2nd Submittal-1st Review
PRCCP20241731
Dec 2025

STORMWATER SITE PLAN REPORT

FOR

FARM 12 – PARKING LOT REVISION

C&A PROJ # 25-018

PREPARED FOR:

FARM 12
3303 8TH AVENUE SE #A
PUYALLUP, WA 98372

PREPARED BY:

Cecil & Associates, LLC
PO BOX 598
BOTHELL, WA 98041

NOVEMBER 18, 2025
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Farm 12 – Parking Lot Revision

Cecil & Associates Project No. 25-018

November 18, 2025

TABLE OF CONTENTS

1. PROJECT OVERVIEW

1.1: PROJECT DESCRIPTION

The Farm 12 Parking Lot Revision project is located at the intersection of 33rd St SE and E Pioneer in the City of Puyallup. The project site includes parcel 0420264069 and has a total lot size of 5.93 acres. The site is zoned CMX – Shaw Pioneer Community Mixed Use and within Agriculture Overlay Zone.

Historically, the site has been used for agricultural purposes as farmland. Sometime between 2022 and 2023 the site was developed with two gravel parking areas that providing parking for the adjacent Step by Step property across the street (east). This project will retroactively permit the parking area improvements and may require additional work to provide necessary stormwater treatment.

The project will be permitted by the City of Puyallup. The City has adopted the 2019 Department of Ecology Stormwater Management Manual for Western Washington (Stormwater Manual), Puyallup Municipal Code 17.42.010, as a basis for stormwater management requirements. The project will be under stormwater review for Minimum Requirements (MR's) 1-9, assuming it is a new development project per Figure 1-3.1 of the Stormwater Manual. The primary components of the stormwater mitigation plan include BMP T9.40: Vegetated Filter Strip, so that runoff can sheet flow off the new parking surface and be filtered, BMP T5.11: Concentrated Flow Dispersion or BMP T5.12: Sheet Flow Dispersion, for onsite stormwater management BMP credit.

Project's that discharge through a manmade conveyance network (stabilized from erosion) to a receiving water listed as a Flow Control Exempt Receiving water are not required to provide flow control per TDA Exemptions listed in I-3.4.7 MR7: Flow Control. This lot is currently graded for runoff to flow across the western/northwestern property line to an adjacent agricultural-use lot. Runoff is collected in a ditch located on the south side of 5th Avenue SE. That ditch is collected in a storm line that flows east in 5th Avenue SE to a storm line that flows north, generally following 33rd Street SE to the Puyallup River. Therefore, this project is considered exempt from flow control. However, runoff treatment and compliance with onsite stormwater BMPs (MR#5) is required.

This statement is not entirely correct. Runoff on the south side of 5th Ave SE within the ditch generally flows westward, but the raised grade of the roadway is collected in a conveyance system that flows east. However, the east end of the 5th Ave ditch may/may not flow eastward and overflow into the trunkline system. Please use language similar to the prior submittal's stormwater report noted under Minimum Requirement 7, Page 11 (Page 17 of 32 of the PDF version).

1.2: EXISTING CONDITIONS SUMMARY

The Farm 12 Parking Lot Revision project site area is 258,473 SF (5.93 acres). The existing site consists of pasture-like grass vegetation. This project is retroactively permitting an existing gravel parking lot abutting 33rd Street SE. The mitigation may require grading/sloping the gravel parking area to direct runoff at stormwater treatment and dispersion BMPs. For purposes of this project 'existing conditions' are assumed to be pasture with farm roads, predating the installation of the gravel parking area.

The site is "flat" to the extent that its difficult to discern runoff patterns with the 'naked' eye. A topographic survey was conducted to determine the slopes and runoff flow patterns. Generally, the existing grade takes runoff to the northwest direction. The road, 33rd Street SE, is moderately elevated above the 'field' and serves as a tributary delineation line.

The parking area will be retroactively permitted with this project. In addition to the parking area, the site contains dirt/gravel roads (associated with farming activity) and multiple buildings assumed to include old farm homes and barns. Due to the nature of the property being farmed established roads, visible from County satellite imagery have changed over time. For purposes of this project the historic impervious surface areas have not been quantified.

The existing storm system consists of a ditch along the eastern property line that is part of the City's MS4 system. This ditch is part of the Southeast Puyallup Basin. The Southeast Puyallup Basin discharges to the Puyallup River. Runoff from 33rd Street SE sheet flows to the ditch and is eventually conveyed towards the Puyallup River located north of site. Runoff from existing gravel parking pad sheet flows towards the grass vegetation and existing ditch.

The road-side ditch that runs along the west side of 33rd Street conveys upstream runoff past the site. Eventually, the ditch becomes undetectable, indicating that road runoff currently disperses over the property area. Culverts will be installed to bypass upstream runoff around the project area, proposed with this permit.

This will require a separate stormwater discharge agreement to allow "public" runoff to discharge onto "private" property. (Per 12/04/25 meeting, use permeable ballast at the approaches).

USDA Soil Survey Map was utilized to analyze existing soils. On-site soils are predominantly Briscot loam (Group C soils).

There are no critical areas within the site.

1.3: PROPOSED CONDITIONS SUMMARY

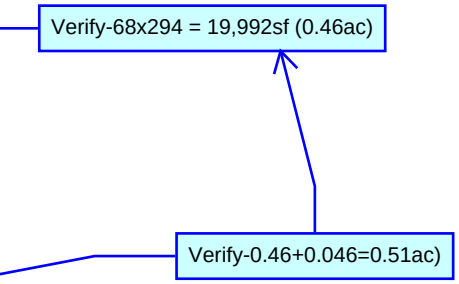
The proposed development will add stormwater treatment and dispersion to the existing gravel parking lot so that it meets the City of Puyallup Design and stormwater management standards.

The proposed development will result in 23,884 SF of new impervious surfaces within the project site area. Total land disturbing area will be approximately 46,634 SF. Therefore, Minimum Requirements 1-9 will apply to this project. The stormwater approach for this project is to provide runoff treatment via BMP T9.40: Vegetated Filter Strip and runoff dispersion to meet

runoff treatment and onsite stormwater BMP requirements. After runoff is treated with applicable BMPs runoff will follow the natural drainage patterns and be conveyed towards an existing ditch north of site (5th Avenue SE system) where it will eventually discharge into the Puyallup River.

Lot Coverage

The following tables show the proposed lot coverage for the Farm 12 Parking Lot Revision project site.

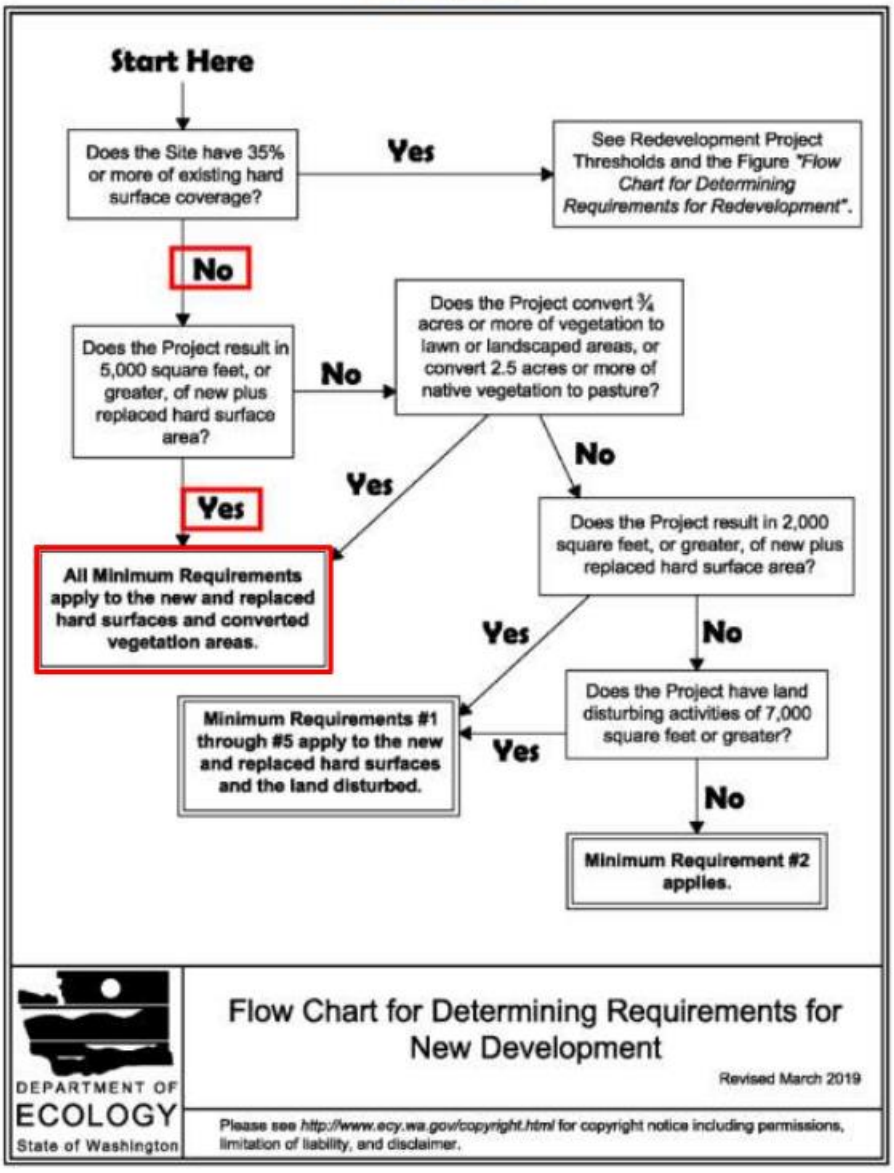


Proposed Lot Coverage (258,473 SF Site Area)			
Coverage	Area (SF)	Area (Acres)	% of Site
Impervious			
Gravel Parking Area	19,150	0.44	
Gravel Shoulder (24x114')	2,746	0.063	
New R/W Impervious Area	1,988	0.046	
Total New Impervious Area	**23,884**	**0.548**	
Total Site Impervious Area	25,053	0.575	9.69%
Pervious			
Grass Vegetation	233,420	5.36	
Total Site Pervious	233,420	5.36	90.3%

2. CONDITIONS AND REQUIREMENTS

The City has adopted the 2019 Department of Ecology Stormwater Management Manual for Western Washington (Stormwater Manual). The project includes more than 5,000 square feet of new or replaced impervious surface and therefore is required to comply with MR's #1through #9, outlined below.

Figure I-3.1: Flow Chart for Determining Requirements for New Development



2.1 MINIMUM REQUIREMENT #1 – PREPARATION OF STORMWATER SITE PLANS

Stormwater Site Plans have been prepared for this project. They are included in the Project's Permit Drawings. The Stormwater Site Plans have been prepared in accordance with Volume I.3.4.1 Stormwater Manual.

2.2 MINIMUM REQUIREMENT #2 –STORMWATER POLLUTION PREVENTION PLANS (SWPPP)

A SWPPP, showing general construction BMPs, has been prepared. A Temporary Erosion Sedimentation Control Plan (CSWPPP) has also been prepared and included with the Permit Documents. Source control BMPs applicable to every site will be implemented on this project. See section 2.3 below for a list of applicable source control BMPs.

2.3 MINIMUM REQUIREMENT #3 – SOURCE CONTROL OF POLLUTION

Volume I.3.4.3 Stormwater Manual contains a list of operational and source control BMPs that projects must implement if the listed uses are proposed as part of the development. Operational and source BMPs are taken from Volume III, Section 1.1 of the Ecology Manual. The following BMPs are applicable to this project.

S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems: this is an operational BMP and not shown in the plans. An Operations & Maintenance Manual has been prepared to cover the upkeep of the proposed conveyance system. This project is not being permitted for maintenance activities that might result in point-source pollution such as oil spills, etc. Therefore, no additional point source BMPs are required for this project.

Section IV-1 contains a list of source control BMPs applicable to all construction sites including:
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

These BMPs will be implemented for this project.

See markup on Section 1.1.

2.4 MINIMUM REQUIREMENT #4 – PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

Natural drainage patterns will be maintained and discharges from the project will occur at the natural location to the extent practical. The proposed drainage design will discharge over the property line to the west/northwest direction. Runoff is eventually collected by the 5th Avenue SE public storm system. The to the City's 33rd Street SE storm system. The 5th Avenue SE storm system flows east to a storm connection near the 33rd Street SE intersection and turns north, flowing toward the Puyallup River outfall.

2.5 MINIMUM REQUIREMENT #5 – ON-SITE STORMWATER MANAGEMENT

The project will follow the list approach (List 3 for flow control exempt projects) to meet the onsite stormwater management requirement. Section 4, below contains an itemized explanation of infeasibility for each stormwater BMP in priority, as required. Generally, infiltration is infeasible due to high groundwater. BMP T5.11: Concentrated Flow Dispersion and BMP T5.12: Sheet Flow Dispersion will be implemented for impervious gravel parking areas. Concentrated flow dispersion will be implemented by conveying stormwater to a gravel dispersion trench with notched board. Sheet flow dispersion is applied at a rate of 10 feet flow path for every 20 feet parking area width being mitigated.

2.6 MINIMUM REQUIREMENT #6 – RUNOFF TREATMENT

The Puyallup River is a basic receiving water downstream of the Carbon River. The standard level of stormwater treatment triggered for this project is Basic Treatment. Runoff from the project will be treated with BMP T9.40: Vegetated Filter Strip. Stormwater modeling to design the filter has been completed with WWHM for sizing of the filter BMP.

The area requiring runoff treatment applies to the gravel parking area and a 24-foot gravel shoulder. The two gravel areas are detached from one another, but the same treatment techniques will be used at each area. Runoff treatment calculations are attached in Appendix A.

2.7 MINIMUM REQUIREMENT #7 – FLOW CONTROL

The downstream receiving water, the Puyallup River, is flow control exempt provided conditions of TDA Exemptions listed in I-3.4.7 MR7: Flow Control are met.

2.8 MINIMUM REQUIREMENT #8 – WETLANDS PROTECTION

There are no known wetlands on or adjacent to the project.

2.9 MINIMUM REQUIREMENT #9 – OPERATION AND MAINTENANCE

The proposed storm drainage system will be owned, operated, and maintained by the site owner. An Operation and Maintenance Manual with provisions consistent with Volume I and Volume V of SWMMWW for all stormwater treatment and flow control facilities/BMPs is attached in Appendix C of this report.

3. PERMANENT STORMWATER CONTROL

3.1: WATER QUALITY

The Farm 12 project will install BMP T9.40: Vegetated Filter Strip for runoff treatment prior to discharging to the City's conveyance system. The vegetated filters strip is sized by methods described in the Manual. Mannings equation is used to solve for runoff velocity over the length and slope of the filter. Then runoff velocity is used to determine the width of the required filter. In the case where a dispersion trench with notched board is used for runoff dispersion the length of the filter is limited by the length of the dispersion trench resulting in a wider filter compared to the sheet flow dispersion directly from the associated gravel surfaces. See Appendix A for WWHM Modeling.

3.2: FLOW CONTROL

The project is flow control exempt, direct discharge to the Puyallup River.

3.3: STORMWATER BMP ANALYSIS (MR #5)

The following BMPs from List #3 was considered to manage runoff from various surfaces:

Hard Surfaces:

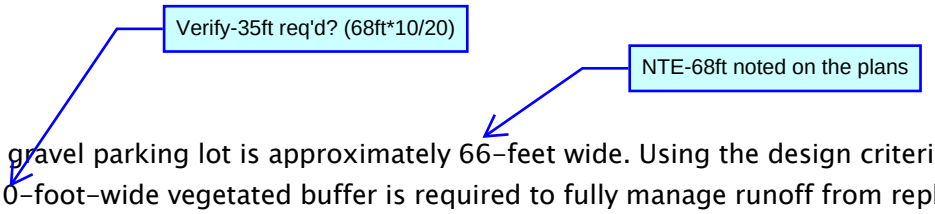
BMP T5.11 Concentrated Flow Dispersion:

A portion of new gravel shoulder does not have a flow path directly adjacent to the new gravel. So runoff is being discharged to a dispersion trench with notched board, in lieu. Dispersion trenches with notched boards can disperse runoff at a rate of 10 lineal feet of dispersion trench per 0.1 cfs of runoff over a 50-foot flow path. The peak runoff rates from the new gravel area do not necessarily necessitate a 40-foot dispersion trench; however, a shorter dispersion trench would increase the width of the Vegetated Filter Strip being used to treat the runoff. Therefore, a 40-foot dispersion trench is being proposed.

BMP T5.12 Sheet Flow Dispersion:

This project chooses to implement BMP T5.12 Sheet Flow Dispersion to manage stormwater runoff from replaced gravel parking lot. The flow path has been sized utilizing the design guidelines set forth by the DOE Manual. The design criteria are as follows:

- Used on flat or moderately sloping (< 15% slope) surfaces.
- Provide a 2-foot-side-transition zone to discourage channeling between the edge of impervious surface and downslope vegetation.
- Provide a 10-foot-wide vegetated buffer for up to 20 feet of width of impervious surface.



The gravel parking lot is approximately 66-feet wide. Using the design criteria above, a minimum of 30-foot-wide vegetated buffer is required to fully manage runoff from replaced gravel parking lot. The same vegetated buffer (flow path) width will be used at the gravel shoulder as well.

No other BMPs were analyzed as this BMP was determined to be feasible for this site.

Lawn and Landscaped Areas:

BMP T5.13 Post Construction Soil Quality and Depth:

The Farm 12 project proposes retain and protect undisturbed soil in areas not being developed and, prior to completion of the project, amend all new, replaced, and disturbed topsoil (including construction lay-down areas) with organic matter in accordance with BMP T5.13 of the 2019 DOE Manual and the City of Puyallup standard detail 01.02.08A.

4. FIGURES

FIGURE 1: VICINITY MAP

FIGURE 2: EXISTING SITE DRAINAGE BASINS

FIGURE 3: DEVELOPED SITE DRAINAGE BASINS

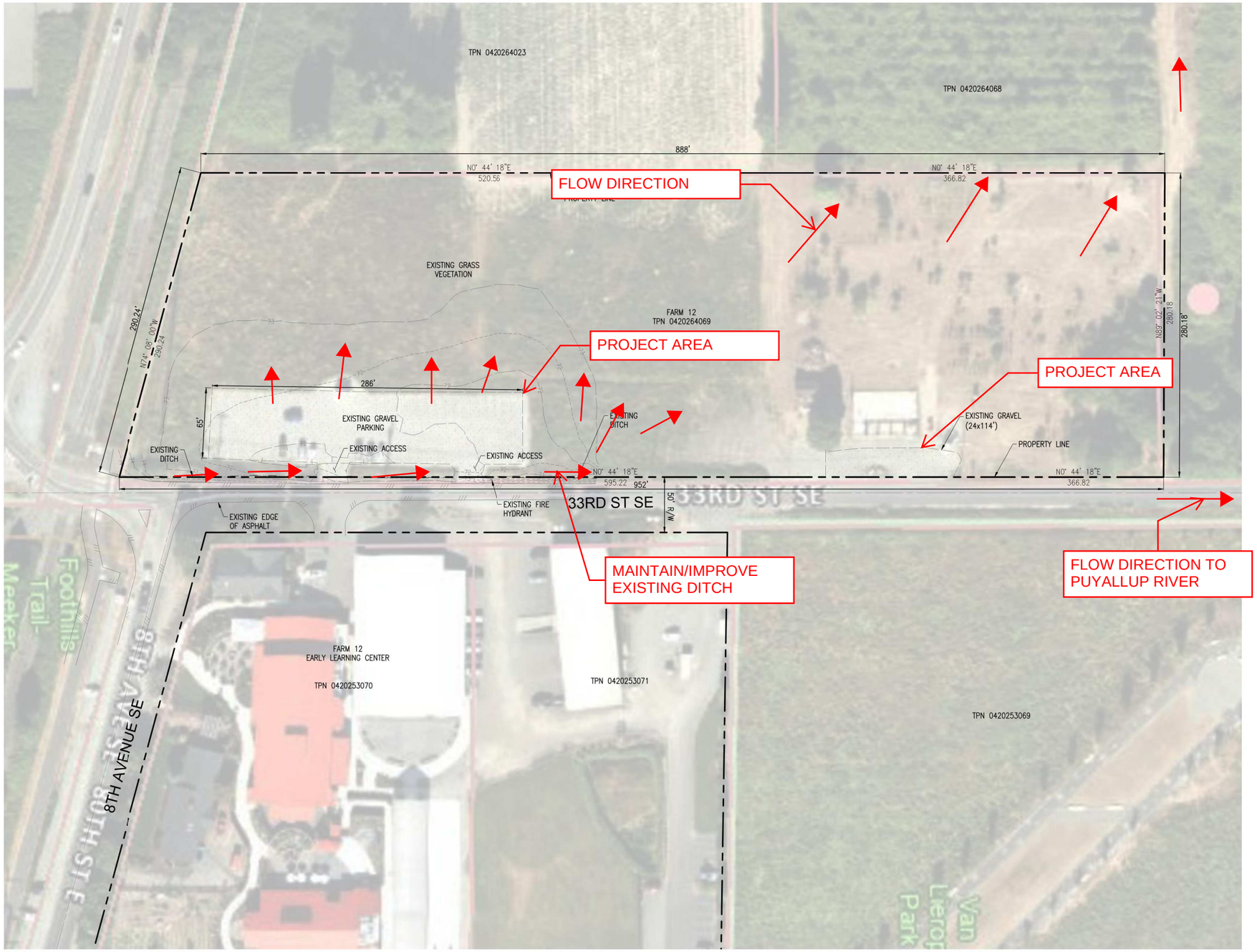
FIGURE 4: SOILS MAP

FIGURE 5: DOWNSTREAM MAP

VICINITY MAP

PORTION OF THE SW 1/4, SW 1/4, SEC. 26, TWP 20 N., R. 4 E., W.M.

EXISTING CONDITIONS MAP



LEGEND

(NOTE: NOT ALL SYMBOLS MAY APPEAR ON THE MAP)

- SURVEY MONUMENT (AS NOTED)
- POWER METER
- POWER POLE
- JUNCTION BOX (AS NOTED)
- CATCH BASIN (CB)
- STORM MANHOLE (SDMH)
- SANITARY SEWER MANHOLE (SSMH)
- CLEANOUT (AS NOTED)
- GAS METER
- GAS VALVE
- WATER VALVE (WV)
- FAUCET
- FIRE HYDRANT(FH) / CONNECTION(FDC)
- WATER MANHOLE
- WATER METER
- BLOW-OFF / AIRVAC
- MONITOR WELL
- SIGN
- IRRIGATION SPRINKLER
- HANDICAP
- CHAIN LINK FENCE
- WATER LINE
- GAS LINE
- T(XX) TELEPHONE LINE (OH) OR (UG)
- P(XX) POWER LINE (OH) OR (UG)
- 50 STORM LINE
- 55 SEWER LINE
- DECIDUOUS TREE
- CONIFEROUS TREE
- CONCRETE
- GRAVEL/SAND (AS NOTED)
- ASPHALT
- BUILDING LINE
- EDGE OF ASPHALT
- DITCH LINE
- PROPERTY LINE

ABBREVIATIONS

(R#)	REFERENCE SURVEYS
(OH)	OVERHEAD
(UG)	UNDERGROUND
(TYP)	TYPICAL
(C)	CALCULATED
(M)	MEASURED

EXISTING LOT COVERAGE:

PROJECT SITE AREA:	258,473 SF (5.93 AC)
TOTAL IMPERVIOUS:	22,676 SF (8.8%)
EXISTING GRAVEL PARKING:	22,676 SF
TOTAL PERVIOUS:	235,797 SF (91.2%)
GRASS VEGETATION:	235,797 SF

N

HORIZ. 0 25 50 100
Scale In Feet

APPROVED

BY _____
CITY OF PUYALLUP
DEVELOPMENT ENGINEERING

DATE _____

NOTE:
THIS APPROVAL IS VOID AFTER 180 DAYS FROM APPROVAL DATE.

THE CITY WILL NOT BE RESPONSIBLE FOR ERRORS AND/OR OMISSIONS ON THESE PLANS.

FIELD CONDITIONS MAY DICTATE CHANGES TO THESE PLANS AS DETERMINED BY THE DEVELOPMENT ENGINEERING MANAGER.

CALL BEFORE YOU DIG 811
UNDERGROUND SERVICE (USA)

REVISIONS

No.	Description	Date
2	PERMIT DOCUMENTS	8/19/2025
1	CIVIL PERMIT APPLICATION	12/12/2023

25-018 Project No.
PFA Drawn By
RJC Designed By
RJC Approved By
8/19/2025 Date

ROGER J. CECIL — STATE OF WASHINGTON — 24372 — REGISTERED PROFESSIONAL ENGINEER — 8/19/2025

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(206) 484-3495
www.cecilnassoc.com

CLIENT
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FAMILY SUPPORT CENTER
3303 8TH AVENUE SE #A
PUYALLUP, WA 98372

KRISTA LINDEN
CONTACT

STEP BY STEP
PARKING LOT REVISION

EXISTING CONDITIONS

C1.00

PORTION OF THE SW 1/4, SW 1/4, SEC. 26, TWP 20 N., R. 4 E., W.M.

Verify-35ft req'd? (68ft*10/20)

30' SHEET FLOW DISPERSION @ 10' PER 20' GRAVE WIDTH

BMP T9.40: VEGETATED FILTER STRIP FOR GRAVEL AREA

BMP T9.40: VEGETATED FILTER STRIP FOR GRAVEL SHOULDER

50' DISPERSION @ 10' DISPERSION TRENCH PER 0.1 CFS PEAK RATE (0.013 CFS)

FLOW DIRECTION (TYP)

APN 0420264069

0.077 CFS FROM ROAD DISPERSED HERE (50' FLOW PATH)

GRASS LINED SWALE

GRAVEL SHOULDER + ROAD TRIBUTARY. ASSUME 0.085 ACRES.

ASSUME 3,850 SF (0.088 ACRES) ROAD AREA

DISCHARGE ROAD AREA

Verify-7,400sf (0.17ac)?

LEGEND

- PROPERTY LINE
- ROAD CENTERLINE
- EASEMENT LINE
- GRAVEL SURFACING
- COMPOST AMENDED FILTER STRIP
- VEGETATED FLOW PATH
- DRAINAGE LINE
- DRAINAGE SWALE

N00°44'18"E 520.56

N00°44'18"E 887.38

N00°44'18"E 366.82

N00°44'18"E 1182.37

75' PACIFIC NW PIPELINE RIGHT-OF-WAY REC. NO. 7786024

PSE EASEMENT REC. NO. 201410100124

PSE EASEMENT REC. NO. 201708030608

40 LF DISPERSION TRENCH

CB TYPE 1 W/ SOLID LID RIM= 71.00 IE IN= 69.50 (6" S)

6" INLET W/ RIP RAP ARMOR IE= 69.70 W/ 5 LF 6" PVC

12" DEEP EXCAVATED SWALE LINE WITH SOD (VEGETATION REQUIRED TO PREVENT EROSION) TOP EL > 71.00 REQUIRED

3" RAISED GRAVEL EDGE

32 LF 12" CULVERT

16 LF 12" CULVERT

12" OUTLET W/ RIP RAP ARMOR IE= 69.70

DISPERSION TOP EL= 71.70

DISPERSION SWALE FLOW LINE EL= 69.70

BERM

12" INLET W/ RIP RAP ARMOR

INLET IE= 71.50

INLET IE= 71.10

OUTLET IE= 71.40

OUTLET IE= 70.00

VEGETATED FILTER STRIP AMEND SOIL TO 8" DEPTH PER DTL 01.02.08a SEE SHEET C4.11

SEE SECTION ON C4.10

DISPERSION FLOW PATH

33RD STREET

HORIZ. 0 15 30 60 Scale In Feet

CALL BEFORE YOU DIG 811 UNDERGROUND SERVICE (USA)

APPROVED

BY_____

CITY OF PUYALLUP DEVELOPMENT ENGINEERING

DATE_____

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KRISTA LINDEN
CONTACT

STEP BY STEP
PARKING LOT REVISION

GRADING & DRAINAGE PLAN

C4.00

City of Puyallup Public Data Viewer

SOILS MAP

PROJECT LOCATION
BRISCOT LOAM

Legend

Environment

Puyallup Soils

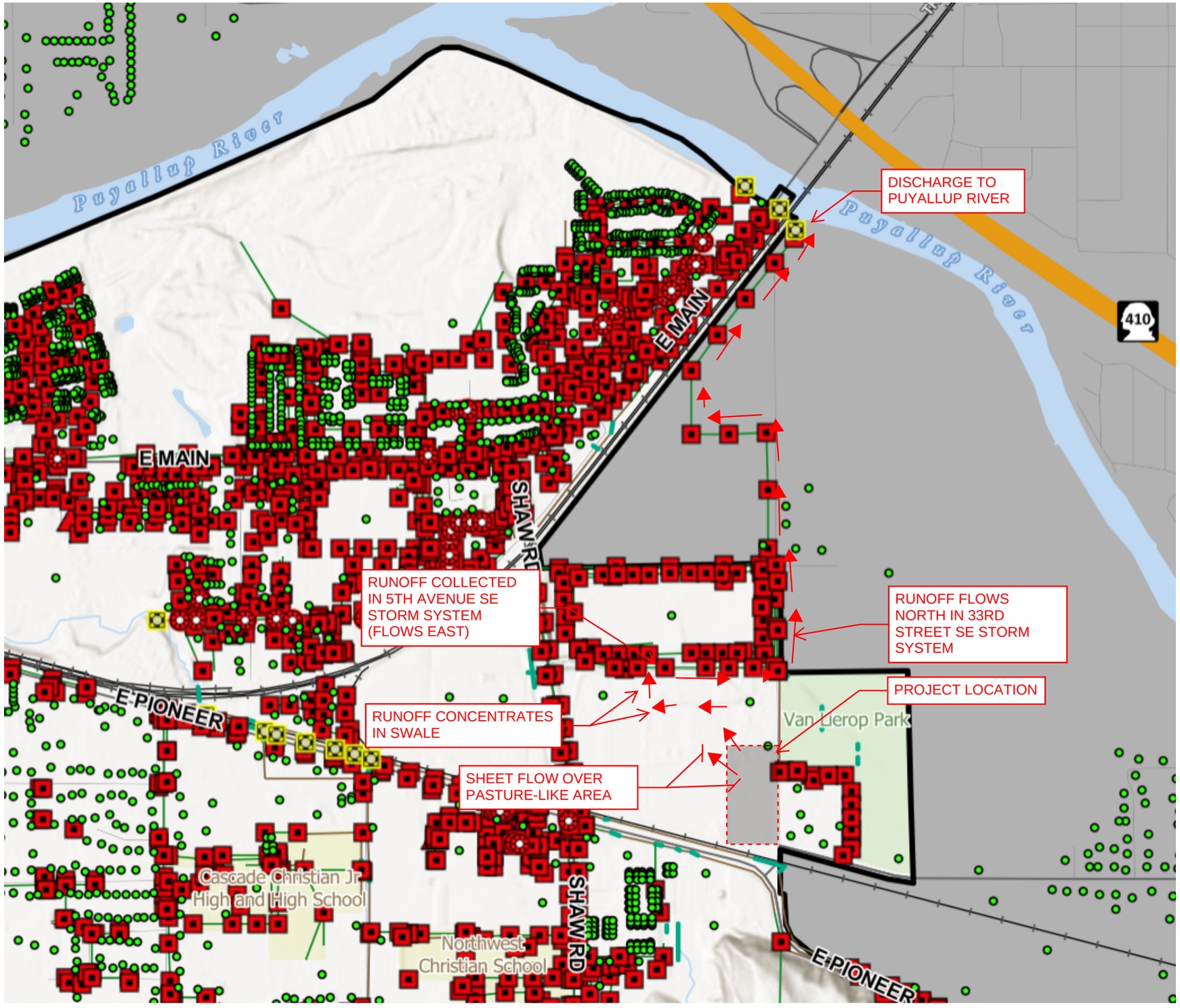
- Alfisols
- Andisols
- Entisols
- Gelisols
- Histosols
- Inceptisols
- Mollisols
- Spodosols
- No Soil
- Bodies of Water
- Data Not Available

N

Esri, NASA, NGA, USGS, FEMA | William Keller - GIS Coordinator

Powered by Esri

DOWNSTREAM MAP



5. APPENDICES

APPENDIX A: SUPPORTING CALCULATIONS

Runoff Treatment Calculations

APPENDIX B: OPERATION & MAINTENANCE MANUAL

APPENDIX A: SUPPORTING CALCULATIONS

GRAVEL PARKING AREA
VEGETATED FILTER STRIP
WATER TREATMENT
CALCULATION

WWHM2012
PROJECT REPORT

Project Name: CAVS For Parking Lot
Site Name: CAVS
Site Address:
City : Puyallup
Report Date: 11/7/2025
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	**acre**
ROADS FLAT	0.485
Impervious Total	0.485
Basin Total	0.485

Verify-See markup on Lot Coverage Table, Section 1.3. (0.505ac?)...likely won't change design.

21,138 SF GRAVEL

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
PARKING FLAT	0.485
Impervious Total	0.485
Basin Total	0.485

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.485

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.485

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.169969
5 year	0.228153
10 year	0.270442
25 year	0.328321
50 year	0.374772
100 year	0.424173

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.169969
5 year	0.228153
10 year	0.270442
25 year	0.328321
50 year	0.374772
100 year	0.424173

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.052 **acre-feet**
On-line facility target flow: 0.0718 **cfs.**
Adjusted for 15 min: 0.0718 **cfs.**
Off-line facility target flow: 0.0413 **cfs.**
Adjusted for 15 min: 0.0413 **cfs.**

ONLINE TREATMENT RATE REQUIRED FOR CAVFS

Perlnd and Implnd Changes

No changes have been made.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Nov 7 2025

Flow Depth (Y)

PARKING IS APPROXIMATLEY 294' WIDE

Rectangular

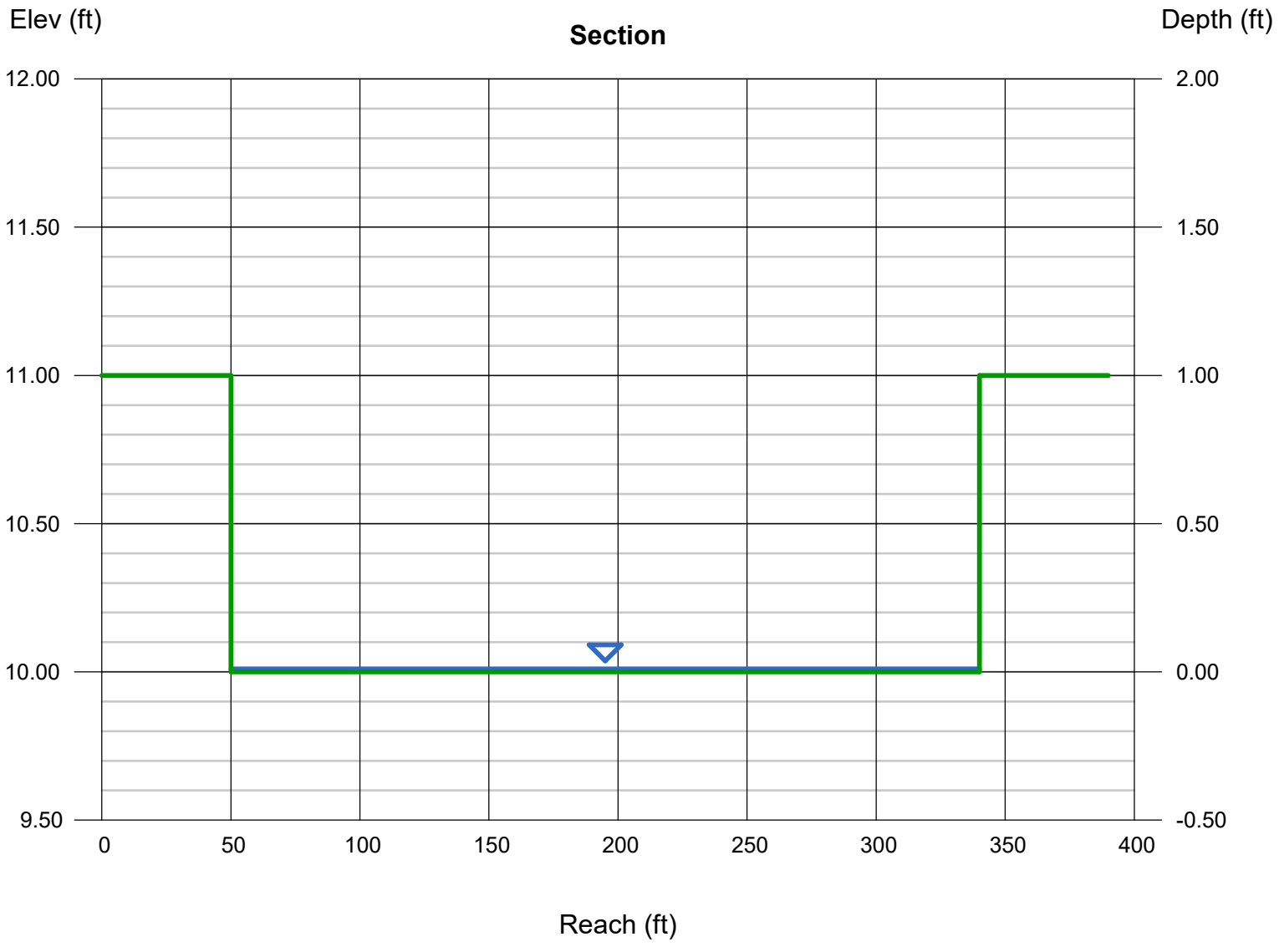
Bottom Width (ft)	= 290.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 10.00
Slope (%)	= 4.00
N-Value	= 0.350

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.07

Highlighted

Depth (ft)	= 0.01
Q (cfs)	= 0.070
Area (sqft)	= 2.90
Velocity (ft/s)	= 0.02
Wetted Perim (ft)	= 290.02
Crit Depth, Yc (ft)	= 0.01
Top Width (ft)	= 290.00
EGL (ft)	= 0.01

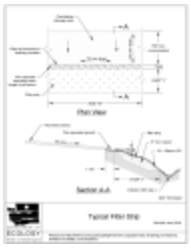


BMP T9.40: Vegetated Filter Strip

Description

A vegetated filter strip is flat with no side slopes (Figure V-7.11: Typical Filter Strip). Contaminated stormwater is distributed as sheet flow across the inlet width of the vegetated filter strip. Runoff Treatment is provided by passage of water over the surface and through grass.

Figure V-7.11: Typical Filter Strip



pdf download

Applications and Limitations

The vegetated filter strip is typically used on-line and adjacent and parallel to a paved area such as parking lots, driveways, and roadways.

Design Criteria

- Use the design criteria specified in Table V-7.6: Sizing Criteria for Vegetated Filter Strips.
- Vegetated filter strips should only receive sheet flow.
- Use curb cuts ≥ 12-inch wide and 1-inch above the vegetated filter strip inlet.
- Calculate the design flow depth using Manning's equation as follows:

$$KQ = (1.49AR^{0.67}\ s^{0.5})/n$$

Substituting for AR:

$$KQ = (1.49Ty^{1.67}\ s^{0.5})/n$$

Where:

$Ty = A_{rectangle}$, ft^2

$y \approx R_{rectangle}$, design depth of flow, ft. (1 inch maximum)

Q = peak Water Quality Design Flow Rate as described in III-2.6 Sizing Your Runoff Treatment BMPs, ft^3/sec

K = The ratio determined by using Figure V-7.7: Ratio of SBUH Peak/WQ Flow (Online)

n = Manning's roughness coefficient

s = Longitudinal slope of the vegetated filter strip, parallel to the direction of flow

T = Width of the vegetated filter strip, perpendicular to the direction of flow, ft.

A = Vegetated filter strip inlet cross-sectional flow area (rectangular), ft^2

R = hydraulic radius, ft.

Rearranging for y:

$$y = [KQn/1.49Ts^{0.5}]^{0.6}$$

y must not exceed 1 inch

Note: As in biofiltration swale design, an adjustment factor of K accounts for the differential between the Water Quality Design Flow Rate calculated by an approved continuous simulation model and the SBUH design flow rate.

- Calculate the design flow velocity V, ft./sec., through the filter strip:

$$V = KQ/Ty$$

V must not exceed 0.5 ft./sec

- Calculate the required length, ft., of the vegetated filter strip at the minimum hydraulic residence time, t, of 9 minutes:

$$L = tV = 540V$$

Table V-7.6: Sizing Criteria for Vegetated Filter Strips

Design Parameter	Vegetated Filter Strip Sizing
Longitudinal Slope	0.01 - 0.33
Maximum velocity	0.5 ft / sec @ K multiplied by the WQ Design Flow Rate
Maximum water depth[1]	1-inch max.
Manning coefficient	0.35
Minimum hydraulic residence time at Water Quality Design Flow Rate	9 minutes

Design Parameter	Vegetated Filter Strip Sizing
Minimum length	Sufficient to achieve hydraulic residence time in the vegetated filter strip
Maximum sideslope	Inlet edge ≥ 1" □ lower than contributing paved area
Max. tributary drainage flowpath	150 feet
Max. longitudinal slope of contributing area	0.05 (steeper than 0.05 needs upslope flow spreader and energy dissipation)
Max. lateral slope of contributing area	0.02 (at the edge of the vegetated filter strip inlet)
1. Below the design water depth install an erosion control blanket, at least 4” of topsoil, and the selected biofiltration seed mix. Above the water line use a straw mulch or sod.	

Washington State Department of Ecology

2019 Stormwater Management Manual for Western Washington (2019 SWMMWW)

Publication No.19-10-021

L=tV=540x0.02f/s= 10.8 feet

GRAVEL SHOULDER VEGETATED FILTER SRIP WATER TREATMENT CALCULATION

WWHM2012
PROJECT REPORT

Project Name: Gravel Shoulder
Site Name: CAVS
Site Address:
City : Puyallup
Report Date: 11/7/2025
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
ROADS FLAT	0.485
Impervious Total	0.485
Basin Total	0.485

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
PARKING FLAT	0.085
Impervious Total	0.085
Basin Total	0.085

SHOULDER AREA PLUS HALF ROAD WIDTH TRIBUTARY

Element Flows To:
Surface Interflow Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.485

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.085

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.169969
5 year	0.228153
10 year	0.270442
25 year	0.328321
50 year	0.374772
100 year	0.424173

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.029788
5 year	0.039986
10 year	0.047397
25 year	0.057541
50 year	0.065682
100 year	0.07434

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0091 **acre-feet**
On-line facility target flow: 0.0125 **cfs.**
Adjusted for 15 min: 0.0125 **cfs.**
Off-line facility target flow: 0.0072 **cfs.**
Adjusted for 15 min: 0.0072 **cfs.**

ONLINE TREATMENT RATE REQUIRED FOR FILTER STRIP

Perlnd and Implnd Changes

No changes have been made.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Nov 7 2025

Flow Depth (Y)

Rectangular

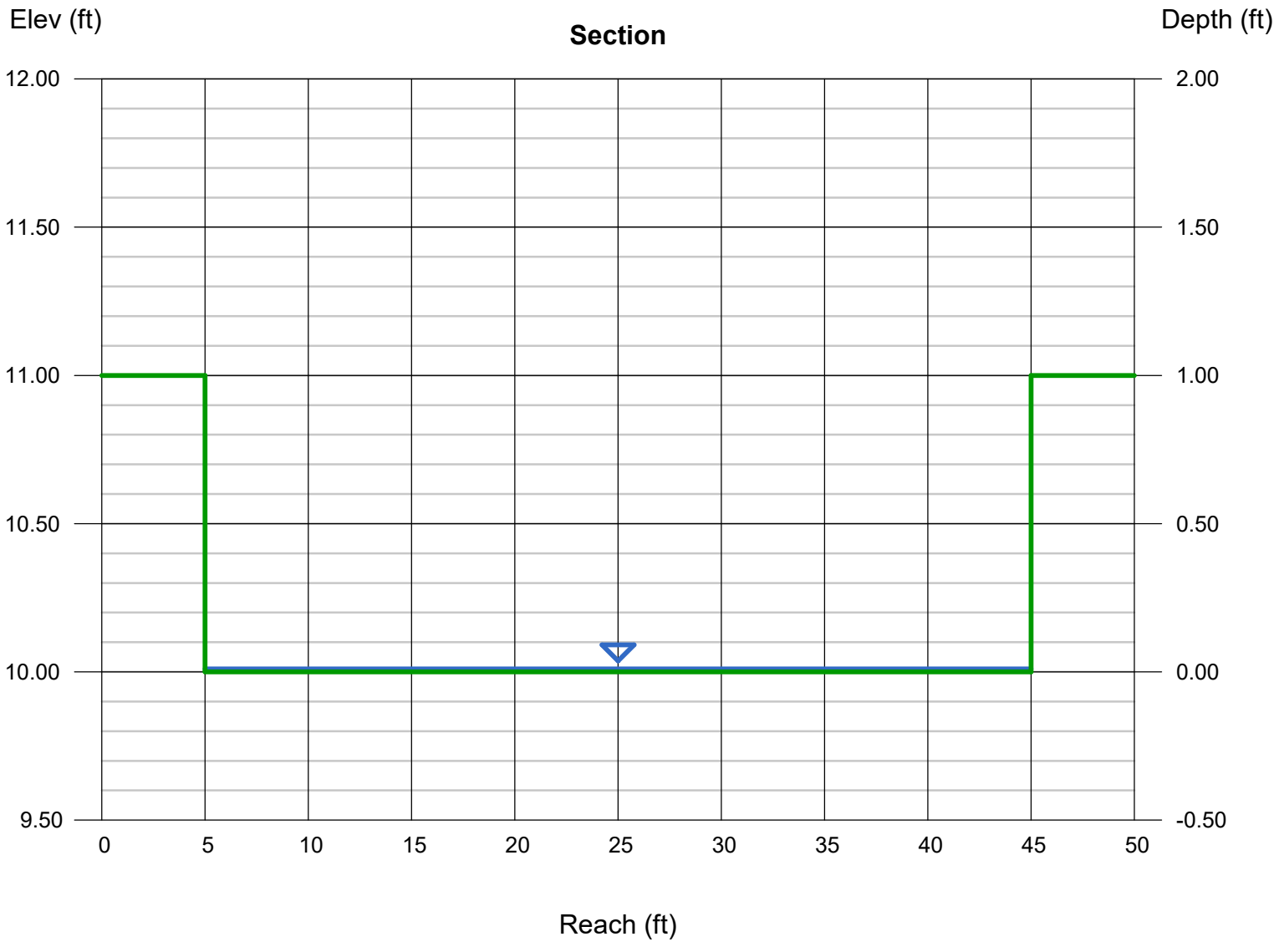
Bottom Width (ft)	= 40.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 10.00
Slope (%)	= 4.00
N-Value	= 0.350

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.01

Highlighted

Depth (ft)	= 0.01
Q (cfs)	= 0.010
Area (sqft)	= 0.40
Velocity (ft/s)	= 0.03
Wetted Perim (ft)	= 40.02
Crit Depth, Yc (ft)	= 0.01
Top Width (ft)	= 40.00
EGL (ft)	= 0.01

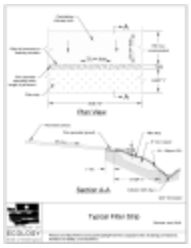


BMP T9.40: Vegetated Filter Strip

Description

A vegetated filter strip is flat with no side slopes (Figure V-7.11: Typical Filter Strip). Contaminated stormwater is distributed as sheet flow across the inlet width of the vegetated filter strip. Runoff Treatment is provided by passage of water over the surface and through grass.

Figure V-7.11: Typical Filter Strip



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Applications and Limitations

The vegetated filter strip is typically used on-line and adjacent and parallel to a paved area such as parking lots, driveways, and roadways.

Design Criteria

- Use the design criteria specified in Table V-7.6: Sizing Criteria for Vegetated Filter Strips.
- Vegetated filter strips should only receive sheet flow.
- Use curb cuts ≥ 12-inch wide and 1-inch above the vegetated filter strip inlet.
- Calculate the design flow depth using Manning's equation as follows:

$$KQ = (1.49AR^{0.67}\ s^{0.5})/n$$

Substituting for AR:

$$KQ = (1.49Ty^{1.67}\ s^{0.5})/n$$

Where:

$Ty = A_{rectangle}$, ft^2

$y \approx R_{rectangle}$, design depth of flow, ft. (1 inch maximum)

Q = peak Water Quality Design Flow Rate as described in III-2.6 Sizing Your Runoff Treatment BMPs, ft^3/sec

K = The ratio determined by using Figure V-7.7: Ratio of SBUH Peak/WQ Flow (Online)

n = Manning's roughness coefficient

s = Longitudinal slope of the vegetated filter strip, parallel to the direction of flow

T = Width of the vegetated filter strip, perpendicular to the direction of flow, ft.

A = Vegetated filter strip inlet cross-sectional flow area (rectangular), ft^2

R = hydraulic radius, ft.

Rearranging for y:

$$y = [KQn/1.49Ts^{0.5}]^{0.6}$$

y must not exceed 1 inch

Note: As in biofiltration swale design, an adjustment factor of K accounts for the differential between the Water Quality Design Flow Rate calculated by an approved continuous simulation model and the SBUH design flow rate.

- Calculate the design flow velocity V, ft./sec., through the filter strip:

$$V = KQ/Ty$$

V must not exceed 0.5 ft./sec

- Calculate the required length, ft., of the vegetated filter strip at the minimum hydraulic residence time, t, of 9 minutes:

$$L = tV = 540V$$

Table V-7.6: Sizing Criteria for Vegetated Filter Strips

Design Parameter	Vegetated Filter Strip Sizing
Longitudinal Slope	0.01 - 0.33
Maximum velocity	0.5 ft / sec @ K multiplied by the WQ Design Flow Rate
Maximum water depth[1]	1-inch max.
Manning coefficient	0.35
Minimum hydraulic residence time at Water Quality Design Flow Rate	9 minutes

Design Parameter	Vegetated Filter Strip Sizing
Minimum length	Sufficient to achieve hydraulic residence time in the vegetated filter strip
Maximum sideslope	Inlet edge ≥ 1" □ lower than contributing paved area
Max. tributary drainage flowpath	150 feet
Max. longitudinal slope of contributing area	0.05 (steeper than 0.05 needs upslope flow spreader and energy dissipation)
Max. lateral slope of contributing area	0.02 (at the edge of the vegetated filter strip inlet)
1. Below the design water depth install an erosion control blanket, at least 4” of topsoil, and the selected biofiltration seed mix. Above the water line use a straw mulch or sod.	

Washington State Department of Ecology

2019 Stormwater Management Manual for Western Washington (2019 SWMMWW)

Publication No.19-10-021

L=tV=540x0.03f/s= 16.2 feet

UPSTREAM ROAD BYPASS
PEAK RATES

WWHM2012
PROJECT REPORT

Project Name: Road Peaks
Site Name: Peaks
Site Address:
City : Puyallup
Report Date: 11/19/2025
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.088
Pervious Total	0.088

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.088

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
PARKING FLAT	0.088
Impervious Total	0.088
Basin Total	0.088

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.088
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.088

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.002161
5 year	0.003468
10 year	0.004441
25 year	0.005781
50 year	0.006855
100 year	0.00799

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.03084
5 year	0.041397
10 year	0.04907
25 year	0.059572
50 year	0.068
100 year	0.076963

APPENDIX B: OPERATION AND MAINTENANCE MANUAL

OPERATIONS & MAINTENANCE MANUAL

FOR

FARM 12 – PARKING LOT REVISION

C&A PROJ # 25-018

PREPARED FOR:

FARM 12
3303 8TH AVENUE SE #A
PUYALLUP, WA 98372

PREPARED BY:

Cecil & Associates, LLC
PO BOX 598
BOTHELL, WA 98041

AUGUST 19, 2025
PERMIT #PRCCP20241731

Table V-A.10: Maintenance Standards - Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

Table V-A.11: Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-A.12: Maintenance Standards - Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables	Remove trash and debris from vault.

Table V-A.19: Maintenance Standards - Media Filter Drain (MFD) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	zone/flow spreader		
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

Table V-A.20: Maintenance Standards - Compost Amended Vegetated Filter Strip (CAVFS)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width