Highway – Offsite Wetland Assessment

1 INTRODUCTION

At the request of Sitts & Hill Engineers, Grette Associates conducted a site visit to a parcel located along E Valley Highway in Sumner, WA to perform a reconnaissance for the presence of wetlands. The subject parcel, which is owned by Lakeland Homeowner's Association, is immediately north of and adjacent to Western Self Storage's site along E Valley Highway (Pierce County Parcel No. 0520063017; Figure 1). This technical memorandum summarizes the offsite assessment of the subject parcel.

Figure 1. Pierce County Parcel Map



2 BACKGROUND

2.1 Local Critical Area Inventory

Pierce County's PublicGIS website was queried to identify any known critical areas within the general area of the subject parcel. According to PublicGIS, one wetland feature is mapped within the subject parcel and extending to the north between E Valley Highway and the BNSF railroad tracks. According to PublicGIS, the wetland was identified through the County Wetland Inventory (CWI) and was previously delineated in 1988, though no information from this delineation could be found online.

2.2 National Wetlands Inventory

The U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) was queried to determine if previously-identified wetlands are present on the subject parcel. According to the NWI Interactive Online Mapper, a Palustrine Scrub-Shrub wetland is located within the parcel. Additionally, a Riverine channel is identified leading to the property from the east and beneath E Valley Highway.

2.3 Web Soil Survey

The Natural Resources Conservation Services' online Web Soil Survey (WSS) mapper was queried to determine the mapped soil series on the subject parcel. According to the WSS, the two soil series mapped on the subject parcel are Semiahmoo muck and Shalcar muck. Both of these soil series are listed as hydric soils

3 METHODS

A Grette Associates Pierce County Qualified Wetland Specialist completed a site visit on November 14, 2023, to identify any wetland features on the subject parcel. As the subject parcel is not owned by Western Self Storage, the assessment was conducted visually from public rights of way along E Valley Highway, and from along the northern parcel boundary of the Western Self Storage property. Wetland vegetation and hydrology indicators within the subject parcel were noted, as well as any stormwater culverts or other surface water sources.

4 RESULTS

One area that appeared to meet the criteria for a regulated wetland was identified during Grette Associates' site assessment (Wetland A; Figure 2).

It should be noted that Wetland A is located within unincorporated Pierce County, while the Western Self Storage property is located within the City of Sumner. For the purposes of this memorandum and application of buffer provisions, the Sumner Municipal Code was used.

Figure 2. Approximate boundary of Wetland A, north of the Western Self Storage parcel

The subject parcel is comprised of a scrub-shrub vegetated depressional area formed by the raised fill associated with the BNSF railroad tracks to the west, the Western Self Storage site to the south, and E Valley Highway to the east. The area is relatively flat, with a slight slope down to the north. Several stormwater culverts were observed entering the wetland from beneath E Valley Highway, conveying water from small seeps located along the hillside east of E Valley Highway.

While field indicators of hydric soils could not be investigated, other strongly-positive indicators of wetland conditions were observed. Vegetation observed on the site was dominated by hydrophytes. This included an overstory of red alder (*Alnus rubra*, FAC) and mature Pacific willow (*Salix lasiandra*, FACW) over red osier dogwood (*Cornus sericea*, FACW), Douglas's spiraea (*Spiraea douglasii*, FACW), reed canarygrass (*Phalaris arundinacea*, FACW), skunk cabbage (*Lysichiton americanus*, OBL), and water parsley (*Oenanthe sarmentosa*, OBL). Positive hydrologic indicators observed included surface inundation and saturation, surface hydrology inputs from stormwater culverts, and a geomorphic setting conducive to the collection of surface water (i.e., depressional concave surface).

Figure 3. Observed site conditions (typ.)

Based on the conditions observed at the site, Wetland A was rated according to the procedures in the WA State Department of Ecology's *Washington State Wetland Rating System for Western Washington – 2014 Update Version 2.0* (Hruby and Yahnke, 2023). The completed wetland rating forms are attached to this memorandum.

According to the results of the rating system, Wetland A is rated as a Category III wetland (Table 1). Based on this rating, the required buffer width according to the Sumner Municipal Code (SMC) Chapter 16.46.150 is 60 feet.

Table 1. Wetland Summary

Wetland Name	Approximate Size[1]	Wetland Rating[2]	Water Quality Score	Hydrology Score	Habitat Score	Buffer Width[3]
Wetland A	80,970 sf	III – 18 pts	7	7	4	60 ft

[1] Wetland A was not delineated and was assessed visually from offsite. Boundary was established in Google Earth.

[2] Rating from Hruby and Yahnke 2023

[3] Buffer width per SMC 16.46.150 Table 1

5 BUFFER REQUIREMENTS

As noted above, Wetland A is located within unincorporated Pierce County, while the Western Self Storage property is located within the City of Sumner. For the purposes of applying buffer provisions, the Sumner Municipal Code applies.

Based on the wetland rating, Wetland A is a Category III wetland requiring a 60 ft buffer width (SMC 16.46.150). According to SMC 16.46.150.M, buffer establishment is subject to the development status of the adjacent parcel. Where new major construction occurs, a buffer is required (SMC 16.46.150.M.1). However, a buffer is not required:

a) In the area contained within the perimeter of a legally preexisting structure or use that is authorized to continue under this title; or

b) Within the footprint of an existing residential dwelling allowed to continue or expand under SMC 18.30.090(B) subject to SMC 16.40.125(B); or

c) To extend landward beyond a legally preexisting structure, pavement or other facility, including but not limited to a building, parking lot, stormwater detention facility, or public right-of-way that contains an improved street. (SMC 16.46.150.M.2)

The legal and pre-existing industrial use on the northern Western Self Storage parcel meets the above conditions where, under the SMC, no buffer is required on Wetland A that would extend into the Western Self Storage property. Therefore, the buffer for Wetland A stops at the northern extent of the Western Self Storage use.

If you have any questions on this technical memorandum, please contact me at (253) 573-9300, or by email at scottm@gretteassociates.com.

Kind Regards,

GRETTE ASSOCIATES, LLC

Scott Maharry
Associate Scientist
Pierce County Qualified Wetland Specialist

REFERENCES:

Hruby, T. & Yahnke, A. (2023). *Washington State Wetland Rating System for Western Washington: 2014 Update (Version 2)*. Publication #23-06-009. Washington Department of Ecology.

Wetland name or number A

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A Date of site visit: 11/14/23

Rated by S Maharry Trained by Ecology? ☑ Yes ☐ No Date of training 4/2010

HGM Class used for rating Depressional Wetland has multiple HGM classes? ☐ Y ☑ N

NOTE: **Form is not complete without the required figures** (figures can be combined).

Source of base aerial photo/map Google Earth

OVERALL WETLAND CATEGORY III (based on functions ☑ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

- ☐ **Category I** – Total score = 23 - 27
- ☐ **Category II** – Total score = 20 - 22
- ☑ **Category III** – Total score = 16 - 19
- ☐ **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☐ L ☑	
Landscape Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	
Value	H ☑ M ☐ L ☐	H ☑ M ☐ L ☐	H ☐ M ☐ L ☑	**TOTAL**
Score Based on Ratings	7	7	4	18

Score for each function based on three ratings (order of ratings is not important)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I ☐ II ☐
Wetland of High Conservation Value	I ☐
Bog	I ☐
Mature Forest	I ☐
Old Growth Forest	I ☐
Coastal Lagoon	I ☐ II ☐
Interdunal	I ☐ II ☐ III ☐ IV ☐
None of the above	☑

Wetland name or number A

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	1
Hydroperiods	D 1.4, H 1.2	2
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	2
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	3
Map of the contributing basin	D 4.3, D 5.3	4
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	5
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	6
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	7

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number __A__

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☑ NO – go to 2 ☐ **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO – Saltwater Tidal Fringe (Estuarine)** ☐ **YES – Freshwater Tidal Fringe**

If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe, it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.

2. The entire wetland unit is flat, and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☑ NO – go to 3 ☐ **YES** – The wetland class is **Flats**

If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet all** of the following criteria?

☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size,

☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☑ NO – go to 4 ☐ **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?

☐ The wetland is on a slope (slope can be very gradual),

☐ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheet flow, or in a swale without distinct banks,

☐ The water leaves the wetland **without being impounded**.

☑ NO – go to 5 ☐ **YES –** The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

Wetland name or number __A__

5. Does the entire wetland unit **meet all** of the following criteria?
   ☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ☐ The overbank flooding occurs at least once every 2 years.

☑ NO – go to 6 ☐ **YES** – The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? This means that any outlet, if present, is higher than the interior of the wetland.

☐ NO – go to 7 ☑ **YES** – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched but has no obvious natural outlet.

☐ NO – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.

Wetland name or number A

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). ☐ points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. ☑ points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing ☐ points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. ☐ points = 1	2
D 1.2. The soil 2 in. below the surface (or duff layer) is true clay or true organic *(use NRCS definitions).* Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed plants > 95% of area ☑ points = 5 Wetland has persistent, ungrazed plants > ½ of area ☐ points = 3 Wetland has persistent, ungrazed plants ≥ 1/10 of area ☐ points = 1 Wetland has persistent, ungrazed plants < 1/10 of area ☐ points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is ≥ ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	2
Total for D 1 Add the points in the boxes above	9

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (Answer YES if there is a TMDL in development or in effect for the basin in which the unit is found.) Yes = 2 No = 0	2
Total for D 3 Add the points in the boxes above	4

Rating of Value If score is: ☑ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number A

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?

D 4.1. Characteristics of surface water outflows from the wetland:

Wetland is a depression or flat depression with no surface water leaving it (no outlet)	☐	points = 4
Wetland has an intermittently flowing stream/ditch, OR highly constricted permanently flowing outlet	☑	points = 2
Wetland is a flat depression (question 7 on key), whose outlet is a permanently flowing ditch	☐	points = 1
Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing	☐	points = 0

2

D 4.2. Depth of storage during wet periods: Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.

Marks of ponding are 3 ft or more above the surface or bottom of outlet	☐	points = 7
Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet	☐	points = 5
Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet	☑	points = 3
The wetland is a "headwater" wetland	☐	points = 3
Wetland is flat but has small depressions on the surface that trap water	☐	points = 1
Marks of ponding less than 0.5 ft (6 in)	☐	points = 0

3

D 4.3. Contribution of the wetland to storage in the watershed: Estimate the ratio of the area of upstream basin contributing surface water to the area of the wetland unit itself.

The area of the basin is less than 10 times the area of the unit	☐	points = 5
The area of the basin is 10 to 100 times the area of the unit	☑	points = 3
The area of the basin is more than 100 times the area of the unit	☐	points = 0
Entire wetland is in the Flats class	☐	points = 5

3

Total for D 4 — Add the points in the boxes above — **8**

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic functions of the site?

D 5.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	1
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff?	Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)?	Yes = 1 No = 0	0
Total for D 5	Add the points in the boxes above	2

Rating of Landscape Potential If score is: ☐ **3 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?

D 6.1. Is the unit in a landscape that has flooding problems? Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.

The wetland captures surface water that would otherwise flow downgradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds):

- Flooding occurs in a sub-basin that is immediately downgradient of unit. ☑ points = 2
- Surface flooding problems are in a sub-basin farther downgradient. ☐ points = 1
- Flooding from groundwater is an issue in the sub-basin. ☐ points = 1
- The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ ☐ points = 0
- There are no problems with flooding downstream of the wetland. ☐ points = 0

2

D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0 — **0**

Total for D 6 — Add the points in the boxes above — **2**

Rating of Value If score is: ☑ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number A

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: Indicators are Cowardin classes and strata within the Forested class. Check the Cowardin plant classes in the wetland. Up to 10 patches may be combined for each class to meet the threshold of ¼ ac if the unit is at least 2.5 ac, or more than 10% of the unit if it is smaller than 2.5 ac.

☐ Aquatic bed	4 structures or more: points = 4
☐ Emergent	3 structures: points = 2
☑ Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
☐ Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

☐ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/groundcover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland if the unit is < 2.5 ac, or ¼ ac if the unit is at least 2.5 ac to count (see text for descriptions of hydroperiods).

☐ Permanently flooded or inundated	4 or more types present: points = 3
☑ Seasonally flooded or inundated	3 types present: points = 2
☐ Occasionally flooded or inundated	2 types present: points = 1
☑ Saturated only	1 type present: points = 0
☐ Permanently flowing stream or river in, or adjacent to, the wetland	
☐ Intermittently or seasonally flowing stream in, or adjacent to, the wetland	
☐ **Lake Fringe wetland**	**2 points**
☐ **Freshwater tidal wetland**	**2 points**

1

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. **Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canada thistle**

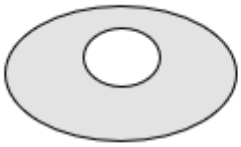
If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

1

H 1.4. Interspersion of habitats

Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. If you have four or more plant classes or three classes and open water, the rating is always high.

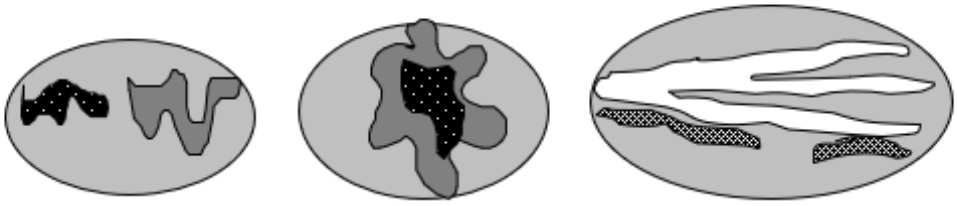
None = 0 points



Low = 1 point

Moderate = 2 points

All three diagrams in this row are **High** = 3 points



0

Wetland name or number A

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. The number of checks is the number of points. ☐ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft long). ☐ Standing snags (dbh > 4 in.) within the wetland ☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extend at least 3.3 ft (1 m) over open water or a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (cut shrubs or trees that have not yet weathered where wood is exposed) ☑ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (structures for egg-laying by amphibians) ☑ Invasive plants cover less than 25% of the wetland area in every stratum of plants (see H 1.1 above for the list of strata and H 1.5 in the manual for the list of aggressive plant species)	2
Total for H 1 Add the points in the boxes above	4

Rating of Site Potential If score is: ☐ **15-18 = H** ☐ **7-14 = M** ☑ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include only habitat polygons accessible from the wetland. *Calculate:* % relatively undisturbed habitat 0 + [(% moderate and low intensity land uses)/2] 0 = 0 % Total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0 wetland surrounding by development	0
H 2.2. Total habitat in 1 km Polygon around the wetland. *Calculate:* % relatively undisturbed habitat 19 + [(% moderate and low intensity land uses)/2] 18 = 37 % Total habitat > 50% of Polygon points = 3 Total habitat 10-50% and in 1-3 patches points = 2 Total habitat 10-50% and > 3 patches points = 1 Total habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☑ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 ☐ It has 3 or more Priority Habitats within 100 m (see next page) ☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ☐ It is mapped as a location for an individual WDFW Priority Species ☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources data ☐ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 Priority Habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	0

Rating of Value If score is: ☐ **2 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

Wetland name or number A

WDFW Priority Habitats

See complete descriptions of Priority Habitats listed by WDFW, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008 (current year, as revised). Priority Habitat and Species List.[133] This list was updated for consistency with guidance from WDFW.

This question is independent of the land use between the wetland unit and the Priority Habitat. All vegetated wetlands are by definition a Priority Habitat but are not included in this list because they are addressed by this rating system.

Count how many of the following Priority Habitats are within 330 ft (100 m) of the wetland unit:

☐ **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

☐ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife. This habitat automatically counts if mapped on the PHS online map within 100m of the wetland. If not mapped, a determination can be made in the field.

☐ **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

☐ **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

☐ **Fresh Deepwater:** Lands permanently flooded with freshwater, including environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live. Substrate does not support emergent vegetation. Do not select if Instream habitat is also present, or if the entire Deepwater feature is included in the wetland unit being rated (such as a pond with a vegetated fringe).

☐ **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

☐ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. Do not select if Fresh Deepwater habitat is also present.

☐ **Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore.

☐ **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in. (81 cm) diameter at breast height (dbh) or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in. (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

[133] http://wdfw.wa.gov/publications/00165/wdfw00165.pdf

Wetland name or number A

☐ **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important. For single oaks or oak stands <0.4 ha in urban areas, WDFW's Management Recommendations for Oregon White Oak[134] provides more detail for determining if they are Priority Habitats

☐ **Riparian:** The area adjacent to freshwater aquatic systems with flowing or standing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

☐ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in. (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in. (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

☐ **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

☐ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie.

[134] https://wdfw.wa.gov/publications/00030/wdfw00030.pdf

Wetland name or number A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

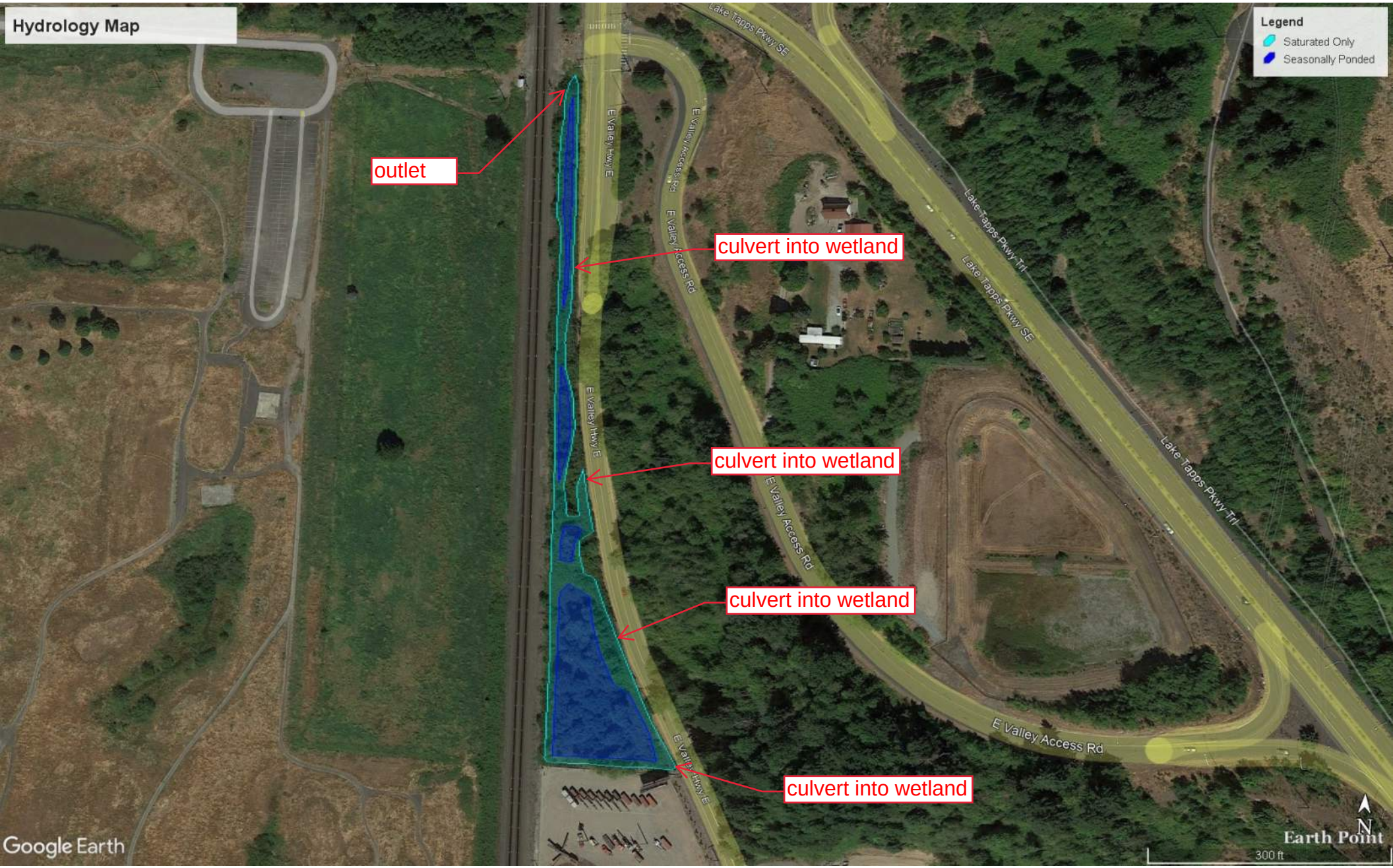
Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes – Go to **SC 1.1** ☑ No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No – Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 10% cover of non-native plant species. If non-native species are *Spartina*, see chapter 4.8 in the manual. ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Does the wetland overlap with any known or historical rare plant or rare & high-quality ecosystem polygons on the WNHP Data Explorer?[135] ☐ Yes = **Category I** ☑ No – Go to **SC 2.2** SC 2.2. Does the wetland have a rare plant species, rare ecosystem (e.g., plant community), or high-quality common ecosystem that may qualify the site as a WHCV? Contact WNHP for resources to help determine the presence of these elements. Yes – Submit data to WA Natural Heritage Program for determination,[136] Go to **SC 2.3** ☐ No = **Not a WHCV** ☑ SC 2.3. Did WNHP review the site within 30 days and determine that it has a rare plant or ecosystem that meets their criteria? ☐ Yes = **Category I** ☐ No = **Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES, you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in. or more of the first 32 in. of the soil profile? ☐ Yes – Go to **SC 3.3** ☑ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in. deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes – Go to **SC 3.3** ☑ No = **Not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Category I bog** ☐ No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in. deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Category I bog** ☑ No = **Not a bog**	**Cat. I**

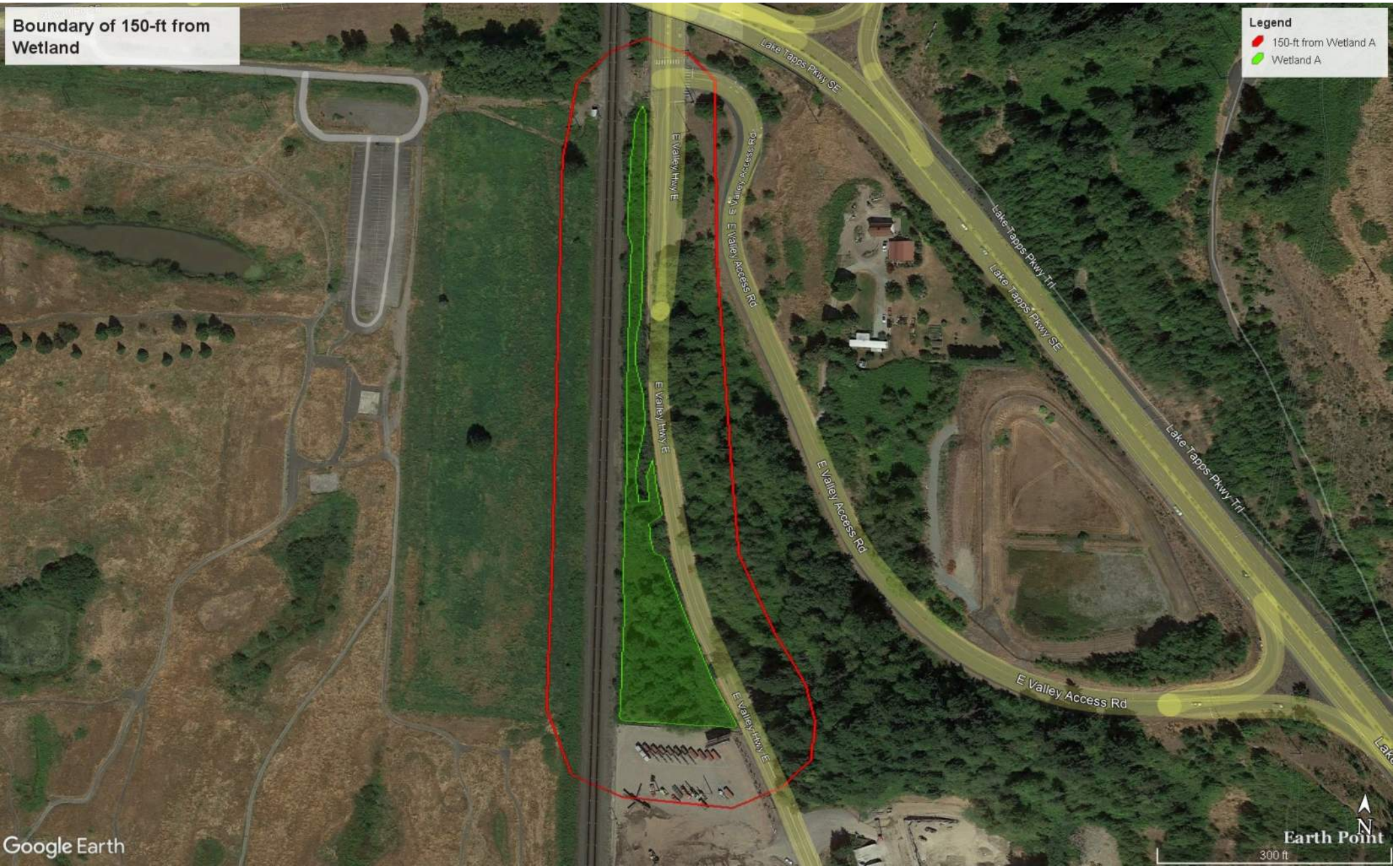
[135] https://www.dnr.wa.gov/NHPdata
[136] https://www.dnr.wa.gov/Publications/amp_nh_sighting_form.pdf

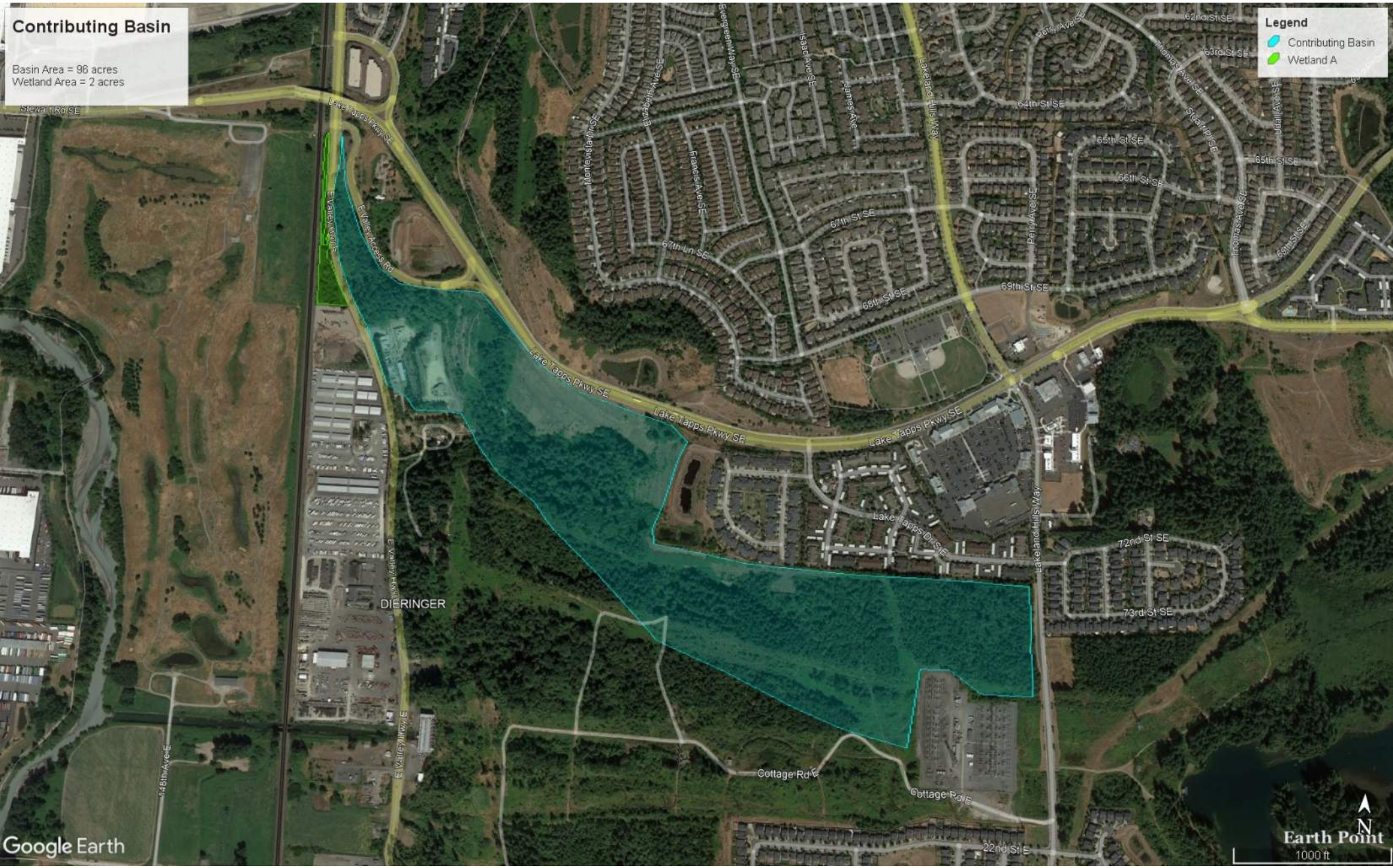
Wetland name or number A

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as Priority Habitats? ***If you answer YES, you will still need to rate the wetland based on its functions.*** ☐ **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in. (81 cm) or more. ☐ **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in. (53 cm). ☐ Yes = **Category I** ☑ No = **Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? ☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks ☐ The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* ☐ The lagoon retains some of its surface water at low tide during spring tides ☐ Yes – Go to **SC 5.1** ☑ No = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species in H 1.5 in the manual). ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2) ☐ Yes = **Category I** ☐ No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer YES, you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: ☐ Long Beach Peninsula: Lands west of SR 103 ☐ Grayland-Westport: Lands west of SR 105 ☐ Ocean Shores-Copalis: Lands west of SR 115 and SR 109 and Ocean Shores Blvd SW, including lands west of E. Oceans Shores Blvd SW. ☐ Yes – Go to **SC 6.1** ☑ No = **Not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ☐ Yes = **Category I** ☐ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ☐ Yes = **Category II** ☐ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ☐ Yes = **Category III** ☐ No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	N/A


Cowardin Plant Classes
Legend
Scrub-Shrub Vegetation
Lake Tapps Pkwy SE
Lake Tapps Pkwy Trl
E Valley Hwy E
E Valley Access Rd
Google Earth
N
Earth Point
300 ft


Hydrology Map
Legend
Saturated Only
Seasonally Ponded
outlet
culvert into wetland
culvert into wetland
culvert into wetland
culvert into wetland
E Valley Hwy E
E Valley Access Rd
Lake Tapps Pkwy SE
Lake Tapps Pkwy Trl
Google Earth
Earth Point
300 ft
N


Boundary of 150-ft from Wetland
Legend
150-ft from Wetland A
Wetland A
Lake Tapps Pkwy SE
E Valley Hwy E
E Valley Access Rd
Lake Tapps Pkwy Trl
Google Earth
N
Earth Point
300 ft


Contributing Basin
Basin Area = 96 acres
Wetland Area = 2 acres
Legend
Contributing Basin
Wetland A
Stewart Rd SE
Lake Tapps Pkwy SE
E Valley Access Rd
E Valley Hwy E
DIERINGER
Montevista Pl SE
Evergreen Way SE
Isaac Ave SE
Jones Ave SE
Lakeland Hills Way
Francis Ave SE
67th Ln SE
67th St SE
68th St SE
69th St SE
64th St SE
65th St SE
66th St SE
Perry Ave SE
Stuart Ave SE
Lake Tapps Dr SE
72nd St SE
73rd St SE
Cottage Rd E
22nd St E
148th Ave E
Google Earth
Earth Point
1000 ft


Land Use Intensity - 1 km
Legend
High Intensity
Low Intensity
Mod Intensity
Undisturbed
Wetland A
Wetland A 1km Circle
LAKELAND HILLS
Stewart Rd SE
Stewart Rd SE
E Valley Hwy E
Lakeland Hills Way
Lake Tapps Pkwy SE
136th Ave E
DIERINGER
E Valley Hwy E
167
Google Earth
N
Earth Point
2000 ft

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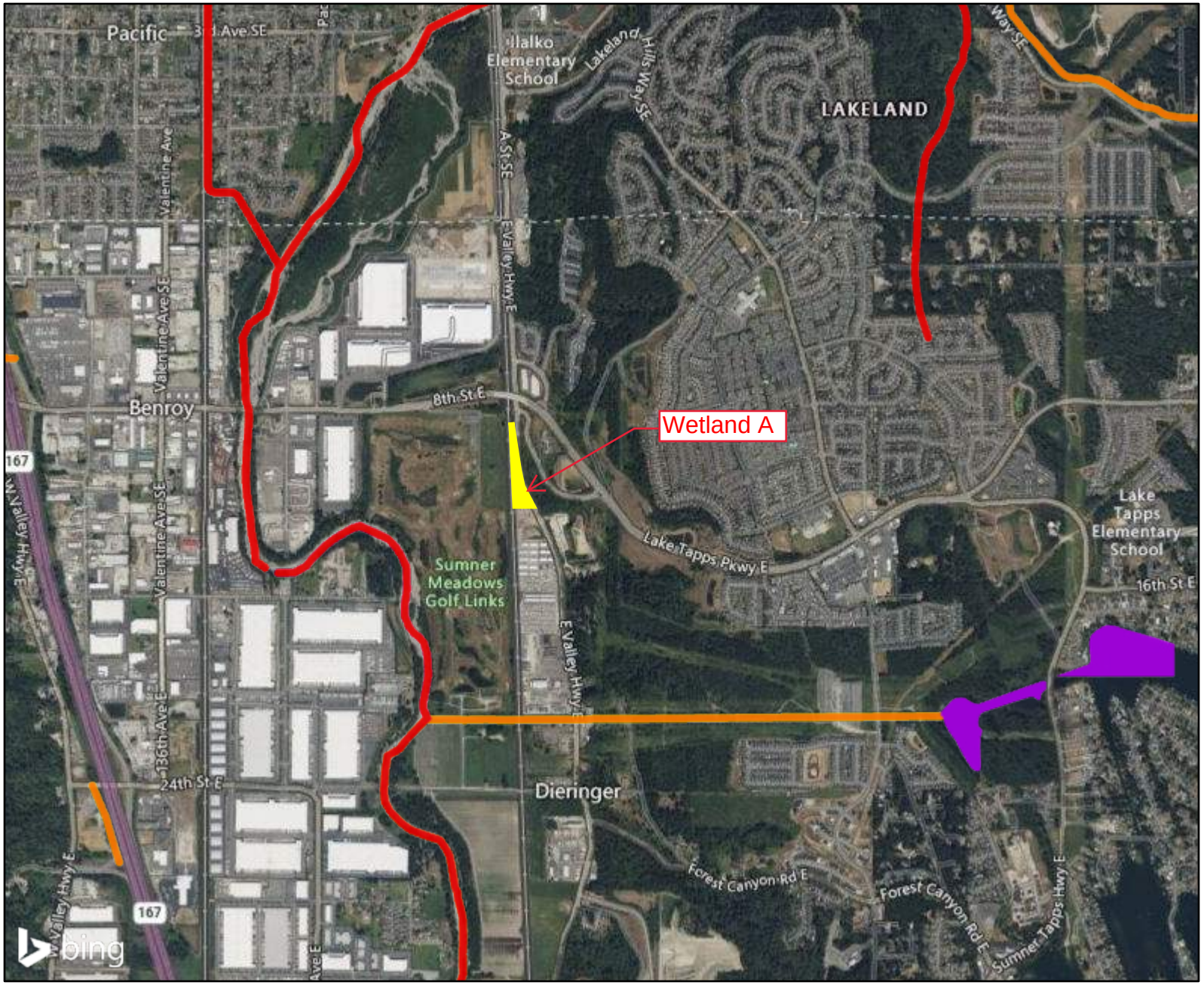

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DEPARTMENT OF ECOLOGY State of Washington

Pierce County

Water quality improvement projects

Select the waterbody or pollutant name to find more information about the specific project.

Waterbody Name(s)	Pollutant(s)	Status	Project Lead(s)
Clarks and Meeker Creeks	Dissolved Oxygen Sediment Fecal Coliform	EPA approved and Has an implementation plan	Donovan Gray 360-407-6407
Clover Creek	Dissolved Oxygen Fecal Coliform Temperature	Under development	Donovan Gray 360-407-6407
Commencement Bay	Dioxin	EPA approved	Donovan Gray 360-407-6407
Puyallup River Watershed	Fecal Coliform	EPA approved and Has implementation plan	Donovan Gray 360-407-6407
Puyallup River Watershed	Multi-parameter Ammonia-N BOD (5-day)	EPA approved	Donovan Gray 360-407-6407
Puyallup River: Upper White River	Sediment Temperature	EPA approved	Donovan Gray 360-407-6407
Puyallup River: Puyallup River Watershed> Lower White River	pH	Under development	Donovan Gray 360-407-6407
South Prairie Creek	Fecal Coliform Temperature	EPA approved and Has an implementation plan	Donovan Gray 360-407-6407
Wapato Lake	Total Phosphorus	EPA approved	Donovan Gray 360-407-6407

Appendix G 2015 Site Development Stormwater Report

Western Self Storage
New Self Storage Buildings
Stormwater Report

Prepared for:

Western Self Storage
1402 East Valley Highway East
Sumner, Washington 98390

Contact: Gary Petersen
Phone: (253) 863-8136

Prepared by:

Sitts & Hill Engineers, Inc.
4815 Center Street
Tacoma, Washington 98409

Phone: (253) 474-9449
Contact: Kathy Hargrave, P.E.

Date: July 2015

Project Number 16,452

Western Self Storage
New Self Storage Buildings
Stormwater Report

Prepared for:

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1402 East Valley Highway East
Sumner, Washington 98390

Contact: Gary Petersen
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Contact: Kathy Hargrave, P.E.
Phone: (253) 474-9449

July 2015 **Job Number 16,452**

Engineer's Certification

I hereby state that this Stormwater Site Plan for the Western Self Storage New Storage Buildings project located at 1402 East Valley Highway East has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Sumner does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

TABLE OF CONTENTS

LIST OF FIGURES

1. PROJECT OVERVIEW

1.1. Scope

This report addresses the stormwater facility improvements associated with the proposed new self storage buildings and driving surfaces which are to be constructed on the north side of the existing Western Self Storage property. The site address is 1402 East Valley Highway East, Sumner, WA 98390. The improvements are largely proposed on parcel number 9520000236 with minimal improvements on parcel number 9520000235. This report has been prepared in accordance with City of Sumner standards and the 2005 Washington State Department of Ecology's Stormwater Management Manual for Western Washington (DOE Manual). The new buildings and asphalt pavement will replace existing gravel driving and parking areas.

1.2. Existing Conditions

Western Self Storage is located on the west side of East Valley Highway and to the south of Lake Tapps Parkway. Please see Figure 1-1: Vicinity Map. The existing project site (1.58 acres) has minimal slopes at up to approximately 2.5% and is comprised entirely of gravel surface. The existing area includes impervious (69,014 SF or 1.58 acres) surfaces.

The existing gravel area is tributary to the existing on-site conveyance system. Sitts & Hill Engineers, Inc., upon physical inspection of the site, did not identify any problems with the existing drainage facilities or any significant stormwater discharges from the existing drainage facilities (runon or runoff) to adjacent properties under the existing conditions.

Stormwater from the site area sheetflows to the west and enters the on-site conveyance system via catch basins. Stormwater is then conveyed to an existing detention pond which discharges to the existing ditch adjacent to the BNSF rail line which ultimately discharges to the White River.

1.3. Proposed Conditions

The proposed project site will contain five new storage buildings (0.47 acres). The project site will also include new asphalt driving surfaces (0.80 acres), landscaping (0.18 acres), and new gravel surfacing (0.13 acres). The project site has been graded to primarily drain to the new on-site conveyance systems comprised of Type 1 and 2 catch basins and drainage piping. Stormwater runoff generated by the proposed roof areas and off-site drainage from East Valley Highway will be conveyed through storm drainage piping to be discharged directly to the existing conveyance system since these areas will not require treatment. A StormFilter manhole, equipped with five cartridges, is proposed to treat runoff from proposed pollution generating impervious surfaces. Proposed impervious surface (asphalt) located at the northern part of the project area will be used as a fire lane only and will therefore not be considered pollution-generating.

Figure 1-1: Vicinity Map

Not to Scale

2. DISCUSSION OF MINIMUM REQUIREMENTS

Per City of Sumner requirements the 2005 DOE manual minimum requirements are to be applied to this project. Figure 2-2 and Figure 2-3 provide flowcharts from the DOE manual which show that Minimum Requirements #1-10 are to be addressed as part of this stormwater report.

2.1. Minimum Requirement #1: Preparation of Stormwater Site Plans

This report and the accompanying plans satisfy this requirement. Both the plans and report have been prepared in accordance with the 2005 DOE Manual by a licensed civil engineer.

2.2. Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

A Construction Stormwater Pollution Prevention Plan (CSWPPP) has been included with this submittal.

2.3. Minimum Requirement #3: Source Control of Pollution

Operational and Structural Source Control BMPs will include the maintenance of stormwater drainage and treatment systems as described in the Operations and Maintenance Manual, included within this report. Please see Appendix C.

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

The project does not propose to alter the downstream flow path from the project site. Stormwater generated by the existing project site sheetflows into the existing on-site conveyance system and is ultimately discharged into the White River after pollution generating surfaces have been treated.

2.5. Minimum Requirement #5: On-site Stormwater Management

This project does not propose to change natural hydrologic characteristics of the project site. The site will result in a net reduction of pollution generating impervious surface upon completion. Runoff will continue to be conveyed to the existing on-site conveyance system as it was in the existing condition after being treated in the proposed StormFilter manhole, with the exception of runoff generated by the proposed roofs and off-site drainage, which will bypass the cartridges and discharge directly to the existing detention pond.

2.6. Minimum Requirement #6: Runoff Treatment

Runoff generated by impervious surfaces from the proposed project site, with the exception of runoff generated by the proposed roof and off-site drainage, will be treated in the proposed StormFilter manhole, which satisfies the requirement for basic runoff treatment. The proposed StormFilter manhole has been designed to treat at least 91% of the total runoff volume as predicted using water quality analysis (WWHM 2012). Per Appendix I-C of the 2005 DOE SWMM, only basic treatment for the White River applies below the Greeenwater River.

No oil control has been proposed for this site since it not a “high-use” site, per section2.1 of Volume 5 of the DOE manual:

- The average daily traffic (ADT) for the site is less than 100 vehicles per 1,000 square feet of gross building area. A traffic engineering report determined that the greatest peak traffic hour for the site is currently 2 vph and that the proposed improvements will not increase traffic generated by the site.
- No petroleum storage or transfer is proposed.
- No storage or maintenance of trucks, buses, trains, or heavy equipment over 10 tons gross weight is proposed.
- There is no road intersection in the vicinity of the project.

2.7. Minimum Requirement #7: Flow Control

Runoff generated by the proposed improvements will be conveyed via a manmade channel into the White River, a flow control exempt receiving water per Appendix I-E of the 2005 DOE SWMM, as shown in Figure 2-1. Restrictions set forth by section 2.5.7 of Volume 1 of the DOE SWMM for flow control exemptions are satisfied since:

- Direct discharge to the exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1,2,3 or 4 or Types “S”, “F”, or “Np” or from any category I, II, or III wetland.
- The project site will be drained by a conveyance system that is comprised entirely of manmade elements and extends to the ordinary high water line of the exempt receiving water.
- The conveyance system between the project site and the exempt receiving water will have sufficient hydraulic capacity to convey discharges from future build-out conditions.
- Any erodible elements of the manmade conveyance system are adequately stabilized to prevent erosion.

Exempt Surface Waters List.

Water Body	Upstream Point/Reach for Exemption (if applicable)
	12205000
Nooksack River, South Fork	0.1 miles upstream of confluence with Skookum Creek
North River	Downstream of confluence with Vesta Creek
Ohanapecosh River	Downstream of confluence with Summit Creek
Puyallup River	Half-mile downstream of confluence with Kellog Creek
Queets River	Downstream of confluence with Tshletshy Creek
Quillayute River	Downstream of Bogachiel River
Quinault River	Downstream of confluence with North Fork Quinault River
Riffe Lake	
Ruby Creek	Ruby Creek at SR-20 crossing downstream of Granite and Canyon Creeks
Satsop River	Downstream of confluence of Middle and East Forks
Satsop River, East Fork	Downstream of confluence with Decker Creek
Sauk River	Downstream of confluence of South Fork and North Fork
Sauk River, North Fork	North Fork Sauk River at Bedal Campground
Silver Lake	Cowlitz County
Skagit River	Downstream of Canadian border
Skokomish River	Downstream of confluence of North and South Fork
Skokomish River, South Fork	Downstream of confluence with Vance Creek
Skokomish River, North Fork	Downstream of confluence with McTaggert Creek
Skookumchuck River	1 mile upstream of Bucoda at SR 507 mile post 11.0
Skykomish River	Downstream of South Fork
Skykomish River, South Fork	Downstream of confluence of Tye and Foss Rivers
Snohomish River	Down stream of confluence of Snoqualmie and Skykomish Rivers
Snoqualmie River	Downstream of confluence of the Middle Fork
Snoqualmie River, Middle Fork	Downstream of confluence with Rainy Creek
Sol Duc River	Downstream of confluence of North and South Fork Soleduck River
Stillaguamish River	Downstream of confluence of North and South Fork
Stillaguamish River, North Fork	7.7 highway miles west of Darrington on SR530, downstream of confluence with French Creek.
Stillaguamish River, South Fork	Downstream of confluence of Cranberry Creek and South Fork
Suiattle River	Downstream of confluence with Milk Creek
Sultan River	0.4 miles upstream of SR2
Swift Creek Reservoir	
Thunder Creek	Downstream of the confluence with Neve Creek
Tilton River	Downstream of confluence with North Fork Tilton River
Toutle River	North and South Fork Confluence
Toutle River, North Fork	Downstream of confluence with Hoffstadt Creek
Toutle River, South Fork	Downstream of confluence with Thirteen Creek
White River	Downstream of confluence with Huckleberry Creek
Willapa River	Downstream of confluence with Mill Creek
Wind River	Downstream of confluence with Cold Creek
Wynochee Lake	
Wynoochee River	Downstream of confluence with Schafer Creek

Figure 2-1: Exempt Surface Waters List

2.8. Minimum Requirement #8: Wetlands Protection

N/A. There are no wetlands on the project site.

2.9. Minimum Requirement #9: Basin/Watershed Planning

No basin plans have been found for the project site location.

2.10. Minimum Requirement #10: Operations and Maintenance

Stormwater conveyance and treatment facilities located on the property will be privately owned and maintained. An Operations and Maintenance Manual is included in Appendix C of this report.

2.11. Optional Guidance #1: Financial Liability

The owner will provide performance bonding as required by the City of Sumner.

2.12. Optional Guidance #2: Off-site Analysis

A qualitative analysis of flows leaving the site is included in Section 3.0 below.

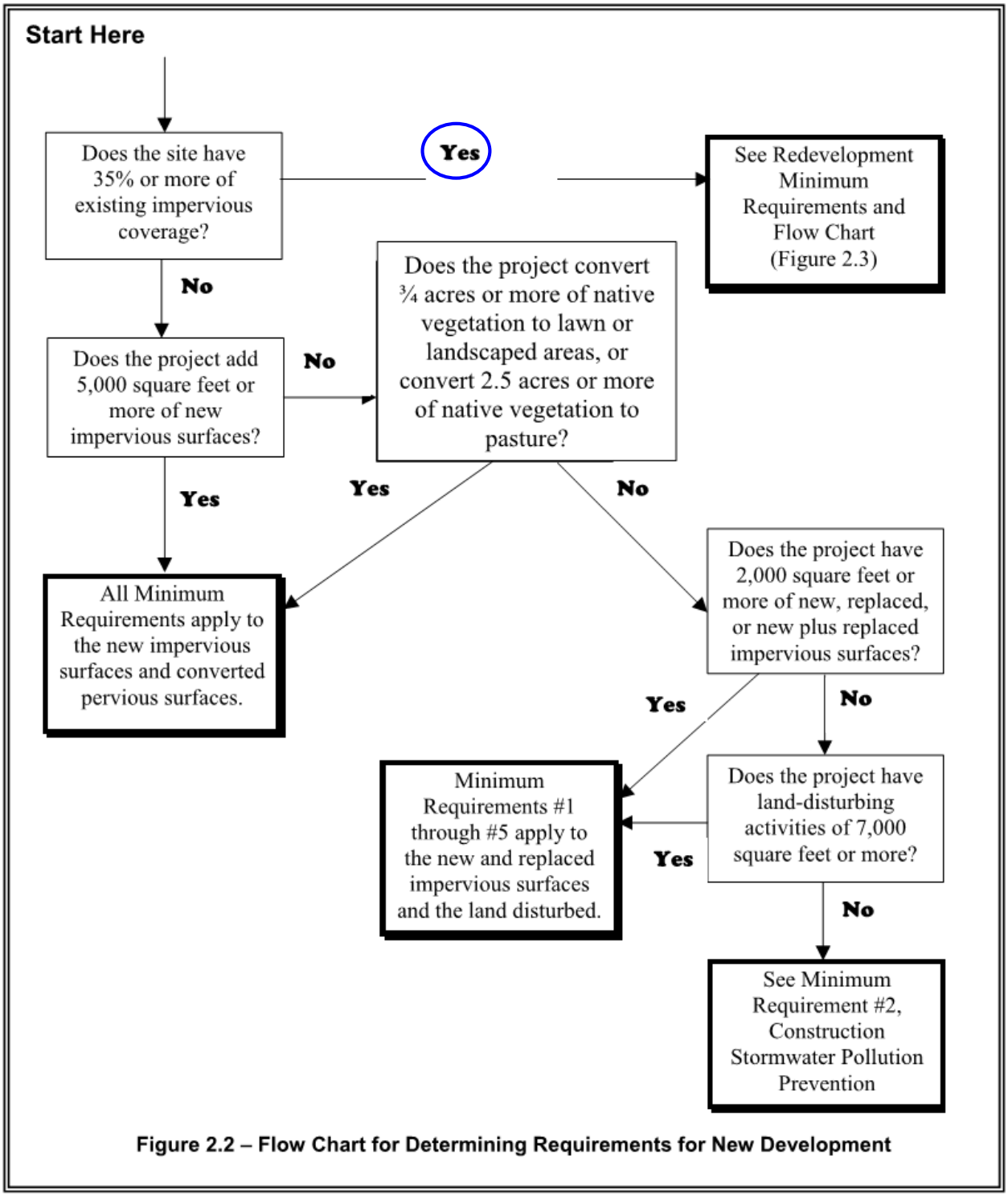

Figure 2-2: Flow Chart for Determining Requirements for New Development per the 2005 DOE Manual

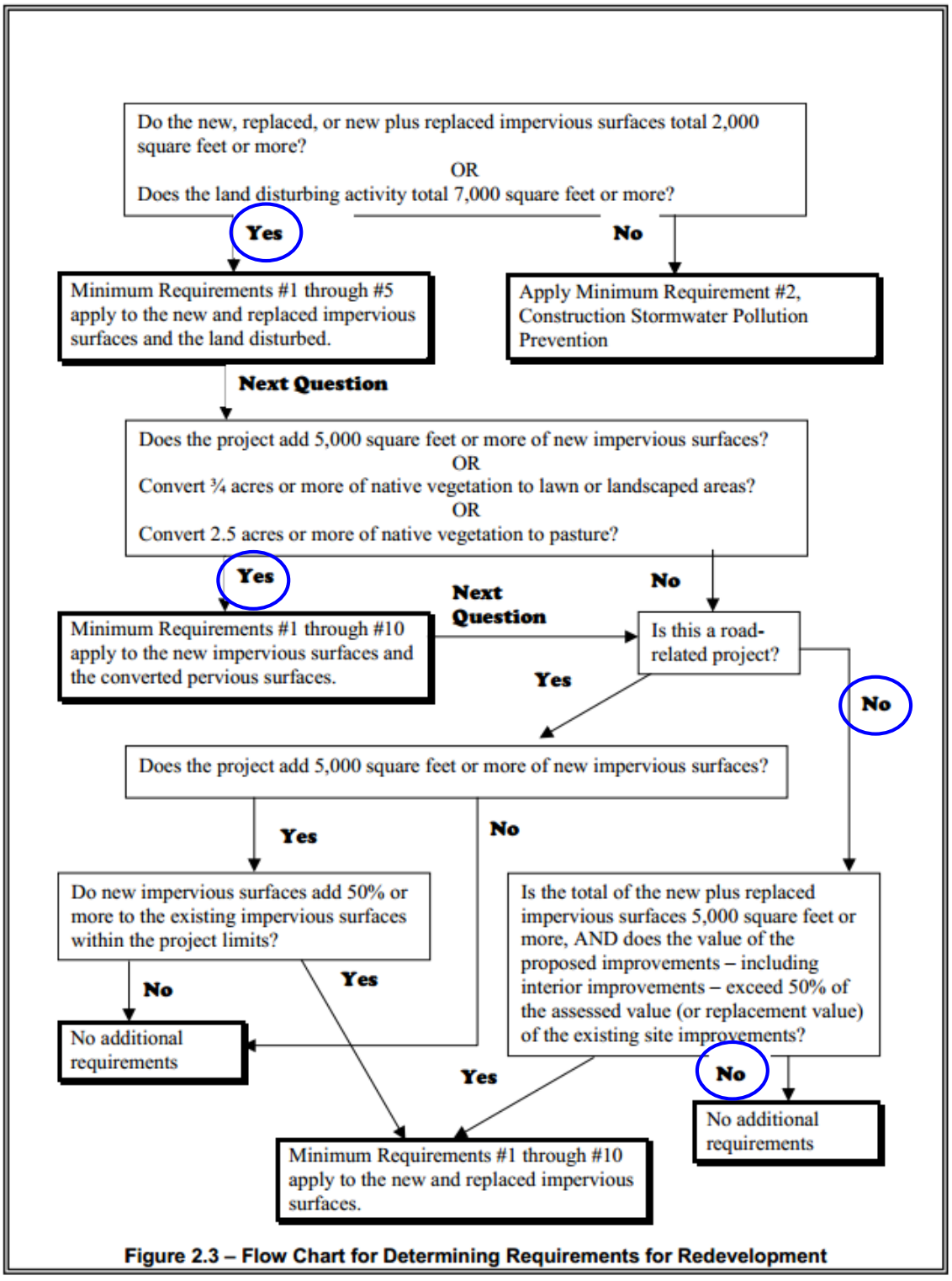

Figure 2.3 – Flow Chart for Determining Requirements for Redevelopment

Figure 2-3: Flow Chart for Determining Requirement for Redevelopment per the 2005 DOE Manual

3. OFF-SITE ANALYSIS

Stormwater from the site area sheetflows to the west and enters the on-site conveyance system via catch basins. Stormwater is then conveyed to an existing detention pond which discharges to the existing ditch adjacent to the rail line which ultimately discharges to the White River.

In the proposed condition, the project site will continue to drain via the existing storm system to the existing detention pond. Prior to entering the detention pond, proposed pollution generating impervious surfaces will be treated by a proposed StormFilter manhole.

A downstream analysis, including physical inspection, concluded no significant problems were encountered with the ditch adjacent to the rail line for at least one-fourth of a mile. The ditch follows the rail line for more than 0.25 miles before it ultimately discharges into the White River. It appears that the ditch is regularly maintained by the City of Sumner.

Sitts and Hill Engineers, Inc., upon physical inspection of the site, did not identify any problems with downstream flow path

- Conveyance system capacity problems
- Localized flooding
- Upland erosion impacts
- Stream channel erosion at the outfall location
- Violations of surface water quality standards as identified in a Basin Plan or a TMDL; or violations of ground water standards in a wellhead protection area

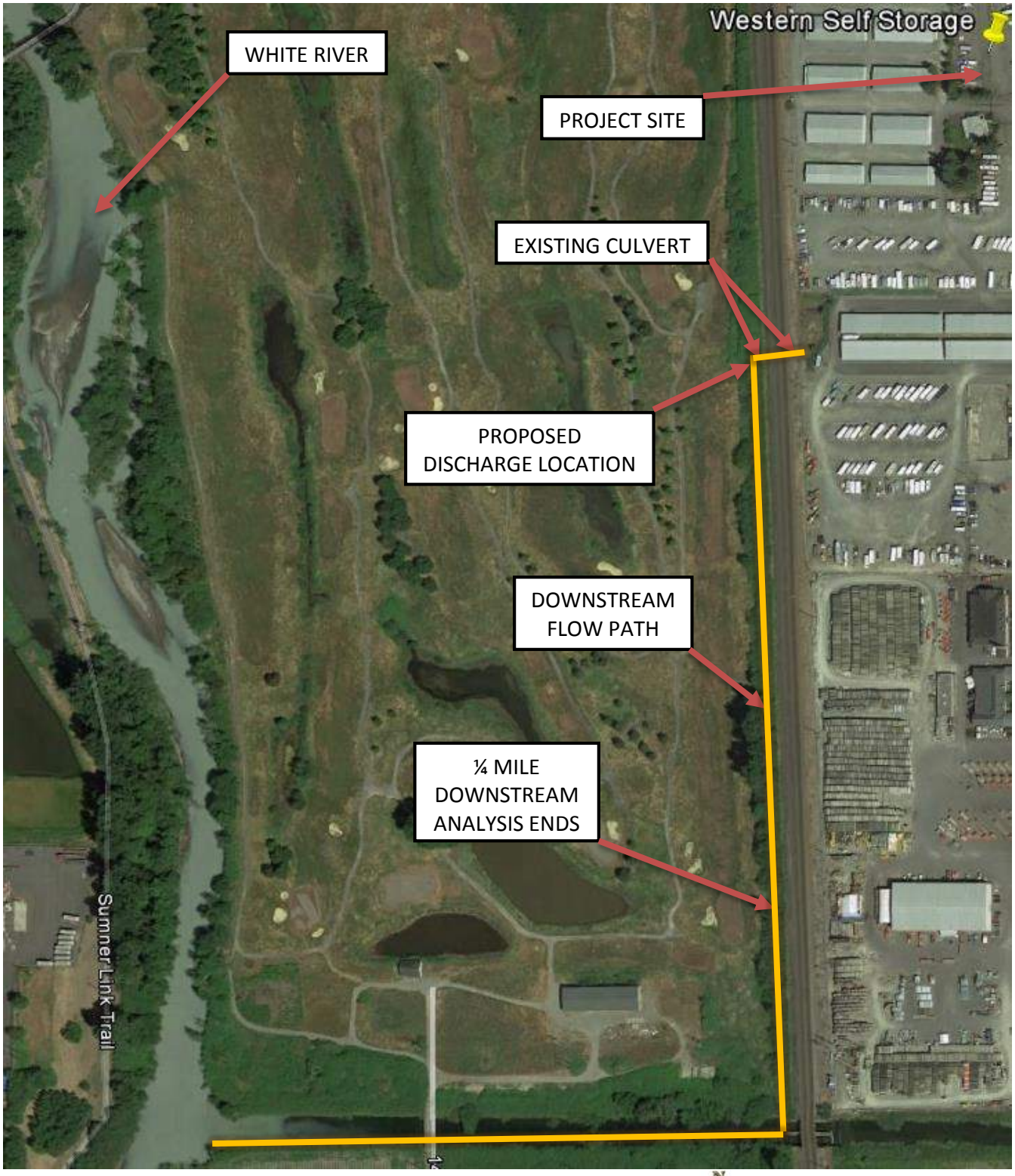

Figure 3-1: Downstream Analysis Aerial Map

4. PERMANENT STORMWATER CONTROL PLAN

The proposed project site improvements will consist of five new self storage buildings (0.47 acres of roof). Proposed improvements also include new asphalt surfaces and landscaped areas. The proposed pollution generating improvements have been graded to drain to a StormFilter manhole equipped with five cartridges for treatment. Stormwater runoff generated by the roofs and off-site surfaces will be conveyed separately, directly to the existing on-site detention pond.

	Existing (Acres)	Proposed (Acres)	Net Change (Acres)
Pervious	0	0.18	0.18
PGIS	1.58	0.93	-0.65
Non-PGIS (Roof)	0	0.47	0.47
Impervious Subtotal	*1.58*	*1.40*	-0.18
Total	**1.58**	**1.58**	**0**

Figure 4-1: Project Areas Tables

The calculations included in Appendix B indicate that the proposed StormFilter manhole will treat at least 91% of the runoff generated by the project site requiring stormwater treatment.

APPENDIX A: CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

Appendix A.1 Construction Stormwater Pollution Prevention Elements

Below is a discussion of each of the twelve Construction Stormwater Pollution Prevention Elements and a summary of applicable BMPs. Design, installation, and maintenance of any specific BMP should be carried out in accordance with the 2005 edition of the Stormwater Management Manual for Western Washington, published by the Department of Ecology (the Manual) and any further instructions detailed in the construction plans. Included in Appendix A are the Manual specifications, tables and figures for each BMP identified in this report.

Appendix A.1.1 Element 1 – Mark Clearing Limits

Prior to commencing any land disturbing activities, the contractor is required to clearly mark and establish the project clearing limits. The clearing activities will consist of removing existing site debris and site grading work. Work limits will be identified in the field from the construction plans. Flagging and fluorescent paint will be used to delineate the limits of construction.

Applicable BMPs: BMP C101: Preserve Natural Vegetation
BMP C103: High Visibility Plastic or Metal Fence

Appendix A.1.2 Element 2 – Establish Construction Access

Construction vehicles will utilize the existing paved roadway off of East Valley Highway East to access the project site. Any debris generated as a result of construction activity will be swept clean as necessary to prevent tracking onto City of Sumner roadways.

Applicable BMPs: N/A

Appendix A.1.3 Element 3 – Control Flow Rates

Sediment control will be provided both during Site Preparation work and site development work. The installation and continued maintenance of the proposed BMPs will protect downstream properties from sediment, erosion, and flooding in accordance with the Manual.

Applicable BMPs: BMP C209: Outlet Protection
BMP C220: Storm Drain Inlet Protection

Appendix A.1.4 Element 4 – Install Sediment Controls

Plastic covering will be used by the contractor at material stockpiles, as needed to mitigate the migration of sediment. Catch Basin Inserts (CBI) will be used by the contractor to deter sediment from entering the existing on-site and off-site catch basins as well as proposed catch basins (upon their installation). If any basin or insert becomes filled with sediment or debris, it must be cleaned in such a manner as to prevent material from entering the stormwater drainage system. Silt fence will be installed along the down-gradient limits of work.

Use of proper sawcutting and surface pollution prevention techniques will occur throughout the project. Proper concrete handling techniques shall be employed during any concrete pouring processes.

Applicable BMPs:
- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP C123: Plastic Covering
- BMP C125: Topsoiling
- BMP C140: Dust Control
- BMP C150: Materials on Hand
- BMP C151: Concrete Handling
- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C153: Material Delivery, Storage and Containment
- BMP C209: Outlet Protection
- BMP C220: Storm Drain Inlet Protection
- BMP C233: Silt Fence

Appendix A.1.5 Element 5 – Stabilize Soils

Any exposed soil requiring stabilization due to poor weather conditions, or left unworked for more than 2 days from October 1 to March 31 (7 days from April 1 to September 30), will be covered at the end of each work shift. Covering material will be anchored to ensure adequate protection. Erosion control measures will remain in place until soil stabilization can be achieved by the establishment of vegetation, gravel subbase material, or final surfacing. After grading has been completed, the area will be stabilized to the extent practicable. Irrigation will be provided, on an as needed basis, to areas requiring vegetation until the vegetation has been established. Dust control will be achieved at the Contractor's discretion by keeping the work area adequately moisture conditioned.

Applicable BMPs:
- BMP C101: Preserving Natural Vegetation
- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP C123: Plastic Covering
- BMP C125: Topsoiling
- BMP C130: Surface Roughening
- BMP C140: Dust Control

Appendix A.1.6 Element 6 – Protect Slopes

There are no steep slopes on-site or in the vicinity of the project. As areas are brought to proposed finish grade they will be stabilized with erosion control seeding.

Applicable BMPs:
- BMP C120: Temporary and Permanent Seeding
- BMP C121: Mulching
- BMP C123: Plastic Covering
- BMP C130: Surface Roughening

Appendix A.1.7 Element 7 – Protect Drain Inlets

All storm drain inlets and catch basins – existing and proposed – gathering runoff from the site are to be protected as necessary during construction. The construction drawings detail the location and protection measure required for each drain inlet. Inlet protection filters are required on all existing inlets. Filters will be inspected frequently during construction (especially after storm events) and pavement will be checked and swept as necessary. If inlet protection filters become filled with sediment, they will be cleaned in such a manner as to prevent sediment from entering the stormwater drainage system. Inlet protection material will also be kept on hand in case additional protection becomes necessary. Paved areas should be swept on an as-needed basis to prevent the transfer of sediment towards the protected storm drain inlets.

Applicable BMPs:
- BMP C150: Materials on Hand
- BMP C201: Grass Lined Channels
- BMP C209: Outlet Protection
- BMP C220: Storm Drain Inlet Protection

Appendix A.1.8 Element 8 – Stabilize Channels and Outlets

There are no existing or proposed channels on the project site. Drainage is currently, and will continue to be, served by a closed conveyance system. No work is proposed at the ditch which conveys stormwater to the White River.

Applicable BMPs: N/A

Appendix A.1.9 Element 9 – Control Pollutants

All material to be demolished and removed will be disposed of at an approved off-site location. Fueling of construction vehicles and other motorized equipment will occur at approved off-site facilities and will occur on-site only in accordance with the DOE's mobile fueling best management practices. Construction equipment will be inspected daily as part of regular maintenance activities. Any leaks or other sources of contamination will be repaired immediately. Spillage or other discharges of pollutants will be reported within 24 hours. The contractor will maintain any materials necessary for rapid cleanup of spills.

Applicable BMPs:
- BMP C150: Materials on Hand
- BMP C152: Sawcutting and Surface Pollution Prevention
- BMPs for Mobile Fueling of Vehicles and Heavy Equipment

Appendix A.1.10 Element 10 – Control Dewatering

We do not anticipate any de-watering during the construction of this project.

Appendix A.1.11 Element 11 – Maintain BMPs

All erosion and sediment control BMPs will be maintained and repaired as needed during construction in accordance with the DOE guidance included in Appendix A. Installed BMPs will be inspected weekly (unless otherwise specified) or after any large storm event for stability and functionality. Deficiencies will be corrected

in such a way as to prevent sediment from either leaving the site or entering the existing or proposed stormwater drainage system. Temporary protection measures will be removed within 30 days of construction completion.

Applicable BMPs: BMP C150: Materials on Hand
BMP C162: Scheduling

Appendix A.1.12 Element 12 – Manage the Project

There are no seasonal work limitations associated with this project. The Erosion Control Specialist identified prior to the start of construction will be on-call at all times.

This Construction Stormwater Pollution Prevention Plan will be retained on-site during construction. A City inspector will be notified if changes are made to this plan. Changes may occur if there are significant modifications to the design, construction, operation, or maintenance of the proposed drainage system or installed BMPs.

The contractor will designate at least one person as a responsible representative in charge of ESC and water quality protection. The designated person shall be the CESCL who is responsible for ensuring compliance with all local, state, and federal ESC and water quality requirements.

Applicable BMPs: BMP C150: Materials on Hand
BMP C160: Certified Erosion and Sediment Control Lead
BMP C162: Scheduling

Appendix A.2 Project Description

Western Self Storage is applying for a land modification permit for development of new self storage buildings. The development will be comprised of a new paved parking and driving area, five self storage buildings, and landscaping.

The project site (1.58 acres) is owned by Western Self Storage. The new self storage buildings, paved parking, and driving areas will be constructed as the final site development. Conveyance piping, catch basins, and StormFilter manhole are proposed and will handle stormwater runoff.

The approximate volumes of earthwork during Site Preparation work have been tabulated below:

ACTIVITY	VOLUME	UNIT
CUT	1,770	CY
FILL	185	CY
NET CUT	1,585	CY

Appendix A.3 Location and Site Description:

The project site address is 1402 East Valley Highway East, Sumner, WA 98390. The site is located on the west side of East Valley Highway and to the south of Lake Tapps Parkway. Please see the vicinity map at the end of this section. The site is situated on parcel number 9520000236. The parcel is located in the southwest quarter

of Section 6, Township 20N, Range 5E of the Willamette Meridian, Pierce County, Washington. The site is accessed from East Valley Highway East. Areas adjacent to the proposed project are developed for light industrial.

Vicinity Map

Not to Scale

Appendix A.4 Existing Conditions

Western Self Storage is located on the west side of East Valley Highway East. Please see the vicinity map from the previous section. The existing project site (1.58 acres) has minimal slopes at up to approximately 2.5% and is comprised entirely of gravel surfaces.

The existing gravel area is tributary to the existing on-site conveyance system. Sitts & Hill Engineers, Inc., upon physical inspection of the site, did not identify any problems with the existing drainage facilities or any significant stormwater discharges from the existing drainage facilities (runon or runoff) to adjacent properties under the existing conditions.

Stormwater from the site area sheetflows to the west and enters the on-site conveyance system via catch basins. Stormwater is then conveyed to an existing detention pond which discharges to the existing ditch adjacent to the rail line which ultimately discharges to the White River.

Appendix A.5 Adjacent Areas

Adjacent properties are zoned for light industrial and are currently being used for storage, topsoil sales, and mining. West of the property is an existing BNSF rail line.

No disturbance to areas adjacent to the project site is proposed. There are no streams, lakes, wetlands, or other riparian areas on or adjacent to the property that will be negatively impacted.

Appendix A.6 Critical Areas

There are no critical areas that will be impacted as a result of this project.

Appendix A.7 Soils

Generally, the soils on-site are Hydrologic Group D soils. For a descriptive and complete evaluation of the site soil, please see the NRCS soil survey included below.

USDA 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 Pierce County Area, Washington

July 6, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

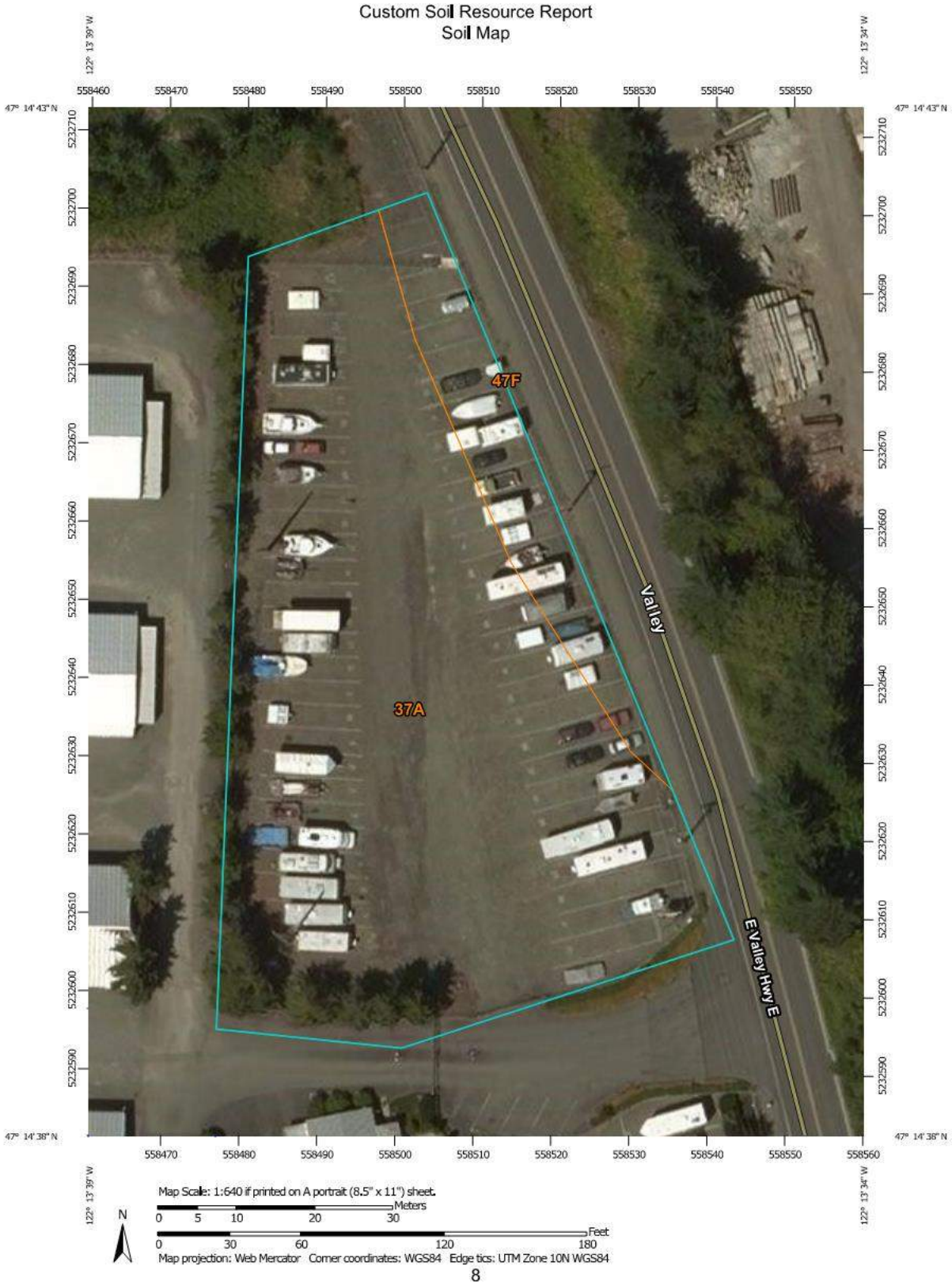
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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


Custom Soil Resource Report
Soil Map
122° 13' 39" W
122° 13' 34" W
47° 14' 43" N
47° 14' 38" N
558460
558470
558480
558490
558500
558510
558520
558530
558540
558550
558560
5232710
5232700
5232690
5232680
5232670
5232660
5232650
5232640
5232630
5232620
5232610
5232600
5232590
47F
37A
Valley
E Valley Hwy E
Map Scale: 1:640 if printed on A portrait (8.5" x 11") sheet.
Meters
0 5 10 20 30
Feet
0 30 60 120 180
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

8

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: http://websoilsurvey.nrcs.usda.gov
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: Pierce County Area, Washington
Survey Area Data: Version 9, Sep 16, 2014

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

Date(s) aerial images were photographed: Jul 8, 2014—Jul 15, 2014

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.

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Map Unit Legend

Pierce County Area, Washington (WA653)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
37A	Semiahmoo muck	1.0	88.3%
47F	Xerochrepts, 45 to 70 percent slopes	0.1	11.7%
Totals for Area of Interest		**1.2**	**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.

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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.

Custom Soil Resource Report

Pierce County Area, Washington

37A—Semiahmoo muck

Map Unit Setting

National map unit symbol: 2hqm
Elevation: 10 to 1,300 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 250 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Semiahmoo and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Semiahmoo

Setting

Landform: Flood plains
Parent material: Herbaceous organic material

Typical profile

H1 - 0 to 12 inches: muck
H2 - 12 to 53 inches: muck
H3 - 53 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly 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 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 26.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Other vegetative classification: Wet Soils (G002XN102WA)

Minor Components

Shalcar

Percent of map unit: 10 percent
Landform: Depressions

Custom Soil Resource Report

47F—Xerochrepts, 45 to 70 percent slopes

Map Unit Setting

National map unit symbol: 2hr5
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 45 to 46 degrees F
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Xerochrepts

Setting

Landform: Valley sides
Parent material: Sandy and gravelly outwash and/or glacial till

Typical profile

H1 - 0 to 6 inches: gravelly sandy loam
H2 - 6 to 40 inches: gravelly sandy loam
H3 - 40 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 45 to 70 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A

Minor Components

Coastal beaches

Percent of map unit:
Landform: Alluvial cones

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Appendix A.8 Potential Erosion Problem Areas

Slopes within the project site are minimal and not prone to erosion. During construction, any sediment or debris that leaves the project site must be swept or mechanically removed to prevent it from entering the drainage system or city roads. Catch basin inserts will also be installed to prevent the migration of sediment. Plastic covering and mulch may also be used as necessary at the contractor's discretion to protect underlying soil.

Appendix A.9 Construction Phasing

This project is proposed in one phase and does not require a construction phasing sequence. Site construction will begin as soon as the permits are issued and should not last more than one year.

Appendix A.10 Construction Schedule

The contractor will coordinate all scheduling needed for the proposed construction. It is anticipated that work will start during the summer of 2015 through the fall of 2015.

The following typical construction sequence will be used:

1. Flag or otherwise mark the limits of construction.
2. Post sign with name and phone number of supervisor.
3. Install sediment and erosion control BMPs, as required.
4. Maintain erosion control measures in accordance with the manufacturer's recommendations throughout construction.
5. Clean the completed project area and conveyance system.
6. Remove any temporary BMPs.

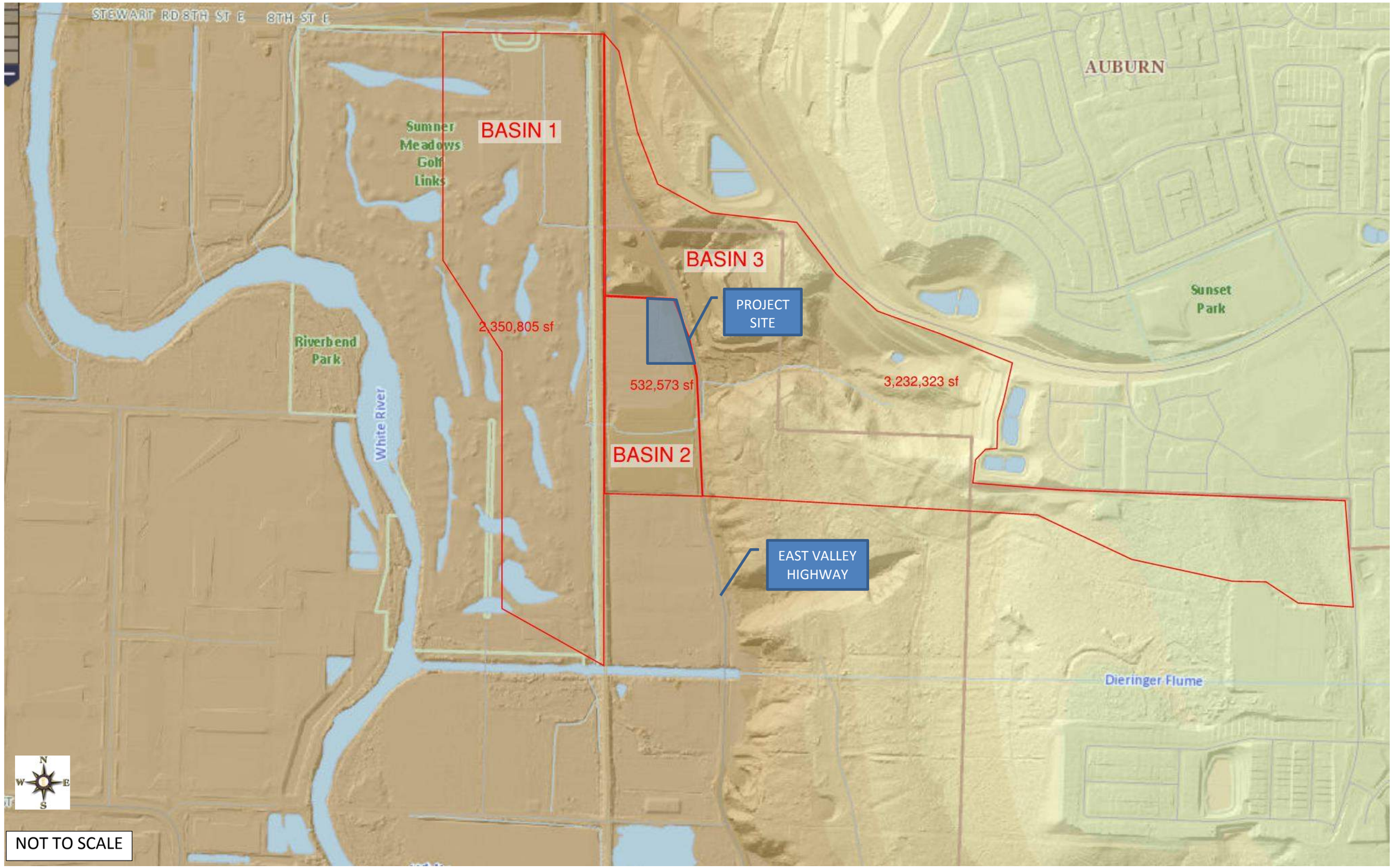
Appendix A.11 Financial/Ownership Responsibilities

The contractor will be responsible for all erosion and maintenance liabilities during construction.

APPENDIX B: ENGINEERING CALCULATIONS

Off-site Calculations

This section of calculations shows that the existing ditch tributary to the White River can adequately handle runoff for the tributary basins shown in the figure included in this section. Basin 1 includes area which was used for a golf course in the past and is directly tributary to the regional ditch on the west side of the BNSF main line. Basin 2 includes area for the project site and adjacent developed land which is part of the same drainage system that this project will tie into. Basin 3 includes forested area and mining operations which is directly bypassed to the drainage ditch via a culvert and piping across the southerly extent of Basin 2.


STEWART RD
8TH ST E
8TH ST E
AUBURN
Sumner Meadows Golf Links
BASIN 1
BASIN 3
PROJECT SITE
2,350,805 sf
532,573 sf
3,232,323 sf
Sunset Park
Riverbend Park
White River
BASIN 2
EAST VALLEY HIGHWAY
Dieringer Flume
N
W
E
S
NOT TO SCALE

Time of Concentration – Basin 1

Sheetflow		
L	300	(ft)
s	1.00%	(%)
n_s	0.15	
T_c	38.65	(min)

Shallow Concentrated Flow			Channel Flow		
L	950	(ft)	L	3904	(ft)
s	1.30%	(%)	s	1.00%	(%)
k	11		k	27	
V	1.25	(fps)	V	2.70	(fps)
T_c	12.62	(min)	T_c	24.10	(min)

Total		
T_c	75.38	(min)

Time of Concentration – Basin 2

Pipe #1 Flow		
L	560.00	(ft)
V	3.0	(fps)
T_c	3.11	(min)

Channel Flow		
L	2459	(ft)
s	1.00%	(%)
k	27	
V	2.70	(fps)
T_c	15.18	(min)

Total		
T_c	18.29	(min)

Time of Concentration – Basin 3

Sheetflow		
L	300	(ft)
s	2.30%	(%)
n_s	0.4	
T_c	60.71	(min)

Shallow Concentrated Flow		
L	2634	(ft)
s	5.20%	(%)
k	3	
V	0.68	(fps)
T_c	64.17	(min)

Channel Flow		
L	1342	(ft)
s	23.30%	(%)
k	27	
V	13.03	(fps)
T_c	1.72	(min)

Channel Flow		
L	1073	(ft)
s	1.40%	(%)
k	23	
V	2.72	(fps)
T_c	6.57	(min)

Pipe #1 Flow		
L	1134.00	(ft)
V	3.0	(fps)
T_c	6.30	(min)

Total		
T_c	139.47	(min)

The following table shows curve numbers, time of concentrations, and flow rates for each basin. A time of concentration of 6 minutes was chosen for Basin 1 to conservatively estimate the storm drainage upon full build-out of the site.

100-Year, 24-Hour

LOCATION		Ground	Type	SUBBASIN ID	AREA	AREA	CN	SUM	Tc	FLOW
FROM	TO	Cover			(SF)	(AC.)		AREA (AC.)	(MIN.)	(CFS)
Basin 1		P	Pervious	1	235080	5.40	92	5.40		
	Ditch	I	Impervious		2115724	48.57	98	48.57	6.0	54.99
Basin 2		P	Pervious	2	0	0.00	86	0.00		
	Ditch	I	Impervious		532573	12.23	98	12.23	18.0	10.42
Basin 3		P	Pervious	3	3010156	69.10	77	69.10		
	Ditch	I	Impervious		222167	5.10	98	5.10	139.0	11.25

The total flowrate for the basins tributary to the regional drainage ditch is 76.67 cfs for the 100-year, 24-hour rainfall event.

Manning's Trapezoidal Cross-Section

Input Data	b	8.0	Bottom Width (ft)
	y	2.17	Flow Depth (ft)
	z	1.5	Side Slopes (ft/ft)
	n	0.040	Mannings "n"
	s	0.4%	Longitudinal Slope (%)

Output data	A	24.38	Flow Area (sf)
	WP	15.81	Wetted Perimeter (ft)
	R	1.542	Hydraulic Radius (ft)
	Q	76.670	Maximum Flow Rate (cfs)
	V	3.144	Velocity @ Maximum Flow Rate (fps)

Cell Formulas:

A = $(b*y)+(z*y^2)$

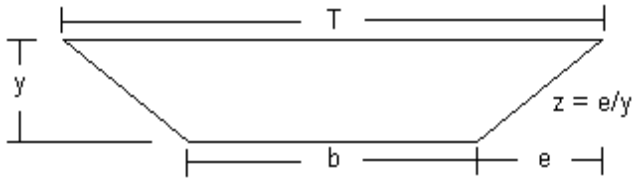
WP = $b+(2*y*(SQRT(z^2+1)))$

R = A/WP

Q = $(1.49/n)*A*R^{(2/3)}*s^{0.5}$

V = Q/A

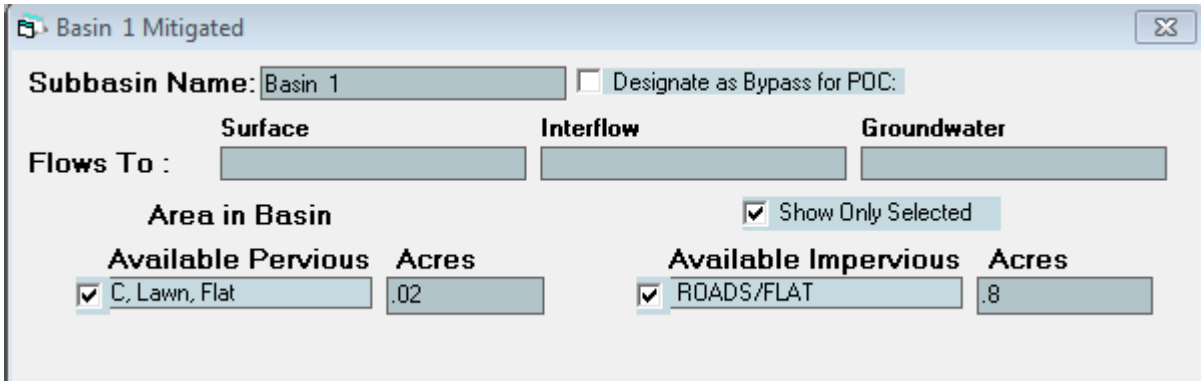
Typical Cross-Section:

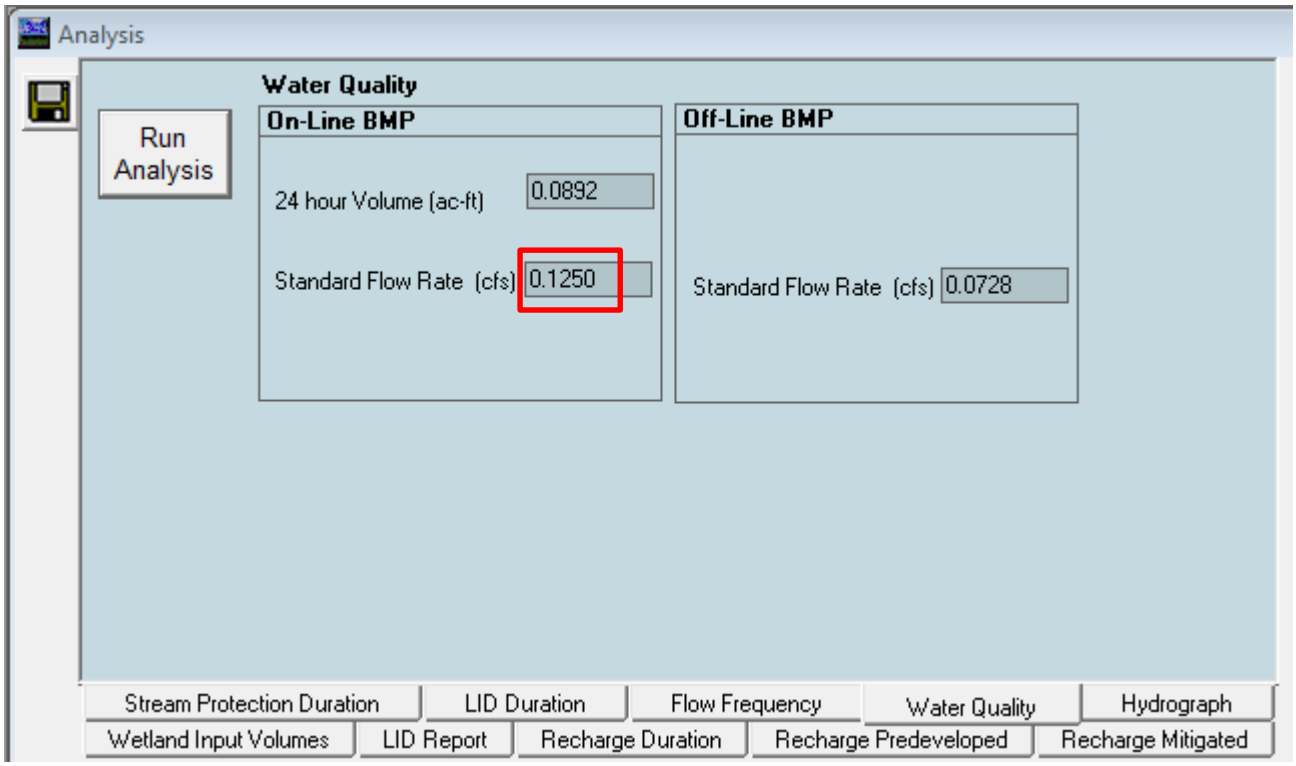


Field data was gathered for this project to typify the regional drainage ditch (cross sectional area, depth, slope). The depth of the ditch averages 4 ft from the bottom of ditch to the top of bank. The above calculation illustrates that the existing ditch is capable of conveying the 100-year, 24-hour rainfall event at a flow depth of 2.17 ft. Therefore, the existing ditch is large enough for the anticipated flows tributary, with adequate freeboard.

Water Quality

The following WWHM calculation is used to determine how many StormFilter cartridges will be required to treat stormwater from pollution generating surfaces.





WASHINGTON STATE DEPARTMENT OF ECOLOGY

September 2014

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) TREATMENT

For

CONTECH Engineered Solutions
Stormwater Management StormFilter®
With ZPG Media at 1 gpm/sq ft media surface area

Ecology's Decision:

Based on the CONTECH Engineered Solutions' (CONTECH) application submissions, Ecology hereby issues a General Use Level Designation (GULD) for the Stormwater Management StormFilter® (StormFilter):

1. **As a basic stormwater treatment practice for total suspended solids (TSS) removal,**
   - **Using ZPG™ media (zeolite/perlite/granular activated carbon), with the size distribution described below,**
   - **Sized at a hydraulic loading rate of 1 gpm/ft^2 of media surface area, per Table 1, and**
   - **Internal bypassing needs to be consistent with the design guidelines in CONTECH's current product design manual.**

Table 1. StormFilter Design Flow Rates per Cartridge

Effective Cartridge Height (inches)	12	18	27
Cartridge Flow Rate (gpm/cartridge)	5	7.5	11.3

2. **Ecology approves StormFilter systems containing ZPG™ media for treatment at the hydraulic loading rates shown in Table 1, to achieve the maximum water quality design flow rate. The water quality design flow rates are calculated using the following procedures:**
   - **Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.**

CONTECH - StormFilter® GULD Maintenance Update (November 2012) Page | 1

Each cartridge can treat 11.3 gpm and since the site runoff flow rate of 0.125 cfs is equivalent to 56.1 gpm a total of 5 cartridges will be required for this site.

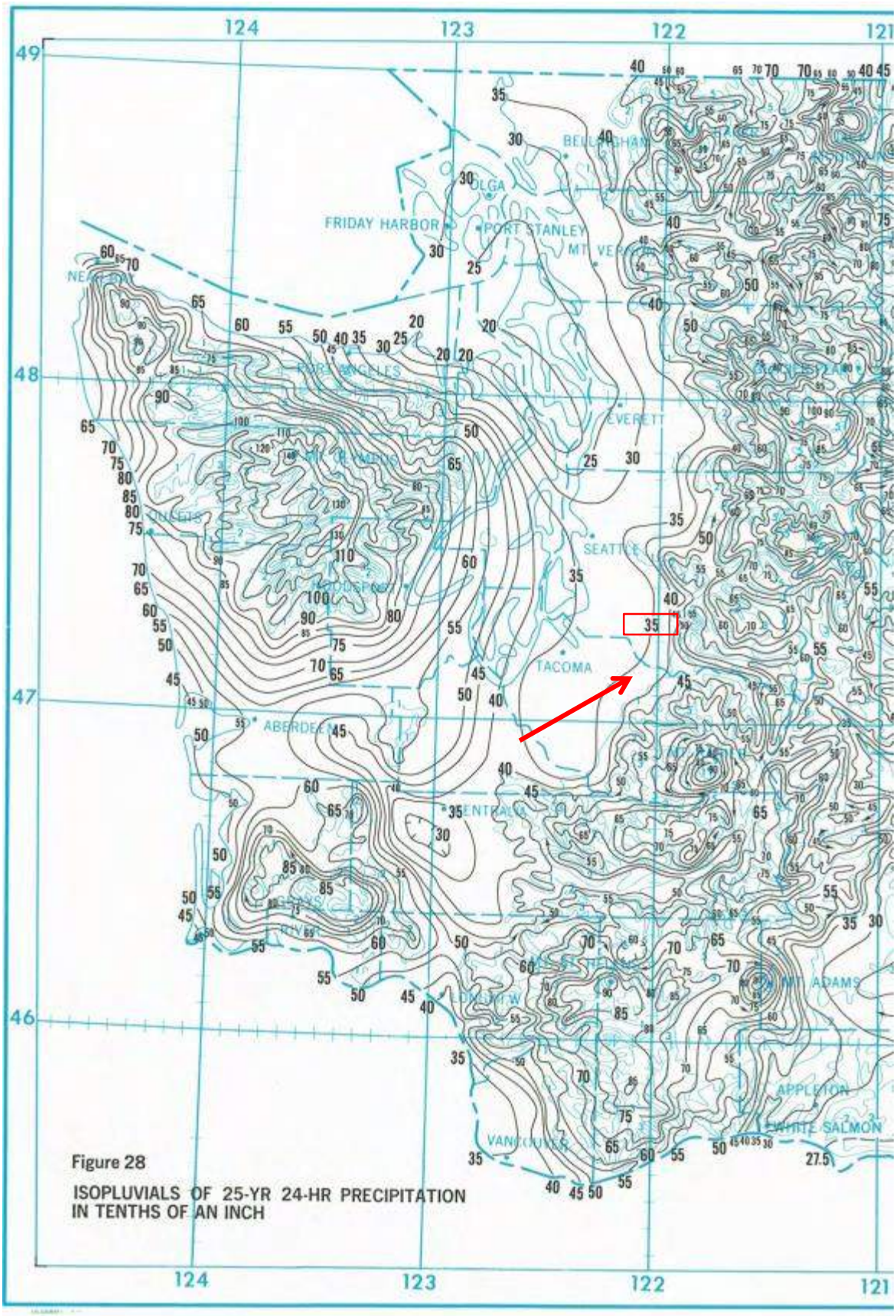
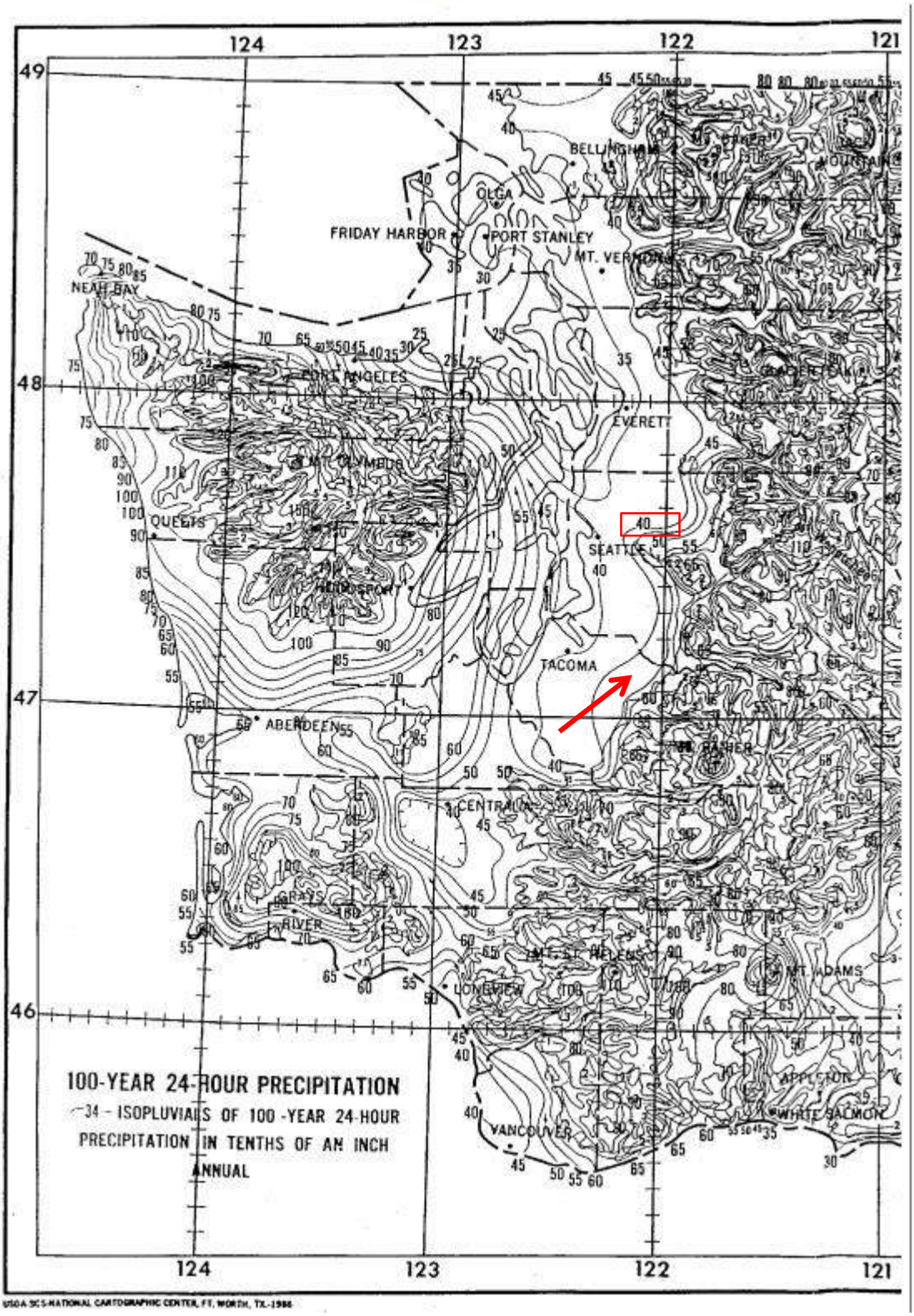


Figure 28

ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

Isopluvial map for 100-year, 24-hr storm event from the 2005 DOE Stormwater Management Manual.

Western Washington Isopluvial 100-year, 24 hour



Curve numbers for calculating peak flow were obtained from Table 2.2 of the 2005 DOE Manual.

Table 2.2
Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas

(Sources: TR 55, 1986, and Stormwater Management Manual, 1992. See Section 2.1.1 for explanation)

Cover type and hydrologic condition.	CNs for hydrologic soil group A	B	C	D
Curve Numbers for Pre-Development Conditions				
Pasture, grassland, or range-continuous forage for grazing:				
Fair condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Good condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80
Woods:				
Fair (Woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
Good (Woods are protected from grazing, and litter and brush adequately cover the soil).	30	55	70	77
Curve Numbers for Post-Development Conditions				
Open space (lawns, parks, golf courses, cemeteries, landscaping, etc.)[1]				
Fair condition (grass cover on 50% - 75% of the area).	77	85	90	92
Good condition (grass cover on >75% of the area)	68	80	86	90
Impervious areas:				
Open water bodies: lakes, wetlands, ponds etc.	100	100	100	100
Paved parking lots, roofs[2], driveways, etc. (excluding right-of-way)	98	98	98	98
Permeable Pavement (See Appendix C to decide which condition below to use)				
Landscaped area	77	85	90	92
50% landscaped area/50% impervious	87	91	94	96
100% impervious area	98	98	98	98
Paved	98	98	98	98
Gravel (including right-of-way)	76	85	89	91
Dirt (including right-of-way)	72	82	87	89
Pasture, grassland, or range-continuous forage for grazing:				
Poor condition (ground cover <50% or heavily grazed with no mulch).	68	79	86	89
Fair condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Good condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80
Woods:				
Poor (Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning).	45	66	77	83
Fair (Woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
Good (Woods are protected from grazing, and litter and brush adequately cover the soil).	30	55	70	77

Single family residential[3]: Dwelling Unit/Gross Acre	Should only be used for subdivisions > 50 acres	Average Percent impervious area[3,4]	
1.0 DU/GA		15	Separate curve number
1.5 DU/GA		20	shall be selected for
2.0 DU/GA		25	pervious & impervious
2.5 DU/GA		30	portions of the site or
3.0 DU/GA		34	basin
3.5 DU/GA		38	
4.0 DU/GA		42	
4.5 DU/GA		46	
5.0 DU/GA		48	
5.5 DU/GA		50	
6.0 DU/GA		52	
6.5 DU/GA		54	
7.0 DU/GA		56	
7.5 DU/GA		58	
PUD's, condos, apartments, commercial businesses, industrial areas & & subdivisions < 50 acres	%impervious must be computed	Separate curve numbers shall be selected for pervious and impervious portions of the site	

For a more detailed and complete description of land use curve numbers refer to chapter two (2) of the Soil Conservation Service's Technical Release No. 55 , (210-VI-TR-55, Second Ed., June 1986).

[1] Composite CN's may be computed for other combinations of open space cover type.
[2] Where roof runoff and driveway runoff are infiltrated or dispersed according to the requirements in Chapter 3, the average percent impervious area may be adjusted in accordance with the procedure described under "Flow Credit for Roof Downspout Infiltration" (Section 3.1.1), and "Flow Credit for Roof Downspout Dispersion" (Section 3.1.2).
[3] Assumes roof and driveway runoff is directed into street/storm system.
[4] All the remaining pervious area (lawn) are considered to be in good condition for these curve numbers.

APPENDIX C: OPERATION AND MAINTENANCE MANUAL

Appendix C.1 Purpose

The purpose of this Manual is to provide guidelines for maintaining the permanent on-site private storm drainage system constructed as a part of the new self storage buildings and associated driving surfaces. The proposed self storage buildings are located just east of existing self storage buildings. The site address is 1402 East Valley Highway East.

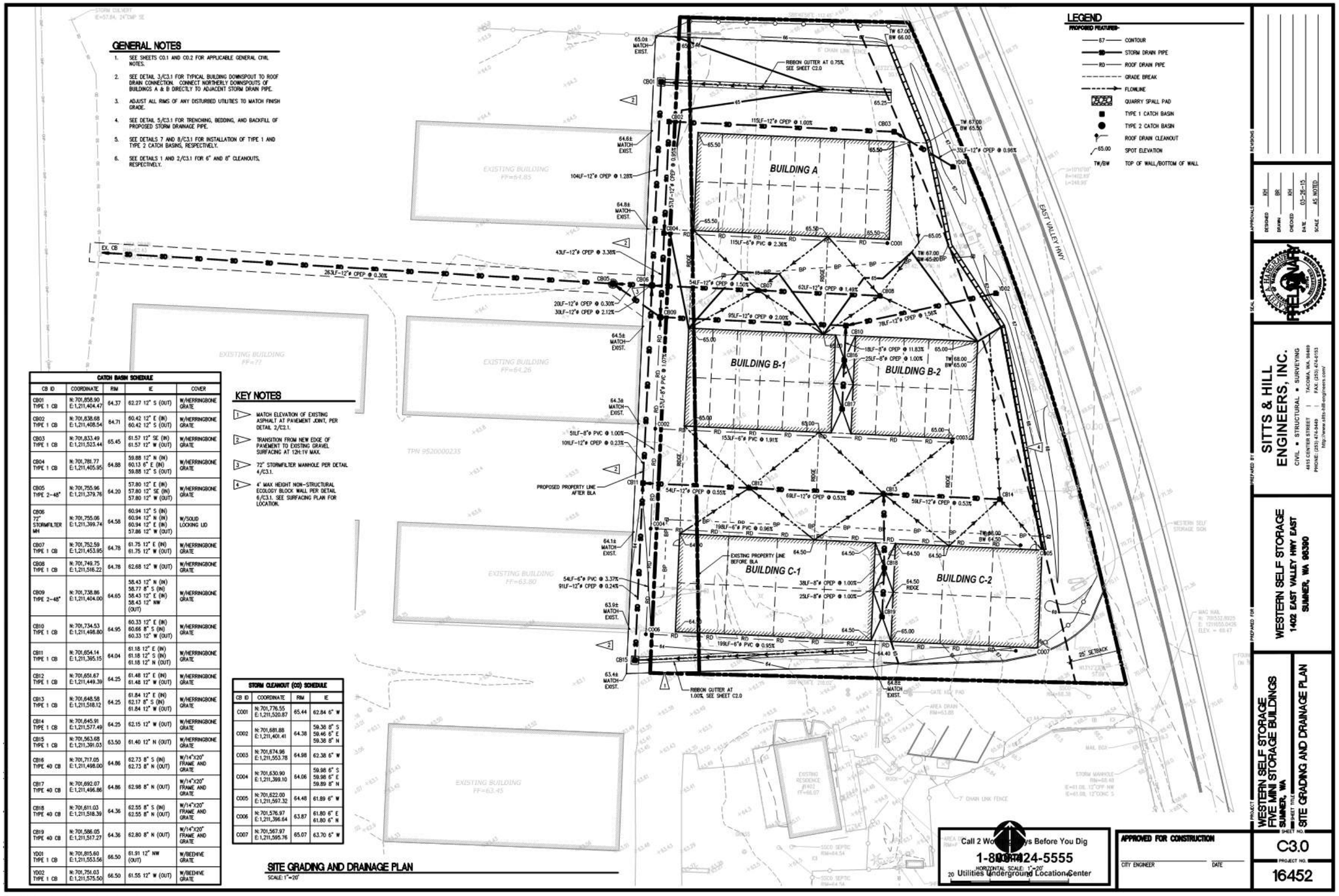
Storm utility improvements have been proposed as a part of the new buildings and driving surfaces. Storm utility improvements include:

StormFilter Manhole
Type 1 Catch Basins
Type 2 Catch Basins
12” Storm Drain Piping
8” Roof Drain Piping
6” Roof Drain Piping
4” Footing Drain Piping

Each portion of the system has to be maintained in good working condition for the system to function properly. Please see “Stormwater Facility Maintenance Exhibit” on the following page for a map of the facilities to be maintained.

Operations and Maintenance will be the responsibility of the Owner, Western Self Storage. Mr. Gary Petersen is the maintenance contact person at Western Self Storage. His information is:

Mr. Gary Petersen
1402 East Valley Highway East
Sumner, Washington 98390
Phone: (253) 863-8136



Facilities to be maintained

Appendix C.2 Permanent Facilities Description

The proposed, permanent, stormwater system designed for this site is for basic water quality treatment. Runoff generated by the proposed non-pollution-generating impervious surface (building roof and off-site drainage) will not require treatment. Runoff generated by the site's pollution-generating impervious surfaces (driving areas) will be directed into a proposed StormFilter manhole equipped with five cartridges. Stormwater will then be conveyed to an existing on-site detention pond. Discharge from the existing detention pond will be conveyed to an existing ditch adjacent to the rail line which discharges into the White River.

Appendix C.3 Discussion of Maintenance

Any buildup of sediment, debris, vegetation, or trash that impedes the designed conveyance system may cause problems. As a result, care must be taken to keep drainage structures clean. A "vactor" truck, or other approved means, should be used to clean the on-site catch basins. Deposits on the paved surface should be swept or mechanically removed in order to prevent sediment or debris from entering the drainage system. Sediment removed must be disposed of at an approved site.

The proposed StormFilter manhole will treat runoff from the on-site asphalt surfaces. These systems meet runoff requirements for basic and phosphorus treatment.

The treatment facilities should be kept free of debris or trash, which could restrict flow. At the option of the owner, the on-site storm drainage system can be maintained through a private maintenance contract, or through self-service. In the event that any or all of the proposed set of five StormFilter cartridges need to be replaced, the replacement cartridge(s) shall meet the requirements of the 2005 DOE Manual and treat an equal or greater volume of runoff than the replaced cartridge(s).

DOE Structural Source Control BMPs applicable to the project include the following:

Applicable BMPs:	BMP S412	Loading and Unloading Areas for Solid Material
	BMP S424:	Roof/Building Drains at Commercial Buildings

The applicable maintenance checklists and excerpts from the 2005 DOE Manual have been included with the Operations and Maintenance Manual for review during routine maintenance inspections.

Appendix C.4 Maintenance Frequency

During construction, all facilities will be monitored and maintained according to their respective maintenance checklists. One form will be filled out for each facility on-site.

Facilities will be inspected weekly during the rainy season, monthly for the period April 1st to October 1st, and after every significant storm event where the precipitation is greater than or equal to one half inch in 24 hours.

When deficiencies are noted, the problems are to be corrected as soon as possible. Any spill of hazardous material (e.g. fuel, lubricant, herbicide, etc.) will be cleaned up immediately and will be reported to the Division of Emergency Management (1-800-258-5990). Contaminated material will be disposed of properly.

This information, including maintenance logs, will be kept on-site at all times during construction and be available to the City of Sumner upon request.

The party responsible for regular maintenance of the stormwater facilities designed for this site will be announced at the preconstruction meeting with the City of Sumner.

Appendix C.5 Annual Cost Estimate

Annual maintenance costs for the storm system will include cleaning of the catch basins and conveyance elements. Approximate annual costs for the tasks are tabulated in the table included in this section. All maintenance activities will be the responsibility of Western Self Storage upon occupation of the facility.

System to Maintain	No. of New Facilities/Structures	Approximate Cost
Catch Basins / Yard Drain	16	(Annual) $150 x 16 = $2,400
StormFilter	5	(Biennial) $260 x 5 = $1,300
Total Annual Cost		**$3,050**

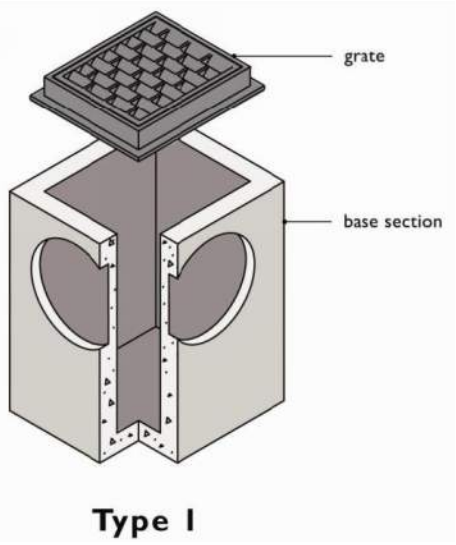
Catch Basins

Catch basins are underground concrete structures typically provided with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two catch basin types.

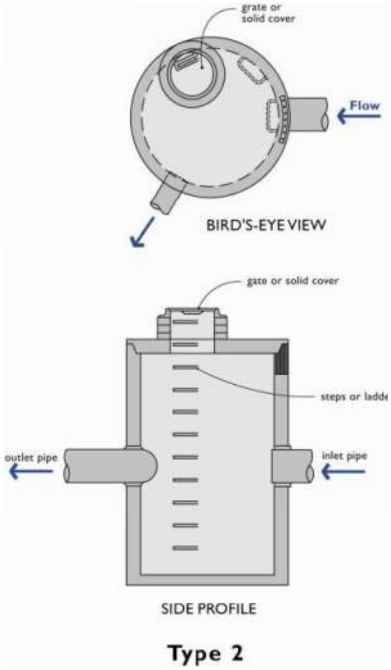
A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter of 4 feet to 8 feet. Type 2 catch basins are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Type 2 catch basins typically have manhole steps mounted on the side of the structure to allow for access.

Both catch basin types typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also provided with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.
The most common cleaning method for catch basins is to utilize a truck with a tank and vacuum hose (vactor truck) to remove sediment and debris from the sump. Catch basins may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual with training and certification in working in hazardous confined spaces.



Type I



Type 2

Catch Basins Checklist

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
ANNUAL	General					"Dump no pollutants " Stencil or stamp not visible	Stencil or stamp should be visible and easily read	Warning signs (e.g., "Dump No Waste-Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets.
MONTHLY,STORM	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.
MONTHLY	General					Trash & Debris	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.
MONTHLY	General					Trash & Debris	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.
MONTHLY	General					Trash & 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.
MONTHLY	General					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 6inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin

Catch Basins Checklist (continued)

Frequency	System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
ANNUAL	General					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.
ANNUAL	General					Structure Damage to Frame and/or Top Slab	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.
ANNUAL	General					Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
ANNUAL	General					Fractures or Cracks in Basin Walls/ Bottom	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 re-grouted and secure at basin wall.
ANNUAL	General					Settlement/Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
MONTHLY	General					Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
MONTHLY	General					Vegetation	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.
MONTHLY	General					Contamination and Pollution	Any evidence of oil, gasoline,contaminants,or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
ANNUAL	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

Catch Basins Checklist (continued)

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
ANNUAL	Catch Basin Cover					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.
ANNUAL	Catch Basin Cover					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
ANNUAL	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.
ANNUAL	Grates					Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
MONTHLY,STORM	Grates					Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
ANNUAL	Grates					Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Key:
(MONTHLY) Monthly from November through April
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

Comments:

Fencing/Shrubbery Screen/Other Landscaping

Fencing and shrubbery screen are provided around open stormwater management facilities to limit unauthorized access for safety purposes and to minimize the visual impact of the facility.

Fencing/Shrubbery Screen/Other Landscaping Checklist

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY	General					Missing or broken parts/dead shrubbery	Any defect in the fence or screen that permits easy entry to a facility.	Fence is mended or shrubs replaced to form a solid barrier to entry.
MONTHLY,STORM	General					Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets.	Replace soil under fence so that no opening exceeds 4 inches in height.
MONTHLY	General					Unruly vegetation	Shrubbery is growing out of control or is infested with weeds.	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.
ANNUAL	Fences					Damaged parts	Posts out of plumb more than 6 inches.	Posts plumb to within 1-1/2 inches of plumb.
ANNUAL	Fences					Damaged parts	Top rails bent more than 6inches.	Top rail free of bends greater than 1 inch.
ANNUAL	Fences					Damaged parts	Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
ANNUAL	Fences					Damaged parts	Missing or loose tension wire.	Tension wire in place and holding fabric.
ANNUAL	Fences					Damaged parts	Missing or loose barbed wire that is sagging more than 2-1/2 inches between posts.	Barbed wire in place with less than 3/4-inch sag between posts.
ANNUAL	Fences					Damaged parts	Extension arm missing, broken, or bent out of shape more than 1-1/2 inches.	Extension arm in place with no bends larger than 3/4 inch.
ANNUAL	Fences					Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
MONTHLY	Fences					Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	No openings in fabric.

Key:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

Grounds (Landscaping)

Landscaping is an essential component of stormwater management. Bare soil areas generate higher levels of stormwater runoff and sedimentation in stormwater facilities. The following check list gives some general guidance for landscape management.

Grounds (Landscaping) Checklist

Date

Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY	General					Weeds (nonpoisonous)	Weeds growing in more than 20% of the landscaped area (trees and shrubs only).	Weeds present in less than 5% of the landscaped area.
MONTHLY	General					Insect hazard	Any presence of poison ivy or other poisonous vegetation or insect nests.	No poisonous vegetation or insect nests present in landscaped area.
MONTHLY,STORM	General					Trash or litter	See Ponds Checklist.	See Ponds Checklist.
MONTHLY,STORM	General					Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.
ANNUAL	Trees and shrubs					Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.
MONTHLY	Trees and shrubs					Damage	Trees or shrubs that have been blown down or knocked over.	Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.
ANNUAL	Trees and shrubs					Damage	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Place stakes and rubber-coated ties around young trees/shrubs for support.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Key:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

Comments:

Inlet/Outlet Storm Pipe

The inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities. Storm sewer pipes convey stormwater. Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Stormwater pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

In addition, outlet stormwater pipes should be inspected to make sure stormwater exits the facility without causing any negative impacts to the drainage area, if applicable.

Inlet/Outlet Storm Pipe Checklist

Date

Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Conditions That Should Exist**
MONTHLY	General					Obstructions including roots	Storm pipe-root enters or deforms pipe, reducing flow.	Use mechanical methods to remove root. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line.
MONTHLY	General					Pipe dented or broken	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
MONTHLY	General					Pipe rusted or deteriorated	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired and/or replaced.
MONTHLY	Erosion					Erosion	Eroded or scoured areas due to flowchannelization, high flows, or vehicular damage.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the damaged area should be re-graded and re-seeded. For smaller bare areas, overseed.
MONTHLY	Pipe outfall					Missing or removed rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
MONTHLY	Pipe outfall					Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.

Inlet/Outlet Storm Pipe Checklist (Continued)

Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
MONTHLY	Pipe outfall					Erosion/Scouring	Eroded or scoured ditch or stream banks due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, damaged area should be re-graded and re-seeded. For smaller bare areas, overseed.
MONTHLY	Pipe Outfall					Missing or Moved Rock	Only one layer of rock exists above native soil area in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
MONTHLY	Pipe Outfall					Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.

If you are unsure whether a problem exists, please contact a Professional Engineer.

Key:
(MONTHLY) Monthly from November through April.
(ANNUAL) Once in late summer (preferable September)
(STORM) After any major storm (use 1-inch in 24 hours as a guideline).

Comments:

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 breaking connections (see Figure 2.2.2). Check loading/ unloading equipment such as valves, pumps, flanges, and connections regularly for leaks and repair as needed.

Volume IV - Source Control BMPs – August 2012
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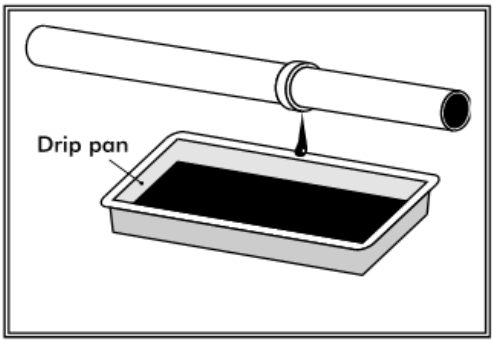

Figure 2.2.2 – Drip Pan

At Tanker Truck and Rail Transfer Areas to Above/Below-ground Storage Tanks:

- To minimize the risk of accidental spillage, prepare an "Operations Plan" that describes procedures for loading/unloading. Train the employees, especially fork lift operators, in its execution and post it or otherwise have it readily available to all employees.
- Report spills of reportable quantities to Ecology.
- Prepare and implement an Emergency Spill Cleanup Plan for the facility (See S406 BMPs for Spills of Oil and Hazardous Substances) which includes the following BMPs:
  - Ensure the cleanup of liquid/solid spills in the loading/unloading area immediately, if a significant spill occurs, and, upon completion of the loading/unloading activity, or, at the end of the working day.
  - Retain and maintain an appropriate oil spill cleanup kit on-site for rapid cleanup of material spills. (See S406 BMPs for Spills of Oil and Hazardous Substances).
  - Ensure that an employee trained in spill containment and cleanup is present during loading/unloading.

At Rail Transfer Areas to Above/below-ground Storage Tanks: Install a drip pan system as illustrated (see Figure 2.2.3) within the rails to collect spills/leaks from tank cars and hose connections, hose reels, and filler nozzles.

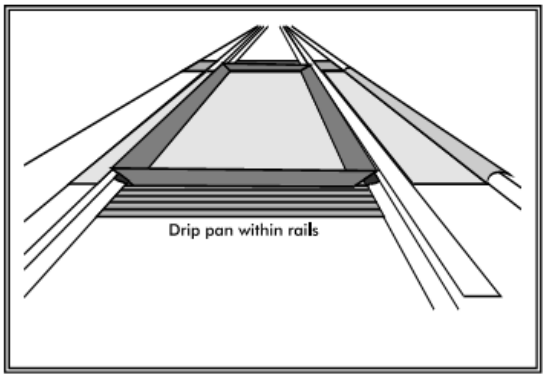

Figure 2.2.3 – Drip Pan Within Rails

Loading/Unloading from/to Marine Vessels: Facilities and procedures for the loading or unloading of petroleum products must comply with Coast Guard requirements specified in Appendix IV-D R.5.

Transfer of Small Quantities from Tanks and Containers: Refer to BMPs Storage of Liquids in Permanent Above-Ground Tanks, and Storage of Liquid, Food Waste, or Dangerous Waste Containers, for requirements on the transfer of small quantities from tanks and containers, respectively.

Applicable Structural Source Control BMPs:

At All Loading/ Unloading Areas:

- Consistent with Uniform Fire Code requirements (Appendix IV-D R.2) and to the extent practicable, conduct unloading or loading of solids and liquids in a manufacturing building, under a roof, or lean-to, or other appropriate cover.
- Berm, dike, and/or slope the loading/unloading area to prevent run-on of stormwater and to prevent the runoff or loss of any spilled material from the area.
- Place curbs along the edge of the shoreline, or slope the edge such that the stormwater can flow to an internal storm sewer system that leads to an approved treatment BMP. Avoid draining directly to the surface water from loading areas.
- Pave and slope loading/unloading areas to prevent the pooling of water. Minimize the use of catch basins and drain lines within the interior of the paved area or place catch basins in designated "alleyways" that are not covered by material, containers, or equipment.
- Retain on-site the necessary materials for rapid cleanup of spills.

Recommended Structural Source Control BMP: For the transfer of pollutant liquids in areas that cannot contain a catastrophic spill, install an automatic shutoff system in case of unanticipated off-loading interruption (e.g. coupling break, hose rupture, overfill, etc.).

At Loading and Unloading Docks:

- Install/maintain overhangs, or door skirts that enclose the trailer end (see Figures 2.2.4 and 2.2.5) to prevent contact with rainwater.
- Design the loading/unloading area with berms, sloping, etc. to prevent the run-on of stormwater.

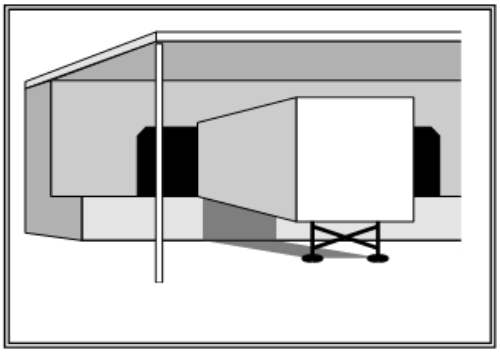

Figure 2.2.4 – Loading Dock with Door Skirt

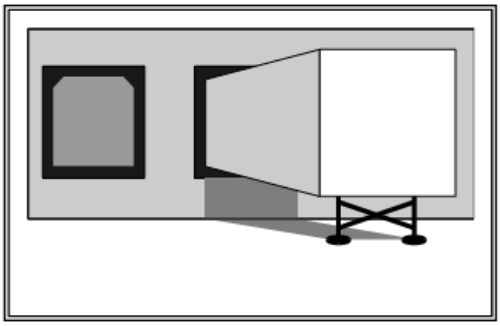

Figure 2.2.5 – Loading Dock with Overhang

At Tanker Truck Transfer Areas to Above/Below-Ground Storage Tanks:

- Pave the area on which the transfer takes place. If any transferred liquid, such as gasoline, is reactive with asphalt, pave the area with Portland cement concrete.

- Slope, berm, or dike the transfer area to a dead-end sump, spill containment sump, a spill control oil/water separator, or other spill control device. The minimum spill retention time should be 15 minutes at the greater flow rate of the highest fuel dispenser nozzle through-put rate, or the peak flow rate of the 6-month, 24-hour storm event over the surface of the containment pad, whichever is greater. The capacity of the spill containment sump should be a minimum of 50 gallons with adequate additional volume provided for grit sedimentation.

S424 BMPs for Roof/ Building Drains at Manufacturing and Commercial Buildings

Description of Pollutant Sources: Stormwater runoff from roofs and sides of manufacturing and commercial buildings can be sources of pollutants caused by leaching of roofing materials, building vents, and other air emission sources. Research has identified vapors and entrained liquid and solid droplets/particles as potential pollutants in roof/building runoff. Metals, solvents, acidic/alkaline pH, BOD, and organics, are some of the pollutant constituents identified.

Ecology has performed a study on zinc in industrial stormwater. The study is presented in Ecology Publication 08-10-025 *Suggested Practices to reduce Zinc Concentrations in Industrial Stormwater Discharges*, website: http://www.ecy.wa.gov/biblio/0810025.html. The user should refer to this document for more details on addressing zinc in stormwater.

Pollutant Control Approach: Evaluate the potential sources of stormwater pollutants and apply source control BMPs where feasible.

Applicable Operational Source Control BMPs:

- If leachates and/or emissions from buildings are suspected sources of stormwater pollutants, then sample and analyze the stormwater draining from the building.
- Sweep the area routinely to remove any zinc residuals.
- If a roof/building stormwater pollutant source is identified, implement appropriate source control measures such as air pollution control equipment, selection of materials, operational changes, material recycle, process changes, etc.

Applicable Structural Source Control BMPs:

- Paint/coat the galvanized surfaces as described in Ecology Publication # 08-10-025.

Applicable Treatment BMPs:

Treat runoff from roofs to the appropriate level. The facility may use enhanced treatment BMPs as described in Volume V of the SWMMWW. Some facilities regulated by the Industrial Stormwater General Permit, or local jurisdiction, may have requirements than cannot be achieved with enhanced treatment BMPs. In these cases, additional treatment measures may be required. A treatment method for meeting stringent requirements such as Chitosan-Enhanced Sand Filtration may be appropriate.

Cover Sheet for Inspection Forms

Name of Inspector:
_____

Date of Inspection:
_____

Number of Sheets Attached:
_____

Inspector's Signature:
_____

Maintenance Log

Action Taken	Name	Date	How Procedure Was Performed	Problems Encountered	Additional Actions Recommended

Appendix H Soil Report

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 Pierce County Area, Washington

November 14, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,230 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 19, Aug 29, 2023

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

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

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
37A	Semiahmoo muck	4.6	98.4%
47F	Xerochrepts, 45 to 70 percent slopes	0.1	1.6%
Totals for Area of Interest		**4.7**	**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.

Pierce County Area, Washington

37A—Semiahmoo muck

Map Unit Setting

National map unit symbol: 2hqm
Elevation: 10 to 1,300 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Semiahmoo, Drained

Setting

Landform: Flood plains
Parent material: Herbaceous organic material

Typical profile

H1 - 0 to 12 inches: muck
H2 - 12 to 53 inches: muck
H3 - 53 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly 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 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 26.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: R002XA003WA - Puget Lowlands Bogs and Fens
Forage suitability group: Wet Soils (G002XN102WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Minor Components

Shalcar

Percent of map unit: 10 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XS101WA)
Hydric soil rating: Yes

Semiahmoo, undrained
Percent of map unit: 5 percent
Landform: Flood plains
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

47F—Xerochrepts, 45 to 70 percent slopes

Map Unit Setting
National map unit symbol: 2hr5
Elevation: 0 to 980 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 100 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Xerochrepts and similar soils: 99 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Xerochrepts

Setting
Landform: Valley sides
Parent material: Sandy and gravelly outwash and/or glacial till

Typical profile
H1 - 0 to 6 inches: gravelly sandy loam
H2 - 6 to 40 inches: gravelly sandy loam
H3 - 40 to 60 inches: very gravelly sandy loam

Properties and qualities
Slope: 45 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Coastal beaches

Percent of map unit: 1 percent
Landform: Alluvial cones
Hydric soil rating: No

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