# *Stormwater Site Plan*

*PREPARED FOR:*

McGranahan Architects
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2111 Pacific Avenue, Suite 100
Tacoma, WA 98402

*PROJECT:*

Pierce College Puyallup
Campus Parking Expansion
Puyallup, WA
2200718.12

*PREPARED BY:*

Claire Hovde
Project Engineer

*REVIEWED BY:*

William J. Fierst, PE
Principal

*DATE:*

February 2022
Revised November 2022
Revised February 2023
Revised March 2023


*03/20/2023*

I hereby state that this Storm Drainage Report for the Pierce College - Puyallup Campus Parking Expansion project has been prepared by me or under my supervision and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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# 1.0 Project Overview

This Stormwater Site Plan (SSP) describes proposed stormwater mitigation for Campus Parking Expansion project at the Pierce College Puyallup (PCP). PCP is bounded by 39th Avenue SE to the south, Wildwood Park Drive to the north and east, and Bradley Lake and commercial properties to the west in Puyallup, Washington. The total campus area is approximately 122.3 acres and is situated on eight separate parcels.

The project proposes two separate parking lots: Parking Lot B and Parking Lot C. See Section 1.2 for proposed basin areas. Improvements include asphalt paving, concrete paving, and stormwater management. Refer to Appendices A-4.1 and A-4.2 for Developed Conditions Maps for more information. Underground detention pipes are proposed for stormwater flow control for proposed impervious surfaces. Bioretention facilities will be used upstream of the proposed flow control facilities for stormwater quality treatment for pollution generating impervious surfaces (PGIS).

This SSP describes the stormwater facilities designed for this project. The drainage plans and report have been prepared to satisfy all requirements of the Department of Ecology (DOE) 2014 *Stormwater Management Manual for Western Washington (SWMMWW)*. This report accompanies the final site plan submitted for the proposed Campus Parking Expansion project at PCP.

## 1.1 Existing Conditions

The 122.30-acre site is currently partially developed and located on the north side of 39th Avenue SE. The site consists of several buildings, parking lots, detention ponds, forested area, wetlands, and an access drive loop that is routed around the perimeter of the developed portion of the site.

PCP is bounded by 39th Avenue SE to the south, Wildwood Park Drive to the north and east, and Bradley Lake and commercial properties to the west in Puyallup, Washington. A main entrance driveway to the site is located on the south side of the property along 39th Avenue SE. An additional driveway connection to the site is located at the northwest of the site and connects to 7th Street SE. All adjacent properties are downgradient of the site and do not appear to discharge stormwater onto the proposed site.

The campus straddles two drainage basins, as outlined by the City of Puyallup Drainage Basin Map. The basin delineation line runs approximately north/south down the middle of the site. The west side of the site is in the State Highway Basin and the east side of the site is in the Pothole Basin. Refer to Appendix A-10, City of Puyallup Drainage Basin Map for more information. The proposed improvements are located within the Pothole Basin. Refer to Appendices A-2.1 and A-2.2 for the Existing Conditions Maps for more information

**Parking Lot B –** Is centrally located on the campus approximately 60 feet east of the Garnero Child Development Center (CDP). Refer to Appendix A-8, Campus Map for building location. Refer to Appendix A-3, Downstream Map for parking lot location. The site is located within the Pothole Basin. The existing conditions at Parking Lot B include an open field consisting of lawn. Topography generally slopes from southwest to northeast. The Parking Lot B site drains to an existing conveyance system that is routed north and then east throughout the campus before ultimately outfalling to an existing detention pond located at the far eastern edge of the campus. The existing detention pond was constructed with the Library Sciences Center (LSC) project and later expanded with the College Center Building (CTR) project. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location. Additionally, the parking lot improvements are adjacent to an existing wetland sperate from the wetland the project outfalls to. A small portion of the existing basin does drain to the adjacent wetland in the existing condition. Refer to Appendix A-2.1, Existing Conditions Map for more information on the Parking Lot B existing basin. Refer to Appendix A-7, Parking Lot B Wetland Basin Exchange Map for more information on the portion of the basin tributary to the wetland.

**Parking Lot C –** Is located at the southeast corner of campus approximately 250 feet southeast of the Gaspard Administration Building (ADM). Refer to Appendix A-8, Campus Map for building location. Refer to Appendix A-3, Downstream Map for parking lot location. The site is located within the Pothole Basin. The existing conditions at Parking Lot C consists of landscape area campus driveway. Topography generally slopes from west to east. The Parking Lot C site drains to an existing conveyance system that is routed north along College Way before ultimately outfalling to an existing detention pond located at the far eastern edge of the campus. The existing detention pond was constructed with the Library Sciences Center (LSC) project and later expanded with the College Center Building (CTR) project. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location. Refer to Appendix A-2.2, Existing Conditions Map for more information.

### 1.1.1 Critical Areas

The site contains five wetlands onsite, per the City of Puyallup GIS Critical Areas Map (see Appendix A-11 for more information). College maps indicate eleven wetlands are located onsite. A Critical Areas Report by Grette Associates dated January 2022 has been completed for the wetlands that near the proposed site improvements. See Appendix C-2, Critical Areas Report by Grette Associates, dated January 2022, for more information. See Section 2.8 for a more information.

### 1.1.2 Site Soils

Soils at the site are mapped by the Natural Resources Conservation Service (NRCS) as predominantly gravelly sandy loam underlain by glacial till. Refer to Appendix A-12 for the NRCS Soils Map.

Based on Geotechnical Engineering Services Report by GeoEngineers, dated January 31, 2022, the site is underlain by glacial till. The report notes long term design infiltration rates ranging from 0.015 to 0.043 in/hr. The long-term design infiltration rate is less than 0.3 in/hr; therefore, infiltration is considered infeasible.

Additional groundwater monitoring was performed by GeoEngineers and presented in an addendum to supplement the Geotechnical Engineering Services Report. See Appendix C-3 for more information.

## 1.2 Proposed Conditions

The project proposes two separate parking lots: Parking Lot B and Parking Lot C. Improvements include asphalt paving, concrete paving, and stormwater management. Refer to Appendices A-4.1 and A-4.2 for Developed Conditions Maps for more information. Underground detention pipes are proposed for stormwater flow control for proposed impervious surfaces. Bioretention facilities will be used upstream of the proposed flow control facilities for stormwater quality treatment for pollution generating impervious surfaces (PGIS).

**Parking Lot B –** Consists of a 70-stall asphalt parking lot with pavers for pedestrian for connection to the campus. Drainage for the proposed parking lot is provided via sheet flow. Water quality for the parking lot is provided via a bioretention facility along the north side of the parking lot. Flow control is provided by 6-foot diameter underground detention pipes located under the proposed parking lot. See Section 4.2 for more information. Proposed site areas are tabulated below.

| | Acres | Percent of Project Area |
|---|---|---|
| Impervious Area | 0.55 | 73% |
| Landscape Area | 0.20 | 27% |
| **Total Disturbed Area** | **0.75** | **100%** |

**Parking Lot C -** Consists of 23 angle parking stalls that are situated along the west side of the College Way loop. The parking stall will be asphalt paving with intermediate landscape islands located throughout the row of stalls. Water quality for the parking stalls is provided via a bioretention facility along the north side of the parking stalls. Flow control will be provided via BMP T5.30 - Full Dispersion. See Section 4.2 for more information. Proposed site areas are tabulated below.

| | Acres | Percent of Project Area |
|---|---|---|
| Impervious Area | 0.11 | 69% |
| Landscape Area | 0.05 | 31% |
| **Total Disturbed Area** | **0.16** | **100%** |

## 2.0 Minimum Requirements

The Campus Parking Expansion project is considered redevelopment and is subject to Minimum Requirements (MRs) 1 through 9 because the project proposes more than 5,000 square feet of new and replaced hard surfaces. However, the project does not exceed 50 percent of the existing site improvement value. Therefore, all minimum requirements apply to new hard surfaces and the converted vegetation. Below is a discussion of how the project meets each of the requirements.

### 2.1 MR 1: Preparation of Stormwater Site Plans

A complete stormwater site plan including civil plans and this report are provided with this site development permit package.

### 2.2 MR 2: Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (CSWPPP) is included with this site development permit package.

### 2.3 MR 3: Source Control of Pollution

The project is required to provide source control of pollution. *SWMMWW* Volume 4, Chapter 4 was used as a reference because this is a commercial project. Maintenance, repair, and cleaning of vehicles will be conducted inside a building which is consistent with the structural source controls of this chapter. Some additional practices include:

- Assign one or more individuals to be responsible for stormwater pollution control related to inspections, operation, maintenance, and emergencies.
- Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste).

- Maintenance and repair of equipment and vehicles that may result in discharge or spillage of pollutants to the ground or into surface water runoff must be conducted inside the detail shop.
- Spills and leaks of gasoline or other pollutants will be promptly contained and cleaned. Solid absorbents should be used for cleanup of liquid spills. Spill cleanup materials shall not be flushed to storm drains. Pollutants shall not be hosed down from any area to the ground or storm drains.
- All pollutants, including waste materials and demolition debris created onsite during construction, shall be handled and disposed of in a manner that does not cause contamination of surface water.

The CSWPPP, under separate cover, provides details on source control of pollution during construction.

### 2.4 MR 4: Preservation of Natural Drainage Systems and Outfalls

The site is currently developed, with several sub-basins located throughout. The Parking Lot B site drains to an existing detention pond that ultimately disperses to an existing wetland. The Parking Lot C site drains existing detention pond that ultimately disperses to an existing wetland. In the proposed condition Parking Lot C will be dispersed to the west of existing wetland existing wetland. Refer to Appendix A-3, Downstream Map for more information on the project sites natural drainage systems and outfalls.

Stormwater from proposed improvements will outfall to the same waterbodies in the existing and proposed conditions within their respective sub-basins. Therefore, all proposed improvements will maintain onsite natural drainage courses.

### 2.5 MR 5: Onsite Stormwater Management

As outlined in *SWMMWW* Figure I-2.4.2*,* the project results in over 5,000 square feet of new plus replaced hard surfaces. Therefore, the project is subject to MRs 1 through 9 and List 2, as outlined in *SWMMWW* Section I-3.4.5.

Per *SWMMWW* Figure I-2.5.1, the project is subject to List 2 for considering feasibility of onsite stormwater management Best Management Practices (BMPs). List 2 feasibility follows:

Lawn and Landscaped Areas:

- BMP T5.13: Post Construction Soil Quality and Depth – The project will meet this requirement.

Roofs:

- No roofs are proposed with the project.

Other Hard Surfaces:

- <u>BMP T5.30: Full Dispersion</u> – Full dispersion is feasible for Parking Lot C as there is adequate native vegetation adjacent to the project site. The project site is considered driveway dispersion as outlined by BMP T5.30 and therefore will comply with BMP T5.11 Concentrated Flow Dispersion. Per BMP T5.30/BMP T5.11, a native vegetated flow path of at least 100 feet is required for stormwater dispersal. Parking Lot C will disperse through approximately 450 feet of native vegetation. The downstream flow path is shown in

Appendix A-14, Parking Lot C Dispersion Tract, as well as calculations showing at least 65 percent of the basin is protected within a tract, as required by BMP T5.30.

BMP T5.11 states that a dispersion trench per BMP T5.10B Downspout Dispersion Systems is required as indicated by Figure III-3.1.5 Typical Downspout Dispersion Trench. Per Figure III-3.1.5, the trench length requires 10 linear feet per 700 square feet of tributary impervious area. The tributary area is approximately 5,800 square feet; therefore, 83 linear feet of dispersion trench has been provided.

Stormwater will be dispersed down slopes greater than 20% adjacent to College Way. However, the Geotechnical engineer for the project has evaluated the slopes proposed for dispersion. Due to underlying glacial till soils and the area being heavily forested, the geotechnical engineer takes no issue with the proposed design. See Appendix C-1, Geotechnical Engineering Services Report by GeoEngineers, dated January 31, 2022, Section 4.6.3.2 for more information.

Due to the topography, not all of the Parking Lot C improvements can be directed to the dispersion trench; therefore, a basin exchange has been provided. Stormwater will be collected from areas that are outside of the project limits in exchange for areas within the project limits that cannot be collected due to topography. See section 4.3 for more information. Refer to Appendix A-5 for an exhibit outlining the basin exchange.

Parking Lot C meets or exceeds all requirements set forth by BMP T5.30 for dispersion.

- <u>BMP T5.15: Permeable Pavement</u> – Permeable pavement is infeasible because the project has underlying soils that are not suitable for infiltration.
- <u>BMP T7.30: Bioretention</u> – Bioretention facilities are infeasible because the project has underlying soils that are not suitable for infiltration. However, bioretention facilities are proposed for the purpose of stormwater quality at all three parking lots.
- <u>BMP T5.12: Sheet Flow Dispersion</u> – Sheet flow dispersion is infeasible for all projects site as there is either not adequate native vegetation or the native vegetation is not directly adjacent to the project site (Parking Lot C).
- <u>BMP T5.11: Concentrated Flow Dispersion</u> – Concentrated flow dispersion is feasible for Parking Lot C as there is adequate native vegetation adjacent to the project site. See BMP T5.30 above for more information.

### 2.6 MR 6: Runoff Treatment

All proposed improvements include PGIS and will provide runoff treatment via BMP T7.30 Bioretention. See section 4.1 for more information. Refer to Appendices A-4.1 and A-4.2 for the location of proposed bioretention facilities. Refer to Appendix B for water quality calculations. Refer to Appendix A-13 for the Treatment Facility Selection Flow Chart.

Due to the topography, not all of the new and replaced PGIS in Parking Lot C can be directed to the bioretention facility; therefore, a treatment trade is proposed. Stormwater will be collected from non-target PGIS that are outside of the project limits in exchange for target PGIS within the project limits that cannot be collected due to topography. Refer to Appendix A-5 for an exhibit outlining the treatment trade.

### 2.7 MR 7: Flow Control

Flow control systems are proposed for all improvements, except Parking Lot C, which will utilize full dispersion. Parking Lot B will utilize 6-foot diameter underground detention pipes. All flow control systems have been calculated using WWHM and meet all requirements of the 2014 *SWMMWW*. See section 4.3 for more information. Refer to Appendix A-4.1 for the location of proposed flow control facilities. Refer to Appendix B for flow control calculations.

### 2.8 MR 8: Wetlands Protection

The site contains five wetlands onsite, per the City of Puyallup GIS Critical Areas Map (see Appendix A-11 for more information). College maps indicate eleven wetlands are located onsite. A Critical Areas Report by Grette Associates dated January 2022 has been completed for the wetlands that near the proposed site improvements. See Appendix C-2, Critical Areas Report by Grette Associates dated, January 2022, for more information. See Section 2.8 for a more information.

Parking Lot B improvements are adjacent to Wetland B which is sperate from the wetland the project outfalls to. Wetland B is considered a Category III wetland with a habitat score of 5 points and an 80-foot buffer. It is located approximately 110 feet from improvements at Parking Lot B. A small portion of the existing basin does drain to the adjacent wetland in the existing condition. A portion of the area tributary to the wetland will drain to the wetland in the proposed condition. However, a basin exchange is proposed to maintain the area tributary to the existing wetland. Therefore, Wetland B will not be impacted by the proposed work. Refer to Appendix A-2.1, Existing Conditions Map for more information on the Parking Lot B existing basin. Refer to Appendix A-7, Parking Lot B Wetland Basin Exchange Map for more information on the portion of the basin tributary to the wetland.

Parking Lot B and C drain to a wetland located at the southeast corner of the campus. No work is planned in or near the wetland, therefore it is not included in the wetland study. The drainage basin tributary to the wetland is large and contains approximately 54.84 acres in total area. The basin is partially developed and includes approximately 14.67 SF of impervious surfaces. Refer to Appendix A-6, Wetland Basin Map for more information. The entire basin has been modeled in WWHM to calculate the wetland hydroperiods in the existing and proposed conditions per the guidelines set forth in the *SWMMWW*, Appendix I-D. The proposed improvements are in compliance with the *SWMMWW* and will therefore not impact the wetlands hydrology. Refer to Appendix B-6, Parking Lots B and C Wetland Hydroperiod Calculations for more information.

The existing hydrology for all onsite wetlands will not be impacted by the proposed work and therefore the project is in compliance with minimum requirement #8.

### 2.9 MR 9: Operations and Maintenance

An Operations and Maintenance Manual is provided with this submittal. See Appendix D for more information.

## 3.0 Offsite Analysis

Parking Lot B discharges at the northeast end of the project site along the College Way. Stormwater is then collected and conveyed via catch-basins and 12-inch storm pipes. Stormwater is routed north for approximately 850 feet along College Way. Stormwater is then routed east through 18-inch storm pipes for approximately 950 feet where it outfalls to a rip rap ditch. Stormwater then flows south for approximately 500 feet before outfalling to the existing detention pond located at the eastern extent of the campus. The existing detention pond outfalls to the Bradley Lake overflow ditch where it is routed north. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location.

Parking Lot C discharges at the northeast end of the project site along the College Way. Stormwater is then collected and conveyed via catch-basins and 12-inch storm pipes. Stormwater is routed north for approximately 1250 feet along College Way where it outfalls to a rip rap ditch. Stormwater then flows south for approximately 500 feet before outfalling to the existing detention pond located at the eastern extent of the campus. The existing detention pond outfalls to the Bradley Lake overflow ditch where it is routed north. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location.

Impacts to offsite drainage courses and conveyance systems are not anticipated.

A downstream capacity analysis was performed for Parking Lot B. Entranco previously wrote a storm drainage report for the College Center building and the portion of College Way to the east of Lot B. The conveyance analysis performed for the 2003 Storm Drainage Report was used to confirm that the existing downstream system has sufficient capacity for the proposed improvements. The downstream capacity analysis calculations and relevant pages from the 2003 Storm Drainage Report are included as Appendix B-6. The analysis was performed from existing STCB#1307 to STCB#1305 using the 100-year, 24-hour storm event, with the following assumptions:

- In the 2003 Storm Drainage Report, the conveyance system was designed assuming 0.2755 acre of impervious surface would be constructed upstream of Stub 1, which discharges in to STCB#1307 (CB 335 in 2003 report). In the proposed condition, 0.55 acre of impervious surface is proposed. Therefore, the project proposes to add an additional 0.2745 acre of impervious surface beyond what was originally planned in the 2003 report.
- All stormwater from proposed Lot B will be detained and released at a rate matching pre-developed, forested conditions. The conveyance calculations are conservative, in that the proposed upstream area is modeled as if no detention is provided.

# 4.0 Permanent Stormwater Control Plan

## 4.1 Existing Site Hydrology

The campus straddles two drainage basins, as outlined by the City of Puyallup Drainage Basin Map. The basin delineation line runs approximately north/south down the middle of the site. The west side of the site is in the State Highway Basin and the east side of the site is in the Pothole Basin. Refer to Appendix A-10, City of Puyallup Drainage Basin Map for more information. The proposed improvements are located within the Pothole Basin. All adjacent properties are downgradient of the site and do not appear to discharge stormwater onto the proposed site.

**Parking Lot B –** Is centrally located on the campus approximately 60 feet east of the Garnero Child Development Center (CDP). Refer to Appendix A-8, Campus Map for building location. Refer to Appendix A-3, Downstream Map for parking lot location. The site is located within the Pothole Basin. The existing conditions at Parking Lot B include an open field consisting of lawn. Topography generally slopes from southwest to northeast. The Parking Lot B site drains to an existing conveyance system that is routed north and then east throughout the campus before ultimately outfalling to an existing detention pond located at the far eastern edge of the campus. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location. A small portion of the existing basin does drain to the adjacent wetland in the existing condition. A portion of the area tributary to the wetland will drain to the wetland in the proposed condition. However, a basin exchange is proposed to maintain the area tributary to the existing wetland. Therefore, the existing hydrology of Wetland B will not be impacted by the proposed work. Refer to Appendix A-2.1, Existing Conditions Map for more information on the Parking Lot B existing basin. Refer to Appendix A-7, Parking Lot B Wetland Basin Exchange Map for more information on the portion of the basin tributary to the wetland.

**Parking Lot C –** Is located at the southeast corner of campus approximately 250 feet southeast of the Gaspard Administration Building (ADM). Refer to Appendix A-8, Campus Map for building location. Refer to Appendix A-3, Downstream Map for parking lot location. The site is located within the Pothole Basin. The existing conditions at Parking Lot C consists of landscape area campus driveway. Topography generally slopes from west to east. The Parking Lot C site drains to an existing conveyance system that is routed north along College Way before ultimately outfalling to an existing detention pond located at the far eastern edge of the campus. The existing detention pond outfalls to a rip rap pad where it eventually disperses into an existing wetland located approximately 320 feet southeast of the detention pond. Refer to Appendix A-3, Downstream Map for existing detention pond location. Refer to Appendix A-2.2, Existing Conditions Map for more information.

## 4.2 Developed Site Hydrology

All proposed improvements will maintain onsite natural drainage courses, as outlined in Section 4.1. Stormwater from proposed improvements will outfall to the same locations within their respective sub-basins. Stormwater flows from proposed developed areas will be properly managed and will meet all the requirements set forth in the *SWMMWW*. Proposed developed hydrology will not further impact downstream drainage courses.

## 4.3 Flow Control System

Flow control systems are proposed for all improvements, except Parking Lot C, which will use full dispersion. Parking Lot B will utilize 6-foot diameter underground detention pipes. Refer to Appendix A-4.1 for the location of proposed flow control facilities. Refer to Appendix B for flow control calculations.

All flow control systems have been calculated using WWHM and meet all requirements of the 2014 *SWMMWW*. The project will utilize BMP T5.13: Post Construction Soil Quality and Depth for all pervious areas impacted by the project. Per *SWMMWW* Volume V, page 913, project areas meeting the requirements set forth by BMP T5.13 may model pervious area as pasture rather lawn. The project intends to utilize these criteria. Refer to Appendix B for flow control calculations for more information.

Due to the topography, not all of the Parking Lot C improvements can be directed to the bioretention facility and dispersion trench; therefore, a basin exchange has been provided. Stormwater will be collected from areas that are outside of the project limits in exchange for areas within the project limits that cannot be collected due to topography. Surface flows will not bypass from one basin to another as all areas are within the same basin. Stormwater will ultimately outfall to an existing wetland located at the southeast corner of the site via a flow spreader. All proposed improvements will maintain onsite natural drainage courses, as outlined in Section 4.1. Only 0.04 acres of target pervious surface cannot be routed to the dispersion trench, however, 0.06 acres of non-target pervious surface is collected due to topography. The total area of pervious surface receiving treatment exceeds the area of pervious surface requiring treatment. Refer to Appendix A-5 for an exhibit outlining the basin exchange.

## 4.4 Water Quality System

The proposed improvements include PGIS. All proposed improvements that include PGIS will provide runoff treatment via BMP T7.30 Bioretention. Refer to Appendices A-4.1 and A-4.2 for the location of proposed bioretention facilities. Bioretention facilities will use perforated pipe underdrains. Stormwater will be treated by the bioretention facilities before being conveyed to the downstream flow control facilities.

Due to the topography, not all of the new and replaced PGIS in Parking Lot C can be directed to the bioretention facility; therefore, a treatment trade is proposed. Stormwater will be collected from non-target PGIS that are outside of the project limits in exchange for target PGIS within the project limits that cannot be collected due to topography. Refer to Appendix A-5 for an exhibit outlining the treatment trade.

All water quality systems have been calculated using WWHM and meet all requirements of the 2014 *SWMMWW.* Refer to Appendix B for water quality calculations.

### 4.5 Conveyance System Analysis and Design

The onsite conveyance system consists of catch basins and 12-inch storm pipes with a minimum slope of 0.005 ft/ft. Parking Lot B has the largest tributary area, and therefore has been used for the conveyance calculation. Refer to Appendix B-5 for the conveyance capacity calculations.

## 5.0 Construction Stormwater Pollution Prevention Plan

A Construction Stormwater Pollution Prevention Plan (CSWPPP) will be included under a separate cover for this site development permit package.

## 6.0 Special Reports and Studies

This project includes a Geotechnical Engineering Services Report by GeoEngineers, dated January 31, 2022; a Critical Areas Report by Grette Associates, dated January 2022; and a Supplemental Groundwater Information Addendum #1 by GeoEngineers, dated October 31, 2022. See Appendix C for special reports.

## 7.0 Conclusion

This analysis is based on data and records either supplied to or obtained by AHBL. These documents are referenced within the text of the analysis. The analysis has been prepared using procedures and practices within the standard accepted practices of the industry. We conclude that this project, as proposed, will not create any new problems within the existing downstream drainage system. This project will not noticeably aggravate any existing downstream problems due to either water quality or quantity.

AHBL, Inc.

Claire Hovde
Project Engineer

CFH/ACP/lsk

February 2022
Revised November 2022
Revised February 2023
Revised March 2023

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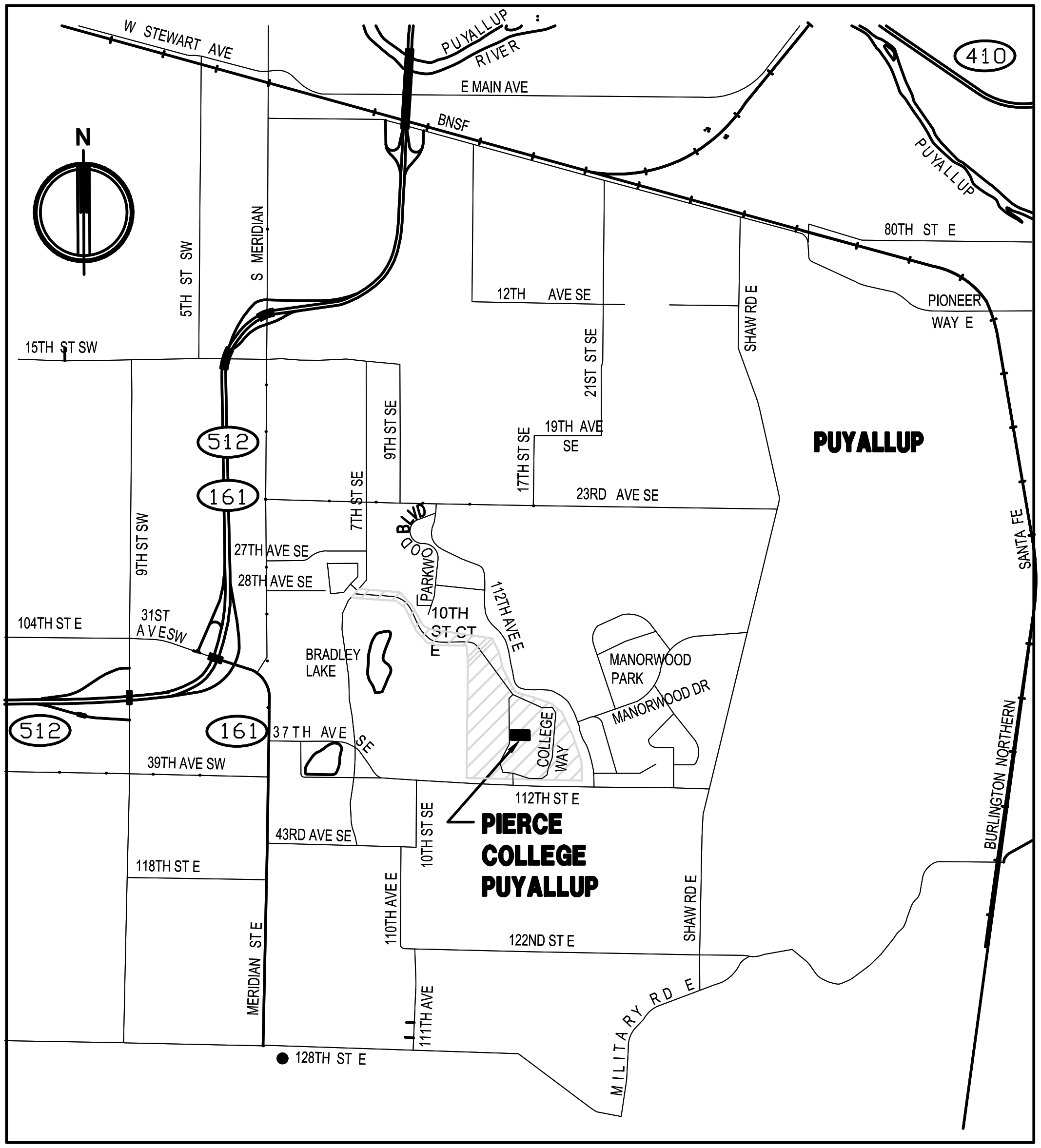
# Appendix A

## Exhibits




AHBL

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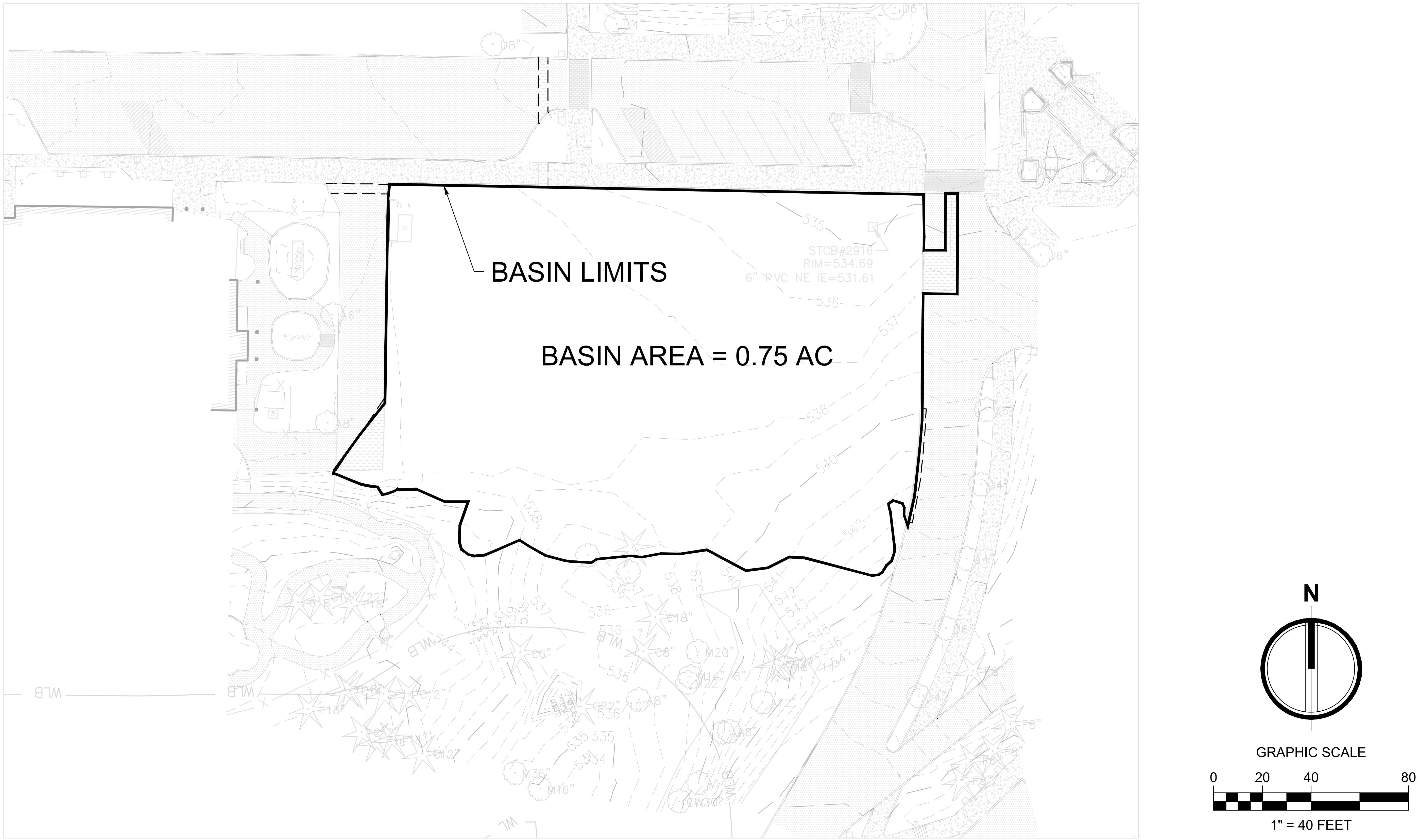
**Pierce College Puyallup**

**Vicinity Map**

DRAWN BY: ACP | DATE: 6/29/2021 | JOB NO.: 2190297.10

**EX A-1**

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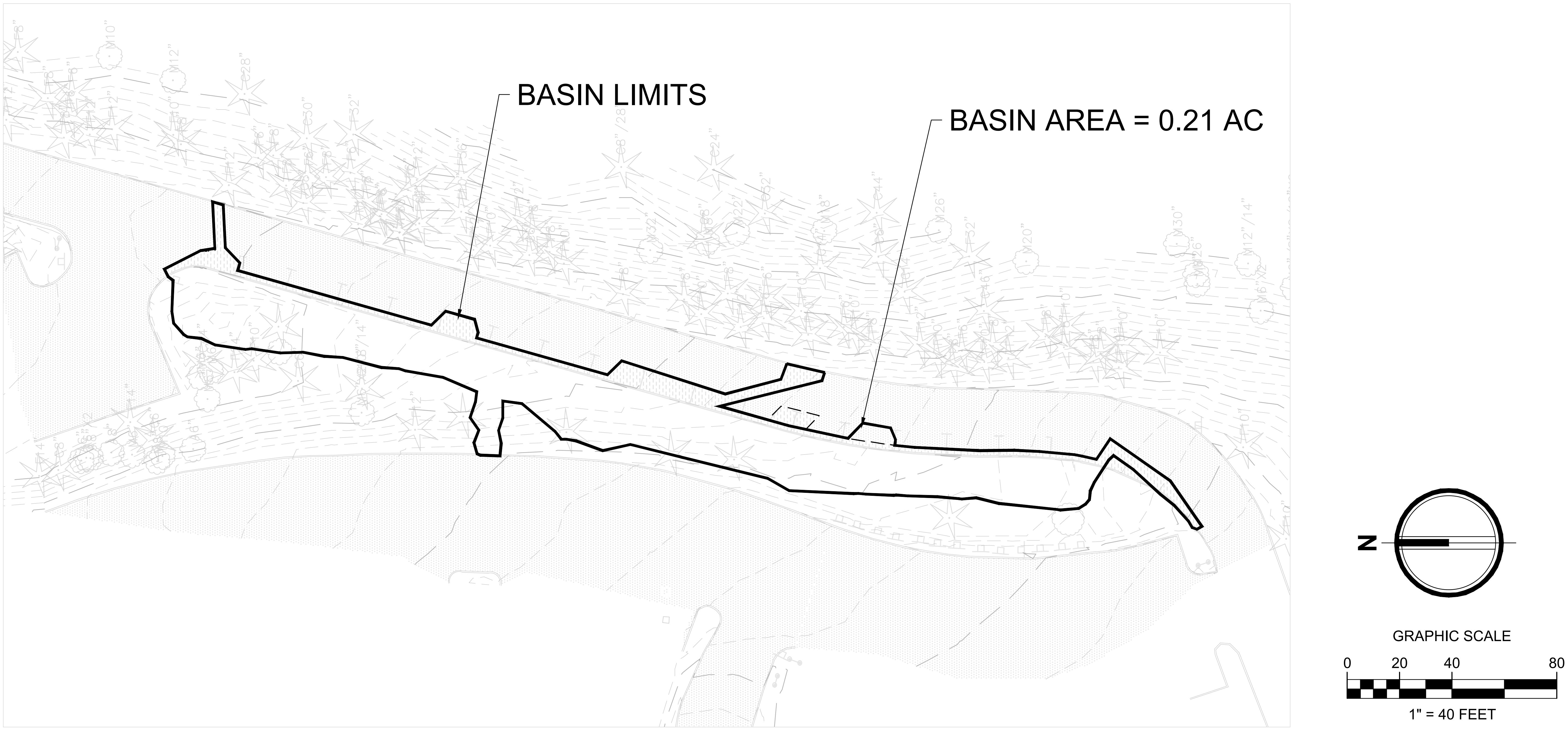
PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**EXISTING BASIN MAP**
**PARKING LOT B**

**EX-A2.1**

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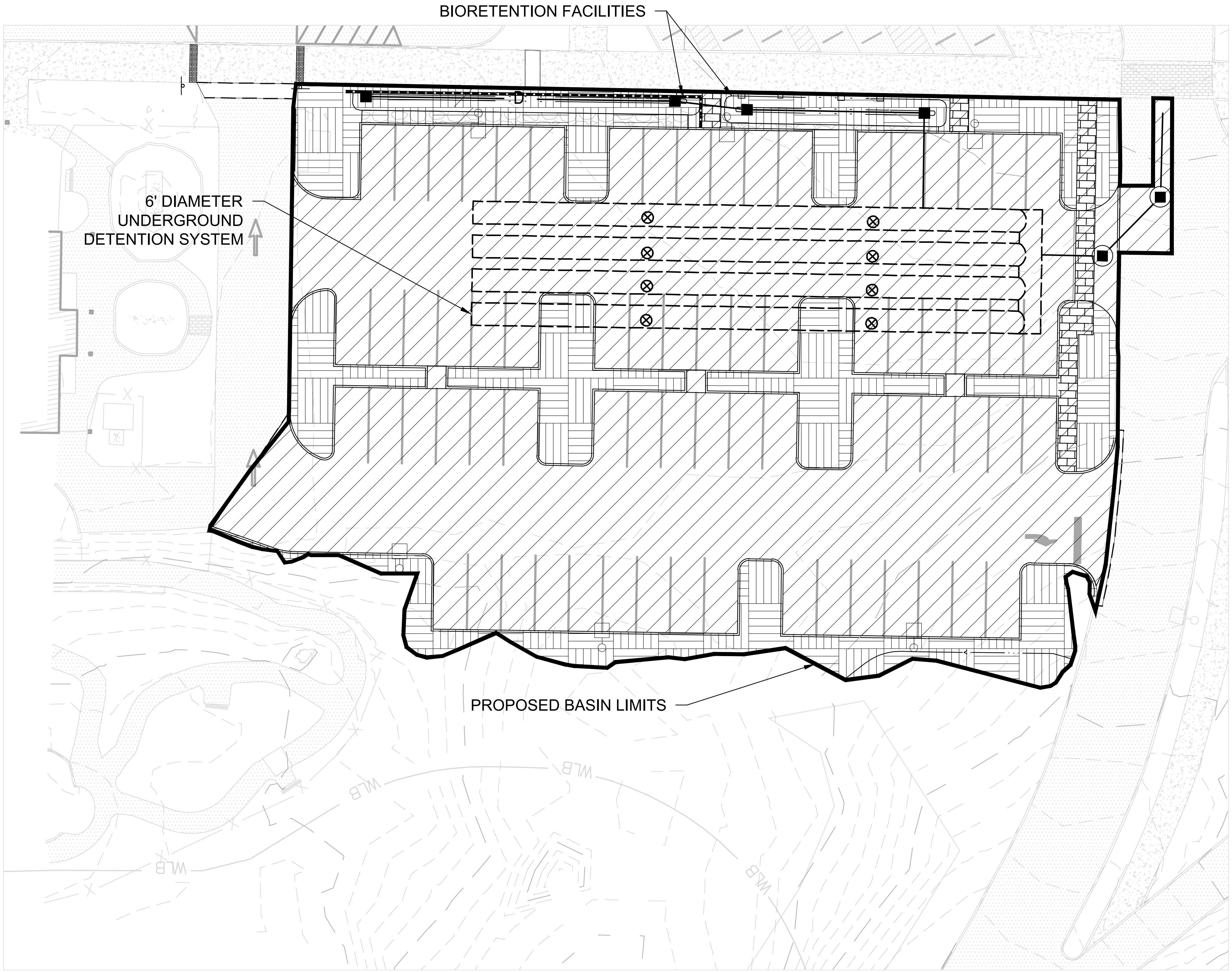
PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**EXISTING BASIN MAP**
**PARKING LOT C**

**EX-A2.2**

Piecre College Puyallup
Downstream Map
Legend
Bradley Lake
Stormwater Flow Path
Parking Lot B
Existing Detention Pond
Pierce College Puyallup
Stormwater Flow Path
Parking Lot C
EX A-3
N
2000 ft
Google Earth




LAWN AND LANDSCAPING

IMPERVIOUS SURFACE

| PROPOSED BASIN AREAS | | |
|---|---|---|
| LANDSCAPE | IMPERVIOUS | TOTAL |
| 0.20 AC | 0.55 AC | 0.75 AC |

N

GRAPHIC SCALE

0 15 30 60

1" = 30 FEET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Landscape Architects
Community Planners
Land Surveyors
Neighbors
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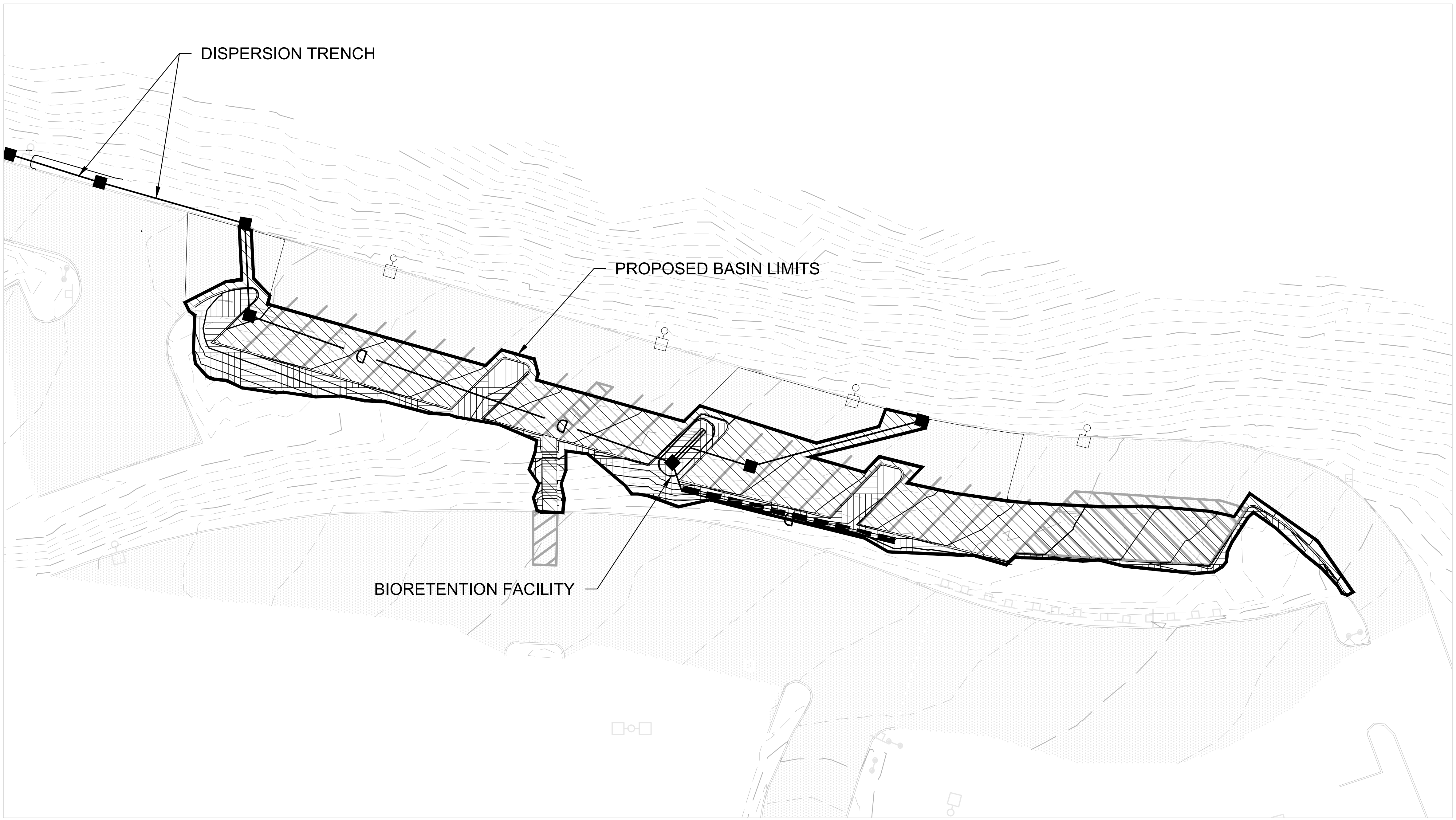
316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL


PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**DEVELOPED BASIN MAP**
**PARKING LOT B**

**EX-A4.1**




LAWN AND LANDSCAPING

IMPERVIOUS SURFACE

| PROPOSED BASIN AREAS | | |
|---|---|---|
| LANDSCAPE | IMPERVIOUS | TOTAL |
| 0.07 AC | 0.14 AC | 0.21 AC |

N

GRAPHIC SCALE

0 20 40 80

1" = 40 FEET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PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

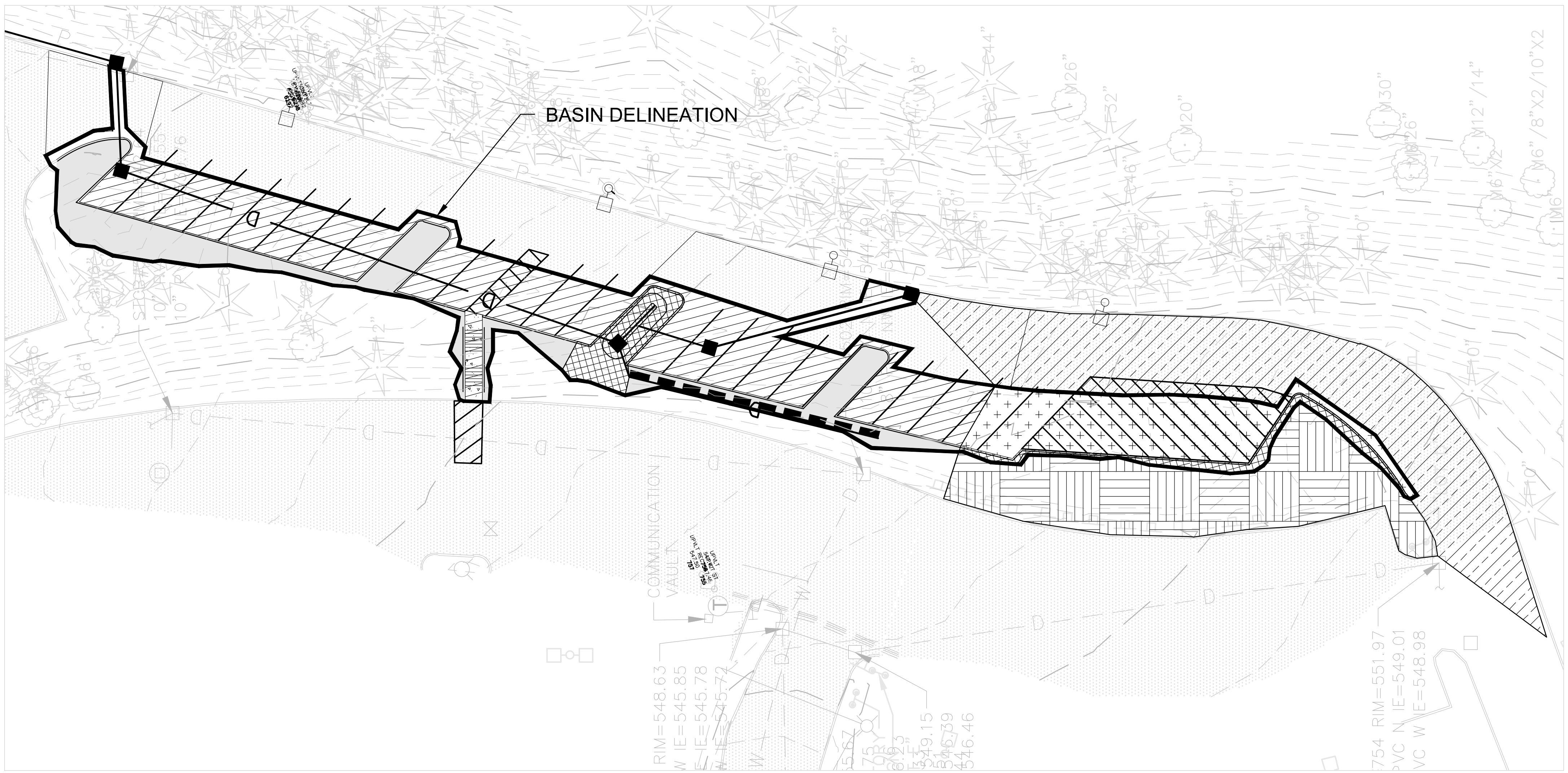
**DEVELOPED BASIN MAP**
**PARKING LOT C**

**EX-A4.2**

# PROPOSED BASIN EXCHANGE AREAS

| TARGET IMPERVIOUS AREA NOT TREATED | NON-TARGET IMPERVIOUS AREA TREATED | TARGET PERVIOUS AREA NOT TREATED | NON-TARGET IMPERVIOUS AREA TREATED |
|---|---|---|---|
| - 0.10 AC | + 0.10 AC | - 0.04 AC | + 0.06 AC |

NOTE: THE WORD "TREATED" IS BEING USED TO DESCRIBE BOTH WATER QUALITY TREATMENT THROUGH BIORETENTION AND FLOW CONTROL THROUGH DISPERSION.




TARGET IMPERVIOUS AREA NOT TREATED

TARGET IMPERVIOUS AREA TREATED

NON-TARGET IMPERVIOUS AREA TREATED

TARGET PERVIOUS AREA NOT TREATED

TARGET PERVIOUS AREA TREATED

NON-TARGET PERVIOUS AREA TREATED

N

GRAPHIC SCALE

0 20 40 80

1" = 40 FEET

# TOTAL AREAS RECEIVING TREATMENT

| | TARGET AREA | NON-TARGET AREA | TOTAL |
|---|---|---|---|
| IMPERVIOUS | 0.04 AC | 0.10 AC | 0.14 AC |
| PERVIOUS | 0.03 AC | 0.06 AC | 0.09 AC |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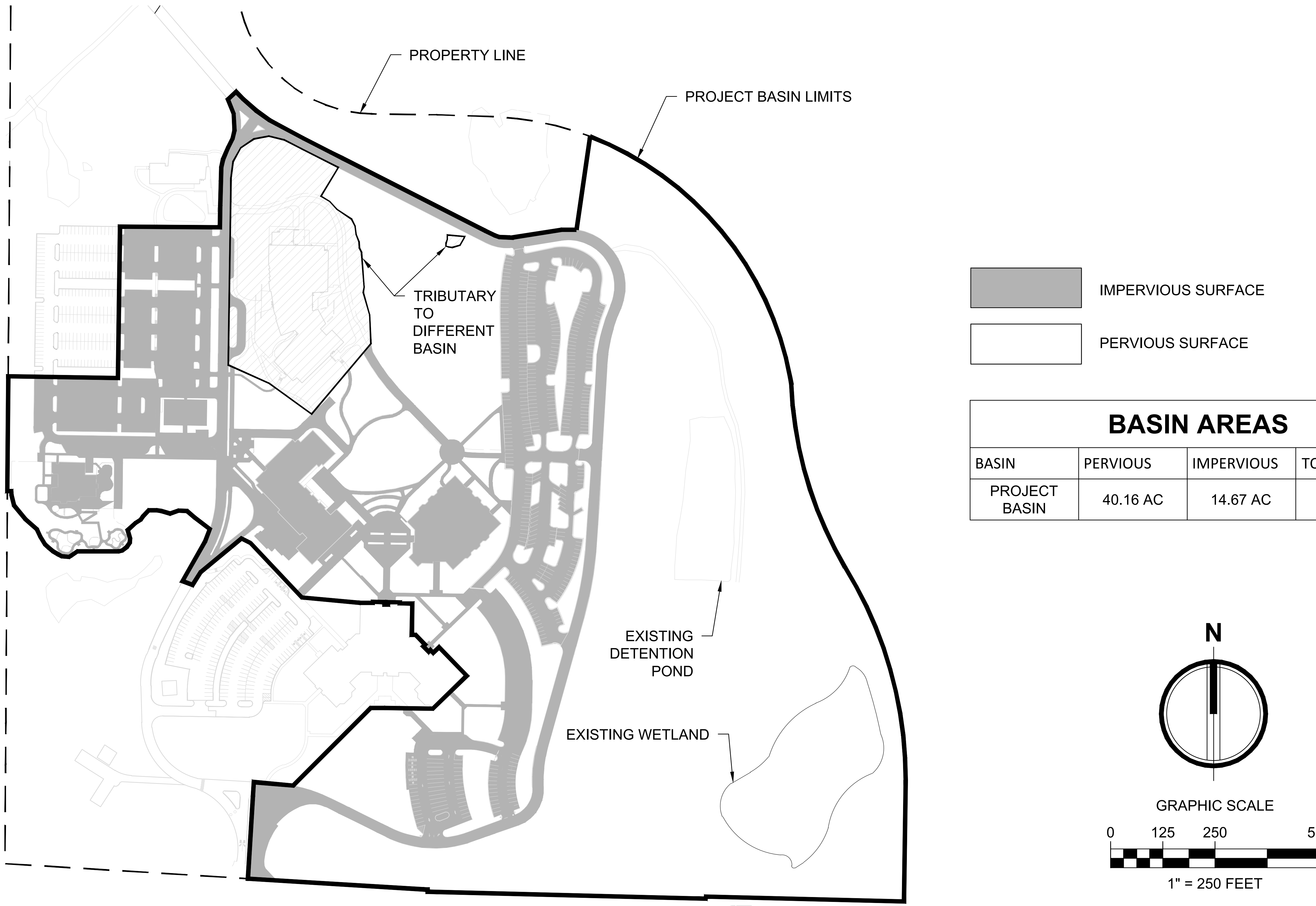
PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**BASIN EXCHANGE MAP**
**PARKING LOT C**

**EX-A5**




## BASIN AREAS

| BASIN | PERVIOUS | IMPERVIOUS | TOTAL |
|---|---|---|---|
| PROJECT BASIN | 40.16 AC | 14.67 AC | 54.84 AC |

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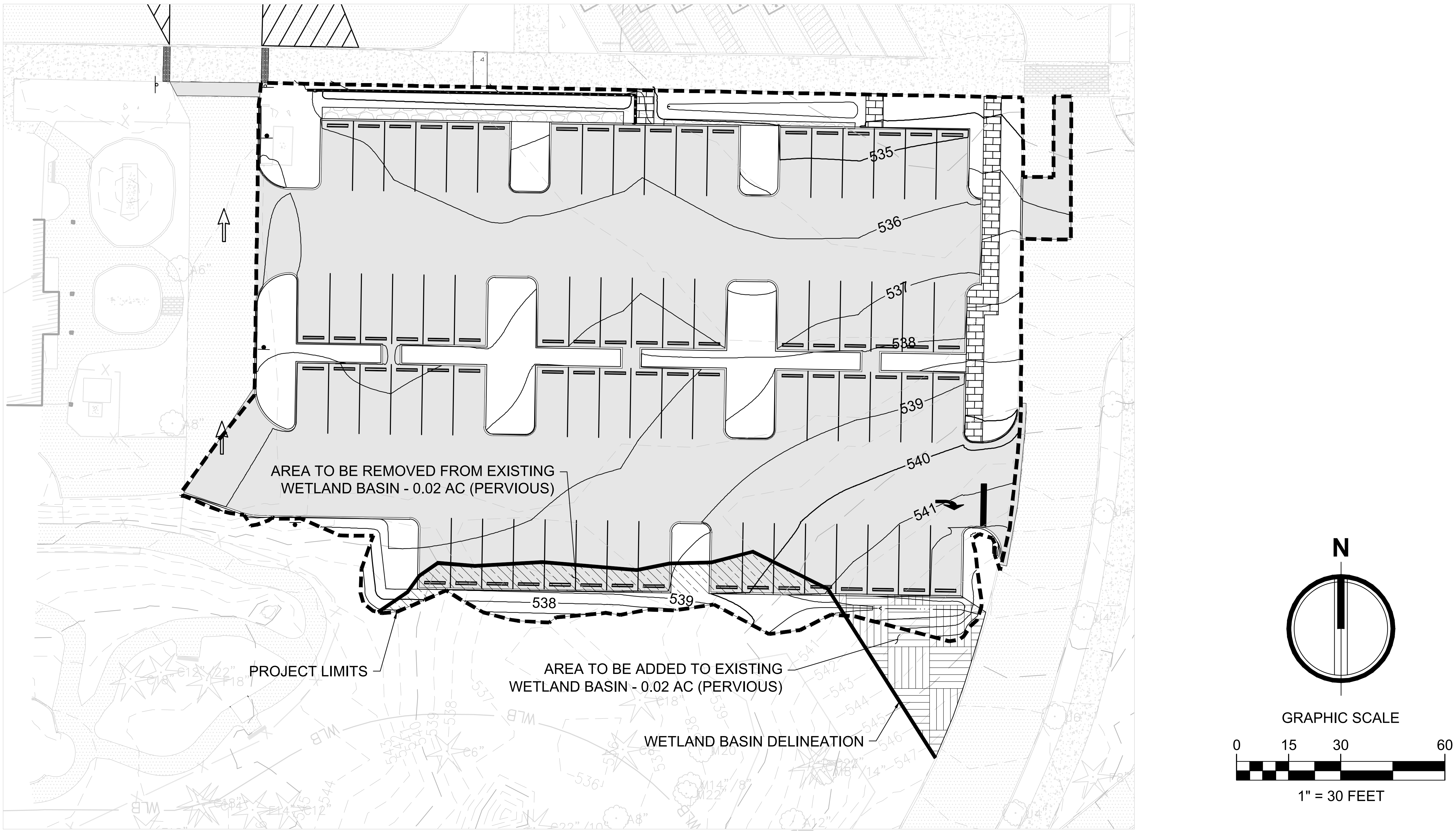
PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**WETLAND BASIN MAP**
**PARKING LOT B AND C**

EX-A6

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PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**WETLAND BASIN EXCHANGE MAP**
**PARKING LOT B**

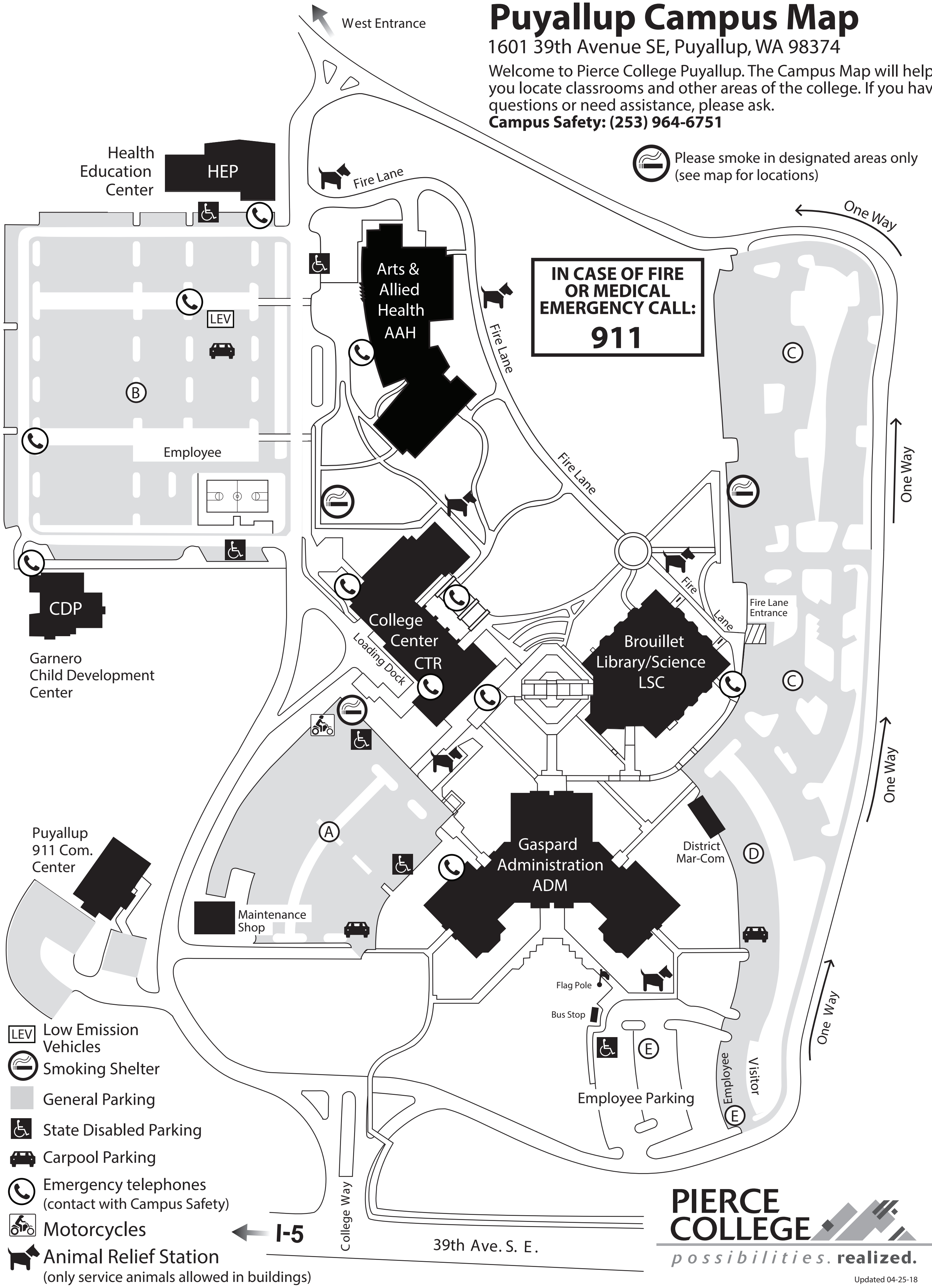
**EX-A7**

# Puyallup Campus Map

1601 39th Avenue SE, Puyallup, WA 98374

Welcome to Pierce College Puyallup. The Campus Map will help you locate classrooms and other areas of the college. If you have questions or need assistance, please ask.

**Campus Safety: (253) 964-6751**



# National Flood Hazard Layer FIRMette

FEMA

122°16'39"W 47°9'35"N


Feet

0 250 500 1,000 1,500 2,000

1:6,000

122°16'2"W 47°9'10"N

*Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

| | |
|---|---|
| SPECIAL FLOOD HAZARD AREAS | Without Base Flood Elevation (BFE) *Zone A, V, A99* |
| | With BFE or Depth *Zone AE, AO, AH, VE, AR* |
| | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* |
| | Future Conditions 1% Annual Chance Flood Hazard *Zone X* |
| | Area with Reduced Flood Risk due to Levee. See Notes. *Zone X* |
| | Area with Flood Risk due to Levee *Zone D* |
| OTHER AREAS | NO SCREEN Area of Minimal Flood Hazard *Zone X* |
| | Effective LOMRs |
| | Area of Undetermined Flood Hazard *Zone D* |
| GENERAL STRUCTURES | Channel, Culvert, or Storm Sewer |
| | Levee, Dike, or Floodwall |
| OTHER FEATURES | B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | 8 Coastal Transect |
| | 513 Base Flood Elevation Line (BFE) |
| | Limit of Study |
| | Jurisdiction Boundary |
| | Coastal Transect Baseline |
| | Profile Baseline |
| | Hydrographic Feature |
| MAP PANELS | Digital Data Available |
| | No Digital Data Available |
| | Unmapped |

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/29/2021 at 4:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

# National Flood Hazard Layer FIRMette

FEMA


*Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

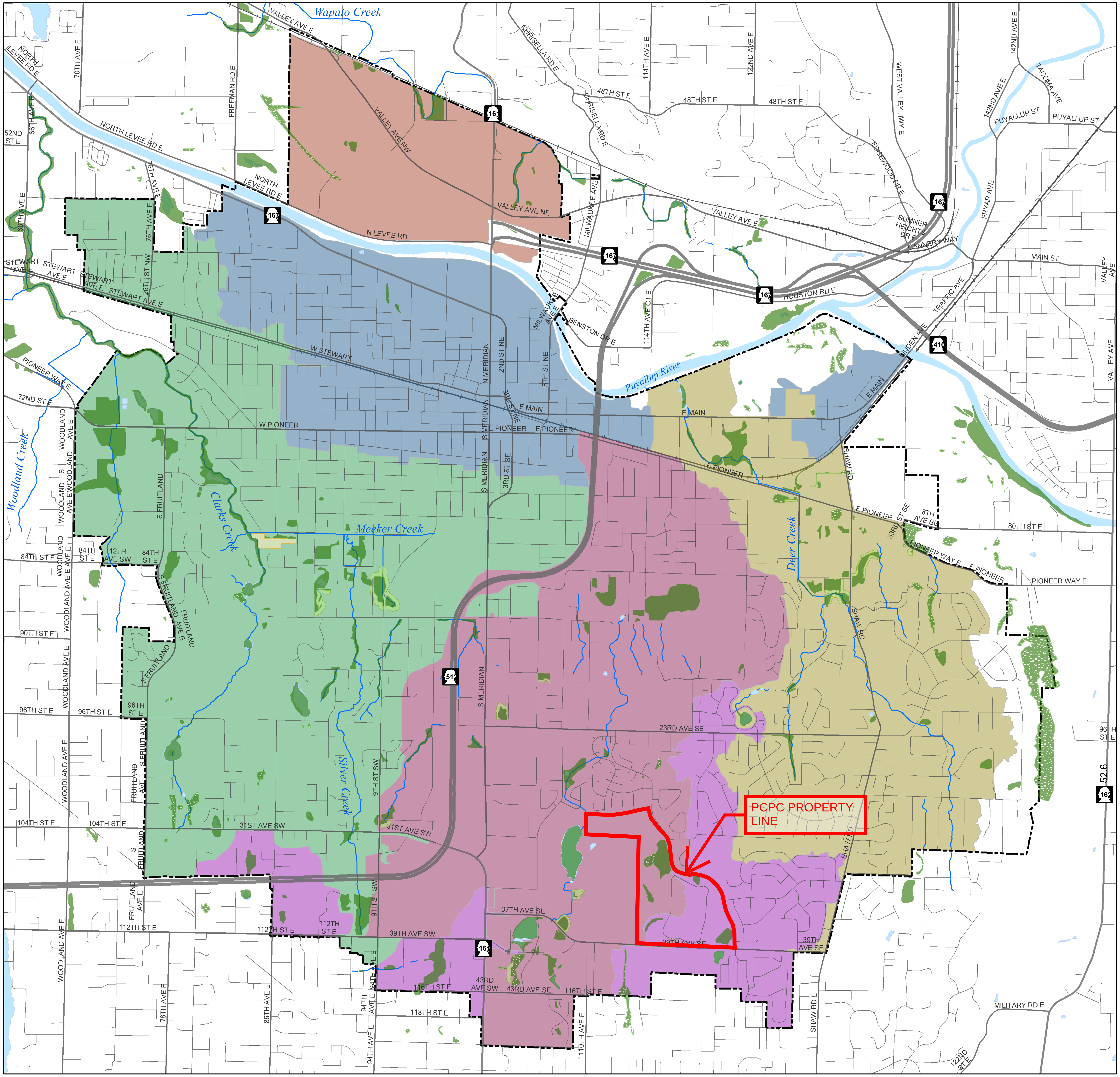
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/29/2021 at 4:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.




# City of Puyallup Drainage Basins

## Legend

### Drainage Basins

- Clarks Creek
- Pothole
- Puyallup River North
- Puyallup River South
- Shaw Road
- State Highway

### Wetlands

- Field-verified
- Unverified
- Buffer
- Mitigation Site

- City Limits
- Waterbodies
- Streams

City of Puyallup drainage data provided as part of the November 2011 Comprehensive Stormwater Plan developed by Brown and Caldwell.
Edited by City of Puyallup Collections Division.

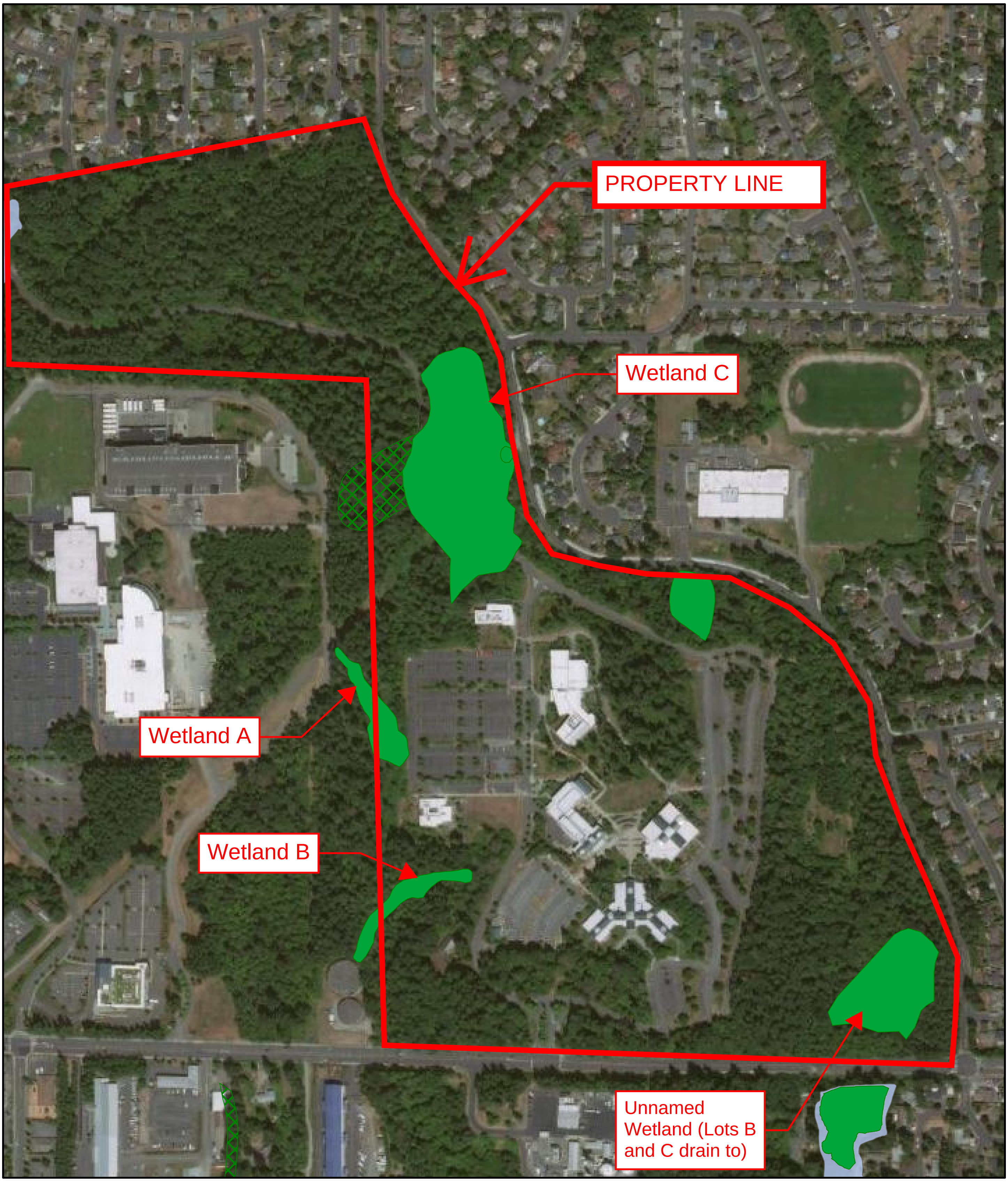
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County and the City of Puyallup assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'. The County and the City of Puyallup makes no warranty of fitness for a particular purpose.

0 1,500 3,000 6,000
Feet

Date: 1/2/2020

File Name: jgrbich/COP Website/Drainage Basins.mxd (PDF)

# ArcGIS Web Map




6/29/2021, 11:26:01 AM

City Limits

Wetlands

Field-verified

Unverified

Unverified

Regulated Floodplain 2017

Zone X (SHADED)

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Maxar

Web AppBuilder for ArcGIS
Maxar | Jennifer Recco, GIS Coordinator, City of Puyallup;


Map Scale: 1:7,010 if printed on B landscape (17" x 11") sheet.

0 100 200 400 600 Meters

0 300 600 1200 1800 Feet

N

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 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Jul 29, 2018—Jul 22, 2019

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 |
|---|---|---|---|
| 4A | Bellingham silty clay loam | 1.4 | 0.3% |
| 13B | Everett very gravelly sandy loam, 0 to 8 percent slopes | 157.9 | 34.8% |
| 18B | Indianola loamy sand, 0 to 5 percent slopes | 20.3 | 4.5% |
| 18C | Indianola loamy sand, 5 to 15 percent slopes | 41.7 | 9.2% |
| 19B | Kapowsin gravelly ashy loam, 0 to 6 percent slopes | 42.1 | 9.3% |
| 19C | Kapowsin gravelly ashy loam, 6 to 15 percent slopes | 141.4 | 31.2% |
| 19E | Kapowsin gravelly ashy loam, 30 to 65 percent slopes | 32.9 | 7.3% |
| 20B | Kitsap silt loam, 2 to 8 percent slopes | 2.8 | 0.6% |
| 24D | Neilton gravelly loamy sand, 8 to 25 percent slopes | 4.4 | 1.0% |
| W | Water | 8.8 | 1.9% |
| **Totals for Area of Interest** | | **453.7** | **100.0%** |

# Pierce County Area, Washington

## 13B—Everett very gravelly sandy loam, 0 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 2t629
*Elevation:* 30 to 900 feet
*Mean annual precipitation:* 35 to 91 inches
*Mean annual air temperature:* 48 to 52 degrees F
*Frost-free period:* 180 to 240 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Everett and similar soils:* 80 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Everett

#### Setting

*Landform:* Eskers, moraines, kames
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Crest, interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Sandy and gravelly glacial outwash

#### Typical profile

*Oi - 0 to 1 inches:* slightly decomposed plant material
*A - 1 to 3 inches:* very gravelly sandy loam
*Bw - 3 to 24 inches:* very gravelly sandy loam
*C1 - 24 to 35 inches:* very gravelly loamy sand
*C2 - 35 to 60 inches:* extremely cobbly coarse sand

#### Properties and qualities

*Slope:* 0 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 3.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4s
*Hydrologic Soil Group:* A

*Forage suitability group:* Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA)
*Other vegetative classification:* Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA)
*Hydric soil rating:* No

### Minor Components

#### Alderwood

*Percent of map unit:* 10 percent
*Landform:* Ridges, hills
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Crest, talf
*Down-slope shape:* Linear, convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

#### Indianola

*Percent of map unit:* 10 percent
*Landform:* Terraces, eskers, kames
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

*Hydrologic Soil Group:* B
*Forage suitability group:* Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
*Other vegetative classification:* Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
*Hydric soil rating:* No

## Minor Components

### Alderwood

*Percent of map unit:* 5 percent
*Landform:* Ridges, hills
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Crest, talf
*Down-slope shape:* Linear, convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

### Mckenna

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

### Dupont

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

### Norma

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

### Harstine

*Percent of map unit:* 2 percent
*Landform:* Ridges
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Crest
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

### Neilton

*Percent of map unit:* 2 percent
*Landform:* Outwash terraces

*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

# Pierce County Area, Washington

## 19C—Kapowsin gravelly ashy loam, 6 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 2t61x
*Elevation:* 50 to 900 feet
*Mean annual precipitation:* 30 to 50 inches
*Mean annual air temperature:* 48 to 52 degrees F
*Frost-free period:* 150 to 220 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

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

### Description of Kapowsin

#### Setting

*Landform:* Moraines
*Landform position (two-dimensional):* Toeslope, footslope
*Landform position (three-dimensional):* Side slope, base slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Volcanic ash mixed with glacial drift over dense glaciomarine deposits

#### Typical profile

*Ap - 0 to 7 inches:* gravelly ashy loam
*Bhs - 7 to 11 inches:* gravelly ashy loam
*Bs1 - 11 to 15 inches:* gravelly ashy loam
*2Bs2 - 15 to 25 inches:* loam
*3Bstm - 25 to 29 inches:* loam
*3Cd - 29 to 59 inches:* gravelly loam

#### Properties and qualities

*Slope:* 6 to 15 percent
*Depth to restrictive feature:* More than 80 inches; More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 to 0.00 in/hr)
*Depth to water table:* About 11 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 5.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B
*Forage suitability group:* Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
*Other vegetative classification:* Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
*Hydric soil rating:* No

## Minor Components

### Alderwood

*Percent of map unit:* 5 percent
*Landform:* Ridges, hills
*Landform position (two-dimensional):* Shoulder
*Landform position (three-dimensional):* Nose slope, talf
*Down-slope shape:* Linear, convex
*Across-slope shape:* Convex
*Hydric soil rating:* No

### Neilton

*Percent of map unit:* 2 percent
*Landform:* Outwash terraces
*Landform position (three-dimensional):* Riser
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Hydric soil rating:* No

### Norma

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

### Mckenna

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

### Dupont

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

### Harstine

*Percent of map unit:* 2 percent
*Landform:* Ridges
*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Nose slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

# Pierce County Area, Washington

## 19E—Kapowsin gravelly ashy loam, 30 to 65 percent slopes

### Map Unit Setting

*National map unit symbol:* 2t620
*Elevation:* 50 to 900 feet
*Mean annual precipitation:* 30 to 50 inches
*Mean annual air temperature:* 48 to 52 degrees F
*Frost-free period:* 150 to 220 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

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

### Description of Kapowsin

#### Setting

*Landform:* Moraines
*Landform position (two-dimensional):* Footslope, backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Volcanic ash mixed with glacial drift over dense glaciomarine deposits

#### Typical profile

*Ap - 0 to 7 inches:* gravelly ashy loam
*Bhs - 7 to 11 inches:* gravelly ashy loam
*Bs1 - 11 to 15 inches:* gravelly ashy loam
*2Bs2 - 15 to 25 inches:* loam
*3Bstm - 25 to 29 inches:* loam
*3Cd - 29 to 59 inches:* gravelly loam

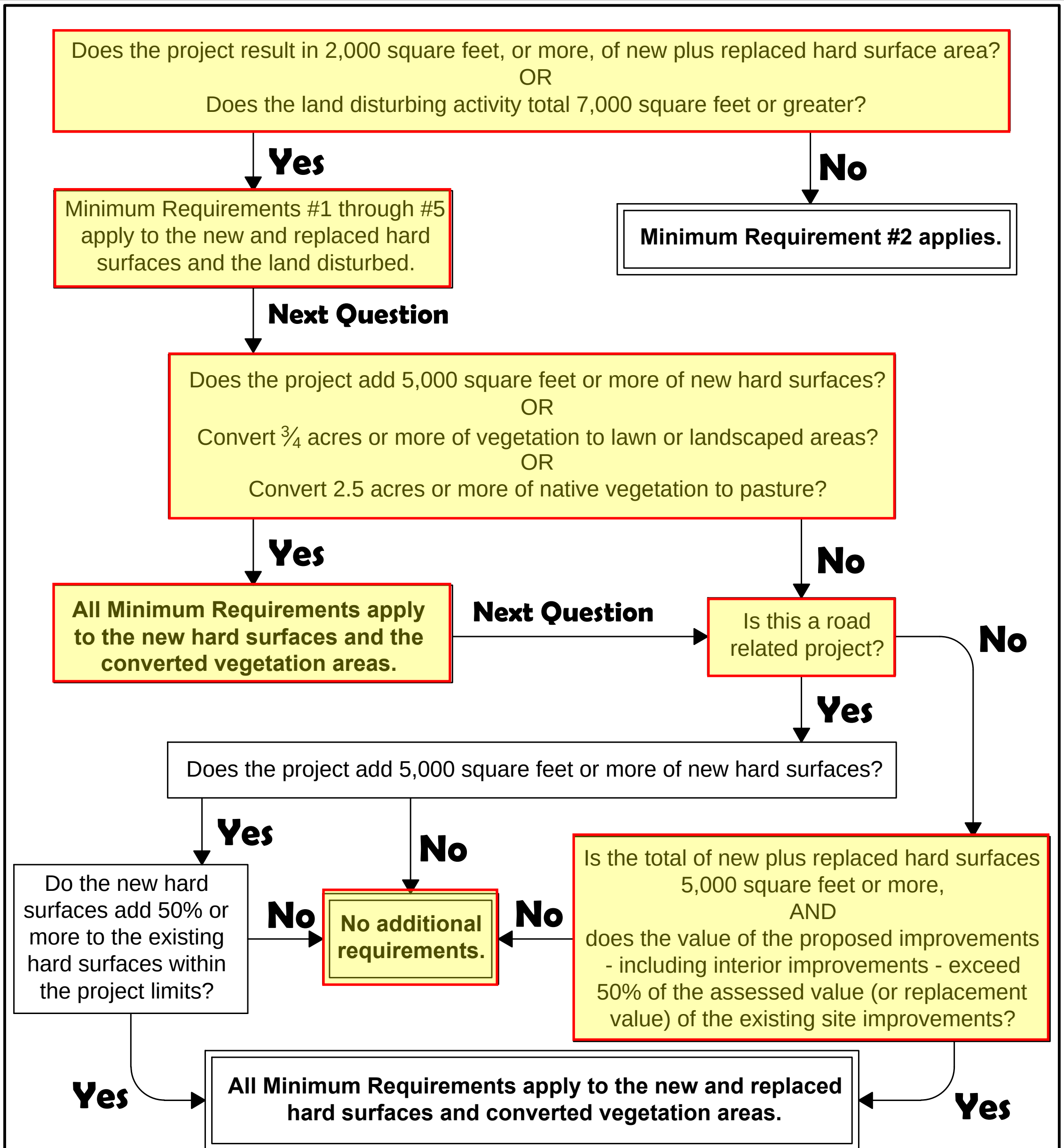
#### Properties and qualities

*Slope:* 30 to 65 percent
*Depth to restrictive feature:* More than 80 inches; More than 80 inches
*Drainage class:* Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 to 0.00 in/hr)
*Depth to water table:* About 11 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water capacity:* Low (about 5.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e

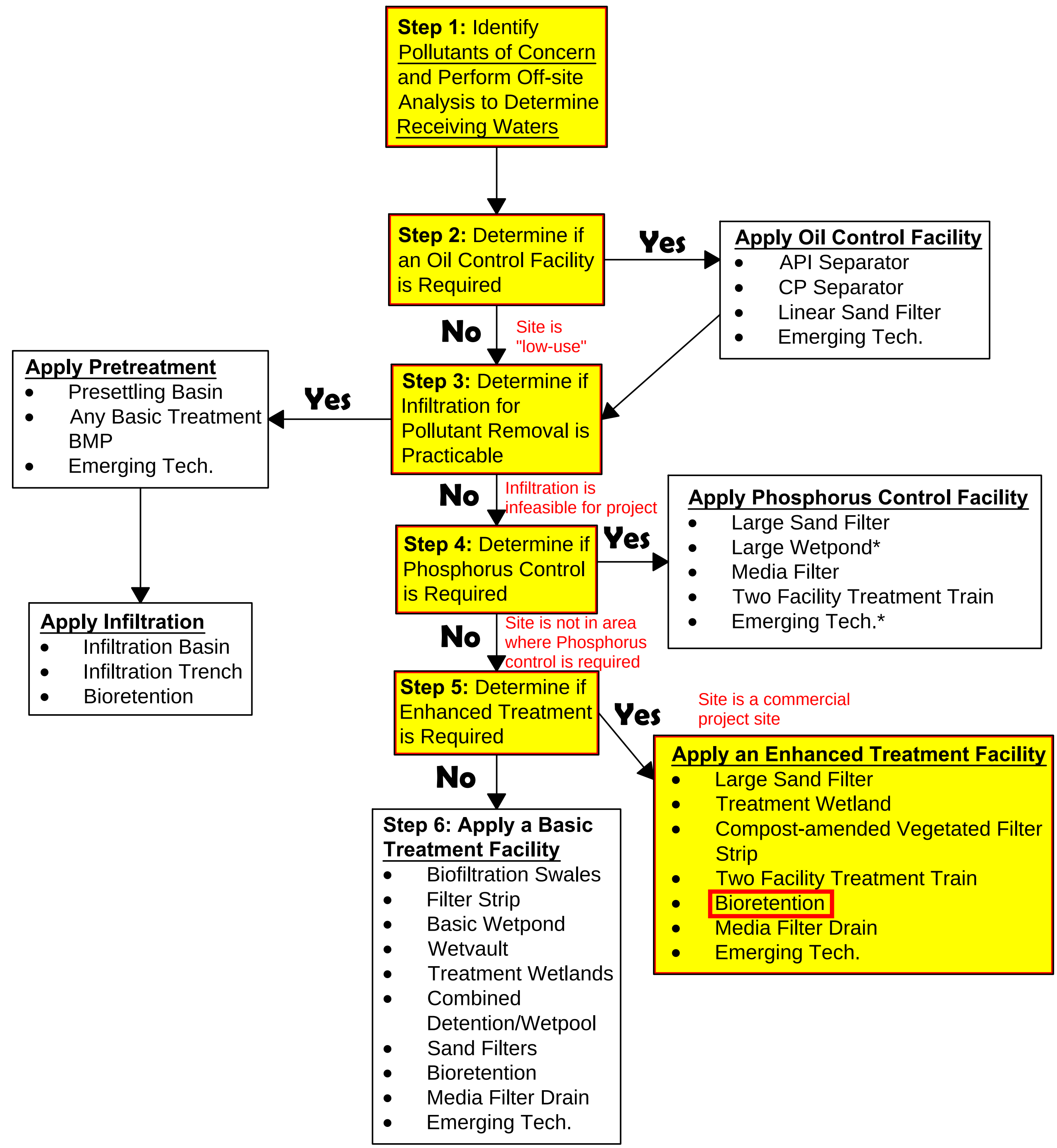
## Figure I-2.4.2 Flow Chart for Determining Requirements for Redevelopment




DEPARTMENT OF
ECOLOGY
State of Washington

Figure I-2.4.2
Flow Chart for Determining Requirements for Redevelopment

Revised June 2015

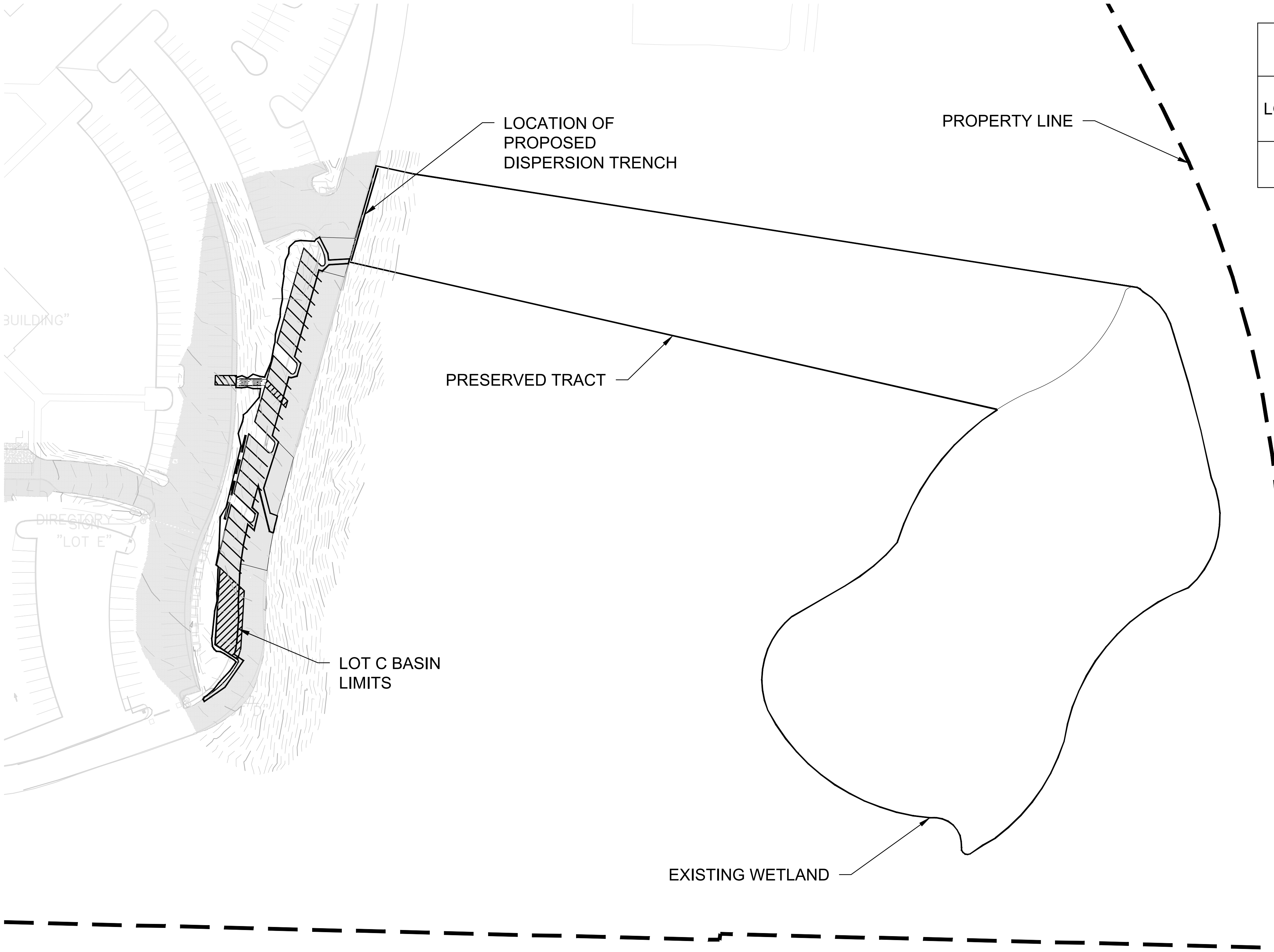



*When **Phosphorus Control and Enhanced** treatment are required, the Large Wetpond and certain types of emerging technologies will not meet both types of treatment requirements. A different or an additional treatment facility will be required to meet Enhanced treatment.

DEPARTMENT OF ECOLOGY
State of Washington

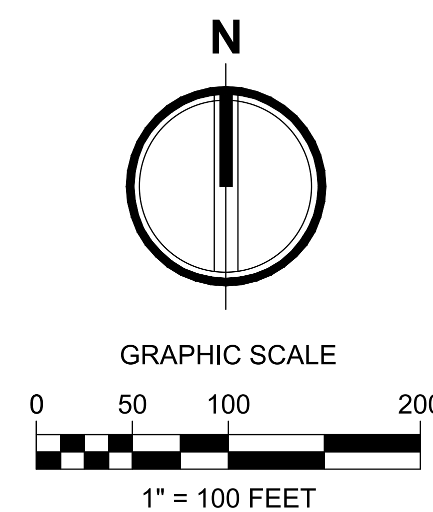
# Figure V-2.1.1
# Treatment Facility Selection Flow Chart

Revised December 2015




## BASIN AREAS

| LOT C BASIN | AREA IN PRESERVED TRACT | TOTAL AREA | PERCENT PRESERVED |
|---|---|---|---|
| 0.21 AC | 3.66 AC | 3.87 AC | 95% |




AHBL
Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors
Neighbors
TACOMA · SEATTLE
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316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

**DISPERSION TRACT**
**PARKING LOT C**

**EX-A14**

# *Appendix B*

## Flow Control, Water Quality, Wetland Hydroperiod, and Conveyance Calculations

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | Parking Lot B |
| Site Name: | |
| Site Address: | |
| City: | |
| Report Date: | 1/13/2022 |
| Gage: | 38 IN CENTRAL |
| Data Start: | 10/01/1901 |
| Data End: | 09/30/2059 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.000 |
| Version Date: | 2019/09/13 |
| Version: | 4.2.17 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# Landuse Basin Data
## Predeveloped Land Use

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Forest, Flat | 0.75 |
| Pervious Total | 0.75 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 0.75 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Pasture, Flat | 0.198 |
| Pervious Total | 0.198 |
| Impervious Land Use | acre |
| PARKING FLAT | 0.55 |
| Impervious Total | 0.55 |
| Basin Total | 0.748 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Tank 1 | Tank 1 | |

# *Routing Elements*
## *Predeveloped Routing*

## *Mitigated Routing*

### Tank 1

| | | |
|---|---|---|
| Dimensions | | |
| Depth: | 6 ft. | |
| Tank Type: | Circular | |
| Diameter: | 6 ft. | |
| Length: | 582 ft. | |
| Discharge Structure | | |
| Riser Height: | 5.9 ft. | |
| Riser Diameter: | 18 in. | |
| Orifice 1 Diameter: | 0.35 in. | Elevation:0.5 ft. |
| Orifice 2 Diameter: | 0.4 in. | Elevation:4.5 ft. |
| Orifice 3 Diameter: | 1.2 in. | Elevation:5.5 ft. |
| Element Flows To: | | |
| Outlet 1 | Outlet 2 | |

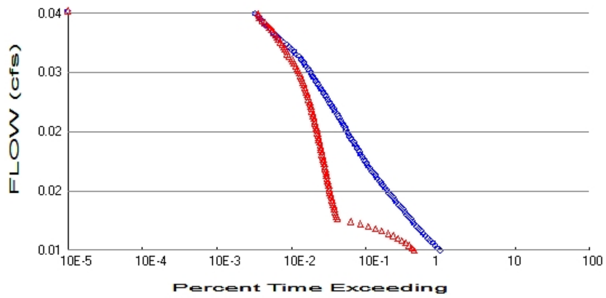
Tank Hydraulic Table

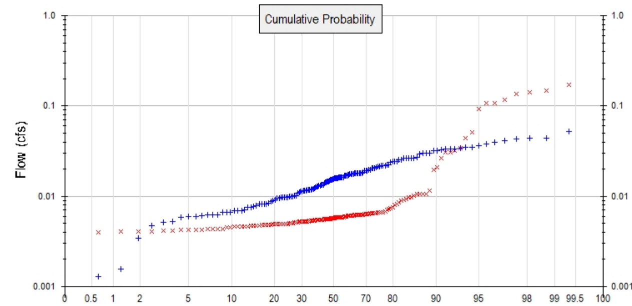
| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 0.0667 | 0.016 | 0.000 | 0.000 | 0.000 |
| 0.1333 | 0.023 | 0.002 | 0.000 | 0.000 |
| 0.2000 | 0.028 | 0.003 | 0.000 | 0.000 |
| 0.2667 | 0.033 | 0.005 | 0.000 | 0.000 |
| 0.3333 | 0.036 | 0.008 | 0.000 | 0.000 |
| 0.4000 | 0.040 | 0.010 | 0.000 | 0.000 |
| 0.4667 | 0.042 | 0.013 | 0.000 | 0.000 |
| 0.5333 | 0.045 | 0.016 | 0.000 | 0.000 |
| 0.6000 | 0.048 | 0.019 | 0.001 | 0.000 |
| 0.6667 | 0.050 | 0.022 | 0.001 | 0.000 |
| 0.7333 | 0.052 | 0.026 | 0.001 | 0.000 |
| 0.8000 | 0.054 | 0.029 | 0.001 | 0.000 |
| 0.8667 | 0.056 | 0.033 | 0.002 | 0.000 |
| 0.9333 | 0.058 | 0.037 | 0.002 | 0.000 |
| 1.0000 | 0.059 | 0.041 | 0.002 | 0.000 |
| 1.0667 | 0.061 | 0.045 | 0.002 | 0.000 |
| 1.1333 | 0.062 | 0.049 | 0.002 | 0.000 |
| 1.2000 | 0.064 | 0.053 | 0.002 | 0.000 |
| 1.2667 | 0.065 | 0.058 | 0.002 | 0.000 |
| 1.3333 | 0.066 | 0.062 | 0.003 | 0.000 |
| 1.4000 | 0.067 | 0.067 | 0.003 | 0.000 |
| 1.4667 | 0.068 | 0.071 | 0.003 | 0.000 |
| 1.5333 | 0.069 | 0.076 | 0.003 | 0.000 |
| 1.6000 | 0.070 | 0.080 | 0.003 | 0.000 |
| 1.6667 | 0.071 | 0.085 | 0.003 | 0.000 |
| 1.7333 | 0.072 | 0.090 | 0.003 | 0.000 |
| 1.8000 | 0.073 | 0.095 | 0.003 | 0.000 |
| 1.8667 | 0.074 | 0.100 | 0.003 | 0.000 |
| 1.9333 | 0.074 | 0.105 | 0.004 | 0.000 |
| 2.0000 | 0.075 | 0.110 | 0.004 | 0.000 |
| 2.0667 | 0.076 | 0.115 | 0.004 | 0.000 |
| 2.1333 | 0.076 | 0.120 | 0.004 | 0.000 |
| 2.2000 | 0.077 | 0.125 | 0.004 | 0.000 |
| 2.2667 | 0.077 | 0.130 | 0.004 | 0.000 |
| 2.3333 | 0.078 | 0.135 | 0.004 | 0.000 |

| | | | | |
|---|---|---|---|---|
| 2.4000 | 0.078 | 0.141 | 0.004 | 0.000 |
| 2.4667 | 0.078 | 0.146 | 0.004 | 0.000 |
| 2.5333 | 0.079 | 0.151 | 0.004 | 0.000 |
| 2.6000 | 0.079 | 0.156 | 0.004 | 0.000 |
| 2.6667 | 0.079 | 0.162 | 0.004 | 0.000 |
| 2.7333 | 0.079 | 0.167 | 0.005 | 0.000 |
| 2.8000 | 0.080 | 0.172 | 0.005 | 0.000 |
| 2.8667 | 0.080 | 0.178 | 0.005 | 0.000 |
| 2.9333 | 0.080 | 0.183 | 0.005 | 0.000 |
| 3.0000 | 0.080 | 0.188 | 0.005 | 0.000 |
| 3.0667 | 0.080 | 0.194 | 0.005 | 0.000 |
| 3.1333 | 0.080 | 0.199 | 0.005 | 0.000 |
| 3.2000 | 0.080 | 0.204 | 0.005 | 0.000 |
| 3.2667 | 0.079 | 0.210 | 0.005 | 0.000 |
| 3.3333 | 0.079 | 0.215 | 0.005 | 0.000 |
| 3.4000 | 0.079 | 0.220 | 0.005 | 0.000 |
| 3.4667 | 0.079 | 0.226 | 0.005 | 0.000 |
| 3.5333 | 0.078 | 0.231 | 0.005 | 0.000 |
| 3.6000 | 0.078 | 0.236 | 0.005 | 0.000 |
| 3.6667 | 0.078 | 0.241 | 0.005 | 0.000 |
| 3.7333 | 0.077 | 0.247 | 0.006 | 0.000 |
| 3.8000 | 0.077 | 0.252 | 0.006 | 0.000 |
| 3.8667 | 0.076 | 0.257 | 0.006 | 0.000 |
| 3.9333 | 0.076 | 0.262 | 0.006 | 0.000 |
| 4.0000 | 0.075 | 0.267 | 0.006 | 0.000 |
| 4.0667 | 0.074 | 0.272 | 0.006 | 0.000 |
| 4.1333 | 0.074 | 0.277 | 0.006 | 0.000 |
| 4.2000 | 0.073 | 0.282 | 0.006 | 0.000 |
| 4.2667 | 0.072 | 0.287 | 0.006 | 0.000 |
| 4.3333 | 0.071 | 0.292 | 0.006 | 0.000 |
| 4.4000 | 0.070 | 0.296 | 0.006 | 0.000 |
| 4.4667 | 0.069 | 0.301 | 0.006 | 0.000 |
| 4.5333 | 0.068 | 0.306 | 0.007 | 0.000 |
| 4.6000 | 0.067 | 0.310 | 0.008 | 0.000 |
| 4.6667 | 0.066 | 0.315 | 0.008 | 0.000 |
| 4.7333 | 0.065 | 0.319 | 0.008 | 0.000 |
| 4.8000 | 0.064 | 0.324 | 0.009 | 0.000 |
| 4.8667 | 0.062 | 0.328 | 0.009 | 0.000 |
| 4.9333 | 0.061 | 0.332 | 0.009 | 0.000 |
| 5.0000 | 0.059 | 0.336 | 0.010 | 0.000 |
| 5.0667 | 0.058 | 0.340 | 0.010 | 0.000 |
| 5.1333 | 0.056 | 0.344 | 0.010 | 0.000 |
| 5.2000 | 0.054 | 0.347 | 0.010 | 0.000 |
| 5.2667 | 0.052 | 0.351 | 0.011 | 0.000 |
| 5.3333 | 0.050 | 0.354 | 0.011 | 0.000 |
| 5.4000 | 0.048 | 0.358 | 0.011 | 0.000 |
| 5.4667 | 0.045 | 0.361 | 0.011 | 0.000 |
| 5.5333 | 0.042 | 0.364 | 0.019 | 0.000 |
| 5.6000 | 0.040 | 0.367 | 0.024 | 0.000 |
| 5.6667 | 0.036 | 0.369 | 0.028 | 0.000 |
| 5.7333 | 0.033 | 0.371 | 0.031 | 0.000 |
| 5.8000 | 0.028 | 0.373 | 0.034 | 0.000 |
| 5.8667 | 0.023 | 0.375 | 0.036 | 0.000 |
| 5.9333 | 0.016 | 0.377 | 0.135 | 0.000 |
| 6.0000 | 0.000 | 0.377 | 0.542 | 0.000 |
| 6.0667 | 0.000 | 0.000 | 1.117 | 0.000 |

# *Analysis Results*

## *POC 1*




+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.75
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.198
Total Impervious Area: 0.55

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.015805 |
| 5 year | 0.024587 |
| 10 year | 0.029359 |
| 25 year | 0.034217 |
| 50 year | 0.037104 |
| 100 year | 0.039478 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.006371 |
| 5 year | 0.01333 |
| 10 year | 0.021441 |
| 25 year | 0.038236 |
| 50 year | 0.05786 |
| 100 year | 0.086358 |

## Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| **Year** | **Predeveloped** | **Mitigated** |
|---|---|---|
| 1902 | 0.012 | 0.006 |
| 1903 | 0.010 | 0.005 |
| 1904 | 0.016 | 0.005 |
| 1905 | 0.008 | 0.006 |
| 1906 | 0.003 | 0.004 |
| 1907 | 0.024 | 0.005 |
| 1908 | 0.018 | 0.005 |
| 1909 | 0.018 | 0.006 |
| 1910 | 0.024 | 0.006 |
| 1911 | 0.016 | 0.005 |

| | | |
|---|---|---|
| 1912 | 0.053 | 0.008 |
| 1913 | 0.025 | 0.011 |
| 1914 | 0.006 | 0.004 |
| 1915 | 0.010 | 0.007 |
| 1916 | 0.016 | 0.005 |
| 1917 | 0.005 | 0.005 |
| 1918 | 0.017 | 0.026 |
| 1919 | 0.012 | 0.005 |
| 1920 | 0.016 | 0.005 |
| 1921 | 0.018 | 0.006 |
| 1922 | 0.018 | 0.006 |
| 1923 | 0.014 | 0.006 |
| 1924 | 0.007 | 0.005 |
| 1925 | 0.008 | 0.005 |
| 1926 | 0.015 | 0.005 |
| 1927 | 0.010 | 0.005 |
| 1928 | 0.012 | 0.006 |
| 1929 | 0.025 | 0.010 |
| 1930 | 0.016 | 0.006 |
| 1931 | 0.015 | 0.006 |
| 1932 | 0.012 | 0.006 |
| 1933 | 0.011 | 0.006 |
| 1934 | 0.033 | 0.135 |
| 1935 | 0.015 | 0.010 |
| 1936 | 0.013 | 0.006 |
| 1937 | 0.021 | 0.005 |
| 1938 | 0.013 | 0.006 |
| 1939 | 0.001 | 0.004 |
| 1940 | 0.014 | 0.006 |
| 1941 | 0.007 | 0.004 |
| 1942 | 0.022 | 0.031 |
| 1943 | 0.011 | 0.006 |
| 1944 | 0.020 | 0.006 |
| 1945 | 0.018 | 0.006 |
| 1946 | 0.010 | 0.005 |
| 1947 | 0.006 | 0.005 |
| 1948 | 0.034 | 0.006 |
| 1949 | 0.029 | 0.009 |
| 1950 | 0.008 | 0.005 |
| 1951 | 0.010 | 0.005 |
| 1952 | 0.044 | 0.007 |
| 1953 | 0.040 | 0.012 |
| 1954 | 0.014 | 0.006 |
| 1955 | 0.012 | 0.005 |
| 1956 | 0.006 | 0.005 |
| 1957 | 0.020 | 0.007 |
| 1958 | 0.043 | 0.141 |
| 1959 | 0.026 | 0.118 |
| 1960 | 0.007 | 0.004 |
| 1961 | 0.027 | 0.020 |
| 1962 | 0.014 | 0.006 |
| 1963 | 0.007 | 0.004 |
| 1964 | 0.008 | 0.005 |
| 1965 | 0.030 | 0.107 |
| 1966 | 0.008 | 0.005 |
| 1967 | 0.013 | 0.005 |
| 1968 | 0.013 | 0.006 |
| 1969 | 0.013 | 0.005 |

| | | |
|---|---|---|
| 1970 | 0.020 | 0.006 |
| 1971 | 0.032 | 0.011 |
| 1972 | 0.021 | 0.006 |
| 1973 | 0.027 | 0.007 |
| 1974 | 0.014 | 0.006 |
| 1975 | 0.034 | 0.051 |
| 1976 | 0.018 | 0.006 |
| 1977 | 0.006 | 0.004 |
| 1978 | 0.030 | 0.044 |
| 1979 | 0.008 | 0.005 |
| 1980 | 0.017 | 0.006 |
| 1981 | 0.016 | 0.006 |
| 1982 | 0.007 | 0.004 |
| 1983 | 0.027 | 0.006 |
| 1984 | 0.011 | 0.005 |
| 1985 | 0.018 | 0.005 |
| 1986 | 0.016 | 0.006 |
| 1987 | 0.030 | 0.011 |
| 1988 | 0.019 | 0.007 |
| 1989 | 0.017 | 0.005 |
| 1990 | 0.019 | 0.006 |
| 1991 | 0.015 | 0.007 |
| 1992 | 0.022 | 0.031 |
| 1993 | 0.021 | 0.006 |
| 1994 | 0.032 | 0.006 |
| 1995 | 0.006 | 0.005 |
| 1996 | 0.035 | 0.108 |
| 1997 | 0.013 | 0.005 |
| 1998 | 0.016 | 0.005 |
| 1999 | 0.001 | 0.005 |
| 2000 | 0.012 | 0.006 |
| 2001 | 0.006 | 0.004 |
| 2002 | 0.022 | 0.006 |
| 2003 | 0.019 | 0.006 |
| 2004 | 0.018 | 0.006 |
| 2005 | 0.032 | 0.006 |
| 2006 | 0.010 | 0.005 |
| 2007 | 0.010 | 0.006 |
| 2008 | 0.017 | 0.006 |
| 2009 | 0.012 | 0.005 |
| 2010 | 0.010 | 0.006 |
| 2011 | 0.008 | 0.005 |
| 2012 | 0.011 | 0.005 |
| 2013 | 0.009 | 0.004 |
| 2014 | 0.007 | 0.004 |
| 2015 | 0.013 | 0.005 |
| 2016 | 0.005 | 0.005 |
| 2017 | 0.024 | 0.006 |
| 2018 | 0.044 | 0.172 |
| 2019 | 0.041 | 0.149 |
| 2020 | 0.013 | 0.005 |
| 2021 | 0.022 | 0.010 |
| 2022 | 0.009 | 0.005 |
| 2023 | 0.018 | 0.007 |
| 2024 | 0.035 | 0.006 |
| 2025 | 0.016 | 0.006 |
| 2026 | 0.027 | 0.008 |
| 2027 | 0.010 | 0.005 |

| | | |
|---|---|---|
| 2028 | 0.008 | 0.004 |
| 2029 | 0.018 | 0.009 |
| 2030 | 0.033 | 0.007 |
| 2031 | 0.011 | 0.005 |
| 2032 | 0.006 | 0.004 |
| 2033 | 0.010 | 0.005 |
| 2034 | 0.010 | 0.005 |
| 2035 | 0.038 | 0.092 |
| 2036 | 0.020 | 0.006 |
| 2037 | 0.005 | 0.005 |
| 2038 | 0.016 | 0.007 |
| 2039 | 0.002 | 0.004 |
| 2040 | 0.009 | 0.005 |
| 2041 | 0.012 | 0.005 |
| 2042 | 0.037 | 0.021 |
| 2043 | 0.018 | 0.009 |
| 2044 | 0.024 | 0.009 |
| 2045 | 0.016 | 0.007 |
| 2046 | 0.019 | 0.034 |
| 2047 | 0.014 | 0.006 |
| 2048 | 0.018 | 0.005 |
| 2049 | 0.016 | 0.006 |
| 2050 | 0.012 | 0.005 |
| 2051 | 0.017 | 0.006 |
| 2052 | 0.010 | 0.006 |
| 2053 | 0.017 | 0.032 |
| 2054 | 0.022 | 0.008 |
| 2055 | 0.007 | 0.004 |
| 2056 | 0.008 | 0.005 |
| 2057 | 0.012 | 0.006 |
| 2058 | 0.015 | 0.007 |
| 2059 | 0.027 | 0.011 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

| Rank | Predeveloped | Mitigated |
|---|---|---|
| 1 | 0.0526 | 0.1721 |
| 2 | 0.0443 | 0.1489 |
| 3 | 0.0443 | 0.1410 |
| 4 | 0.0428 | 0.1346 |
| 5 | 0.0413 | 0.1177 |
| 6 | 0.0400 | 0.1082 |
| 7 | 0.0377 | 0.1072 |
| 8 | 0.0367 | 0.0918 |
| 9 | 0.0347 | 0.0506 |
| 10 | 0.0347 | 0.0443 |
| 11 | 0.0340 | 0.0338 |
| 12 | 0.0337 | 0.0320 |
| 13 | 0.0334 | 0.0309 |
| 14 | 0.0331 | 0.0309 |
| 15 | 0.0325 | 0.0265 |
| 16 | 0.0321 | 0.0210 |
| 17 | 0.0317 | 0.0198 |
| 18 | 0.0302 | 0.0116 |
| 19 | 0.0300 | 0.0107 |
| 20 | 0.0298 | 0.0107 |
| 21 | 0.0291 | 0.0106 |
| 22 | 0.0267 | 0.0105 |

| | | |
|---|---|---|
| 23 | 0.0266 | 0.0100 |
| 24 | 0.0266 | 0.0097 |
| 25 | 0.0266 | 0.0096 |
| 26 | 0.0265 | 0.0092 |
| 27 | 0.0264 | 0.0092 |
| 28 | 0.0252 | 0.0089 |
| 29 | 0.0251 | 0.0085 |
| 30 | 0.0245 | 0.0081 |
| 31 | 0.0244 | 0.0080 |
| 32 | 0.0243 | 0.0076 |
| 33 | 0.0239 | 0.0074 |
| 34 | 0.0221 | 0.0072 |
| 35 | 0.0220 | 0.0070 |
| 36 | 0.0219 | 0.0067 |
| 37 | 0.0218 | 0.0067 |
| 38 | 0.0217 | 0.0066 |
| 39 | 0.0213 | 0.0066 |
| 40 | 0.0211 | 0.0066 |
| 41 | 0.0208 | 0.0065 |
| 42 | 0.0205 | 0.0065 |
| 43 | 0.0204 | 0.0065 |
| 44 | 0.0204 | 0.0065 |
| 45 | 0.0196 | 0.0064 |
| 46 | 0.0195 | 0.0064 |
| 47 | 0.0192 | 0.0063 |
| 48 | 0.0191 | 0.0063 |
| 49 | 0.0191 | 0.0063 |
| 50 | 0.0184 | 0.0063 |
| 51 | 0.0182 | 0.0063 |
| 52 | 0.0181 | 0.0062 |
| 53 | 0.0180 | 0.0062 |
| 54 | 0.0180 | 0.0062 |
| 55 | 0.0180 | 0.0062 |
| 56 | 0.0180 | 0.0062 |
| 57 | 0.0178 | 0.0062 |
| 58 | 0.0178 | 0.0061 |
| 59 | 0.0177 | 0.0061 |
| 60 | 0.0176 | 0.0061 |
| 61 | 0.0176 | 0.0061 |
| 62 | 0.0174 | 0.0061 |
| 63 | 0.0172 | 0.0060 |
| 64 | 0.0170 | 0.0060 |
| 65 | 0.0169 | 0.0060 |
| 66 | 0.0169 | 0.0059 |
| 67 | 0.0168 | 0.0059 |
| 68 | 0.0163 | 0.0059 |
| 69 | 0.0163 | 0.0059 |
| 70 | 0.0163 | 0.0059 |
| 71 | 0.0162 | 0.0059 |
| 72 | 0.0161 | 0.0059 |
| 73 | 0.0161 | 0.0059 |
| 74 | 0.0160 | 0.0058 |
| 75 | 0.0159 | 0.0058 |
| 76 | 0.0158 | 0.0058 |
| 77 | 0.0158 | 0.0058 |
| 78 | 0.0158 | 0.0058 |
| 79 | 0.0156 | 0.0057 |
| 80 | 0.0154 | 0.0057 |

| | | |
|---|---|---|
| 81 | 0.0153 | 0.0057 |
| 82 | 0.0152 | 0.0057 |
| 83 | 0.0151 | 0.0056 |
| 84 | 0.0149 | 0.0056 |
| 85 | 0.0145 | 0.0056 |
| 86 | 0.0144 | 0.0056 |
| 87 | 0.0144 | 0.0056 |
| 88 | 0.0144 | 0.0056 |
| 89 | 0.0143 | 0.0055 |
| 90 | 0.0140 | 0.0055 |
| 91 | 0.0135 | 0.0055 |
| 92 | 0.0134 | 0.0055 |
| 93 | 0.0133 | 0.0055 |
| 94 | 0.0130 | 0.0055 |
| 95 | 0.0130 | 0.0055 |
| 96 | 0.0130 | 0.0055 |
| 97 | 0.0128 | 0.0055 |
| 98 | 0.0128 | 0.0054 |
| 99 | 0.0125 | 0.0054 |
| 100 | 0.0123 | 0.0054 |
| 101 | 0.0121 | 0.0054 |
| 102 | 0.0120 | 0.0054 |
| 103 | 0.0118 | 0.0053 |
| 104 | 0.0117 | 0.0053 |
| 105 | 0.0117 | 0.0053 |
| 106 | 0.0117 | 0.0053 |
| 107 | 0.0116 | 0.0053 |
| 108 | 0.0115 | 0.0053 |
| 109 | 0.0115 | 0.0053 |
| 110 | 0.0113 | 0.0052 |
| 111 | 0.0112 | 0.0052 |
| 112 | 0.0110 | 0.0052 |
| 113 | 0.0108 | 0.0052 |
| 114 | 0.0102 | 0.0051 |
| 115 | 0.0102 | 0.0051 |
| 116 | 0.0099 | 0.0050 |
| 117 | 0.0099 | 0.0050 |
| 118 | 0.0098 | 0.0050 |
| 119 | 0.0098 | 0.0050 |
| 120 | 0.0098 | 0.0050 |
| 121 | 0.0097 | 0.0050 |
| 122 | 0.0097 | 0.0050 |
| 123 | 0.0096 | 0.0049 |
| 124 | 0.0096 | 0.0049 |
| 125 | 0.0095 | 0.0049 |
| 126 | 0.0091 | 0.0049 |
| 127 | 0.0090 | 0.0049 |
| 128 | 0.0087 | 0.0049 |
| 129 | 0.0083 | 0.0048 |
| 130 | 0.0083 | 0.0048 |
| 131 | 0.0083 | 0.0048 |
| 132 | 0.0082 | 0.0048 |
| 133 | 0.0082 | 0.0047 |
| 134 | 0.0079 | 0.0047 |
| 135 | 0.0077 | 0.0047 |
| 136 | 0.0076 | 0.0047 |
| 137 | 0.0075 | 0.0047 |
| 138 | 0.0070 | 0.0047 |

| | | |
|---|---|---|
| 139 | 0.0069 | 0.0046 |
| 140 | 0.0069 | 0.0046 |
| 141 | 0.0068 | 0.0046 |
| 142 | 0.0067 | 0.0045 |
| 143 | 0.0066 | 0.0045 |
| 144 | 0.0066 | 0.0043 |
| 145 | 0.0062 | 0.0043 |
| 146 | 0.0062 | 0.0043 |
| 147 | 0.0062 | 0.0043 |
| 148 | 0.0061 | 0.0042 |
| 149 | 0.0060 | 0.0042 |
| 150 | 0.0060 | 0.0042 |
| 151 | 0.0058 | 0.0042 |
| 152 | 0.0053 | 0.0042 |
| 153 | 0.0051 | 0.0041 |
| 154 | 0.0047 | 0.0041 |
| 155 | 0.0034 | 0.0041 |
| 156 | 0.0016 | 0.0041 |
| 157 | 0.0013 | 0.0040 |
| 158 | 0.0008 | 0.0036 |

## Duration Flows
The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0079 | 54282 | 24487 | 45 | Pass |
| 0.0082 | 50160 | 22725 | 45 | Pass |
| 0.0085 | 46564 | 20853 | 44 | Pass |
| 0.0088 | 43312 | 18786 | 43 | Pass |
| 0.0091 | 40260 | 16764 | 41 | Pass |
| 0.0094 | 37451 | 14809 | 39 | Pass |
| 0.0097 | 34902 | 12892 | 36 | Pass |
| 0.0100 | 32553 | 11014 | 33 | Pass |
| 0.0103 | 30332 | 8992 | 29 | Pass |
| 0.0106 | 28310 | 7379 | 26 | Pass |
| 0.0109 | 26432 | 5928 | 22 | Pass |
| 0.0111 | 24819 | 4677 | 18 | Pass |
| 0.0114 | 23296 | 3446 | 14 | Pass |
| 0.0117 | 21950 | 2280 | 10 | Pass |
| 0.0120 | 20637 | 2220 | 10 | Pass |
| 0.0123 | 19440 | 2171 | 11 | Pass |
| 0.0126 | 18282 | 2125 | 11 | Pass |
| 0.0129 | 17241 | 2086 | 12 | Pass |
| 0.0132 | 16160 | 2049 | 12 | Pass |
| 0.0135 | 15158 | 2008 | 13 | Pass |
| 0.0138 | 14271 | 1971 | 13 | Pass |
| 0.0141 | 13462 | 1933 | 14 | Pass |
| 0.0144 | 12665 | 1895 | 14 | Pass |
| 0.0147 | 11950 | 1857 | 15 | Pass |
| 0.0150 | 11241 | 1821 | 16 | Pass |
| 0.0153 | 10582 | 1794 | 16 | Pass |
| 0.0156 | 9972 | 1769 | 17 | Pass |
| 0.0159 | 9385 | 1746 | 18 | Pass |
| 0.0162 | 8847 | 1716 | 19 | Pass |
| 0.0165 | 8338 | 1683 | 20 | Pass |
| 0.0168 | 7856 | 1662 | 21 | Pass |
| 0.0170 | 7462 | 1642 | 22 | Pass |
| 0.0173 | 7030 | 1617 | 23 | Pass |
| 0.0176 | 6620 | 1593 | 24 | Pass |
| 0.0179 | 6271 | 1572 | 25 | Pass |
| 0.0182 | 5978 | 1547 | 25 | Pass |
| 0.0185 | 5701 | 1520 | 26 | Pass |
| 0.0188 | 5444 | 1499 | 27 | Pass |
| 0.0191 | 5197 | 1478 | 28 | Pass |
| 0.0194 | 4946 | 1452 | 29 | Pass |
| 0.0197 | 4703 | 1425 | 30 | Pass |
| 0.0200 | 4515 | 1401 | 31 | Pass |
| 0.0203 | 4334 | 1377 | 31 | Pass |
| 0.0206 | 4159 | 1358 | 32 | Pass |
| 0.0209 | 3956 | 1338 | 33 | Pass |
| 0.0212 | 3770 | 1315 | 34 | Pass |
| 0.0215 | 3577 | 1290 | 36 | Pass |
| 0.0218 | 3416 | 1274 | 37 | Pass |
| 0.0221 | 3259 | 1257 | 38 | Pass |
| 0.0224 | 3135 | 1234 | 39 | Pass |
| 0.0227 | 3026 | 1214 | 40 | Pass |
| 0.0229 | 2928 | 1193 | 40 | Pass |
| 0.0232 | 2813 | 1169 | 41 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.0235 | 2683 | 1149 | 42 | Pass |
| 0.0238 | 2555 | 1127 | 44 | Pass |
| 0.0241 | 2452 | 1105 | 45 | Pass |
| 0.0244 | 2358 | 1086 | 46 | Pass |
| 0.0247 | 2256 | 1067 | 47 | Pass |
| 0.0250 | 2139 | 1045 | 48 | Pass |
| 0.0253 | 2040 | 1023 | 50 | Pass |
| 0.0256 | 1952 | 1004 | 51 | Pass |
| 0.0259 | 1860 | 987 | 53 | Pass |
| 0.0262 | 1777 | 970 | 54 | Pass |
| 0.0265 | 1691 | 944 | 55 | Pass |
| 0.0268 | 1618 | 923 | 57 | Pass |
| 0.0271 | 1561 | 903 | 57 | Pass |
| 0.0274 | 1482 | 883 | 59 | Pass |
| 0.0277 | 1407 | 861 | 61 | Pass |
| 0.0280 | 1338 | 842 | 62 | Pass |
| 0.0283 | 1270 | 806 | 63 | Pass |
| 0.0286 | 1217 | 791 | 64 | Pass |
| 0.0288 | 1163 | 772 | 66 | Pass |
| 0.0291 | 1105 | 753 | 68 | Pass |
| 0.0294 | 1055 | 731 | 69 | Pass |
| 0.0297 | 1007 | 709 | 70 | Pass |
| 0.0300 | 964 | 680 | 70 | Pass |
| 0.0303 | 920 | 658 | 71 | Pass |
| 0.0306 | 872 | 629 | 72 | Pass |
| 0.0309 | 815 | 602 | 73 | Pass |
| 0.0312 | 774 | 579 | 74 | Pass |
| 0.0315 | 738 | 558 | 75 | Pass |
| 0.0318 | 694 | 513 | 73 | Pass |
| 0.0321 | 637 | 490 | 76 | Pass |
| 0.0324 | 601 | 475 | 79 | Pass |
| 0.0327 | 556 | 457 | 82 | Pass |
| 0.0330 | 517 | 434 | 83 | Pass |
| 0.0333 | 478 | 414 | 86 | Pass |
| 0.0336 | 434 | 392 | 90 | Pass |
| 0.0339 | 394 | 369 | 93 | Pass |
| 0.0342 | 363 | 354 | 97 | Pass |
| 0.0344 | 340 | 338 | 99 | Pass |
| 0.0347 | 310 | 321 | 103 | Pass |
| 0.0350 | 297 | 302 | 101 | Pass |
| 0.0353 | 273 | 280 | 102 | Pass |
| 0.0356 | 252 | 264 | 104 | Pass |
| 0.0359 | 237 | 244 | 102 | Pass |
| 0.0362 | 223 | 223 | 100 | Pass |
| 0.0365 | 206 | 203 | 98 | Pass |
| 0.0368 | 195 | 200 | 102 | Pass |
| 0.0371 | 180 | 197 | 109 | Pass |

# Model Default Modifications

Total of 0 changes have been made.

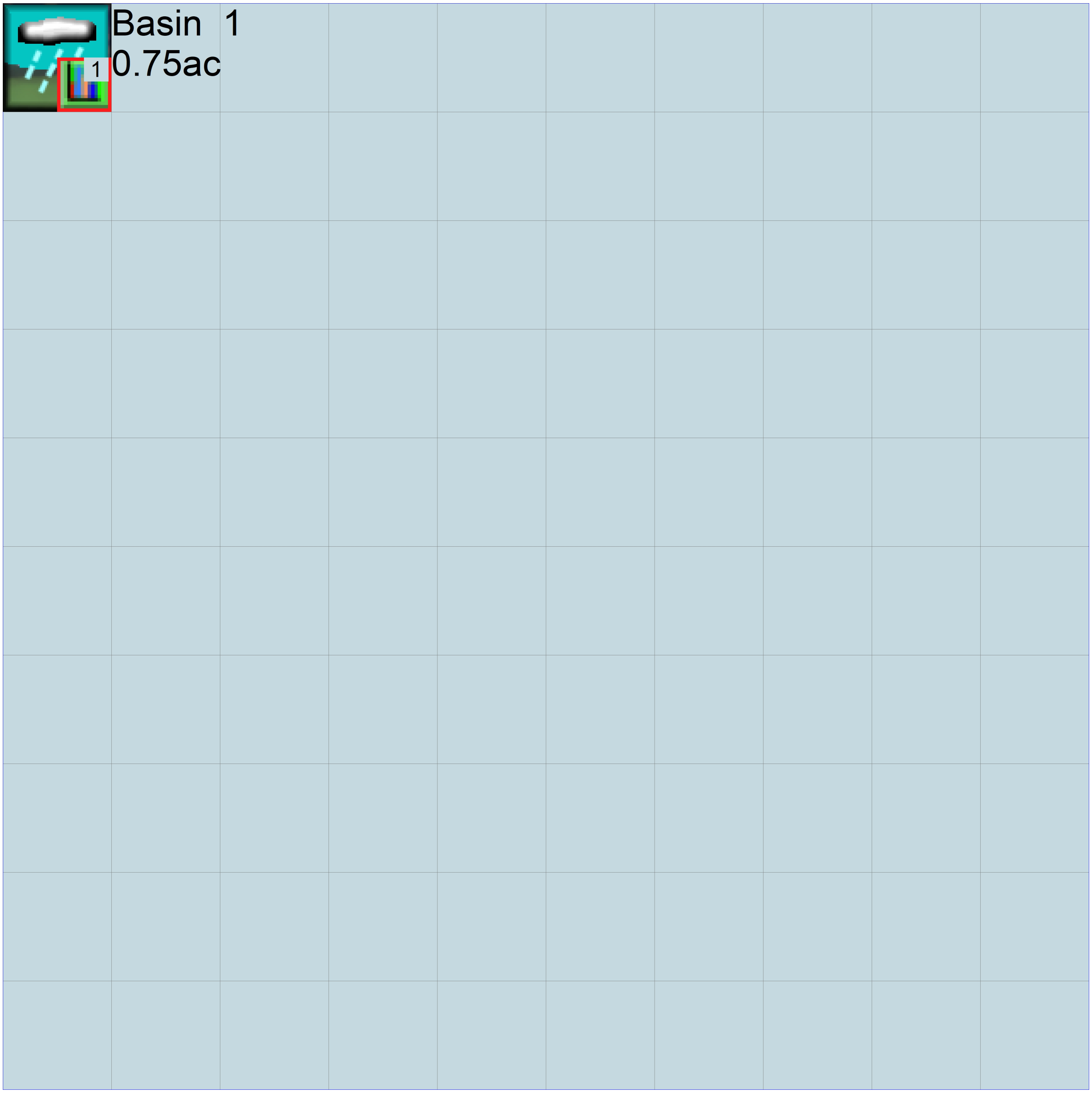
## PERLND Changes

No PERLND changes have been made.

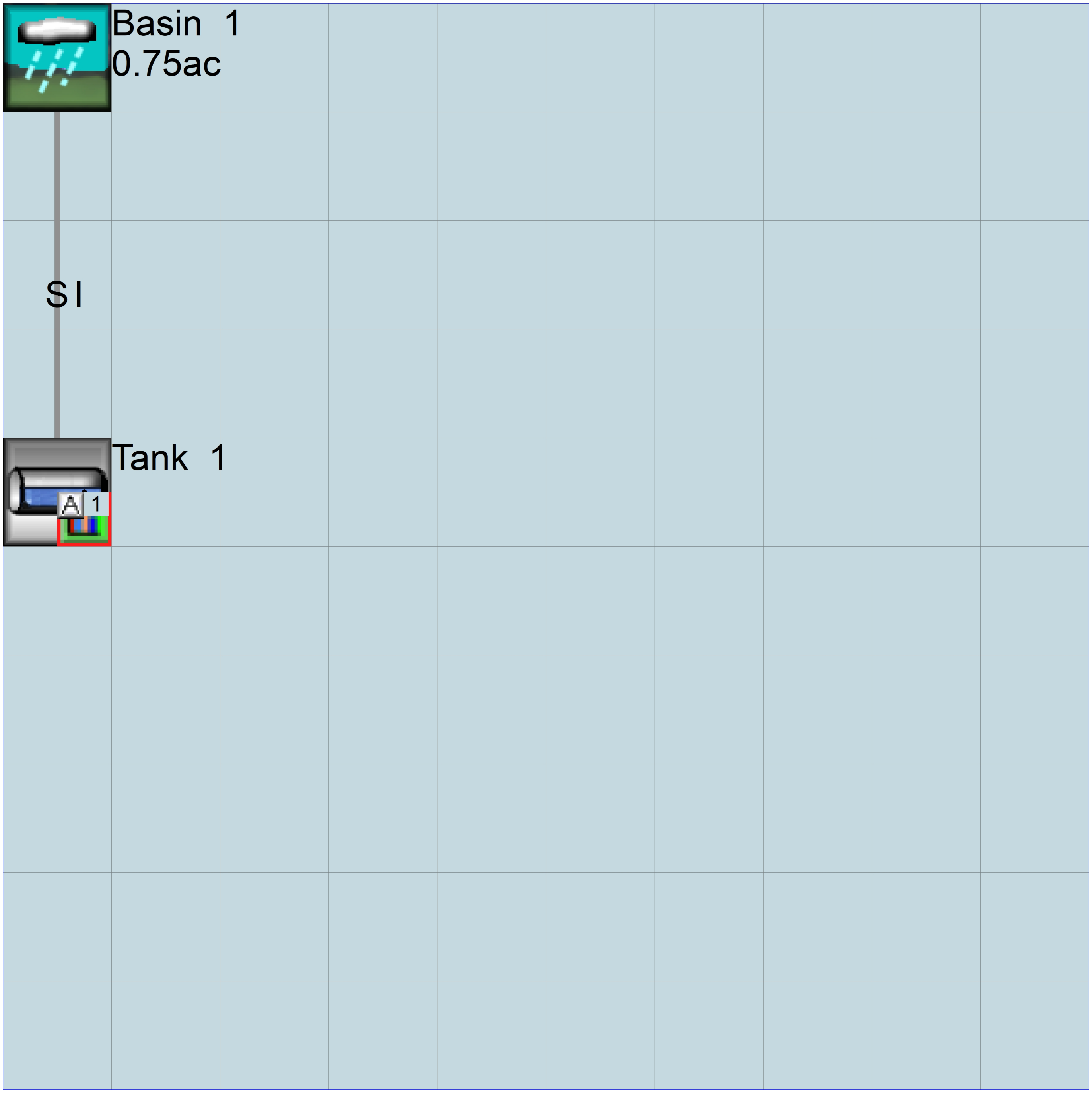
## IMPLND Changes

No IMPLND changes have been made.

# Appendix
## Predeveloped Schematic



## *Mitigated Schematic*



# Disclaimer

## Legal Notice



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Local (360)943-0304

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B-2 Parking Lot B Water Quality Calculations

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | Parking Lot B |
| Site Name: | |
| Site Address: | |
| City: | |
| Report Date: | 1/3/2023 |
| Gage: | 38 IN CENTRAL |
| Data Start: | 10/01/1901 |
| Data End: | 09/30/2059 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.000 |
| Version Date: | 2021/08/18 |
| Version: | 4.2.18 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# *Landuse Basin Data*
## *Predeveloped Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Forest, Flat | 0.75 |
| Pervious Total | 0.75 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 0.75 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

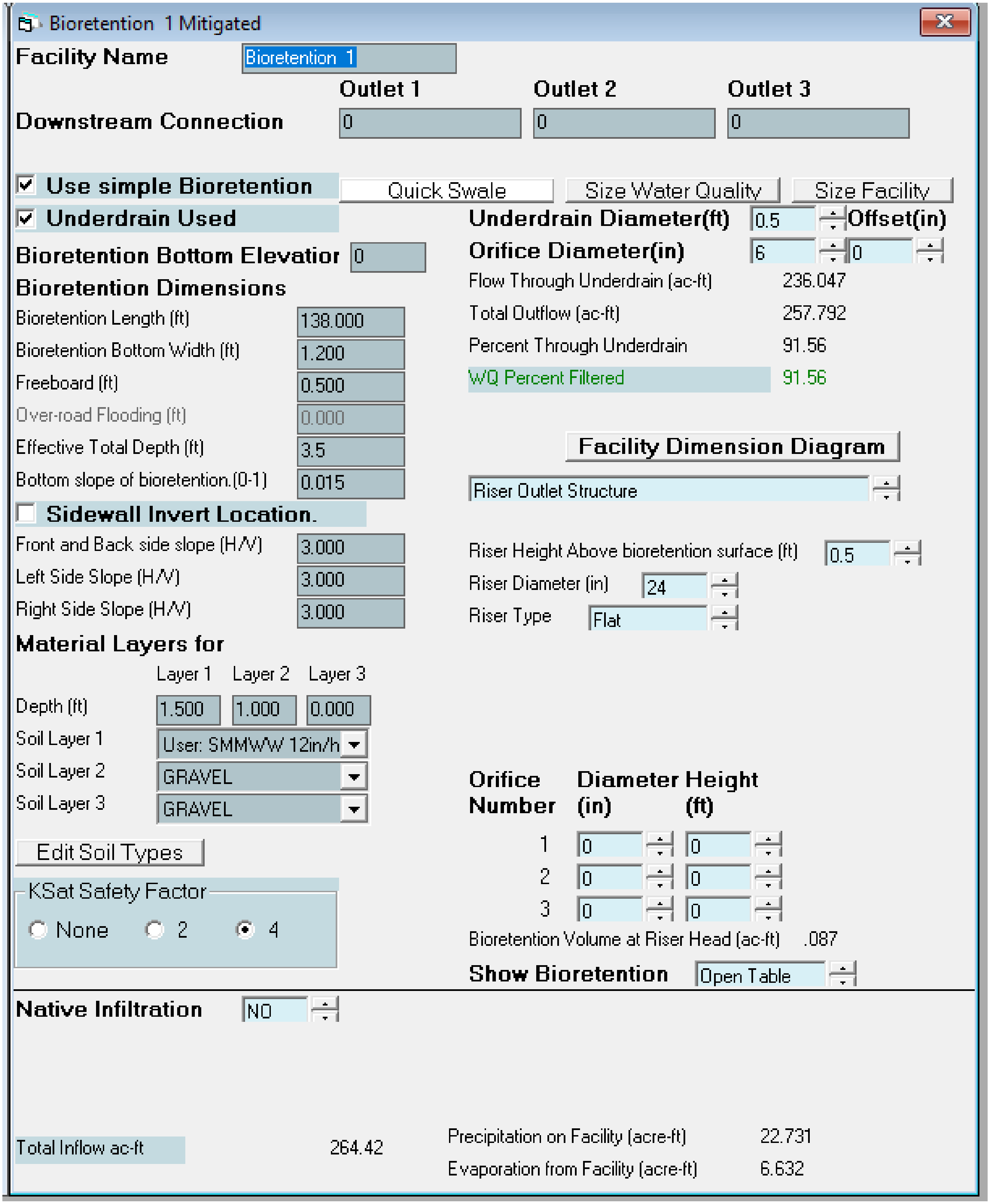
### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Pasture, Flat | 0.2 |
| Pervious Total | 0.2 |
| Impervious Land Use | acre |
| PARKING FLAT | 0.55 |
| Impervious Total | 0.55 |
| Basin Total | 0.75 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Surface retention 1 | Surface retention 1 | |

# Routing Elements
## Predeveloped Routing



## *Mitigated Routing*

### Bioretention 1

| | |
|---|---|
| Bottom Length: | 138.00 ft. |
| Bottom Width: | 1.20 ft. |
| Material thickness of first layer: | 1.5 |
| Material type for first layer: | SMMWW 12in/hr |
| Material thickness of second layer: | 1 |
| Material type for second layer: | GRAVEL |
| Material thickness of third layer: | 0 |
| Material type for third layer: | GRAVEL |
| Underdrain used | |
| Underdrain Diameter (feet): | 0.5 |
| Orifice Diameter (in.): | 6 |
| Offset (in.): | 0 |
| Flow Through Underdrain (ac-ft.): | 236.047 |
| Total Outflow (ac-ft.): | 257.792 |
| Percent Through Underdrain: | 91.56 |

Discharge Structure

| | |
|---|---|
| Riser Height: | 0.5 ft. |
| Riser Diameter: | 24 in. |

Element Flows To:

Outlet 1 Outlet 2

Bioretention Hydraulic Table

| **Stage(feet)** | **Area(ac.)** | **Volume(ac-ft.)** | **Discharge(cfs)** | **Infilt(cfs)** |
|---|---|---|---|---|
| 0.0000 | 0.0569 | 0.0000 | 0.0000 | 0.0000 |
| 0.0385 | 0.0569 | 0.0000 | 0.0000 | 0.0000 |
| 0.0769 | 0.0560 | 0.0001 | 0.0000 | 0.0000 |
| 0.1154 | 0.0551 | 0.0001 | 0.0000 | 0.0000 |
| 0.1538 | 0.0542 | 0.0002 | 0.0000 | 0.0000 |
| 0.1923 | 0.0533 | 0.0002 | 0.0000 | 0.0000 |
| 0.2308 | 0.0524 | 0.0003 | 0.0001 | 0.0000 |
| 0.2692 | 0.0516 | 0.0004 | 0.0001 | 0.0000 |
| 0.3077 | 0.0507 | 0.0005 | 0.0002 | 0.0000 |
| 0.3462 | 0.0498 | 0.0006 | 0.0002 | 0.0000 |
| 0.3846 | 0.0489 | 0.0007 | 0.0003 | 0.0000 |
| 0.4231 | 0.0481 | 0.0008 | 0.0004 | 0.0000 |
| 0.4615 | 0.0472 | 0.0009 | 0.0005 | 0.0000 |
| 0.5000 | 0.0463 | 0.0010 | 0.0006 | 0.0000 |
| 0.5385 | 0.0455 | 0.0011 | 0.0007 | 0.0000 |
| 0.5769 | 0.0446 | 0.0012 | 0.0008 | 0.0000 |
| 0.6154 | 0.0437 | 0.0014 | 0.0010 | 0.0000 |
| 0.6538 | 0.0429 | 0.0015 | 0.0011 | 0.0000 |
| 0.6923 | 0.0420 | 0.0017 | 0.0012 | 0.0000 |
| 0.7308 | 0.0412 | 0.0018 | 0.0013 | 0.0000 |
| 0.7692 | 0.0403 | 0.0020 | 0.0015 | 0.0000 |
| 0.8077 | 0.0395 | 0.0022 | 0.0018 | 0.0000 |
| 0.8462 | 0.0386 | 0.0023 | 0.0020 | 0.0000 |
| 0.8846 | 0.0378 | 0.0025 | 0.0023 | 0.0000 |
| 0.9231 | 0.0369 | 0.0027 | 0.0026 | 0.0000 |
| 0.9615 | 0.0361 | 0.0029 | 0.0029 | 0.0000 |
| 1.0000 | 0.0353 | 0.0031 | 0.0029 | 0.0000 |
| 1.0385 | 0.0344 | 0.0033 | 0.0032 | 0.0000 |
| 1.0769 | 0.0336 | 0.0036 | 0.0035 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| 1.1154 | 0.0328 | 0.0038 | 0.0039 | 0.0000 |
| 1.1538 | 0.0319 | 0.0040 | 0.0043 | 0.0000 |
| 1.1923 | 0.0311 | 0.0043 | 0.0047 | 0.0000 |
| 1.2308 | 0.0303 | 0.0045 | 0.0052 | 0.0000 |
| 1.2692 | 0.0295 | 0.0048 | 0.0056 | 0.0000 |
| 1.3077 | 0.0287 | 0.0050 | 0.0056 | 0.0000 |
| 1.3462 | 0.0278 | 0.0053 | 0.0061 | 0.0000 |
| 1.3846 | 0.0270 | 0.0056 | 0.0066 | 0.0000 |
| 1.4231 | 0.0262 | 0.0059 | 0.0071 | 0.0000 |
| 1.4615 | 0.0254 | 0.0061 | 0.0077 | 0.0000 |
| 1.5000 | 0.0246 | 0.0064 | 0.0083 | 0.0000 |
| 1.5385 | 0.0238 | 0.0067 | 0.0089 | 0.0000 |
| 1.5769 | 0.0230 | 0.0070 | 0.0093 | 0.0000 |
| 1.6154 | 0.0222 | 0.0073 | 0.0095 | 0.0000 |
| 1.6538 | 0.0214 | 0.0076 | 0.0102 | 0.0000 |
| 1.6923 | 0.0206 | 0.0079 | 0.0109 | 0.0000 |
| 1.7308 | 0.0198 | 0.0082 | 0.0153 | 0.0000 |
| 1.7692 | 0.0190 | 0.0085 | 0.0153 | 0.0000 |
| 1.8077 | 0.0183 | 0.0088 | 0.0153 | 0.0000 |
| 1.8462 | 0.0175 | 0.0092 | 0.0153 | 0.0000 |
| 1.8846 | 0.0167 | 0.0095 | 0.0153 | 0.0000 |
| 1.9231 | 0.0159 | 0.0098 | 0.0153 | 0.0000 |
| 1.9615 | 0.0151 | 0.0102 | 0.0153 | 0.0000 |
| 2.0000 | 0.0144 | 0.0106 | 0.0153 | 0.0000 |
| 2.0385 | 0.0136 | 0.0109 | 0.0153 | 0.0000 |
| 2.0769 | 0.0128 | 0.0117 | 0.0153 | 0.0000 |
| 2.1154 | 0.0121 | 0.0124 | 0.0153 | 0.0000 |
| 2.1538 | 0.0113 | 0.0132 | 0.0153 | 0.0000 |
| 2.1923 | 0.0105 | 0.0140 | 0.0153 | 0.0000 |
| 2.2308 | 0.0098 | 0.0148 | 0.0153 | 0.0000 |
| 2.2692 | 0.0090 | 0.0156 | 0.0153 | 0.0000 |
| 2.3077 | 0.0083 | 0.0164 | 0.0153 | 0.0000 |
| 2.3462 | 0.0075 | 0.0173 | 0.0153 | 0.0000 |
| 2.3846 | 0.0068 | 0.0181 | 0.0153 | 0.0000 |
| 2.4231 | 0.0060 | 0.0190 | 0.0153 | 0.0000 |
| 2.4615 | 0.0053 | 0.0199 | 0.0153 | 0.0000 |
| 2.5000 | 0.0045 | 0.0208 | 0.0153 | 0.0000 |
| 2.5000 | 0.0038 | 0.0208 | 0.0153 | 0.0000 |

Bioretention Hydraulic Table

| **Stage(feet)** | **Area(ac.)** | **Volume(ac-ft.)** | **Discharge(cfs)** | **To Amended(cfs)** | **Infilt(cfs)** |
|---|---|---|---|---|---|
| 2.5000 | 0.0569 | 0.0208 | 0.0000 | 0.0115 | 0.0000 |
| 2.5385 | 0.0578 | 0.0230 | 0.0000 | 0.0115 | 0.0000 |
| 2.5769 | 0.0587 | 0.0253 | 0.0000 | 0.0121 | 0.0000 |
| 2.6154 | 0.0596 | 0.0275 | 0.0000 | 0.0124 | 0.0000 |
| 2.6538 | 0.0605 | 0.0298 | 0.0000 | 0.0127 | 0.0000 |
| 2.6923 | 0.0614 | 0.0322 | 0.0000 | 0.0130 | 0.0000 |
| 2.7308 | 0.0623 | 0.0346 | 0.0000 | 0.0133 | 0.0000 |
| 2.7692 | 0.0632 | 0.0370 | 0.0000 | 0.0136 | 0.0000 |
| 2.8077 | 0.0642 | 0.0394 | 0.0000 | 0.0139 | 0.0000 |
| 2.8462 | 0.0651 | 0.0419 | 0.0000 | 0.0142 | 0.0000 |
| 2.8846 | 0.0660 | 0.0444 | 0.0000 | 0.0144 | 0.0000 |
| 2.9231 | 0.0669 | 0.0470 | 0.0000 | 0.0147 | 0.0000 |
| 2.9615 | 0.0678 | 0.0496 | 0.0000 | 0.0150 | 0.0000 |
| 3.0000 | 0.0688 | 0.0522 | 0.0000 | 0.0153 | 0.0000 |
| 3.0385 | 0.0697 | 0.0549 | 0.1601 | 0.0153 | 0.0000 |
| 3.0769 | 0.0706 | 0.0576 | 0.4524 | 0.0153 | 0.0000 |
| 3.1154 | 0.0716 | 0.0603 | 0.8304 | 0.0153 | 0.0000 |

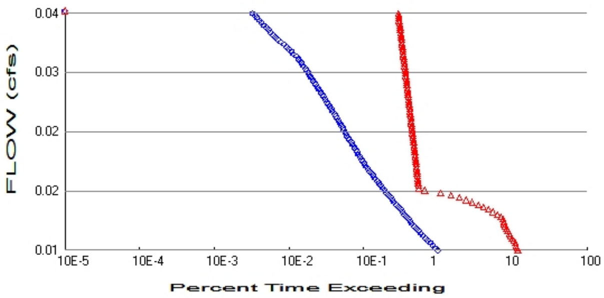
| | | | | | |
|---|---|---|---|---|---|
| 3.1538 | 0.0725 | 0.0631 | 1.2766 | 0.0153 | 0.0000 |
| 3.1923 | 0.0734 | 0.0659 | 1.7799 | 0.0153 | 0.0000 |
| 3.2308 | 0.0744 | 0.0687 | 2.3316 | 0.0153 | 0.0000 |
| 3.2692 | 0.0753 | 0.0716 | 2.9237 | 0.0153 | 0.0000 |
| 3.3077 | 0.0763 | 0.0745 | 3.5484 | 0.0153 | 0.0000 |
| 3.3462 | 0.0772 | 0.0775 | 4.1981 | 0.0153 | 0.0000 |
| 3.3846 | 0.0782 | 0.0805 | 4.8649 | 0.0153 | 0.0000 |
| 3.4231 | 0.0791 | 0.0835 | 5.5408 | 0.0153 | 0.0000 |
| 3.4615 | 0.0801 | 0.0865 | 6.2177 | 0.0153 | 0.0000 |
| 3.5000 | 0.0810 | 0.0896 | 6.8875 | 0.0153 | 0.0000 |

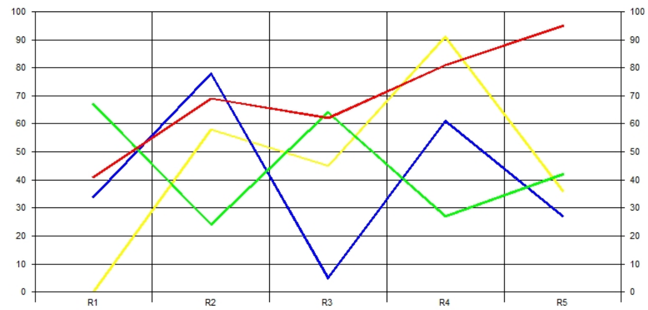
## Surface retention 1

Element Flows To:

| | |
|---|---|
| Outlet 1 | Outlet 2 |
| | Bioretention 1 |

# *Analysis Results*
## *POC 1*



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.75
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.2
Total Impervious Area: 0.55

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.015805 |
| 5 year | 0.024587 |
| 10 year | 0.029359 |
| 25 year | 0.034217 |
| 50 year | 0.037104 |
| 100 year | 0.039478 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.143781 |
| 5 year | 0.209235 |
| 10 year | 0.243239 |
| 25 year | 0.276999 |
| 50 year | 0.296717 |
| 100 year | 0.312757 |

## Annual Peaks
Annual Peaks for Predeveloped and Mitigated. POC #1

| **Year** | **Predeveloped** | **Mitigated** |
|---|---|---|
| 1902 | 0.012 | 0.144 |
| 1903 | 0.010 | 0.086 |
| 1904 | 0.016 | 0.167 |
| 1905 | 0.008 | 0.121 |
| 1906 | 0.003 | 0.054 |
| 1907 | 0.024 | 0.206 |
| 1908 | 0.018 | 0.123 |
| 1909 | 0.018 | 0.128 |
| 1910 | 0.024 | 0.197 |
| 1911 | 0.016 | 0.095 |

| | | |
|---|---|---|
| 1912 | 0.053 | 0.374 |
| 1913 | 0.025 | 0.115 |
| 1914 | 0.006 | 0.205 |
| 1915 | 0.010 | 0.128 |
| 1916 | 0.016 | 0.243 |
| 1917 | 0.005 | 0.062 |
| 1918 | 0.017 | 0.132 |
| 1919 | 0.012 | 0.095 |
| 1920 | 0.016 | 0.090 |
| 1921 | 0.018 | 0.135 |
| 1922 | 0.018 | 0.156 |
| 1923 | 0.014 | 0.100 |
| 1924 | 0.007 | 0.071 |
| 1925 | 0.008 | 0.113 |
| 1926 | 0.015 | 0.139 |
| 1927 | 0.010 | 0.127 |
| 1928 | 0.012 | 0.120 |
| 1929 | 0.025 | 0.255 |
| 1930 | 0.016 | 0.113 |
| 1931 | 0.015 | 0.137 |
| 1932 | 0.012 | 0.157 |
| 1933 | 0.011 | 0.146 |
| 1934 | 0.033 | 0.251 |
| 1935 | 0.015 | 0.111 |
| 1936 | 0.013 | 0.095 |
| 1937 | 0.021 | 0.220 |
| 1938 | 0.013 | 0.136 |
| 1939 | 0.001 | 0.123 |
| 1940 | 0.014 | 0.198 |
| 1941 | 0.007 | 0.071 |
| 1942 | 0.022 | 0.218 |
| 1943 | 0.011 | 0.210 |
| 1944 | 0.020 | 0.303 |
| 1945 | 0.018 | 0.176 |
| 1946 | 0.010 | 0.069 |
| 1947 | 0.006 | 0.137 |
| 1948 | 0.034 | 0.179 |
| 1949 | 0.029 | 0.220 |
| 1950 | 0.008 | 0.089 |
| 1951 | 0.010 | 0.093 |
| 1952 | 0.044 | 0.324 |
| 1953 | 0.040 | 0.296 |
| 1954 | 0.014 | 0.130 |
| 1955 | 0.012 | 0.076 |
| 1956 | 0.006 | 0.015 |
| 1957 | 0.020 | 0.115 |
| 1958 | 0.043 | 0.202 |
| 1959 | 0.026 | 0.210 |
| 1960 | 0.007 | 0.119 |
| 1961 | 0.027 | 0.293 |
| 1962 | 0.014 | 0.156 |
| 1963 | 0.007 | 0.079 |
| 1964 | 0.008 | 0.140 |
| 1965 | 0.030 | 0.186 |
| 1966 | 0.008 | 0.082 |
| 1967 | 0.013 | 0.137 |
| 1968 | 0.013 | 0.128 |
| 1969 | 0.013 | 0.120 |

| | | |
|---|---|---|
| 1970 | 0.020 | 0.181 |
| 1971 | 0.032 | 0.190 |
| 1972 | 0.021 | 0.295 |
| 1973 | 0.027 | 0.244 |
| 1974 | 0.014 | 0.205 |
| 1975 | 0.034 | 0.285 |
| 1976 | 0.018 | 0.201 |
| 1977 | 0.006 | 0.069 |
| 1978 | 0.030 | 0.223 |
| 1979 | 0.008 | 0.057 |
| 1980 | 0.017 | 0.103 |
| 1981 | 0.016 | 0.097 |
| 1982 | 0.007 | 0.121 |
| 1983 | 0.027 | 0.226 |
| 1984 | 0.011 | 0.135 |
| 1985 | 0.018 | 0.117 |
| 1986 | 0.016 | 0.129 |
| 1987 | 0.030 | 0.186 |
| 1988 | 0.019 | 0.126 |
| 1989 | 0.017 | 0.115 |
| 1990 | 0.019 | 0.146 |
| 1991 | 0.015 | 0.186 |
| 1992 | 0.022 | 0.196 |
| 1993 | 0.021 | 0.110 |
| 1994 | 0.032 | 0.184 |
| 1995 | 0.006 | 0.058 |
| 1996 | 0.035 | 0.161 |
| 1997 | 0.013 | 0.102 |
| 1998 | 0.016 | 0.186 |
| 1999 | 0.001 | 0.031 |
| 2000 | 0.012 | 0.179 |
| 2001 | 0.006 | 0.096 |
| 2002 | 0.022 | 0.252 |
| 2003 | 0.019 | 0.155 |
| 2004 | 0.018 | 0.154 |
| 2005 | 0.032 | 0.167 |
| 2006 | 0.010 | 0.059 |
| 2007 | 0.010 | 0.232 |
| 2008 | 0.017 | 0.111 |
| 2009 | 0.012 | 0.069 |
| 2010 | 0.010 | 0.202 |
| 2011 | 0.008 | 0.036 |
| 2012 | 0.011 | 0.188 |
| 2013 | 0.009 | 0.100 |
| 2014 | 0.007 | 0.039 |
| 2015 | 0.013 | 0.156 |
| 2016 | 0.005 | 0.037 |
| 2017 | 0.024 | 0.300 |
| 2018 | 0.044 | 0.192 |
| 2019 | 0.041 | 0.266 |
| 2020 | 0.013 | 0.094 |
| 2021 | 0.022 | 0.193 |
| 2022 | 0.009 | 0.090 |
| 2023 | 0.018 | 0.191 |
| 2024 | 0.035 | 0.353 |
| 2025 | 0.016 | 0.106 |
| 2026 | 0.027 | 0.153 |
| 2027 | 0.010 | 0.123 |

| | | |
|---|---|---|
| 2028 | 0.008 | 0.056 |
| 2029 | 0.018 | 0.113 |
| 2030 | 0.033 | 0.197 |
| 2031 | 0.011 | 0.081 |
| 2032 | 0.006 | 0.015 |
| 2033 | 0.010 | 0.055 |
| 2034 | 0.010 | 0.104 |
| 2035 | 0.038 | 0.208 |
| 2036 | 0.020 | 0.142 |
| 2037 | 0.005 | 0.099 |
| 2038 | 0.016 | 0.202 |
| 2039 | 0.002 | 0.031 |
| 2040 | 0.009 | 0.151 |
| 2041 | 0.012 | 0.114 |
| 2042 | 0.037 | 0.227 |
| 2043 | 0.018 | 0.167 |
| 2044 | 0.024 | 0.162 |
| 2045 | 0.016 | 0.105 |
| 2046 | 0.019 | 0.137 |
| 2047 | 0.014 | 0.098 |
| 2048 | 0.018 | 0.159 |
| 2049 | 0.016 | 0.176 |
| 2050 | 0.012 | 0.138 |
| 2051 | 0.017 | 0.269 |
| 2052 | 0.010 | 0.112 |
| 2053 | 0.017 | 0.160 |
| 2054 | 0.022 | 0.201 |
| 2055 | 0.007 | 0.057 |
| 2056 | 0.008 | 0.194 |
| 2057 | 0.012 | 0.096 |
| 2058 | 0.015 | 0.103 |
| 2059 | 0.027 | 0.206 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated.  POC #1

| Rank | Predeveloped | Mitigated |
|---|---|---|
| 1 | 0.0526 | 0.3741 |
| 2 | 0.0443 | 0.3534 |
| 3 | 0.0443 | 0.3242 |
| 4 | 0.0428 | 0.3030 |
| 5 | 0.0413 | 0.2999 |
| 6 | 0.0400 | 0.2960 |
| 7 | 0.0377 | 0.2951 |
| 8 | 0.0367 | 0.2934 |
| 9 | 0.0347 | 0.2854 |
| 10 | 0.0347 | 0.2689 |
| 11 | 0.0340 | 0.2658 |
| 12 | 0.0337 | 0.2552 |
| 13 | 0.0334 | 0.2519 |
| 14 | 0.0331 | 0.2514 |
| 15 | 0.0325 | 0.2442 |
| 16 | 0.0321 | 0.2430 |
| 17 | 0.0317 | 0.2317 |
| 18 | 0.0302 | 0.2270 |
| 19 | 0.0300 | 0.2256 |
| 20 | 0.0298 | 0.2234 |
| 21 | 0.0291 | 0.2200 |
| 22 | 0.0267 | 0.2199 |

| | | |
|---|---|---|
| 23 | 0.0266 | 0.2177 |
| 24 | 0.0266 | 0.2098 |
| 25 | 0.0266 | 0.2097 |
| 26 | 0.0265 | 0.2083 |
| 27 | 0.0264 | 0.2064 |
| 28 | 0.0252 | 0.2062 |
| 29 | 0.0251 | 0.2054 |
| 30 | 0.0245 | 0.2046 |
| 31 | 0.0244 | 0.2024 |
| 32 | 0.0243 | 0.2022 |
| 33 | 0.0239 | 0.2017 |
| 34 | 0.0221 | 0.2014 |
| 35 | 0.0220 | 0.2010 |
| 36 | 0.0219 | 0.1980 |
| 37 | 0.0218 | 0.1974 |
| 38 | 0.0217 | 0.1966 |
| 39 | 0.0213 | 0.1959 |
| 40 | 0.0211 | 0.1942 |
| 41 | 0.0208 | 0.1928 |
| 42 | 0.0205 | 0.1922 |
| 43 | 0.0204 | 0.1914 |
| 44 | 0.0204 | 0.1903 |
| 45 | 0.0196 | 0.1880 |
| 46 | 0.0195 | 0.1861 |
| 47 | 0.0192 | 0.1861 |
| 48 | 0.0191 | 0.1857 |
| 49 | 0.0191 | 0.1856 |
| 50 | 0.0184 | 0.1839 |
| 51 | 0.0182 | 0.1810 |
| 52 | 0.0181 | 0.1793 |
| 53 | 0.0180 | 0.1789 |
| 54 | 0.0180 | 0.1763 |
| 55 | 0.0180 | 0.1758 |
| 56 | 0.0180 | 0.1669 |
| 57 | 0.0178 | 0.1668 |
| 58 | 0.0178 | 0.1665 |
| 59 | 0.0177 | 0.1618 |
| 60 | 0.0176 | 0.1607 |
| 61 | 0.0176 | 0.1598 |
| 62 | 0.0174 | 0.1592 |
| 63 | 0.0172 | 0.1574 |
| 64 | 0.0170 | 0.1563 |
| 65 | 0.0169 | 0.1562 |
| 66 | 0.0169 | 0.1559 |
| 67 | 0.0168 | 0.1554 |
| 68 | 0.0163 | 0.1541 |
| 69 | 0.0163 | 0.1532 |
| 70 | 0.0163 | 0.1508 |
| 71 | 0.0162 | 0.1461 |
| 72 | 0.0161 | 0.1456 |
| 73 | 0.0161 | 0.1438 |
| 74 | 0.0160 | 0.1418 |
| 75 | 0.0159 | 0.1404 |
| 76 | 0.0158 | 0.1385 |
| 77 | 0.0158 | 0.1377 |
| 78 | 0.0158 | 0.1374 |
| 79 | 0.0156 | 0.1371 |
| 80 | 0.0154 | 0.1369 |

| | | |
|---|---|---|
| 81 | 0.0153 | 0.1366 |
| 82 | 0.0152 | 0.1360 |
| 83 | 0.0151 | 0.1351 |
| 84 | 0.0149 | 0.1347 |
| 85 | 0.0145 | 0.1322 |
| 86 | 0.0144 | 0.1300 |
| 87 | 0.0144 | 0.1286 |
| 88 | 0.0144 | 0.1278 |
| 89 | 0.0143 | 0.1277 |
| 90 | 0.0140 | 0.1275 |
| 91 | 0.0135 | 0.1266 |
| 92 | 0.0134 | 0.1263 |
| 93 | 0.0133 | 0.1230 |
| 94 | 0.0130 | 0.1230 |
| 95 | 0.0130 | 0.1227 |
| 96 | 0.0130 | 0.1214 |
| 97 | 0.0128 | 0.1211 |
| 98 | 0.0128 | 0.1205 |
| 99 | 0.0125 | 0.1196 |
| 100 | 0.0123 | 0.1186 |
| 101 | 0.0121 | 0.1171 |
| 102 | 0.0120 | 0.1154 |
| 103 | 0.0118 | 0.1152 |
| 104 | 0.0117 | 0.1145 |
| 105 | 0.0117 | 0.1137 |
| 106 | 0.0117 | 0.1133 |
| 107 | 0.0116 | 0.1132 |
| 108 | 0.0115 | 0.1131 |
| 109 | 0.0115 | 0.1124 |
| 110 | 0.0113 | 0.1110 |
| 111 | 0.0112 | 0.1106 |
| 112 | 0.0110 | 0.1097 |
| 113 | 0.0108 | 0.1059 |
| 114 | 0.0102 | 0.1050 |
| 115 | 0.0102 | 0.1035 |
| 116 | 0.0099 | 0.1031 |
| 117 | 0.0099 | 0.1031 |
| 118 | 0.0098 | 0.1023 |
| 119 | 0.0098 | 0.1002 |
| 120 | 0.0098 | 0.1000 |
| 121 | 0.0097 | 0.0985 |
| 122 | 0.0097 | 0.0979 |
| 123 | 0.0096 | 0.0974 |
| 124 | 0.0096 | 0.0965 |
| 125 | 0.0095 | 0.0963 |
| 126 | 0.0091 | 0.0950 |
| 127 | 0.0090 | 0.0947 |
| 128 | 0.0087 | 0.0945 |
| 129 | 0.0083 | 0.0941 |
| 130 | 0.0083 | 0.0926 |
| 131 | 0.0083 | 0.0900 |
| 132 | 0.0082 | 0.0898 |
| 133 | 0.0082 | 0.0887 |
| 134 | 0.0079 | 0.0858 |
| 135 | 0.0077 | 0.0818 |
| 136 | 0.0076 | 0.0809 |
| 137 | 0.0075 | 0.0792 |
| 138 | 0.0070 | 0.0755 |

| | | |
|---|---|---|
| 139 | 0.0069 | 0.0715 |
| 140 | 0.0069 | 0.0710 |
| 141 | 0.0068 | 0.0693 |
| 142 | 0.0067 | 0.0692 |
| 143 | 0.0066 | 0.0689 |
| 144 | 0.0066 | 0.0625 |
| 145 | 0.0062 | 0.0592 |
| 146 | 0.0062 | 0.0585 |
| 147 | 0.0062 | 0.0572 |
| 148 | 0.0061 | 0.0572 |
| 149 | 0.0060 | 0.0561 |
| 150 | 0.0060 | 0.0551 |
| 151 | 0.0058 | 0.0535 |
| 152 | 0.0053 | 0.0388 |
| 153 | 0.0051 | 0.0366 |
| 154 | 0.0047 | 0.0365 |
| 155 | 0.0034 | 0.0315 |
| 156 | 0.0016 | 0.0312 |
| 157 | 0.0013 | 0.0152 |
| 158 | 0.0008 | 0.0146 |

## Duration Flows

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0079 | 54282 | 643201 | 1184 | Fail |
| 0.0082 | 50160 | 626027 | 1248 | Fail |
| 0.0085 | 46564 | 609407 | 1308 | Fail |
| 0.0088 | 43312 | 592787 | 1368 | Fail |
| 0.0091 | 40260 | 568965 | 1413 | Fail |
| 0.0094 | 37451 | 536666 | 1432 | Fail |
| 0.0097 | 34902 | 508744 | 1457 | Fail |
| 0.0100 | 32553 | 491625 | 1510 | Fail |
| 0.0103 | 30332 | 473842 | 1562 | Fail |
| 0.0106 | 28310 | 455005 | 1607 | Fail |
| 0.0109 | 26432 | 432180 | 1635 | Fail |
| 0.0111 | 24819 | 426807 | 1719 | Fail |
| 0.0114 | 23296 | 420269 | 1804 | Fail |
| 0.0117 | 21950 | 406696 | 1852 | Fail |
| 0.0120 | 20637 | 379217 | 1837 | Fail |
| 0.0123 | 19440 | 340326 | 1750 | Fail |
| 0.0126 | 18282 | 297668 | 1628 | Fail |
| 0.0129 | 17241 | 258832 | 1501 | Fail |
| 0.0132 | 16160 | 222434 | 1376 | Fail |
| 0.0135 | 15158 | 189803 | 1252 | Fail |
| 0.0138 | 14271 | 158280 | 1109 | Fail |
| 0.0141 | 13462 | 130912 | 972 | Fail |
| 0.0144 | 12665 | 105372 | 831 | Fail |
| 0.0147 | 11950 | 81771 | 684 | Fail |
| 0.0150 | 11241 | 59057 | 525 | Fail |
| 0.0153 | 10582 | 36548 | 345 | Fail |
| 0.0156 | 9972 | 30276 | 303 | Fail |
| 0.0159 | 9385 | 30027 | 319 | Fail |
| 0.0162 | 8847 | 29783 | 336 | Fail |
| 0.0165 | 8338 | 29556 | 354 | Fail |
| 0.0168 | 7856 | 29318 | 373 | Fail |
| 0.0170 | 7462 | 29102 | 390 | Fail |
| 0.0173 | 7030 | 28886 | 410 | Fail |
| 0.0176 | 6620 | 28653 | 432 | Fail |
| 0.0179 | 6271 | 28426 | 453 | Fail |
| 0.0182 | 5978 | 28182 | 471 | Fail |
| 0.0185 | 5701 | 27939 | 490 | Fail |
| 0.0188 | 5444 | 27711 | 509 | Fail |
| 0.0191 | 5197 | 27484 | 528 | Fail |
| 0.0194 | 4946 | 27279 | 551 | Fail |
| 0.0197 | 4703 | 27052 | 575 | Fail |
| 0.0200 | 4515 | 26814 | 593 | Fail |
| 0.0203 | 4334 | 26587 | 613 | Fail |
| 0.0206 | 4159 | 26354 | 633 | Fail |
| 0.0209 | 3956 | 26132 | 660 | Fail |
| 0.0212 | 3770 | 25878 | 686 | Fail |
| 0.0215 | 3577 | 25684 | 718 | Fail |
| 0.0218 | 3416 | 25462 | 745 | Fail |
| 0.0221 | 3259 | 25235 | 774 | Fail |
| 0.0224 | 3135 | 25036 | 798 | Fail |
| 0.0227 | 3026 | 24803 | 819 | Fail |
| 0.0229 | 2928 | 24598 | 840 | Fail |
| 0.0232 | 2813 | 24398 | 867 | Fail |
| 0.0235 | 2683 | 24205 | 902 | Fail |

| | | | | |
|---|---|---|---|---|
| 0.0238 | 2555 | 23994 | 939 | Fail |
| 0.0241 | 2452 | 23806 | 970 | Fail |
| 0.0244 | 2358 | 23601 | 1000 | Fail |
| 0.0247 | 2256 | 23379 | 1036 | Fail |
| 0.0250 | 2139 | 23185 | 1083 | Fail |
| 0.0253 | 2040 | 22980 | 1126 | Fail |
| 0.0256 | 1952 | 22770 | 1166 | Fail |
| 0.0259 | 1860 | 22576 | 1213 | Fail |
| 0.0262 | 1777 | 22387 | 1259 | Fail |
| 0.0265 | 1691 | 22199 | 1312 | Fail |
| 0.0268 | 1618 | 22005 | 1360 | Fail |
| 0.0271 | 1561 | 21839 | 1399 | Fail |
| 0.0274 | 1482 | 21662 | 1461 | Fail |
| 0.0277 | 1407 | 21473 | 1526 | Fail |
| 0.0280 | 1338 | 21302 | 1592 | Fail |
| 0.0283 | 1270 | 21130 | 1663 | Fail |
| 0.0286 | 1217 | 20941 | 1720 | Fail |
| 0.0288 | 1163 | 20742 | 1783 | Fail |
| 0.0291 | 1105 | 20576 | 1862 | Fail |
| 0.0294 | 1055 | 20382 | 1931 | Fail |
| 0.0297 | 1007 | 20199 | 2005 | Fail |
| 0.0300 | 964 | 20016 | 2076 | Fail |
| 0.0303 | 920 | 19850 | 2157 | Fail |
| 0.0306 | 872 | 19673 | 2256 | Fail |
| 0.0309 | 815 | 19495 | 2392 | Fail |
| 0.0312 | 774 | 19313 | 2495 | Fail |
| 0.0315 | 738 | 19163 | 2596 | Fail |
| 0.0318 | 694 | 18980 | 2734 | Fail |
| 0.0321 | 637 | 18820 | 2954 | Fail |
| 0.0324 | 601 | 18648 | 3102 | Fail |
| 0.0327 | 556 | 18482 | 3324 | Fail |
| 0.0330 | 517 | 18321 | 3543 | Fail |
| 0.0333 | 478 | 18149 | 3796 | Fail |
| 0.0336 | 434 | 17994 | 4146 | Fail |
| 0.0339 | 394 | 17850 | 4530 | Fail |
| 0.0342 | 363 | 17689 | 4873 | Fail |
| 0.0344 | 340 | 17534 | 5157 | Fail |
| 0.0347 | 310 | 17363 | 5600 | Fail |
| 0.0350 | 297 | 17219 | 5797 | Fail |
| 0.0353 | 273 | 17052 | 6246 | Fail |
| 0.0356 | 252 | 16886 | 6700 | Fail |
| 0.0359 | 237 | 16748 | 7066 | Fail |
| 0.0362 | 223 | 16592 | 7440 | Fail |
| 0.0365 | 206 | 16432 | 7976 | Fail |
| 0.0368 | 195 | 16282 | 8349 | Fail |
| 0.0371 | 180 | 16127 | 8959 | Fail |

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

## Water Quality

Water Quality BMP Flow and Volume for POC #1

| | |
|---|---|
| On-line facility volume: | 0 acre-feet |
| On-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |
| Off-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |

# LID Report

| LID Technique | Used for Treatment ? | Total Volume Needs Treatment (ac-ft) | Volume Through Facility (ac-ft) | Infiltration Volume (ac-ft) | Cumulative Volume Infiltration Credit | Percent Volume Infiltrated | Water Quality | Percent Water Quality Treated | Comment |
|---|---|---|---|---|---|---|---|---|---|
| retention 1 POC | ☐ | 234.59 | | | ☐ | 0.00 | | | |
| Total Volume Infiltrated | | 234.59 | 0.00 | 0.00 | | 0.00 | 0.00 | 0% | No Treat. Credit |
| Compliance with LID Standard 8% of 2-yr to 50% of 2-yr | | | | | | | | | Duration Analysis Result = Failed |
| | | | | | | | | | |

# Model Default Modifications

Total of 0 changes have been made.

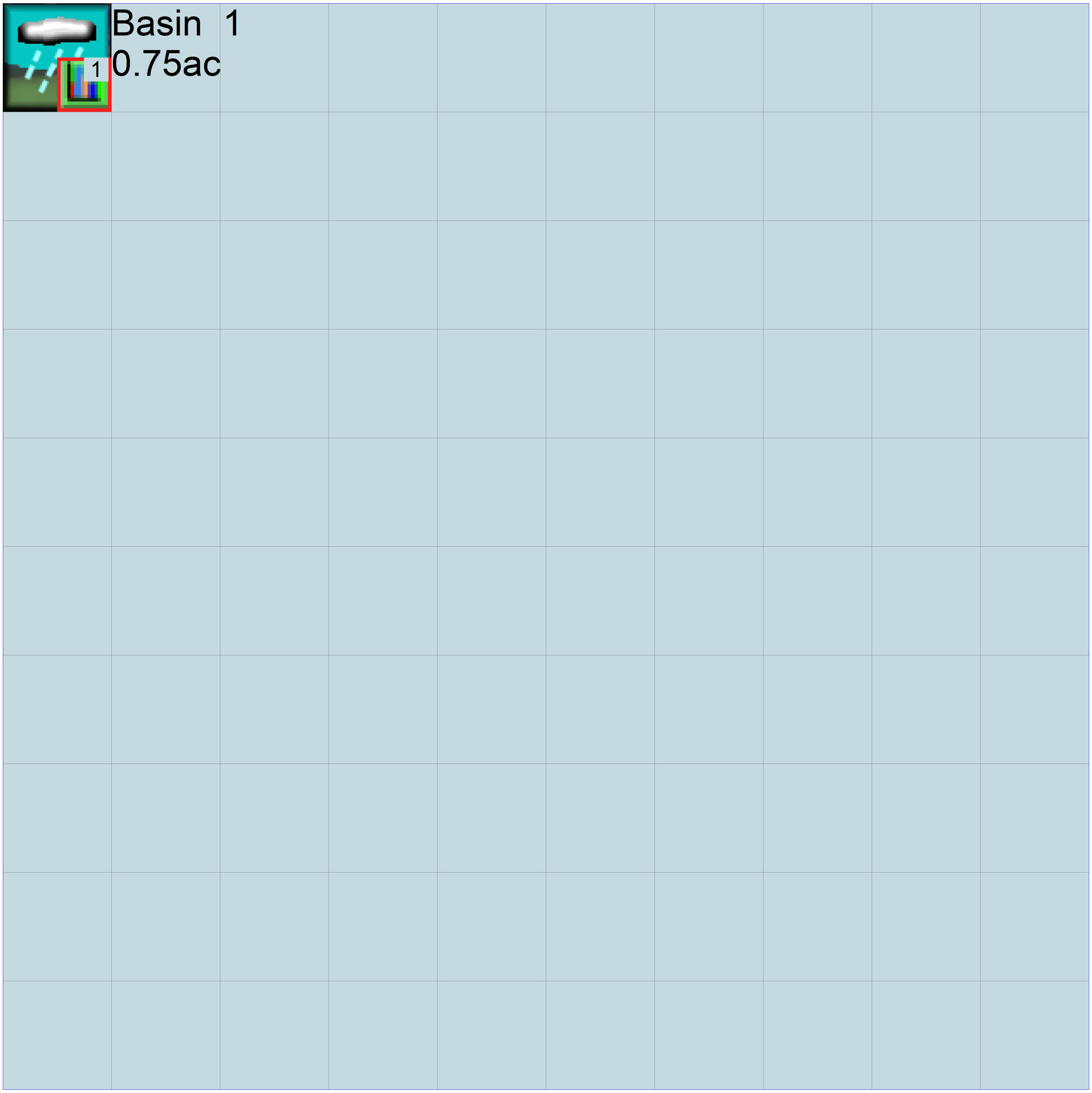
## PERLND Changes

No PERLND changes have been made.

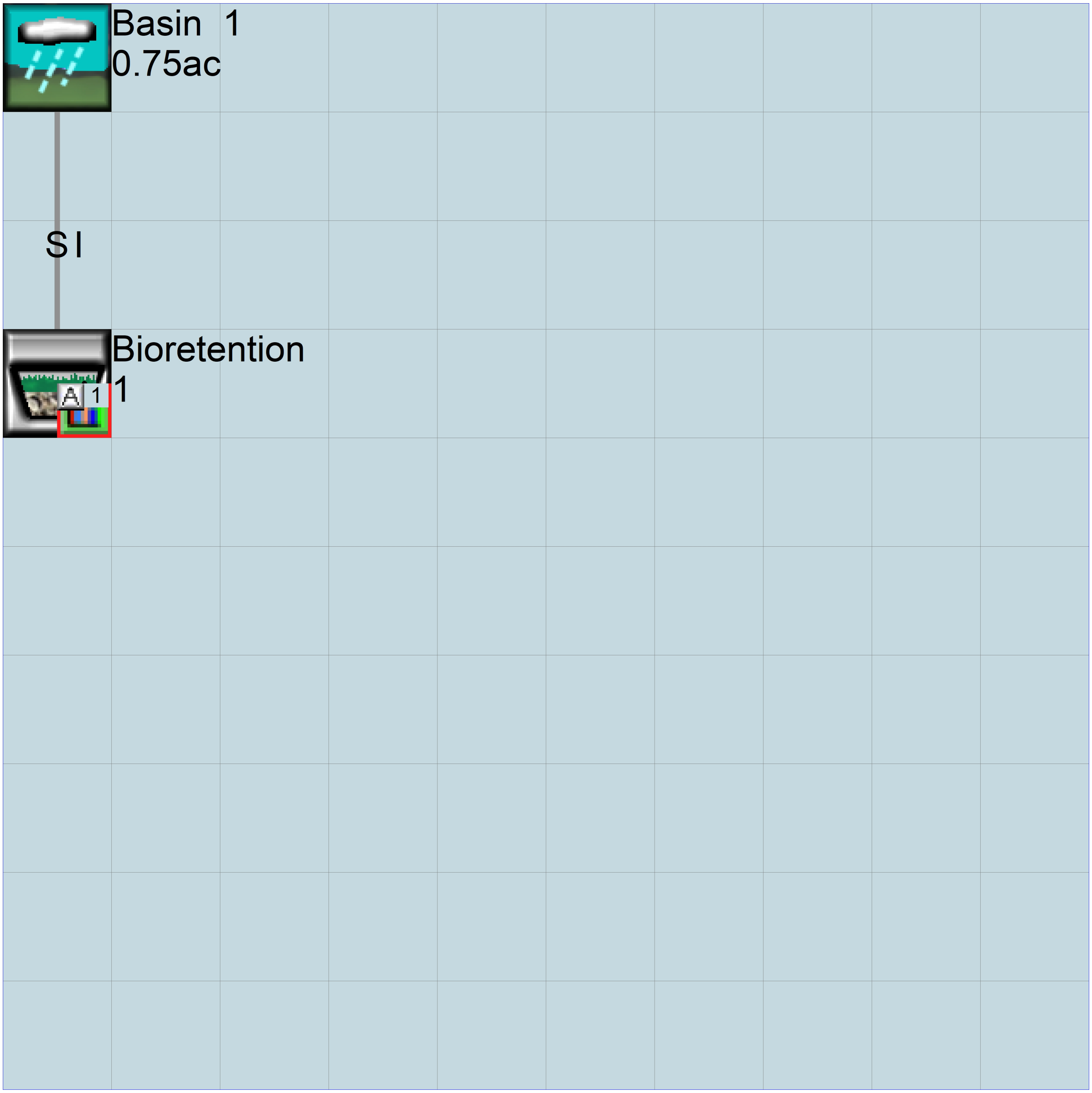
## IMPLND Changes

No IMPLND changes have been made.

# *Appendix*
## *Predeveloped Schematic*



*Mitigated Schematic*



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B-3 Parking Lot C Water Quality Calculations

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | 20221103 Parking Lot C |
| Site Name: | Pierce College Puyallup |
| Site Address: | |
| City: | |
| Report Date: | 1/3/2023 |
| Gage: | 38 IN CENTRAL |
| Data Start: | 10/01/1901 |
| Data End: | 09/30/2059 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.000 |
| Version Date: | 2021/08/18 |
| Version: | 4.2.18 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# Landuse Basin Data

## *Predeveloped Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Forest, Flat | 0.23 |
| Pervious Total | 0.23 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 0.23 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### Basin 2

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| A B, Pasture, Flat | 0.09 |
| Pervious Total | 0.09 |
| Impervious Land Use | acre |
| PARKING MOD | 0.14 |
| Impervious Total | 0.14 |
| Basin Total | 0.23 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Surface retention 2 | Surface retention 2 | |

# Routing Elements

## *Predeveloped Routing*

Bioretention 2 Mitigated

**Facility Name** Bioretention 2

| | Outlet 1 | Outlet 2 | Outlet 3 |
|---|---|---|---|
| **Downstream Connection** | 0 | 0 | 0 |

☑ **Use simple Bioretention** Quick Swale | Size Water Quality | Size Facility

☑ **Underdrain Used**

**Bioretention Bottom Elevation** 0

**Bioretention Dimensions**

| | |
|---|---|
| Bioretention Length (ft) | 16.800 |
| Bioretention Bottom Width (ft) | 1.850 |
| Freeboard (ft) | 0.500 |
| Over-road Flooding (ft) | 0.000 |
| Effective Total Depth (ft) | 3.5 |
| Bottom slope of bioretention.(0-1) | 0.000 |

☐ **Sidewall Invert Location.**

| | |
|---|---|
| Front and Back side slope (H/V) | 4.000 |
| Left Side Slope (H/V) | 4.000 |
| Right Side Slope (H/V) | 4.000 |

**Material Layers for**

| | Layer 1 | Layer 2 | Layer 3 |
|---|---|---|---|
| Depth (ft) | 1.500 | 1.000 | 0.000 |

| | |
|---|---|
| Soil Layer 1 | User: SMMWW 12in/h |
| Soil Layer 2 | GRAVEL |
| Soil Layer 3 | GRAVEL |

Edit Soil Types

KSat Safety Factor

○ None ○ 2 ◉ 4

**Underdrain Diameter(ft)** 0.5 **Offset(in)**

**Orifice Diameter(in)** 6 0

| | |
|---|---|
| Flow Through Underdrain (ac-ft) | 57.558 |
| Total Outflow (ac-ft) | 63.236 |
| Percent Through Underdrain | 91.02 |
| WQ Percent Filtered | 91.02 |

**Facility Dimension Diagram**

Riser Outlet Structure

| | |
|---|---|
| Riser Height Above bioretention surface (ft) | 0.5 |
| Riser Diameter (in) | 24 |
| Riser Type | Flat |

| **Orifice Number** | **Diameter (in)** | **Height (ft)** |
|---|---|---|
| 1 | 0 | 0 |
| 2 | 0 | 0 |
| 3 | 0 | 0 |

Bioretention Volume at Riser Head (ac-ft) .032

**Show Bioretention** Open Table

**Native Infiltration** NO

| | |
|---|---|
| Total Inflow ac-ft | 65.611 |
| Precipitation on Facility (acre-ft) | 8.144 |
| Evaporation from Facility (acre-ft) | 2.375 |

## *Mitigated Routing*

## Bioretention 2

| | |
|---|---|
| Bottom Length: | 16.80 ft. |
| Bottom Width: | 1.85 ft. |
| Material thickness of first layer: | 1.5 |
| Material type for first layer: | SMMWW 12in/hr |
| Material thickness of second layer: | 1 |
| Material type for second layer: | GRAVEL |
| Material thickness of third layer: | 0 |
| Material type for third layer: | GRAVEL |
| Underdrain used | |
| Underdrain Diameter (feet): | 0.5 |
| Orifice Diameter (in.): | 6 |
| Offset (in.): | 0 |
| Flow Through Underdrain (ac-ft.): | 57.558 |
| Total Outflow (ac-ft.): | 63.236 |
| Percent Through Underdrain: | 91.02 |

Discharge Structure

Riser Height: 0.5 ft.
Riser Diameter: 24 in.

Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.0185 | 0.0000 | 0.0000 | 0.0000 |
| 0.0385 | 0.0185 | 0.0000 | 0.0000 | 0.0000 |
| 0.0769 | 0.0180 | 0.0000 | 0.0000 | 0.0000 |
| 0.1154 | 0.0176 | 0.0000 | 0.0000 | 0.0000 |
| 0.1538 | 0.0172 | 0.0001 | 0.0000 | 0.0000 |
| 0.1923 | 0.0168 | 0.0001 | 0.0000 | 0.0000 |
| 0.2308 | 0.0164 | 0.0001 | 0.0000 | 0.0000 |
| 0.2692 | 0.0161 | 0.0001 | 0.0000 | 0.0000 |
| 0.3077 | 0.0157 | 0.0002 | 0.0000 | 0.0000 |
| 0.3462 | 0.0153 | 0.0002 | 0.0000 | 0.0000 |
| 0.3846 | 0.0149 | 0.0003 | 0.0001 | 0.0000 |
| 0.4231 | 0.0145 | 0.0003 | 0.0001 | 0.0000 |
| 0.4615 | 0.0142 | 0.0003 | 0.0001 | 0.0000 |
| 0.5000 | 0.0138 | 0.0004 | 0.0001 | 0.0000 |
| 0.5385 | 0.0134 | 0.0004 | 0.0001 | 0.0000 |
| 0.5769 | 0.0131 | 0.0005 | 0.0002 | 0.0000 |
| 0.6154 | 0.0127 | 0.0005 | 0.0002 | 0.0000 |
| 0.6538 | 0.0124 | 0.0006 | 0.0002 | 0.0000 |
| 0.6923 | 0.0120 | 0.0007 | 0.0002 | 0.0000 |
| 0.7308 | 0.0117 | 0.0007 | 0.0003 | 0.0000 |
| 0.7692 | 0.0114 | 0.0008 | 0.0003 | 0.0000 |
| 0.8077 | 0.0110 | 0.0009 | 0.0003 | 0.0000 |
| 0.8462 | 0.0107 | 0.0010 | 0.0004 | 0.0000 |
| 0.8846 | 0.0104 | 0.0011 | 0.0004 | 0.0000 |
| 0.9231 | 0.0101 | 0.0011 | 0.0005 | 0.0000 |
| 0.9615 | 0.0098 | 0.0012 | 0.0005 | 0.0000 |
| 1.0000 | 0.0095 | 0.0013 | 0.0005 | 0.0000 |
| 1.0385 | 0.0092 | 0.0014 | 0.0006 | 0.0000 |
| 1.0769 | 0.0089 | 0.0015 | 0.0007 | 0.0000 |

| | | | | |
|---|---|---|---|---|
| 1.1154 | 0.0086 | 0.0016 | 0.0007 | 0.0000 |
| 1.1538 | 0.0083 | 0.0018 | 0.0008 | 0.0000 |
| 1.1923 | 0.0080 | 0.0019 | 0.0009 | 0.0000 |
| 1.2308 | 0.0077 | 0.0020 | 0.0010 | 0.0000 |
| 1.2692 | 0.0074 | 0.0021 | 0.0010 | 0.0000 |
| 1.3077 | 0.0072 | 0.0023 | 0.0011 | 0.0000 |
| 1.3462 | 0.0069 | 0.0024 | 0.0011 | 0.0000 |
| 1.3846 | 0.0066 | 0.0025 | 0.0012 | 0.0000 |
| 1.4231 | 0.0064 | 0.0027 | 0.0013 | 0.0000 |
| 1.4615 | 0.0061 | 0.0028 | 0.0014 | 0.0000 |
| 1.5000 | 0.0059 | 0.0030 | 0.0016 | 0.0000 |
| 1.5385 | 0.0056 | 0.0031 | 0.0017 | 0.0000 |
| 1.5769 | 0.0054 | 0.0033 | 0.0017 | 0.0000 |
| 1.6154 | 0.0051 | 0.0035 | 0.0018 | 0.0000 |
| 1.6538 | 0.0049 | 0.0036 | 0.0019 | 0.0000 |
| 1.6923 | 0.0047 | 0.0038 | 0.0020 | 0.0000 |
| 1.7308 | 0.0044 | 0.0040 | 0.0029 | 0.0000 |
| 1.7692 | 0.0042 | 0.0041 | 0.0029 | 0.0000 |
| 1.8077 | 0.0040 | 0.0043 | 0.0029 | 0.0000 |
| 1.8462 | 0.0038 | 0.0045 | 0.0029 | 0.0000 |
| 1.8846 | 0.0036 | 0.0047 | 0.0029 | 0.0000 |
| 1.9231 | 0.0034 | 0.0049 | 0.0029 | 0.0000 |
| 1.9615 | 0.0032 | 0.0051 | 0.0029 | 0.0000 |
| 2.0000 | 0.0030 | 0.0053 | 0.0029 | 0.0000 |
| 2.0385 | 0.0028 | 0.0055 | 0.0029 | 0.0000 |
| 2.0769 | 0.0026 | 0.0058 | 0.0029 | 0.0000 |
| 2.1154 | 0.0024 | 0.0060 | 0.0029 | 0.0000 |
| 2.1538 | 0.0022 | 0.0062 | 0.0029 | 0.0000 |
| 2.1923 | 0.0021 | 0.0065 | 0.0029 | 0.0000 |
| 2.2308 | 0.0019 | 0.0067 | 0.0029 | 0.0000 |
| 2.2692 | 0.0017 | 0.0070 | 0.0029 | 0.0000 |
| 2.3077 | 0.0016 | 0.0072 | 0.0029 | 0.0000 |
| 2.3462 | 0.0014 | 0.0075 | 0.0029 | 0.0000 |
| 2.3846 | 0.0013 | 0.0078 | 0.0029 | 0.0000 |
| 2.4231 | 0.0011 | 0.0080 | 0.0029 | 0.0000 |
| 2.4615 | 0.0010 | 0.0083 | 0.0029 | 0.0000 |
| 2.5000 | 0.0008 | 0.0086 | 0.0029 | 0.0000 |
| 2.5000 | 0.0007 | 0.0086 | 0.0029 | 0.0000 |

Bioretention Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | To Amended(cfs) | Infilt(cfs) |
|---|---|---|---|---|---|
| 2.5000 | 0.018459 | 0.008622 | 0.0000 | 0.0022 | 0.0000 |
| 2.5385 | 0.018876 | 0.009340 | 0.0000 | 0.0022 | 0.0000 |
| 2.5769 | 0.019296 | 0.010074 | 0.0000 | 0.0023 | 0.0000 |
| 2.6154 | 0.019722 | 0.010824 | 0.0000 | 0.0023 | 0.0000 |
| 2.6538 | 0.020151 | 0.011591 | 0.0000 | 0.0024 | 0.0000 |
| 2.6923 | 0.020585 | 0.012374 | 0.0000 | 0.0024 | 0.0000 |
| 2.7308 | 0.021023 | 0.013175 | 0.0000 | 0.0025 | 0.0000 |
| 2.7692 | 0.021466 | 0.013992 | 0.0000 | 0.0025 | 0.0000 |
| 2.8077 | 0.021912 | 0.014826 | 0.0000 | 0.0026 | 0.0000 |
| 2.8462 | 0.022364 | 0.015677 | 0.0000 | 0.0027 | 0.0000 |
| 2.8846 | 0.022819 | 0.016546 | 0.0000 | 0.0027 | 0.0000 |
| 2.9231 | 0.023279 | 0.017433 | 0.0000 | 0.0028 | 0.0000 |
| 2.9615 | 0.023744 | 0.018337 | 0.0000 | 0.0028 | 0.0000 |
| 3.0000 | 0.024212 | 0.019259 | 0.0000 | 0.0029 | 0.0000 |
| 3.0385 | 0.024685 | 0.020200 | 0.1601 | 0.0029 | 0.0000 |
| 3.0769 | 0.025162 | 0.021158 | 0.4524 | 0.0029 | 0.0000 |
| 3.1154 | 0.025644 | 0.022135 | 0.8304 | 0.0029 | 0.0000 |

| | | | | | |
|---|---|---|---|---|---|
| 3.1538 | 0.026130 | 0.023131 | 1.2766 | 0.0029 | 0.0000 |
| 3.1923 | 0.026620 | 0.024145 | 1.7799 | 0.0029 | 0.0000 |
| 3.2308 | 0.027115 | 0.025179 | 2.3316 | 0.0029 | 0.0000 |
| 3.2692 | 0.027614 | 0.026231 | 2.9237 | 0.0029 | 0.0000 |
| 3.3077 | 0.028118 | 0.027303 | 3.5484 | 0.0029 | 0.0000 |
| 3.3462 | 0.028625 | 0.028394 | 4.1981 | 0.0029 | 0.0000 |
| 3.3846 | 0.029137 | 0.029505 | 4.8649 | 0.0029 | 0.0000 |
| 3.4231 | 0.029654 | 0.030636 | 5.5408 | 0.0029 | 0.0000 |
| 3.4615 | 0.030175 | 0.031786 | 6.2177 | 0.0029 | 0.0000 |
| 3.5000 | 0.030700 | 0.032957 | 6.8875 | 0.0029 | 0.0000 |

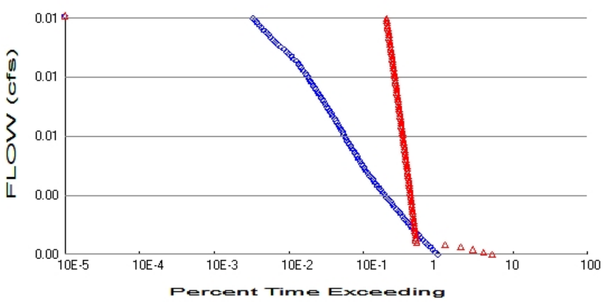
## Surface retention 2

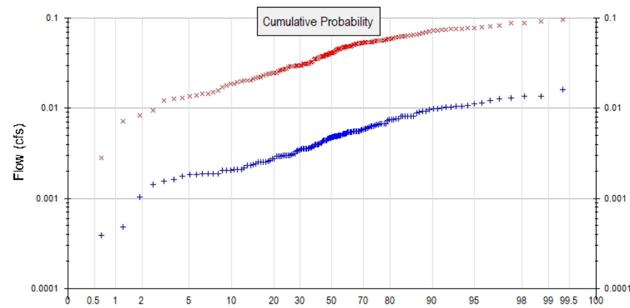
Element Flows To:

| | |
|---|---|
| Outlet 1 | Outlet 2 |
| | Bioretention 2 |

# *Analysis Results*

## *POC 1*




+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

| | |
|---|---|
| Total Pervious Area: | 0.23 |
| Total Impervious Area: | 0 |

Mitigated Landuse Totals for POC #1

| | |
|---|---|
| Total Pervious Area: | 0.09 |
| Total Impervious Area: | 0.14 |

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.004847 |
| 5 year | 0.00754 |
| 10 year | 0.009004 |
| 25 year | 0.010493 |
| 50 year | 0.011378 |
| 100 year | 0.012106 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.040983 |
| 5 year | 0.061748 |
| 10 year | 0.072792 |
| 25 year | 0.083898 |
| 50 year | 0.090445 |
| 100 year | 0.0958 |

## Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| **Year** | **Predeveloped** | **Mitigated** |
|---|---|---|
| 1902 | 0.004 | 0.045 |
| 1903 | 0.003 | 0.020 |
| 1904 | 0.005 | 0.036 |
| 1905 | 0.002 | 0.040 |
| 1906 | 0.001 | 0.013 |
| 1907 | 0.007 | 0.057 |
| 1908 | 0.006 | 0.031 |
| 1909 | 0.005 | 0.028 |
| 1910 | 0.008 | 0.057 |
| 1911 | 0.005 | 0.026 |

| | | |
|---|---|---|
| 1912 | 0.016 | 0.095 |
| 1913 | 0.008 | 0.031 |
| 1914 | 0.002 | 0.054 |
| 1915 | 0.003 | 0.040 |
| 1916 | 0.005 | 0.075 |
| 1917 | 0.002 | 0.014 |
| 1918 | 0.005 | 0.036 |
| 1919 | 0.004 | 0.038 |
| 1920 | 0.005 | 0.026 |
| 1921 | 0.006 | 0.041 |
| 1922 | 0.006 | 0.043 |
| 1923 | 0.004 | 0.029 |
| 1924 | 0.002 | 0.019 |
| 1925 | 0.003 | 0.035 |
| 1926 | 0.005 | 0.041 |
| 1927 | 0.003 | 0.037 |
| 1928 | 0.004 | 0.024 |
| 1929 | 0.008 | 0.076 |
| 1930 | 0.005 | 0.029 |
| 1931 | 0.005 | 0.038 |
| 1932 | 0.004 | 0.045 |
| 1933 | 0.003 | 0.046 |
| 1934 | 0.010 | 0.070 |
| 1935 | 0.005 | 0.031 |
| 1936 | 0.004 | 0.051 |
| 1937 | 0.007 | 0.063 |
| 1938 | 0.004 | 0.041 |
| 1939 | 0.000 | 0.049 |
| 1940 | 0.004 | 0.052 |
| 1941 | 0.002 | 0.007 |
| 1942 | 0.007 | 0.066 |
| 1943 | 0.003 | 0.059 |
| 1944 | 0.006 | 0.088 |
| 1945 | 0.006 | 0.045 |
| 1946 | 0.003 | 0.017 |
| 1947 | 0.002 | 0.038 |
| 1948 | 0.010 | 0.054 |
| 1949 | 0.009 | 0.073 |
| 1950 | 0.003 | 0.022 |
| 1951 | 0.003 | 0.048 |
| 1952 | 0.014 | 0.093 |
| 1953 | 0.012 | 0.078 |
| 1954 | 0.004 | 0.032 |
| 1955 | 0.004 | 0.019 |
| 1956 | 0.002 | 0.003 |
| 1957 | 0.006 | 0.033 |
| 1958 | 0.013 | 0.054 |
| 1959 | 0.008 | 0.066 |
| 1960 | 0.002 | 0.046 |
| 1961 | 0.008 | 0.075 |
| 1962 | 0.004 | 0.047 |
| 1963 | 0.002 | 0.021 |
| 1964 | 0.002 | 0.030 |
| 1965 | 0.009 | 0.057 |
| 1966 | 0.003 | 0.022 |
| 1967 | 0.004 | 0.042 |
| 1968 | 0.004 | 0.037 |
| 1969 | 0.004 | 0.024 |

| | | |
|---|---|---|
| 1970 | 0.006 | 0.047 |
| 1971 | 0.010 | 0.054 |
| 1972 | 0.006 | 0.068 |
| 1973 | 0.008 | 0.081 |
| 1974 | 0.004 | 0.063 |
| 1975 | 0.010 | 0.076 |
| 1976 | 0.005 | 0.053 |
| 1977 | 0.002 | 0.019 |
| 1978 | 0.009 | 0.061 |
| 1979 | 0.003 | 0.021 |
| 1980 | 0.005 | 0.030 |
| 1981 | 0.005 | 0.024 |
| 1982 | 0.002 | 0.042 |
| 1983 | 0.008 | 0.065 |
| 1984 | 0.003 | 0.051 |
| 1985 | 0.005 | 0.030 |
| 1986 | 0.005 | 0.038 |
| 1987 | 0.009 | 0.059 |
| 1988 | 0.006 | 0.038 |
| 1989 | 0.005 | 0.035 |
| 1990 | 0.006 | 0.049 |
| 1991 | 0.005 | 0.048 |
| 1992 | 0.007 | 0.054 |
| 1993 | 0.006 | 0.031 |
| 1994 | 0.010 | 0.053 |
| 1995 | 0.002 | 0.027 |
| 1996 | 0.011 | 0.047 |
| 1997 | 0.004 | 0.025 |
| 1998 | 0.005 | 0.056 |
| 1999 | 0.000 | 0.012 |
| 2000 | 0.004 | 0.055 |
| 2001 | 0.002 | 0.013 |
| 2002 | 0.007 | 0.079 |
| 2003 | 0.006 | 0.049 |
| 2004 | 0.005 | 0.061 |
| 2005 | 0.010 | 0.078 |
| 2006 | 0.003 | 0.016 |
| 2007 | 0.003 | 0.071 |
| 2008 | 0.005 | 0.030 |
| 2009 | 0.004 | 0.018 |
| 2010 | 0.003 | 0.060 |
| 2011 | 0.002 | 0.015 |
| 2012 | 0.004 | 0.052 |
| 2013 | 0.003 | 0.031 |
| 2014 | 0.002 | 0.020 |
| 2015 | 0.004 | 0.039 |
| 2016 | 0.002 | 0.015 |
| 2017 | 0.007 | 0.083 |
| 2018 | 0.014 | 0.061 |
| 2019 | 0.013 | 0.076 |
| 2020 | 0.004 | 0.021 |
| 2021 | 0.007 | 0.051 |
| 2022 | 0.003 | 0.024 |
| 2023 | 0.006 | 0.068 |
| 2024 | 0.011 | 0.089 |
| 2025 | 0.005 | 0.027 |
| 2026 | 0.008 | 0.043 |
| 2027 | 0.003 | 0.030 |

| | | |
|---|---|---|
| 2028 | 0.003 | 0.014 |
| 2029 | 0.006 | 0.033 |
| 2030 | 0.010 | 0.053 |
| 2031 | 0.003 | 0.023 |
| 2032 | 0.002 | 0.003 |
| 2033 | 0.003 | 0.013 |
| 2034 | 0.003 | 0.028 |
| 2035 | 0.012 | 0.057 |
| 2036 | 0.006 | 0.040 |
| 2037 | 0.001 | 0.035 |
| 2038 | 0.005 | 0.058 |
| 2039 | 0.000 | 0.010 |
| 2040 | 0.003 | 0.041 |
| 2041 | 0.004 | 0.024 |
| 2042 | 0.011 | 0.063 |
| 2043 | 0.005 | 0.054 |
| 2044 | 0.007 | 0.049 |
| 2045 | 0.005 | 0.029 |
| 2046 | 0.006 | 0.039 |
| 2047 | 0.004 | 0.027 |
| 2048 | 0.006 | 0.047 |
| 2049 | 0.005 | 0.049 |
| 2050 | 0.004 | 0.036 |
| 2051 | 0.005 | 0.073 |
| 2052 | 0.003 | 0.032 |
| 2053 | 0.005 | 0.048 |
| 2054 | 0.007 | 0.054 |
| 2055 | 0.002 | 0.008 |
| 2056 | 0.002 | 0.064 |
| 2057 | 0.004 | 0.022 |
| 2058 | 0.005 | 0.029 |
| 2059 | 0.008 | 0.055 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated.  POC #1

| **Rank** | **Predeveloped** | **Mitigated** |
|---|---|---|
| 1 | 0.0161 | 0.0954 |
| 2 | 0.0136 | 0.0926 |
| 3 | 0.0136 | 0.0891 |
| 4 | 0.0131 | 0.0884 |
| 5 | 0.0127 | 0.0829 |
| 6 | 0.0123 | 0.0813 |
| 7 | 0.0116 | 0.0790 |
| 8 | 0.0112 | 0.0785 |
| 9 | 0.0107 | 0.0776 |
| 10 | 0.0106 | 0.0764 |
| 11 | 0.0104 | 0.0757 |
| 12 | 0.0103 | 0.0756 |
| 13 | 0.0102 | 0.0748 |
| 14 | 0.0101 | 0.0747 |
| 15 | 0.0100 | 0.0735 |
| 16 | 0.0098 | 0.0731 |
| 17 | 0.0097 | 0.0714 |
| 18 | 0.0093 | 0.0704 |
| 19 | 0.0092 | 0.0681 |
| 20 | 0.0091 | 0.0677 |
| 21 | 0.0089 | 0.0660 |
| 22 | 0.0082 | 0.0655 |

| | | |
|---|---|---|
| 23 | 0.0082 | 0.0648 |
| 24 | 0.0082 | 0.0639 |
| 25 | 0.0082 | 0.0632 |
| 26 | 0.0081 | 0.0630 |
| 27 | 0.0081 | 0.0625 |
| 28 | 0.0077 | 0.0615 |
| 29 | 0.0077 | 0.0612 |
| 30 | 0.0075 | 0.0606 |
| 31 | 0.0075 | 0.0596 |
| 32 | 0.0074 | 0.0592 |
| 33 | 0.0073 | 0.0589 |
| 34 | 0.0068 | 0.0576 |
| 35 | 0.0068 | 0.0570 |
| 36 | 0.0067 | 0.0569 |
| 37 | 0.0067 | 0.0567 |
| 38 | 0.0067 | 0.0567 |
| 39 | 0.0065 | 0.0559 |
| 40 | 0.0065 | 0.0552 |
| 41 | 0.0064 | 0.0549 |
| 42 | 0.0063 | 0.0544 |
| 43 | 0.0063 | 0.0544 |
| 44 | 0.0063 | 0.0543 |
| 45 | 0.0060 | 0.0539 |
| 46 | 0.0060 | 0.0539 |
| 47 | 0.0059 | 0.0536 |
| 48 | 0.0059 | 0.0535 |
| 49 | 0.0058 | 0.0531 |
| 50 | 0.0057 | 0.0529 |
| 51 | 0.0056 | 0.0528 |
| 52 | 0.0055 | 0.0525 |
| 53 | 0.0055 | 0.0524 |
| 54 | 0.0055 | 0.0514 |
| 55 | 0.0055 | 0.0513 |
| 56 | 0.0055 | 0.0506 |
| 57 | 0.0055 | 0.0493 |
| 58 | 0.0054 | 0.0490 |
| 59 | 0.0054 | 0.0488 |
| 60 | 0.0054 | 0.0487 |
| 61 | 0.0054 | 0.0486 |
| 62 | 0.0053 | 0.0483 |
| 63 | 0.0053 | 0.0481 |
| 64 | 0.0052 | 0.0481 |
| 65 | 0.0052 | 0.0472 |
| 66 | 0.0052 | 0.0472 |
| 67 | 0.0051 | 0.0470 |
| 68 | 0.0050 | 0.0466 |
| 69 | 0.0050 | 0.0457 |
| 70 | 0.0050 | 0.0455 |
| 71 | 0.0050 | 0.0453 |
| 72 | 0.0049 | 0.0450 |
| 73 | 0.0049 | 0.0447 |
| 74 | 0.0049 | 0.0435 |
| 75 | 0.0049 | 0.0425 |
| 76 | 0.0049 | 0.0420 |
| 77 | 0.0048 | 0.0417 |
| 78 | 0.0048 | 0.0412 |
| 79 | 0.0048 | 0.0411 |
| 80 | 0.0047 | 0.0407 |

| | | |
|---|---|---|
| 81 | 0.0047 | 0.0407 |
| 82 | 0.0047 | 0.0404 |
| 83 | 0.0046 | 0.0395 |
| 84 | 0.0046 | 0.0395 |
| 85 | 0.0044 | 0.0394 |
| 86 | 0.0044 | 0.0391 |
| 87 | 0.0044 | 0.0384 |
| 88 | 0.0044 | 0.0380 |
| 89 | 0.0044 | 0.0380 |
| 90 | 0.0043 | 0.0378 |
| 91 | 0.0041 | 0.0378 |
| 92 | 0.0041 | 0.0370 |
| 93 | 0.0041 | 0.0367 |
| 94 | 0.0040 | 0.0362 |
| 95 | 0.0040 | 0.0359 |
| 96 | 0.0040 | 0.0356 |
| 97 | 0.0039 | 0.0353 |
| 98 | 0.0039 | 0.0353 |
| 99 | 0.0038 | 0.0348 |
| 100 | 0.0038 | 0.0332 |
| 101 | 0.0037 | 0.0328 |
| 102 | 0.0037 | 0.0322 |
| 103 | 0.0036 | 0.0315 |
| 104 | 0.0036 | 0.0315 |
| 105 | 0.0036 | 0.0314 |
| 106 | 0.0036 | 0.0314 |
| 107 | 0.0036 | 0.0310 |
| 108 | 0.0035 | 0.0310 |
| 109 | 0.0035 | 0.0302 |
| 110 | 0.0035 | 0.0301 |
| 111 | 0.0034 | 0.0300 |
| 112 | 0.0034 | 0.0298 |
| 113 | 0.0033 | 0.0298 |
| 114 | 0.0031 | 0.0294 |
| 115 | 0.0031 | 0.0293 |
| 116 | 0.0030 | 0.0292 |
| 117 | 0.0030 | 0.0290 |
| 118 | 0.0030 | 0.0285 |
| 119 | 0.0030 | 0.0276 |
| 120 | 0.0030 | 0.0274 |
| 121 | 0.0030 | 0.0269 |
| 122 | 0.0030 | 0.0267 |
| 123 | 0.0030 | 0.0264 |
| 124 | 0.0029 | 0.0256 |
| 125 | 0.0029 | 0.0248 |
| 126 | 0.0028 | 0.0245 |
| 127 | 0.0028 | 0.0245 |
| 128 | 0.0027 | 0.0243 |
| 129 | 0.0026 | 0.0240 |
| 130 | 0.0025 | 0.0238 |
| 131 | 0.0025 | 0.0229 |
| 132 | 0.0025 | 0.0224 |
| 133 | 0.0025 | 0.0222 |
| 134 | 0.0024 | 0.0219 |
| 135 | 0.0024 | 0.0214 |
| 136 | 0.0023 | 0.0206 |
| 137 | 0.0023 | 0.0205 |
| 138 | 0.0022 | 0.0202 |

| | | |
|---|---|---|
| 139 | 0.0021 | 0.0201 |
| 140 | 0.0021 | 0.0194 |
| 141 | 0.0021 | 0.0188 |
| 142 | 0.0020 | 0.0186 |
| 143 | 0.0020 | 0.0180 |
| 144 | 0.0020 | 0.0171 |
| 145 | 0.0019 | 0.0158 |
| 146 | 0.0019 | 0.0153 |
| 147 | 0.0019 | 0.0145 |
| 148 | 0.0019 | 0.0145 |
| 149 | 0.0018 | 0.0140 |
| 150 | 0.0018 | 0.0135 |
| 151 | 0.0018 | 0.0131 |
| 152 | 0.0016 | 0.0128 |
| 153 | 0.0016 | 0.0122 |
| 154 | 0.0014 | 0.0096 |
| 155 | 0.0010 | 0.0083 |
| 156 | 0.0005 | 0.0071 |
| 157 | 0.0004 | 0.0028 |
| 158 | 0.0002 | 0.0028 |

## Duration Flows

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0024 | 54298 | 290189 | 534 | Fail |
| 0.0025 | 50187 | 223375 | 445 | Fail |
| 0.0026 | 46575 | 162545 | 348 | Fail |
| 0.0027 | 43334 | 111134 | 256 | Fail |
| 0.0028 | 40260 | 67866 | 168 | Fail |
| 0.0029 | 37462 | 28542 | 76 | Pass |
| 0.0030 | 34908 | 27905 | 79 | Pass |
| 0.0031 | 32576 | 27673 | 84 | Pass |
| 0.0031 | 30315 | 27423 | 90 | Pass |
| 0.0032 | 28265 | 27146 | 96 | Pass |
| 0.0033 | 26437 | 26886 | 101 | Fail |
| 0.0034 | 24786 | 26670 | 107 | Fail |
| 0.0035 | 23296 | 26443 | 113 | Fail |
| 0.0036 | 21928 | 26182 | 119 | Fail |
| 0.0037 | 20642 | 25939 | 125 | Fail |
| 0.0038 | 19412 | 25711 | 132 | Fail |
| 0.0039 | 18288 | 25501 | 139 | Fail |
| 0.0040 | 17219 | 25268 | 146 | Fail |
| 0.0041 | 16160 | 25047 | 154 | Fail |
| 0.0041 | 15141 | 24819 | 163 | Fail |
| 0.0042 | 14271 | 24587 | 172 | Fail |
| 0.0043 | 13451 | 24376 | 181 | Fail |
| 0.0044 | 12665 | 24155 | 190 | Fail |
| 0.0045 | 11944 | 23933 | 200 | Fail |
| 0.0046 | 11235 | 23717 | 211 | Fail |
| 0.0047 | 10565 | 23506 | 222 | Fail |
| 0.0048 | 9972 | 23313 | 233 | Fail |
| 0.0049 | 9374 | 23108 | 246 | Fail |
| 0.0050 | 8842 | 22886 | 258 | Fail |
| 0.0050 | 8332 | 22664 | 272 | Fail |
| 0.0051 | 7861 | 22448 | 285 | Fail |
| 0.0052 | 7462 | 22243 | 298 | Fail |
| 0.0053 | 7030 | 22033 | 313 | Fail |
| 0.0054 | 6609 | 21833 | 330 | Fail |
| 0.0055 | 6277 | 21623 | 344 | Fail |
| 0.0056 | 5978 | 21423 | 358 | Fail |
| 0.0057 | 5701 | 21218 | 372 | Fail |
| 0.0058 | 5437 | 21013 | 386 | Fail |
| 0.0059 | 5197 | 20797 | 400 | Fail |
| 0.0060 | 4940 | 20598 | 416 | Fail |
| 0.0060 | 4703 | 20387 | 433 | Fail |
| 0.0061 | 4513 | 20182 | 447 | Fail |
| 0.0062 | 4335 | 19977 | 460 | Fail |
| 0.0063 | 4159 | 19795 | 475 | Fail |
| 0.0064 | 3957 | 19590 | 495 | Fail |
| 0.0065 | 3766 | 19385 | 514 | Fail |
| 0.0066 | 3577 | 19207 | 536 | Fail |
| 0.0067 | 3414 | 19008 | 556 | Fail |
| 0.0068 | 3259 | 18847 | 578 | Fail |
| 0.0069 | 3134 | 18642 | 594 | Fail |
| 0.0069 | 3027 | 18465 | 610 | Fail |
| 0.0070 | 2926 | 18277 | 624 | Fail |
| 0.0071 | 2814 | 18116 | 643 | Fail |
| 0.0072 | 2682 | 17933 | 668 | Fail |

| | | | | |
|---|---|---|---|---|
| 0.0073 | 2555 | 17761 | 695 | Fail |
| 0.0074 | 2451 | 17590 | 717 | Fail |
| 0.0075 | 2359 | 17435 | 739 | Fail |
| 0.0076 | 2256 | 17230 | 763 | Fail |
| 0.0077 | 2140 | 17074 | 797 | Fail |
| 0.0078 | 2038 | 16908 | 829 | Fail |
| 0.0079 | 1952 | 16753 | 858 | Fail |
| 0.0079 | 1860 | 16587 | 891 | Fail |
| 0.0080 | 1778 | 16432 | 924 | Fail |
| 0.0081 | 1690 | 16266 | 962 | Fail |
| 0.0082 | 1619 | 16116 | 995 | Fail |
| 0.0083 | 1561 | 15961 | 1022 | Fail |
| 0.0084 | 1482 | 15817 | 1067 | Fail |
| 0.0085 | 1407 | 15673 | 1113 | Fail |
| 0.0086 | 1338 | 15501 | 1158 | Fail |
| 0.0087 | 1270 | 15340 | 1207 | Fail |
| 0.0088 | 1218 | 15191 | 1247 | Fail |
| 0.0088 | 1163 | 15019 | 1291 | Fail |
| 0.0089 | 1103 | 14858 | 1347 | Fail |
| 0.0090 | 1055 | 14698 | 1393 | Fail |
| 0.0091 | 1006 | 14559 | 1447 | Fail |
| 0.0092 | 963 | 14404 | 1495 | Fail |
| 0.0093 | 919 | 14244 | 1549 | Fail |
| 0.0094 | 872 | 14077 | 1614 | Fail |
| 0.0095 | 814 | 13928 | 1711 | Fail |
| 0.0096 | 772 | 13795 | 1786 | Fail |
| 0.0097 | 737 | 13651 | 1852 | Fail |
| 0.0097 | 694 | 13529 | 1949 | Fail |
| 0.0098 | 636 | 13368 | 2101 | Fail |
| 0.0099 | 601 | 13235 | 2202 | Fail |
| 0.0100 | 555 | 13091 | 2358 | Fail |
| 0.0101 | 517 | 12964 | 2507 | Fail |
| 0.0102 | 478 | 12825 | 2683 | Fail |
| 0.0103 | 434 | 12692 | 2924 | Fail |
| 0.0104 | 394 | 12543 | 3183 | Fail |
| 0.0105 | 363 | 12426 | 3423 | Fail |
| 0.0106 | 341 | 12299 | 3606 | Fail |
| 0.0107 | 311 | 12183 | 3917 | Fail |
| 0.0107 | 297 | 12055 | 4058 | Fail |
| 0.0108 | 273 | 11939 | 4373 | Fail |
| 0.0109 | 253 | 11822 | 4672 | Fail |
| 0.0110 | 237 | 11701 | 4937 | Fail |
| 0.0111 | 224 | 11590 | 5174 | Fail |
| 0.0112 | 207 | 11479 | 5545 | Fail |
| 0.0113 | 195 | 11352 | 5821 | Fail |
| 0.0114 | 181 | 11241 | 6210 | Fail |

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

## Water Quality

Water Quality BMP Flow and Volume for POC #1

| | |
|---|---|
| On-line facility volume: | 0.008 acre-feet |
| On-line facility target flow: | 0.0044 cfs. |
| Adjusted for 15 min: | 0.0044 cfs. |
| Off-line facility target flow: | 0.0024 cfs. |
| Adjusted for 15 min: | 0.0024 cfs. |

# LID Report

| LID Technique | Used for Treatment ? | Total Volume Needs Treatment (ac-ft) | Volume Through Facility (ac-ft) | Infiltration Volume (ac-ft) | Cumulative Volume Infiltration Credit | Percent Volume Infiltrated | Water Quality | Percent Water Quality Treated | Comment |
|---|---|---|---|---|---|---|---|---|---|
| retention 2 POC | ☐ | 57.54 | | | ☐ | 0.00 | | | |
| Total Volume Infiltrated | | 57.54 | 0.00 | 0.00 | | 0.00 | 0.00 | 0% | No Treat. Credit |
| Compliance with LID Standard 8% of 2-yr to 50% of 2-yr | | | | | | | | | Duration Analysis Result = Failed |
| | | | | | | | | | |

# Model Default Modifications

Total of 0 changes have been made.

## PERLND Changes

No PERLND changes have been made.

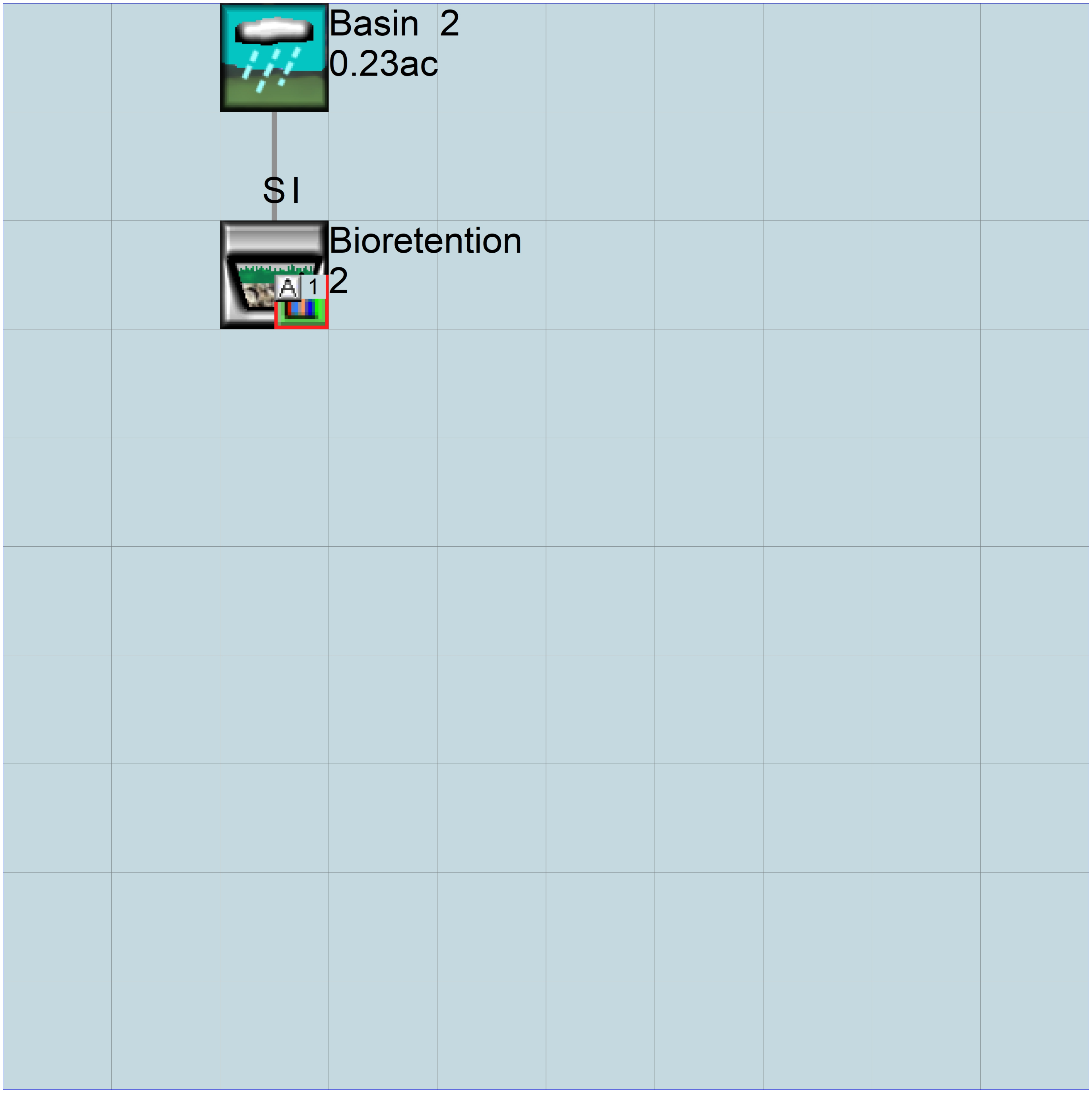
## IMPLND Changes

No IMPLND changes have been made.

# Appendix

## Predeveloped Schematic

## *Mitigated Schematic*



# Disclaimer

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Local (360)943-0304

www.clearcreeksolutions.com

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | Parking Lot B Wetland Calc |
| Site Name: | Pierce College Puyallup |
| Site Address: | 1601 39th Ave SE |
| City: | Puyallup |
| Report Date: | 2/4/2022 |
| Gage: | 38 IN CENTRAL |
| Data Start: | 10/01/1901 |
| Data End: | 09/30/2059 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.000 |
| Version Date: | 2019/09/13 |
| Version: | 4.2.17 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# Landuse Basin Data

## *Predeveloped Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Forest, Flat | 40.16 |
| Pervious Total | 40.16 |
| Impervious Land Use | acre |
| ROADS FLAT | 14.67 |
| Impervious Total | 14.67 |
| Basin Total | 54.83 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### Basin 1

| | | |
|---|---|---|
| Bypass: | No | |
| GroundWater: | No | |
| Pervious Land Use | acre | |
| C, Forest, Flat | 39.41 | |
| C, Pasture, Flat | 0.2 | Parking Lot B Pervious Area |
| Pervious Total | 39.61 | |
| Impervious Land Use | acre | |
| ROADS FLAT | 15.22 | 14.67 ac (Existing Impervious)<br>00.55 ac (Parking Lot B Impervious) |
| Impervious Total | 15.22 | |
| Basin Total | 54.83 | |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

# Routing Elements

## Predeveloped Routing

## *Mitigated Routing*

## Duration Flows

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 2.7463 | 6349 | 7014 | 110 | Fail |
| 2.8381 | 5601 | 6244 | 111 | Fail |
| 2.9299 | 4943 | 5546 | 112 | Fail |
| 3.0217 | 4417 | 4898 | 110 | Fail |
| 3.1135 | 3903 | 4390 | 112 | Fail |
| 3.2053 | 3510 | 3899 | 111 | Fail |
| 3.2971 | 3170 | 3502 | 110 | Fail |
| 3.3889 | 2862 | 3176 | 110 | Fail |
| 3.4807 | 2599 | 2895 | 111 | Fail |
| 3.5725 | 2367 | 2631 | 111 | Fail |
| 3.6643 | 2156 | 2399 | 111 | Fail |
| 3.7561 | 1966 | 2192 | 111 | Fail |
| 3.8479 | 1788 | 2011 | 112 | Fail |
| 3.9397 | 1635 | 1817 | 111 | Fail |
| 4.0315 | 1493 | 1677 | 112 | Fail |
| 4.1232 | 1368 | 1531 | 111 | Fail |
| 4.2150 | 1229 | 1402 | 114 | Fail |
| 4.3068 | 1104 | 1282 | 116 | Fail |
| 4.3986 | 1016 | 1151 | 113 | Fail |
| 4.4904 | 921 | 1044 | 113 | Fail |
| 4.5822 | 849 | 958 | 112 | Fail |
| 4.6740 | 760 | 884 | 116 | Fail |
| 4.7658 | 694 | 806 | 116 | Fail |
| 4.8576 | 623 | 735 | 117 | Fail |
| 4.9494 | 576 | 673 | 116 | Fail |
| 5.0412 | 528 | 601 | 113 | Fail |
| 5.1330 | 479 | 555 | 115 | Fail |
| 5.2248 | 437 | 514 | 117 | Fail |
| 5.3166 | 399 | 464 | 116 | Fail |
| 5.4084 | 358 | 432 | 120 | Fail |
| 5.5002 | 328 | 387 | 117 | Fail |
| 5.5919 | 301 | 353 | 117 | Fail |
| 5.6837 | 275 | 324 | 117 | Fail |
| 5.7755 | 252 | 300 | 119 | Fail |
| 5.8673 | 234 | 273 | 116 | Fail |
| 5.9591 | 215 | 255 | 118 | Fail |
| 6.0509 | 202 | 235 | 116 | Fail |
| 6.1427 | 186 | 214 | 115 | Fail |
| 6.2345 | 174 | 202 | 116 | Fail |
| 6.3263 | 154 | 191 | 124 | Fail |
| 6.4181 | 141 | 175 | 124 | Fail |
| 6.5099 | 130 | 159 | 122 | Fail |
| 6.6017 | 120 | 142 | 118 | Fail |
| 6.6935 | 114 | 129 | 113 | Fail |
| 6.7853 | 100 | 121 | 121 | Fail |
| 6.8771 | 96 | 114 | 118 | Fail |
| 6.9689 | 94 | 108 | 114 | Fail |
| 7.0606 | 89 | 97 | 108 | Pass |
| 7.1524 | 85 | 94 | 110 | Pass |
| 7.2442 | 77 | 92 | 119 | Fail |
| 7.3360 | 71 | 84 | 118 | Fail |
| 7.4278 | 66 | 80 | 121 | Fail |
| 7.5196 | 62 | 73 | 117 | Fail |
| 7.6114 | 59 | 70 | 118 | Fail |

| | | | | |
|---|---|---|---|---|
| 7.7032 | 56 | 65 | 116 | Fail |
| 7.7950 | 53 | 61 | 115 | Fail |
| 7.8868 | 52 | 58 | 111 | Fail |
| 7.9786 | 44 | 56 | 127 | Fail |
| 8.0704 | 41 | 53 | 129 | Fail |
| 8.1622 | 40 | 51 | 127 | Fail |
| 8.2540 | 38 | 46 | 121 | Fail |
| 8.3458 | 37 | 40 | 108 | Pass |
| 8.4376 | 36 | 39 | 108 | Pass |
| 8.5293 | 33 | 37 | 112 | Fail |
| 8.6211 | 32 | 36 | 112 | Fail |
| 8.7129 | 30 | 35 | 116 | Fail |
| 8.8047 | 29 | 34 | 117 | Fail |
| 8.8965 | 28 | 31 | 110 | Pass |
| 8.9883 | 27 | 30 | 111 | Fail |
| 9.0801 | 26 | 29 | 111 | Fail |
| 9.1719 | 24 | 28 | 116 | Fail |
| 9.2637 | 24 | 27 | 112 | Fail |
| 9.3555 | 24 | 26 | 108 | Pass |
| 9.4473 | 23 | 25 | 108 | Pass |
| 9.5391 | 22 | 24 | 109 | Pass |
| 9.6309 | 22 | 24 | 109 | Pass |
| 9.7227 | 21 | 23 | 109 | Pass |
| 9.8145 | 21 | 22 | 104 | Pass |
| 9.9063 | 20 | 22 | 110 | Pass |
| 9.9981 | 19 | 22 | 115 | Fail |
| 10.0898 | 19 | 21 | 110 | Pass |
| 10.1816 | 19 | 20 | 105 | Pass |
| 10.2734 | 19 | 20 | 105 | Pass |
| 10.3652 | 18 | 19 | 105 | Pass |
| 10.4570 | 18 | 19 | 105 | Pass |
| 10.5488 | 16 | 19 | 118 | Fail |
| 10.6406 | 16 | 19 | 118 | Fail |
| 10.7324 | 15 | 18 | 120 | Fail |
| 10.8242 | 15 | 17 | 113 | Fail |
| 10.9160 | 14 | 16 | 114 | Fail |
| 11.0078 | 13 | 16 | 123 | Fail |
| 11.0996 | 13 | 15 | 115 | Fail |
| 11.1914 | 13 | 15 | 115 | Fail |
| 11.2832 | 12 | 13 | 108 | Pass |
| 11.3750 | 11 | 13 | 118 | Fail |
| 11.4668 | 11 | 13 | 118 | Fail |
| 11.5585 | 11 | 13 | 118 | Fail |
| 11.6503 | 11 | 12 | 109 | Pass |
| 11.7421 | 10 | 12 | 120 | Fail |
| 11.8339 | 9 | 11 | 122 | Fail |

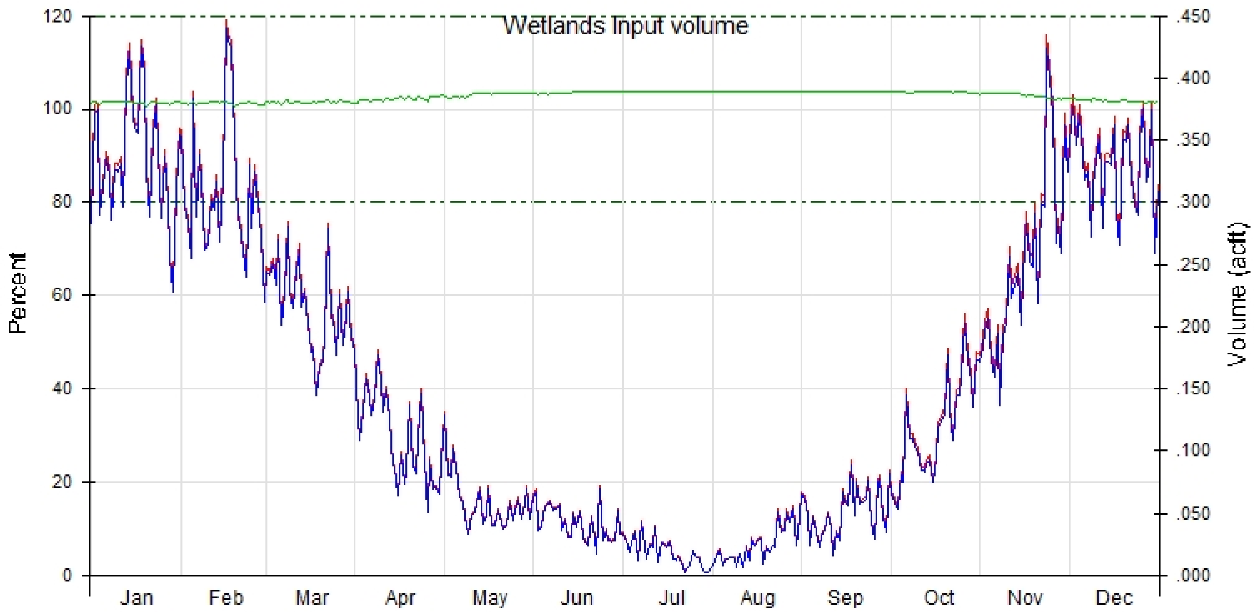
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

## Water Quality

Water Quality BMP Flow and Volume for POC #1

| | |
|---|---|
| On-line facility volume: | 0 acre-feet |
| On-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |
| Off-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |

# Wetland Input Volumes




- Percent - Predeveloped - Mitigated

Wetlands Input Volume for POC 1
Average Annual Volume (acft)
Series 1: 501 POC 1 Predeveloped flow
Series 2: 801 POC 1 Mitigated flow

| **Month** | **Series 1** | **Series 2** | **Percent** | **Pass/Fail** |
|---|---|---|---|---|
| Jan | 10.3006 | 10.4476 | 101.4 | Pass |
| Feb | 8.8841 | 9.0008 | 101.3 | Pass |
| Mar | 6.6987 | 6.7998 | 101.5 | Pass |
| Apr | 3.3524 | 3.4208 | 102.0 | Pass |
| May | 1.8381 | 1.8944 | 103.1 | Pass |
| Jun | 1.2639 | 1.3086 | 103.5 | Pass |
| Jul | 0.5960 | 0.6182 | 103.7 | Pass |
| Aug | 0.7066 | 0.7331 | 103.7 | Pass |
| Sep | 1.4904 | 1.5463 | 103.7 | Pass |
| Oct | 3.5792 | 3.7097 | 103.6 | Pass |
| Nov | 7.4693 | 7.6851 | 102.9 | Pass |
| Dec | 10.2018 | 10.3906 | 101.9 | Pass |

| **Day** | **Predevel** | **Mitigated** | **Percent** | **Pass/Fail** |
|---|---|---|---|---|
| Jan1 | 0.2826 | 0.2865 | 101.4 | Pass |
| 2 | 0.3714 | 0.3780 | 101.8 | Pass |
| 3 | 0.3745 | 0.3800 | 101.4 | Pass |
| 4 | 0.2897 | 0.2929 | 101.1 | Pass |
| 5 | 0.3123 | 0.3170 | 101.5 | Pass |
| 6 | 0.3358 | 0.3411 | 101.6 | Pass |
| 7 | 0.3221 | 0.3270 | 101.5 | Pass |
| 8 | 0.2858 | 0.2902 | 101.6 | Pass |
| 9 | 0.3262 | 0.3317 | 101.7 | Pass |
| 10 | 0.3253 | 0.3306 | 101.6 | Pass |
| 11 | 0.3314 | 0.3364 | 101.5 | Pass |
| 12 | 0.2969 | 0.3013 | 101.5 | Pass |
| 13 | 0.3945 | 0.4013 | 101.7 | Pass |
| 14 | 0.4218 | 0.4282 | 101.5 | Pass |

| | | | | |
|---|---|---|---|---|
| 15 | 0.3673 | 0.3719 | 101.2 | Pass |
| 16 | 0.3614 | 0.3663 | 101.4 | Pass |
| 17 | 0.3557 | 0.3607 | 101.4 | Pass |
| 18 | 0.4252 | 0.4311 | 101.4 | Pass |
| 19 | 0.4045 | 0.4093 | 101.2 | Pass |
| 20 | 0.3261 | 0.3284 | 100.7 | Pass |
| 21 | 0.2890 | 0.2924 | 101.2 | Pass |
| 22 | 0.3546 | 0.3606 | 101.7 | Pass |
| 23 | 0.3782 | 0.3842 | 101.6 | Pass |
| 24 | 0.3413 | 0.3456 | 101.2 | Pass |
| 25 | 0.2877 | 0.2912 | 101.2 | Pass |
| 26 | 0.3372 | 0.3419 | 101.4 | Pass |
| 27 | 0.3007 | 0.3043 | 101.2 | Pass |
| 28 | 0.2558 | 0.2586 | 101.1 | Pass |
| 29 | 0.2283 | 0.2312 | 101.3 | Pass |
| 30 | 0.3107 | 0.3163 | 101.8 | Pass |
| 31 | 0.3539 | 0.3594 | 101.6 | Pass |
| Feb1 | 0.3530 | 0.3577 | 101.3 | Pass |
| 2 | 0.2961 | 0.2996 | 101.2 | Pass |
| 3 | 0.2837 | 0.2867 | 101.1 | Pass |
| 4 | 0.2544 | 0.2578 | 101.3 | Pass |
| 5 | 0.3833 | 0.3895 | 101.6 | Pass |
| 6 | 0.2880 | 0.2906 | 100.9 | Pass |
| 7 | 0.3375 | 0.3424 | 101.4 | Pass |
| 8 | 0.2930 | 0.2963 | 101.1 | Pass |
| 9 | 0.2615 | 0.2649 | 101.3 | Pass |
| 10 | 0.2654 | 0.2689 | 101.3 | Pass |
| 11 | 0.3014 | 0.3065 | 101.7 | Pass |
| 12 | 0.2945 | 0.2991 | 101.6 | Pass |
| 13 | 0.3169 | 0.3219 | 101.6 | Pass |
| 14 | 0.2686 | 0.2722 | 101.3 | Pass |
| 15 | 0.3200 | 0.3250 | 101.6 | Pass |
| 16 | 0.4404 | 0.4474 | 101.6 | Pass |
| 17 | 0.4292 | 0.4348 | 101.3 | Pass |
| 18 | 0.4252 | 0.4304 | 101.2 | Pass |
| 19 | 0.3506 | 0.3531 | 100.7 | Pass |
| 20 | 0.2853 | 0.2876 | 100.8 | Pass |
| 21 | 0.2849 | 0.2884 | 101.2 | Pass |
| 22 | 0.2602 | 0.2632 | 101.2 | Pass |
| 23 | 0.2396 | 0.2429 | 101.4 | Pass |
| 24 | 0.3300 | 0.3355 | 101.7 | Pass |
| 25 | 0.2792 | 0.2823 | 101.1 | Pass |
| 26 | 0.3252 | 0.3298 | 101.4 | Pass |
| 27 | 0.2982 | 0.3014 | 101.1 | Pass |
| 28 | 0.2734 | 0.2760 | 101.0 | Pass |
| 29 | 0.2201 | 0.2224 | 101.0 | Pass |
| Mar1 | 0.2449 | 0.2485 | 101.5 | Pass |
| 2 | 0.2414 | 0.2449 | 101.4 | Pass |
| 3 | 0.2511 | 0.2549 | 101.5 | Pass |
| 4 | 0.2339 | 0.2370 | 101.3 | Pass |
| 5 | 0.2696 | 0.2737 | 101.5 | Pass |
| 6 | 0.2012 | 0.2034 | 101.1 | Pass |
| 7 | 0.2268 | 0.2308 | 101.8 | Pass |
| 8 | 0.2799 | 0.2851 | 101.8 | Pass |
| 9 | 0.2282 | 0.2313 | 101.4 | Pass |
| 10 | 0.2151 | 0.2181 | 101.4 | Pass |
| 11 | 0.2441 | 0.2478 | 101.5 | Pass |
| 12 | 0.2623 | 0.2664 | 101.6 | Pass |

| | | | | |
|---|---|---|---|---|
| 13 | 0.2164 | 0.2192 | 101.3 | Pass |
| 14 | 0.2280 | 0.2312 | 101.4 | Pass |
| 15 | 0.2026 | 0.2053 | 101.3 | Pass |
| 16 | 0.1791 | 0.1815 | 101.3 | Pass |
| 17 | 0.1813 | 0.1841 | 101.5 | Pass |
| 18 | 0.1452 | 0.1471 | 101.3 | Pass |
| 19 | 0.1680 | 0.1706 | 101.5 | Pass |
| 20 | 0.1715 | 0.1743 | 101.6 | Pass |
| 21 | 0.1918 | 0.1952 | 101.7 | Pass |
| 22 | 0.2786 | 0.2838 | 101.9 | Pass |
| 23 | 0.2086 | 0.2116 | 101.5 | Pass |
| 24 | 0.1991 | 0.2022 | 101.6 | Pass |
| 25 | 0.1777 | 0.1802 | 101.4 | Pass |
| 26 | 0.2251 | 0.2295 | 102.0 | Pass |
| 27 | 0.1848 | 0.1876 | 101.5 | Pass |
| 28 | 0.2067 | 0.2104 | 101.8 | Pass |
| 29 | 0.2277 | 0.2315 | 101.7 | Pass |
| 30 | 0.1910 | 0.1934 | 101.3 | Pass |
| 31 | 0.1808 | 0.1831 | 101.3 | Pass |
| Apr1 | 0.1264 | 0.1280 | 101.3 | Pass |
| 2 | 0.1085 | 0.1105 | 101.8 | Pass |
| 3 | 0.1310 | 0.1336 | 101.9 | Pass |
| 4 | 0.1586 | 0.1616 | 101.9 | Pass |
| 5 | 0.1430 | 0.1454 | 101.7 | Pass |
| 6 | 0.1286 | 0.1307 | 101.6 | Pass |
| 7 | 0.1418 | 0.1445 | 101.9 | Pass |
| 8 | 0.1774 | 0.1810 | 102.1 | Pass |
| 9 | 0.1568 | 0.1597 | 101.9 | Pass |
| 10 | 0.1316 | 0.1335 | 101.5 | Pass |
| 11 | 0.1486 | 0.1519 | 102.2 | Pass |
| 12 | 0.1256 | 0.1280 | 101.9 | Pass |
| 13 | 0.0883 | 0.0900 | 101.9 | Pass |
| 14 | 0.0864 | 0.0885 | 102.4 | Pass |
| 15 | 0.0643 | 0.0658 | 102.3 | Pass |
| 16 | 0.0970 | 0.0996 | 102.7 | Pass |
| 17 | 0.0734 | 0.0748 | 101.9 | Pass |
| 18 | 0.0824 | 0.0844 | 102.4 | Pass |
| 19 | 0.1361 | 0.1399 | 102.8 | Pass |
| 20 | 0.0883 | 0.0901 | 101.9 | Pass |
| 21 | 0.0820 | 0.0837 | 102.1 | Pass |
| 22 | 0.1090 | 0.1118 | 102.6 | Pass |
| 23 | 0.1460 | 0.1495 | 102.4 | Pass |
| 24 | 0.0930 | 0.0948 | 102.0 | Pass |
| 25 | 0.0509 | 0.0518 | 101.6 | Pass |
| 26 | 0.0928 | 0.0954 | 102.8 | Pass |
| 27 | 0.0695 | 0.0712 | 102.5 | Pass |
| 28 | 0.0707 | 0.0725 | 102.7 | Pass |
| 29 | 0.0650 | 0.0668 | 102.8 | Pass |
| 30 | 0.0896 | 0.0923 | 103.0 | Pass |
| May1 | 0.1281 | 0.1315 | 102.7 | Pass |
| 2 | 0.0804 | 0.0823 | 102.3 | Pass |
| 3 | 0.0786 | 0.0805 | 102.4 | Pass |
| 4 | 0.1023 | 0.1052 | 102.8 | Pass |
| 5 | 0.0867 | 0.0891 | 102.7 | Pass |
| 6 | 0.0630 | 0.0646 | 102.5 | Pass |
| 7 | 0.0584 | 0.0600 | 102.6 | Pass |
| 8 | 0.0471 | 0.0483 | 102.5 | Pass |
| 9 | 0.0334 | 0.0343 | 102.6 | Pass |

| | | | | |
|---|---|---|---|---|
| 10 | 0.0480 | 0.0496 | 103.2 | Pass |
| 11 | 0.0509 | 0.0526 | 103.3 | Pass |
| 12 | 0.0575 | 0.0594 | 103.4 | Pass |
| 13 | 0.0681 | 0.0704 | 103.4 | Pass |
| 14 | 0.0420 | 0.0434 | 103.3 | Pass |
| 15 | 0.0468 | 0.0484 | 103.5 | Pass |
| 16 | 0.0702 | 0.0726 | 103.4 | Pass |
| 17 | 0.0407 | 0.0419 | 103.1 | Pass |
| 18 | 0.0404 | 0.0418 | 103.3 | Pass |
| 19 | 0.0517 | 0.0536 | 103.5 | Pass |
| 20 | 0.0462 | 0.0478 | 103.4 | Pass |
| 21 | 0.0372 | 0.0385 | 103.4 | Pass |
| 22 | 0.0397 | 0.0410 | 103.4 | Pass |
| 23 | 0.0577 | 0.0597 | 103.4 | Pass |
| 24 | 0.0444 | 0.0459 | 103.3 | Pass |
| 25 | 0.0527 | 0.0545 | 103.3 | Pass |
| 26 | 0.0603 | 0.0623 | 103.3 | Pass |
| 27 | 0.0449 | 0.0464 | 103.3 | Pass |
| 28 | 0.0556 | 0.0575 | 103.5 | Pass |
| 29 | 0.0702 | 0.0726 | 103.4 | Pass |
| 30 | 0.0460 | 0.0475 | 103.4 | Pass |
| 31 | 0.0632 | 0.0654 | 103.6 | Pass |
| Jun1 | 0.0669 | 0.0693 | 103.5 | Pass |
| 2 | 0.0364 | 0.0376 | 103.1 | Pass |
| 3 | 0.0392 | 0.0405 | 103.4 | Pass |
| 4 | 0.0543 | 0.0562 | 103.5 | Pass |
| 5 | 0.0572 | 0.0590 | 103.0 | Pass |
| 6 | 0.0586 | 0.0606 | 103.3 | Pass |
| 7 | 0.0525 | 0.0543 | 103.4 | Pass |
| 8 | 0.0535 | 0.0553 | 103.5 | Pass |
| 9 | 0.0556 | 0.0575 | 103.4 | Pass |
| 10 | 0.0366 | 0.0378 | 103.3 | Pass |
| 11 | 0.0437 | 0.0452 | 103.5 | Pass |
| 12 | 0.0308 | 0.0319 | 103.5 | Pass |
| 13 | 0.0312 | 0.0323 | 103.6 | Pass |
| 14 | 0.0494 | 0.0512 | 103.7 | Pass |
| 15 | 0.0391 | 0.0405 | 103.7 | Pass |
| 16 | 0.0504 | 0.0523 | 103.7 | Pass |
| 17 | 0.0316 | 0.0328 | 103.7 | Pass |
| 18 | 0.0269 | 0.0279 | 103.6 | Pass |
| 19 | 0.0245 | 0.0254 | 103.7 | Pass |
| 20 | 0.0463 | 0.0480 | 103.7 | Pass |
| 21 | 0.0306 | 0.0318 | 103.7 | Pass |
| 22 | 0.0169 | 0.0175 | 103.7 | Pass |
| 23 | 0.0700 | 0.0726 | 103.7 | Pass |
| 24 | 0.0282 | 0.0292 | 103.6 | Pass |
| 25 | 0.0356 | 0.0370 | 103.7 | Pass |
| 26 | 0.0285 | 0.0295 | 103.7 | Pass |
| 27 | 0.0264 | 0.0274 | 103.7 | Pass |
| 28 | 0.0284 | 0.0295 | 103.7 | Pass |
| 29 | 0.0518 | 0.0538 | 103.7 | Pass |
| 30 | 0.0327 | 0.0339 | 103.7 | Pass |
| Jul1 | 0.0338 | 0.0351 | 103.7 | Pass |
| 2 | 0.0284 | 0.0295 | 103.7 | Pass |
| 3 | 0.0180 | 0.0187 | 103.7 | Pass |
| 4 | 0.0263 | 0.0272 | 103.7 | Pass |
| 5 | 0.0341 | 0.0354 | 103.7 | Pass |
| 6 | 0.0119 | 0.0124 | 103.7 | Pass |

| | | | | |
|---|---|---|---|---|
| 7 | 0.0430 | 0.0446 | 103.7 | Pass |
| 8 | 0.0330 | 0.0342 | 103.7 | Pass |
| 9 | 0.0127 | 0.0132 | 103.7 | Pass |
| 10 | 0.0239 | 0.0248 | 103.7 | Pass |
| 11 | 0.0230 | 0.0239 | 103.7 | Pass |
| 12 | 0.0392 | 0.0406 | 103.7 | Pass |
| 13 | 0.0106 | 0.0110 | 103.7 | Pass |
| 14 | 0.0263 | 0.0272 | 103.6 | Pass |
| 15 | 0.0239 | 0.0248 | 103.7 | Pass |
| 16 | 0.0222 | 0.0230 | 103.7 | Pass |
| 17 | 0.0272 | 0.0282 | 103.7 | Pass |
| 18 | 0.0135 | 0.0140 | 103.7 | Pass |
| 19 | 0.0117 | 0.0121 | 103.7 | Pass |
| 20 | 0.0148 | 0.0154 | 103.7 | Pass |
| 21 | 0.0110 | 0.0114 | 103.7 | Pass |
| 22 | 0.0032 | 0.0033 | 103.7 | Pass |
| 23 | 0.0060 | 0.0062 | 103.7 | Pass |
| 24 | 0.0072 | 0.0075 | 103.7 | Pass |
| 25 | 0.0196 | 0.0203 | 103.7 | Pass |
| 26 | 0.0146 | 0.0152 | 103.7 | Pass |
| 27 | 0.0134 | 0.0139 | 103.7 | Pass |
| 28 | 0.0063 | 0.0066 | 103.7 | Pass |
| 29 | 0.0022 | 0.0023 | 103.7 | Pass |
| 30 | 0.0021 | 0.0022 | 103.7 | Pass |
| 31 | 0.0067 | 0.0069 | 103.7 | Pass |
| Aug1 | 0.0073 | 0.0076 | 103.7 | Pass |
| 2 | 0.0158 | 0.0164 | 103.7 | Pass |
| 3 | 0.0204 | 0.0211 | 103.7 | Pass |
| 4 | 0.0074 | 0.0077 | 103.7 | Pass |
| 5 | 0.0123 | 0.0128 | 103.7 | Pass |
| 6 | 0.0133 | 0.0138 | 103.7 | Pass |
| 7 | 0.0144 | 0.0150 | 103.7 | Pass |
| 8 | 0.0135 | 0.0140 | 103.8 | Pass |
| 9 | 0.0061 | 0.0063 | 103.7 | Pass |
| 10 | 0.0166 | 0.0172 | 103.7 | Pass |
| 11 | 0.0066 | 0.0068 | 103.7 | Pass |
| 12 | 0.0228 | 0.0236 | 103.7 | Pass |
| 13 | 0.0114 | 0.0119 | 103.7 | Pass |
| 14 | 0.0297 | 0.0308 | 103.7 | Pass |
| 15 | 0.0238 | 0.0247 | 103.7 | Pass |
| 16 | 0.0283 | 0.0293 | 103.7 | Pass |
| 17 | 0.0290 | 0.0301 | 103.7 | Pass |
| 18 | 0.0091 | 0.0094 | 103.7 | Pass |
| 19 | 0.0225 | 0.0234 | 103.7 | Pass |
| 20 | 0.0180 | 0.0187 | 103.7 | Pass |
| 21 | 0.0233 | 0.0242 | 103.7 | Pass |
| 22 | 0.0223 | 0.0231 | 103.7 | Pass |
| 23 | 0.0515 | 0.0534 | 103.7 | Pass |
| 24 | 0.0352 | 0.0365 | 103.7 | Pass |
| 25 | 0.0356 | 0.0369 | 103.7 | Pass |
| 26 | 0.0510 | 0.0529 | 103.7 | Pass |
| 27 | 0.0431 | 0.0447 | 103.7 | Pass |
| 28 | 0.0539 | 0.0559 | 103.7 | Pass |
| 29 | 0.0240 | 0.0249 | 103.7 | Pass |
| 30 | 0.0318 | 0.0330 | 103.7 | Pass |
| 31 | 0.0650 | 0.0674 | 103.7 | Pass |
| Sep1 | 0.0621 | 0.0644 | 103.8 | Pass |
| 2 | 0.0479 | 0.0497 | 103.7 | Pass |

| | | | | |
|---|---|---|---|---|
| 3 | 0.0234 | 0.0243 | 103.7 | Pass |
| 4 | 0.0463 | 0.0480 | 103.7 | Pass |
| 5 | 0.0352 | 0.0365 | 103.7 | Pass |
| 6 | 0.0226 | 0.0234 | 103.7 | Pass |
| 7 | 0.0326 | 0.0338 | 103.7 | Pass |
| 8 | 0.0355 | 0.0368 | 103.7 | Pass |
| 9 | 0.0495 | 0.0514 | 103.7 | Pass |
| 10 | 0.0381 | 0.0395 | 103.7 | Pass |
| 11 | 0.0164 | 0.0170 | 103.7 | Pass |
| 12 | 0.0343 | 0.0355 | 103.7 | Pass |
| 13 | 0.0285 | 0.0295 | 103.7 | Pass |
| 14 | 0.0669 | 0.0695 | 103.7 | Pass |
| 15 | 0.0595 | 0.0618 | 103.7 | Pass |
| 16 | 0.0560 | 0.0581 | 103.7 | Pass |
| 17 | 0.0889 | 0.0923 | 103.7 | Pass |
| 18 | 0.0476 | 0.0494 | 103.7 | Pass |
| 19 | 0.0747 | 0.0775 | 103.7 | Pass |
| 20 | 0.0571 | 0.0592 | 103.7 | Pass |
| 21 | 0.0595 | 0.0617 | 103.7 | Pass |
| 22 | 0.0610 | 0.0633 | 103.8 | Pass |
| 23 | 0.0760 | 0.0788 | 103.7 | Pass |
| 24 | 0.0429 | 0.0445 | 103.7 | Pass |
| 25 | 0.0299 | 0.0311 | 103.7 | Pass |
| 26 | 0.0738 | 0.0766 | 103.7 | Pass |
| 27 | 0.0780 | 0.0810 | 103.7 | Pass |
| 28 | 0.0471 | 0.0488 | 103.7 | Pass |
| 29 | 0.0345 | 0.0358 | 103.7 | Pass |
| 30 | 0.0814 | 0.0844 | 103.7 | Pass |
| Oct1 | 0.0660 | 0.0684 | 103.7 | Pass |
| 2 | 0.0594 | 0.0616 | 103.7 | Pass |
| 3 | 0.0536 | 0.0556 | 103.7 | Pass |
| 4 | 0.0798 | 0.0828 | 103.7 | Pass |
| 5 | 0.0746 | 0.0774 | 103.7 | Pass |
| 6 | 0.1448 | 0.1499 | 103.5 | Pass |
| 7 | 0.1096 | 0.1133 | 103.4 | Pass |
| 8 | 0.1105 | 0.1144 | 103.6 | Pass |
| 9 | 0.1051 | 0.1089 | 103.6 | Pass |
| 10 | 0.0990 | 0.1026 | 103.7 | Pass |
| 11 | 0.0842 | 0.0873 | 103.7 | Pass |
| 12 | 0.0835 | 0.0867 | 103.7 | Pass |
| 13 | 0.0896 | 0.0929 | 103.7 | Pass |
| 14 | 0.0928 | 0.0963 | 103.7 | Pass |
| 15 | 0.0747 | 0.0775 | 103.7 | Pass |
| 16 | 0.0935 | 0.0970 | 103.7 | Pass |
| 17 | 0.1191 | 0.1236 | 103.7 | Pass |
| 18 | 0.1227 | 0.1273 | 103.7 | Pass |
| 19 | 0.1304 | 0.1353 | 103.7 | Pass |
| 20 | 0.1765 | 0.1831 | 103.7 | Pass |
| 21 | 0.1321 | 0.1370 | 103.7 | Pass |
| 22 | 0.1083 | 0.1122 | 103.6 | Pass |
| 23 | 0.1430 | 0.1482 | 103.7 | Pass |
| 24 | 0.1450 | 0.1503 | 103.7 | Pass |
| 25 | 0.1602 | 0.1662 | 103.7 | Pass |
| 26 | 0.2032 | 0.2106 | 103.7 | Pass |
| 27 | 0.1730 | 0.1792 | 103.6 | Pass |
| 28 | 0.1569 | 0.1624 | 103.5 | Pass |
| 29 | 0.1353 | 0.1399 | 103.4 | Pass |
| 30 | 0.1731 | 0.1792 | 103.5 | Pass |

| | | | | |
|---|---|---|---|---|
| 31 | 0.1713 | 0.1767 | 103.2 | Pass |
| Nov1 | 0.1842 | 0.1904 | 103.4 | Pass |
| 2 | 0.1965 | 0.2034 | 103.5 | Pass |
| 3 | 0.2070 | 0.2144 | 103.6 | Pass |
| 4 | 0.1733 | 0.1794 | 103.5 | Pass |
| 5 | 0.1592 | 0.1648 | 103.5 | Pass |
| 6 | 0.1950 | 0.2018 | 103.5 | Pass |
| 7 | 0.1364 | 0.1410 | 103.3 | Pass |
| 8 | 0.1936 | 0.2003 | 103.5 | Pass |
| 9 | 0.2027 | 0.2095 | 103.3 | Pass |
| 10 | 0.2556 | 0.2644 | 103.4 | Pass |
| 11 | 0.2231 | 0.2305 | 103.3 | Pass |
| 12 | 0.2341 | 0.2418 | 103.3 | Pass |
| 13 | 0.2426 | 0.2507 | 103.3 | Pass |
| 14 | 0.2014 | 0.2078 | 103.2 | Pass |
| 15 | 0.2417 | 0.2490 | 103.0 | Pass |
| 16 | 0.2838 | 0.2919 | 102.9 | Pass |
| 17 | 0.2530 | 0.2606 | 103.0 | Pass |
| 18 | 0.2483 | 0.2558 | 103.0 | Pass |
| 19 | 0.2911 | 0.2994 | 102.8 | Pass |
| 20 | 0.2188 | 0.2245 | 102.6 | Pass |
| 21 | 0.2993 | 0.3079 | 102.9 | Pass |
| 22 | 0.2965 | 0.3042 | 102.6 | Pass |
| 23 | 0.4240 | 0.4348 | 102.5 | Pass |
| 24 | 0.4006 | 0.4100 | 102.3 | Pass |
| 25 | 0.3705 | 0.3784 | 102.1 | Pass |
| 26 | 0.2670 | 0.2722 | 102.0 | Pass |
| 27 | 0.2801 | 0.2866 | 102.3 | Pass |
| 28 | 0.2594 | 0.2650 | 102.1 | Pass |
| 29 | 0.3622 | 0.3712 | 102.5 | Pass |
| 30 | 0.3254 | 0.3326 | 102.2 | Pass |
| Dec1 | 0.3475 | 0.3557 | 102.4 | Pass |
| 2 | 0.3772 | 0.3861 | 102.4 | Pass |
| 3 | 0.3468 | 0.3540 | 102.1 | Pass |
| 4 | 0.3706 | 0.3786 | 102.1 | Pass |
| 5 | 0.3545 | 0.3618 | 102.0 | Pass |
| 6 | 0.3175 | 0.3235 | 101.9 | Pass |
| 7 | 0.3251 | 0.3313 | 101.9 | Pass |
| 8 | 0.2726 | 0.2775 | 101.8 | Pass |
| 9 | 0.3123 | 0.3194 | 102.3 | Pass |
| 10 | 0.3335 | 0.3403 | 102.0 | Pass |
| 11 | 0.3526 | 0.3598 | 102.1 | Pass |
| 12 | 0.2794 | 0.2840 | 101.6 | Pass |
| 13 | 0.3319 | 0.3384 | 101.9 | Pass |
| 14 | 0.3331 | 0.3389 | 101.7 | Pass |
| 15 | 0.3301 | 0.3356 | 101.7 | Pass |
| 16 | 0.3630 | 0.3692 | 101.7 | Pass |
| 17 | 0.2930 | 0.2977 | 101.6 | Pass |
| 18 | 0.2655 | 0.2702 | 101.8 | Pass |
| 19 | 0.3509 | 0.3583 | 102.1 | Pass |
| 20 | 0.3487 | 0.3553 | 101.9 | Pass |
| 21 | 0.3618 | 0.3682 | 101.8 | Pass |
| 22 | 0.3177 | 0.3227 | 101.6 | Pass |
| 23 | 0.2979 | 0.3031 | 101.8 | Pass |
| 24 | 0.2893 | 0.2943 | 101.7 | Pass |
| 25 | 0.3489 | 0.3551 | 101.8 | Pass |
| 26 | 0.3760 | 0.3813 | 101.4 | Pass |
| 27 | 0.3167 | 0.3210 | 101.4 | Pass |

| | | | | |
|---|---|---|---|---|
| 28 | 0.3321 | 0.3373 | 101.6 | Pass |
| 29 | 0.3749 | 0.3811 | 101.7 | Pass |
| 30 | 0.2589 | 0.2621 | 101.2 | Pass |
| 31 | 0.3103 | 0.3152 | 101.6 | Pass |

# Model Default Modifications

Total of 0 changes have been made.

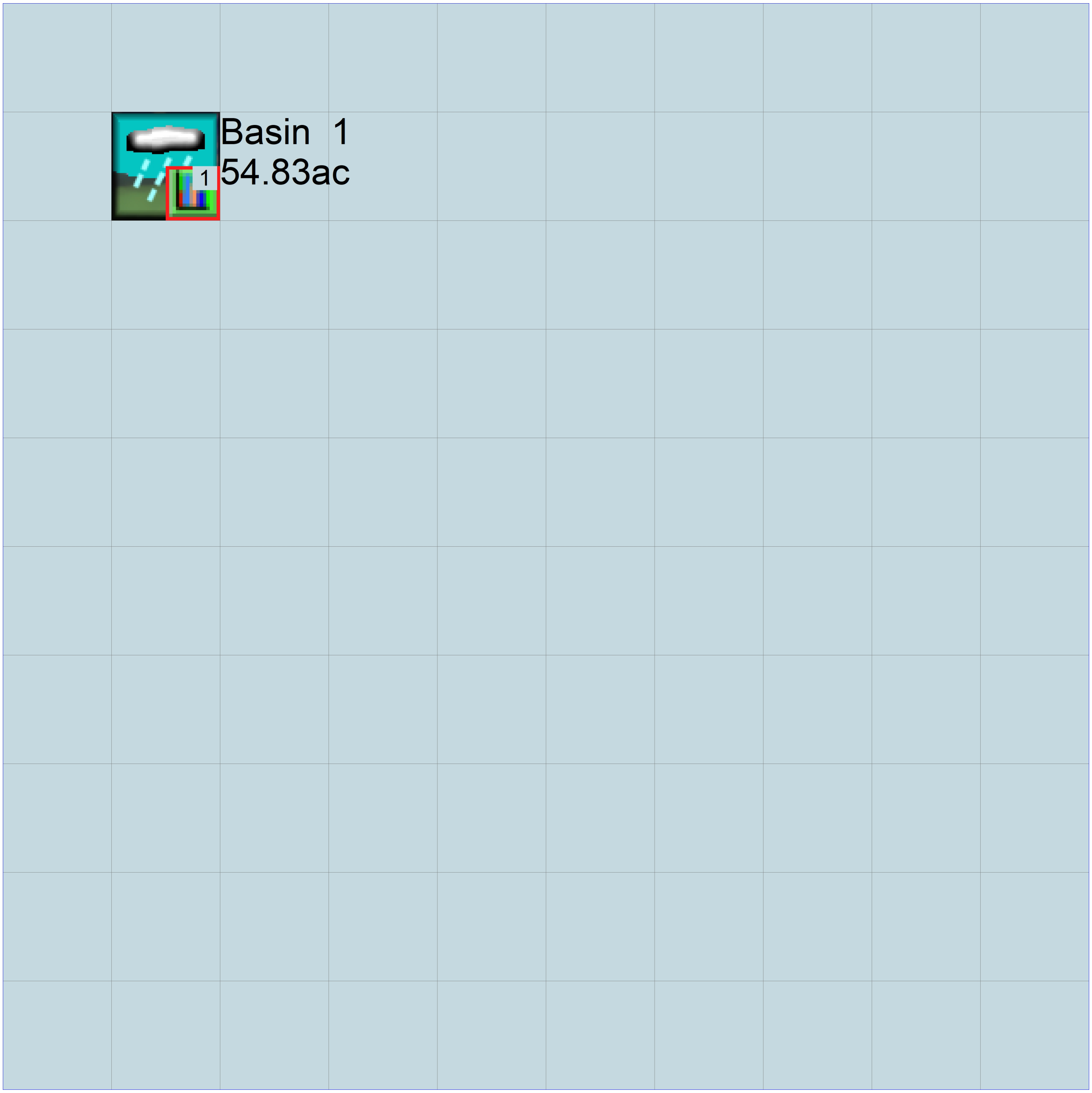
## PERLND Changes

No PERLND changes have been made.

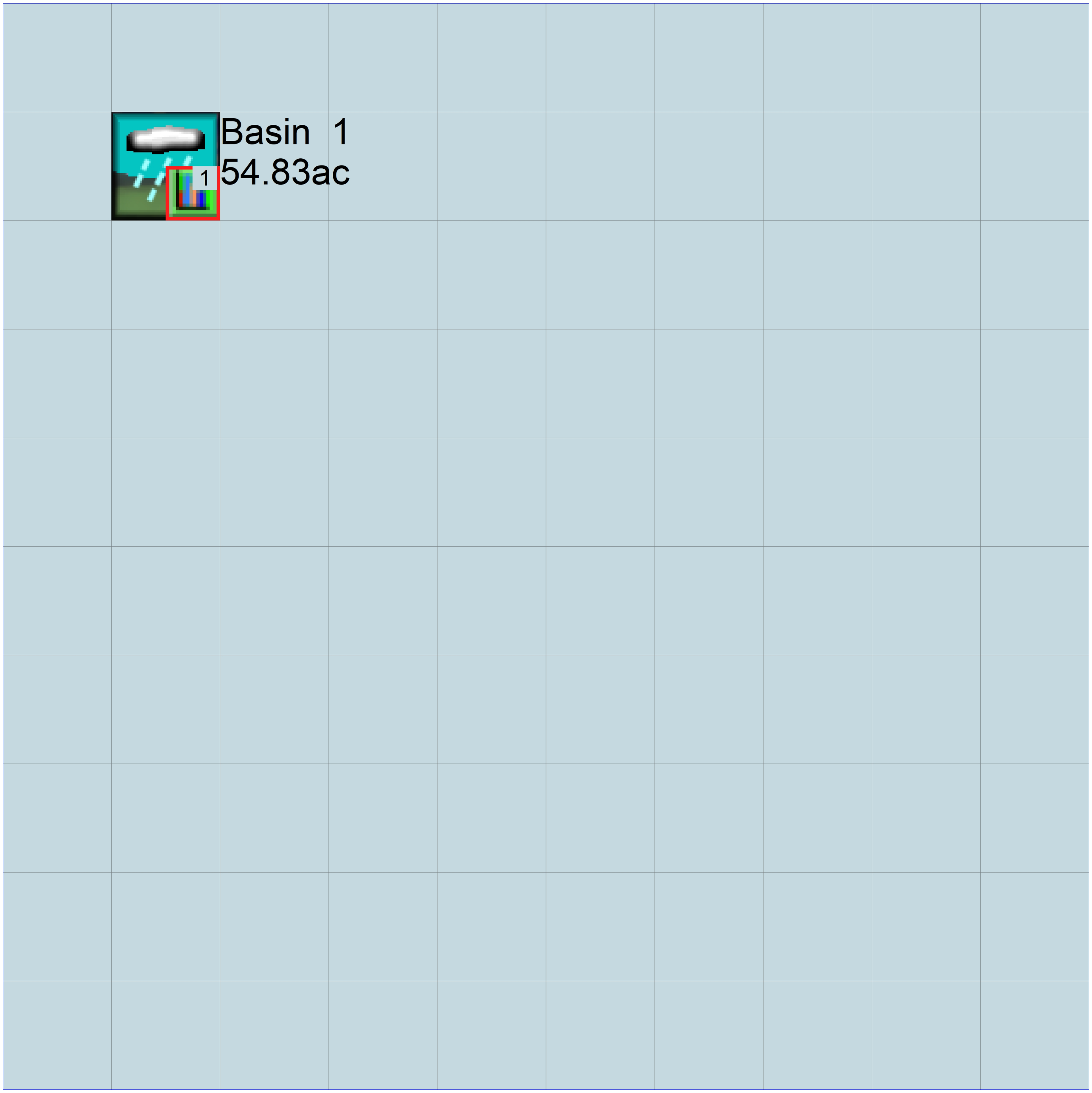
## IMPLND Changes

No IMPLND changes have been made.

# Appendix
## Predeveloped Schematic



## *Mitigated Schematic*



# Disclaimer

## Legal Notice



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Local (360)943-0304

www.clearcreeksolutions.com

## Pipe Capacity Calculation

12" Storm Line Outfall

| | | |
|---|---|---|
| **Inputs:** | | |
| Pipe Diameter, $d_o$ | 1.000 | ft |
| Manning Roughness, n | 0.011 | CPEP |
| Pipe Slope, $s_o$ | 0.005 | rise/run |
| Percent of (or ratio to) full depth (100% or 1 if flowing full) | 1.000 | fraction |
| | | |
| **Results:** | | |
| Maximum Flow Through Pipe, Q | 2.985 | ft^3/s |
| Velocity, v | 3.801 | ft/s |
| Velocity head, hv | 0.225 | ft |
| Flow Area, A | 0.785 | ft^2/s |
| Wetted Perimeter, P | 3.142 | ft |
| Hydraulic Radius | 0.250 | ft |

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

WWHM Outflow to POC 1 Mitigated for Parking Lot B:

WWHM Inputs:

| Basin Area | Rain Gage: | Precip Factor: |
|---|---|---|
| = 0.55 ac (impervious) | | |
| = 0.198 AC (pervious) | 38 IN CENTRAL | 1.000 |

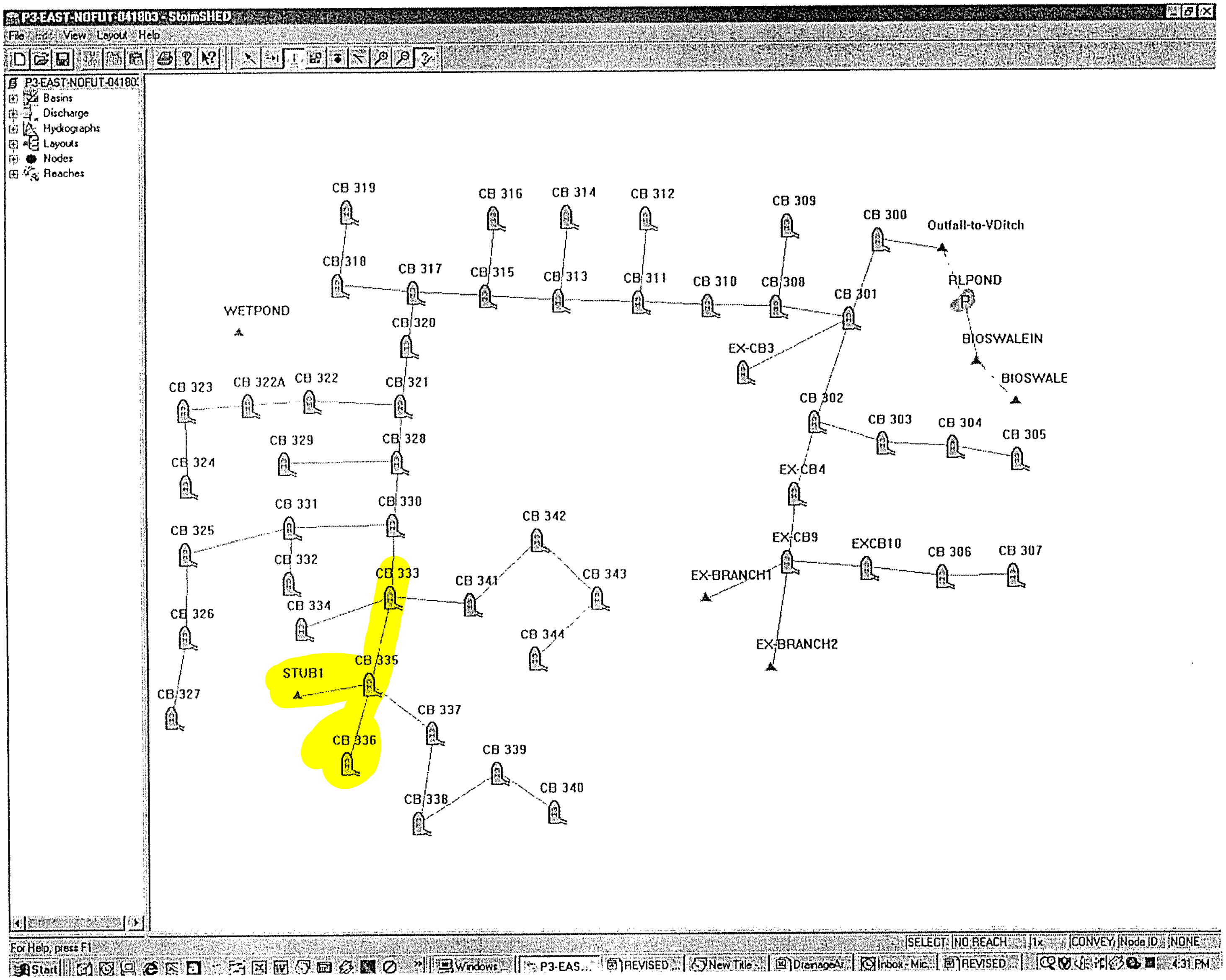
Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.006371 |
| 5 year | 0.01333 |
| 10 year | 0.021441 |
| 25 year | 0.038236 |
| 50 year | 0.05786 |
| 100 year | 0.086358 |

Parking Lot B has been modeled for the 100 year flow conveyance capacity to be conservative, since Parking Lot B has the worst case scenario for conveyance as it has the largest area draining to a conveyance system. The 100-year WWHM peak flow using 15-minute time steps ($Q_{100}$) is 0.08636 CFS.

Using Manning's equation, the maximum flow through a 12" CPEP pipe at 0.5% slope is 2.985 CFS
2.985 CFS capacity is larger than the 0.08636 CFS peak flow.
**The storm drain is adequately sized and will not surcharge**.

# Appendix B-6 Downstream Capacity Analysis Calculations




EAST DRAINAGE LAYOUT

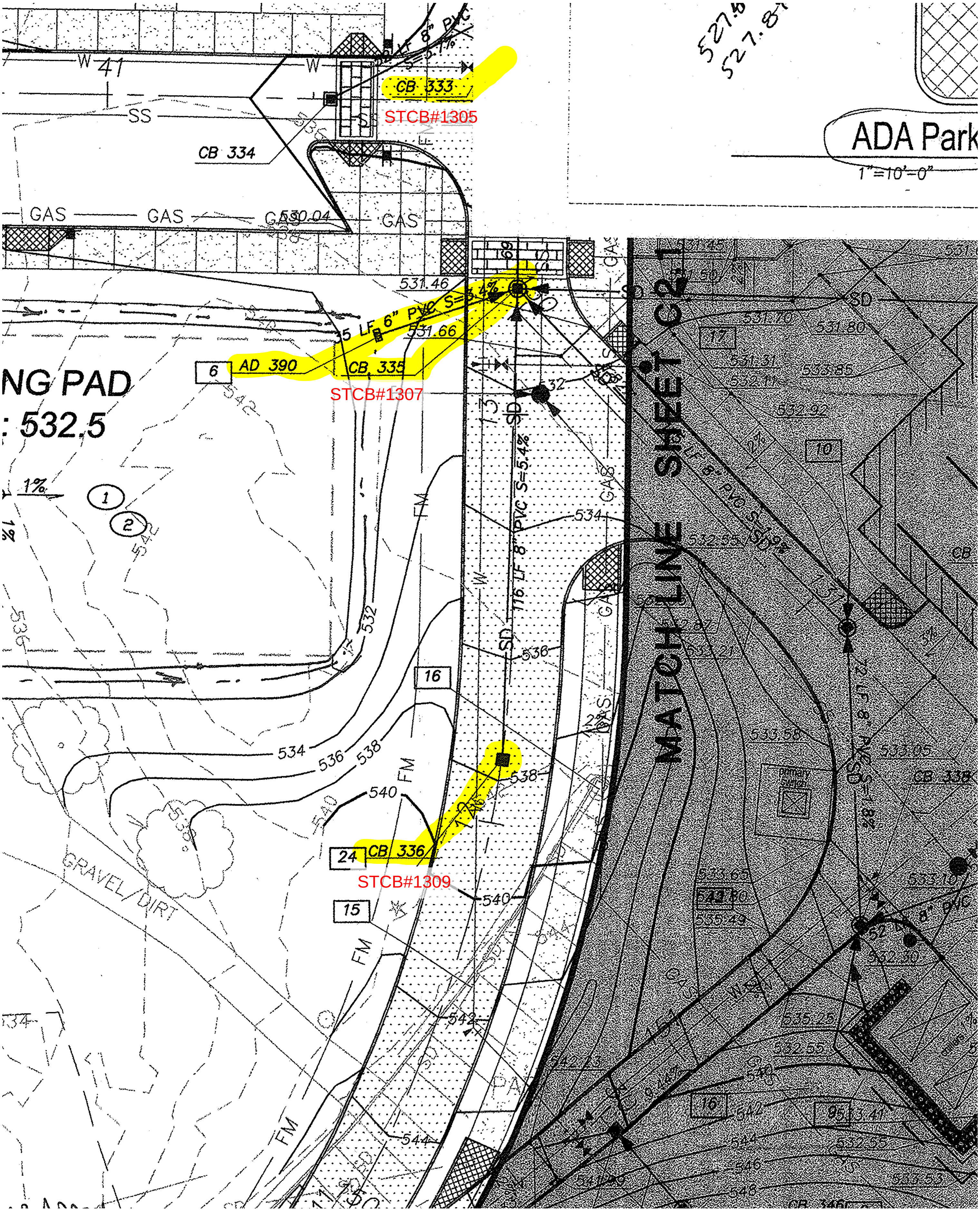
Pierce College Puyallup Phase III Feb 2003 JKN

StormShed Report
Project: P3-EAST-NOFUT-041803

Tuesday, April 22, 2003
Page C1

Excerpt from 2003 Storm Drainage Report

Excerpt from 2003 as-builts



| | | | | | |
|---|---|---|---|---|---|
| LANDSCAPING | | 86.00 | 0.1333 ac | | |
| FUTURE WALKS | | 98.00 | 0.2900 ac | | |
| FUTURE LANDSCAPE | | 86.00 | 0.6184 ac | | |

**Pervious TC Data:**

| Flow type: | Description: | Length: | Slope: | Coeff: | Travel Time |
|---|---|---|---|---|---|
| Fixed | None Entered | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-331

| | | | | |
|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min |
| | Area | CN | TC | |
| Pervious | 0.0201 ac | 98.00 | 0.08 hrs | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | |
| Total | 0.0201 ac | | | |

**Supporting Data:**

**Pervious CN Data:**

| | | |
|---|---|---|
| IMPERVIOUS | 98.00 | 0.0201 ac |
| LANDSCAPING | 86.00 | 0.0000 ac |

**Pervious TC Data:**

| Flow type: | Description: | Length: | Slope: | Coeff: | Travel Time |
|---|---|---|---|---|---|
| Fixed | None Entered | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-332

| | | | | |
|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min |
| | Area | CN | TC | |
| Pervious | 0.7802 ac | 95.14 | 0.08 hrs | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | |
| Total | 0.7802 ac | | | |

**Supporting Data:**

**Pervious CN Data:**

| | | |
|---|---|---|
| IMPERVIOUS | 98.00 | 0.5944 ac |
| LANDSCAPED | 86.00 | 0.1858 ac |

**Pervious TC Data:**

| Flow type: | Description: | Length: | Slope: | Coeff: | Travel Time |
|---|---|---|---|---|---|
| Fixed | None Entered | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-333

| | | | | |
|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min |
| | Area | CN | TC | |
| Pervious | 0.2447 ac | 92.90 | 0.08 hrs | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | |
| Total | 0.2447 ac | | | |

**Supporting Data:**

**Pervious CN Data:**

| | | |
|---|---|---|
| IMPERVIOUS | 98.00 | 0.1407 ac |
| LANDSCAPED | 86.00 | 0.1040 ac |

**Pervious TC Data:**

| Flow type: | Description: | Length: | Slope: | Coeff: | Travel Time |
|---|---|---|---|---|---|
| Fixed | None Entered | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

Excerpt from 2003 Storm Drainage Report

## Drainage Area: B-334

| | | | | | |
|---|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number | |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 | |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min | |
| | Area | CN | TC | | |
| Pervious | 0.5910 ac | 91.37 | 0.08 hrs | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | |
| Total | 0.5910 ac | | | | |
| **Supporting Data:** | | | | | |
| **Pervious CN Data:** | | | | | |
| IMPERVIOUS | | 98.00 | 0.2905 ac | | |
| LANDSCAPED | | 86.00 | 0.2380 ac | | |
| FOREST | | 81.00 | 0.0625 ac | | |
| **Pervious TC Data:** | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-335

| | | | | | | |
|---|---|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number | | |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 | | |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min | | |
| | Area | CN | TC | | | |
| Pervious | 0.3733 ac | 91.89 | 0.08 hrs | | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | | |
| Total | 0.3733 ac | | | | | |
| **Supporting Data:** | | | | | | |
| **Pervious CN Data:** | | | | | | |
| IMPERVIOUS | | 98.00 | 0.1832 ac | | | |
| LANDSCAPING | | 86.00 | 0.1901 ac | | | |
| **Pervious TC Data:** | | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-336

| | | | | | | |
|---|---|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number | | |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 | | |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min | | |
| | Area | CN | TC | | | |
| Pervious | 0.2152 ac | 94.01 | 0.08 hrs | | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | | |
| Total | 0.2152 ac | | | | | |
| **Supporting Data:** | | | | | | |
| **Pervious CN Data:** | | | | | | |
| IMPERVIOUS | | 98.00 | 0.1437 ac | | | |
| LANDSCAPING | | 86.00 | 0.0715 ac | | | |
| **Pervious TC Data:** | | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-337

| | | | |
|---|---|---|---|
| Hyd Method: | SBUH Hyd | Loss Method: | SCS CN Number |
| Peak Factor: | 484.00 | SCS Abs: | 0.20 |
| Storm Dur: | 24.00 hrs | Intv: | 10.00 min |

Excerpt from 2003 Storm Drainage Report

| | Area | CN | TC | | | |
|---|---|---|---|---|---|---|
| Pervious | 0.4020 ac | 94.99 | 0.25 hrs | | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | | |
| Total | 0.4020 ac | | | | | |
| **Supporting Data:** | | | | | | |
| **Pervious CN Data:** | | | | | | |
| IMPERVIOUS | | 98.00 | 0.3010 ac | | | |
| LANDSCAPED | | 86.00 | 0.1010 ac | | | |
| **Pervious TC Data:** | | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 15.1300 | 15.13 min |

## Drainage Area: B-EXCB3-FUT

| | | | | | | |
|---|---|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number | | |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 | | |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min | | |
| | Area | CN | TC | | | |
| Pervious | 0.4519 ac | 92.72 | 0.08 hrs | | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | | |
| Total | 0.4519 ac | | | | | |
| **Supporting Data:** | | | | | | |
| **Pervious CN Data:** | | | | | | |
| IMPERVIOUS | | 98.00 | 0.2530 ac | | | |
| LANDSCAPED | | 86.00 | 0.0310 ac | | | |
| FUTURE LANDSCAPE | | 86.00 | 0.1679 ac | | | |
| **Pervious TC Data:** | | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

## Drainage Area: B-EXCB4-FUT

| | | | | | | |
|---|---|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number | | |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 | | |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min | | |
| | Area | CN | TC | | | |
| Pervious | 1.3607 ac | 93.65 | 0.50 hrs | | | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | | | |
| Total | 1.3607 ac | | | | | |
| **Supporting Data:** | | | | | | |
| **Pervious CN Data:** | | | | | | |
| IMPERVIOUS (CB5,CB6) | | 98.00 | 0.7590 ac | | | |
| LANDSCAPED | | 86.00 | 0.2210 ac | | | |
| FUTURE WALKS | | 98.00 | 0.1081 ac | | | |
| FUTURE LANDSCAPE | | 86.00 | 0.2726 ac | | | |
| **Pervious TC Data:** | | | | | | |
| Flow type: | Description: | | Length: | Slope: | Coeff: | Travel Time |
| Fixed | None Entered | | 0.00 ft | 0.00% | 30.0000 | 30.00 min |

## Drainage Area: B-STUB1

| | | | | |
|---|---|---|---|---|
| Hyd Method: | SBUH Hyd | | Loss Method: | SCS CN Number |
| Peak Factor: | 484.00 | | SCS Abs: | 0.20 |
| Storm Dur: | 24.00 hrs | | Intv: | 10.00 min |
| | Area | CN | TC | |
| Pervious | 0.2755 ac | 98.00 | 0.08 hrs | |
| Impervious | 0.0000 ac | 0.00 | 0.00 hrs | |
| Total | 0.2755 ac | | | |

Excerpt from 2003 Storm Drainage Report

**Supporting Data:**
**Pervious CN Data:**

| | | |
|---|---|---|
| ROOF BUSINESS DEVELOPMENT | 98.00 | 0.2755 ac |

**Pervious TC Data:**

| Flow type: | Description: | Length: | Slope: | Coeff: | Travel Time |
|---|---|---|---|---|---|
| Fixed | None Entered | 0.00 ft | 0.00% | 5.0000 | 5.00 min |

Pipe system was designed to collect 0.2755 acres of impervious surface into STCB#1307 (CB 335 in 2003 Entranco report).
We are adding an additional 0.2745 acres of impervious surface (0.55 ac - 0.2755 ac = 0.2745 ac) and 0.20 acres of lawn into this basin.

Existing Upstream Area

Total impervious area = 0.1407 + 0.1832 + 0.1437 + 0.2755 = 0.7431 acres
CN = 98
Total lawn area = 0.1040 + 0.1901 + 0.0715 = 0.3656 acres
CN = 86

Total area = 1.1087 acres (48,294 sf) ---> 67% impervious

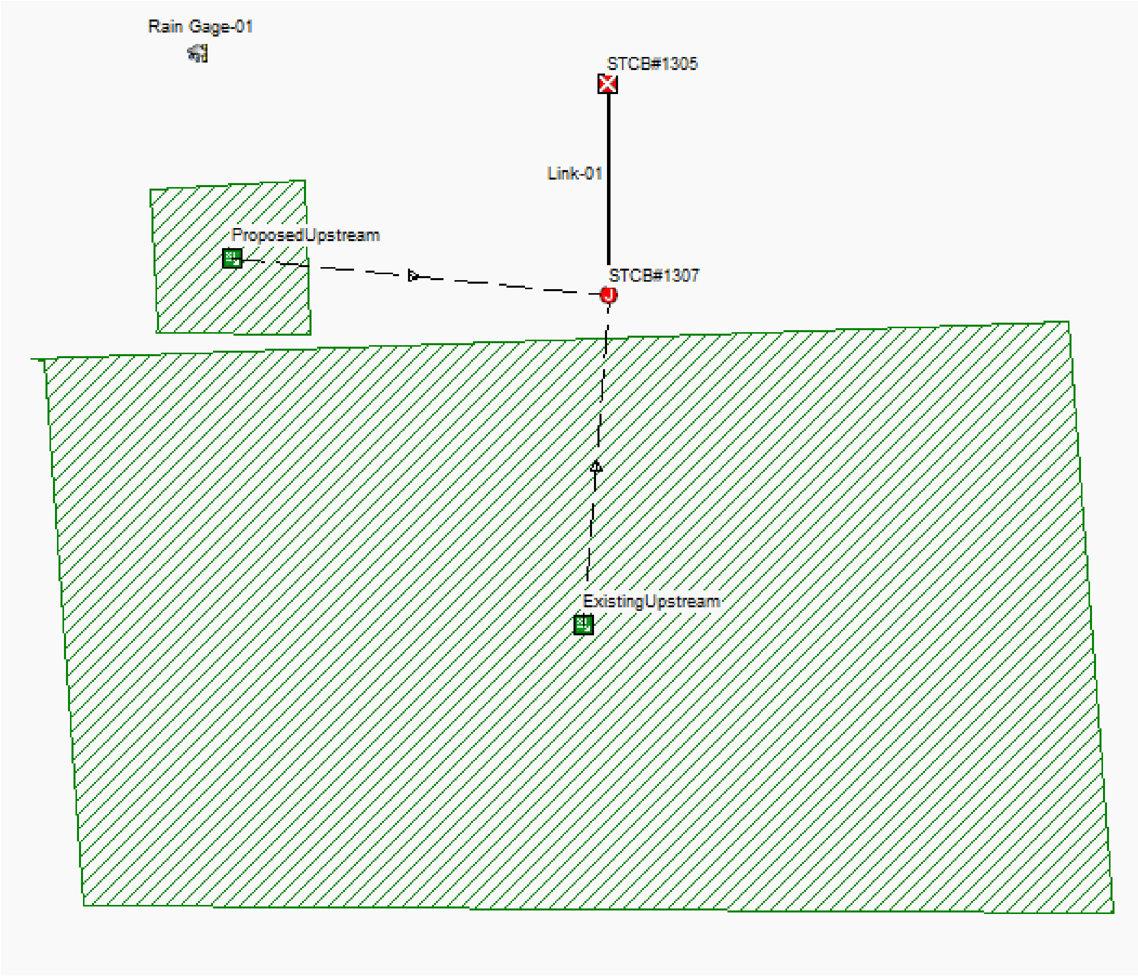
Proposed Upstream Area

impervious area already accounted for in old report

Total impervious area = 0.55 ac - 0.2755 = 0.2745 acres
This area is detained, but we are being conservative in our calculations
Total lawn area = 0.20 acres

Total area = 0.4745 acres (20,669 sf) ---> 58 % impervious

| SN | Element ID | Description | From (Inlet) Node | To (Outlet) Node | Length | Inlet Invert Elevation | Inlet Invert Offset | Outlet Invert Elevation | Outlet Invert Offset | Total Drop | Average Slope | Pipe Shape | Pipe Diameter or Height | Pipe Width | Manning's Roughness | Entrance Losses | Exit/Bend Losses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (%) | | (inches) | (inches) | | | |
| 1 | Link-01 | | STCB#1307 | STCB#1305 | 70.33 | 525.20 | -0.30 | 523.97 | -0.14 | 1.23 | 1.7500 | CIRCULAR | 12.000 | 12.00 | 0.0130 | 0.5000 | 0.5000 |



| Additional Losses | Initial Flow (cfs) | Flap Gate | Lengthening Factor | Peak Flow (cfs) | Time of Peak Flow Occurrence (days hh:mm) | Max Flow Velocity (ft/sec) | Travel Time (min) | Design Flow Capacity (cfs) | Max Flow / Design Flow Ratio | Max Flow Depth / Total Depth Ratio | Total Time Surcharged (min) | Max Flow Depth (ft) | Reported Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | 0.00 | NO | 1.00 | 1.22 | 0  08:00 | 5.26 | 0.22 | 5.01 | 0.24 | 0.34 | 0.00 | 0.34 | Calculated |

| SN | Element ID | X Coordinate | Y Coordinate | Description | Invert Elevation (ft) | Boundary Type | Flap Gate | Fixed Water Elevation (ft) | Peak Inflow (cfs) | Peak Lateral Inflow (cfs) | Maximum HGL Depth Attained (ft) | Maximum HGL Elevation Attained (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | STCB#1305 | -1346.30 | 7852.86 | | 524.11 | NORMAL | NO | | 1.22 | 0.00 | 0.34 | 524.45 |

| SN | Element ID | X Coordinate | Y Coordinate | Description | Invert Elevation | Ground/Rim (Max) Elevation | Ground/Rim (Max) Offset | Initial Water Elevation | Initial Water Depth | Surcharge Elevation | Surcharge Depth | Ponded Area | Minimum Pipe Cover | Peak Inflow | Peak Lateral Inflow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft²) | (inches) | (cfs) | (cfs) |
| 1 | STCB#1307 | -1343.88 | 7617.97 | | 525.50 | 534.15 | 8.65 | 525.50 | 0.00 | 534.15 | 0.00 | 0.00 | 95.40 | 1.22 | 1.22 |

| Maximum HGL Elevation Attained (ft) | Maximum HGL Depth Attained (ft) | Maximum Surcharge Depth Attained (ft) | Minimum Freeboard Attained (ft) | Average HGL Elevation Attained (ft) | Average HGL Depth Attained (ft) | Time of Maximum HGL Occurrence (days hh:mm) | Time of Peak Flooding Occurrence (days hh:mm) | Total Flooded Volume (ac-inches) | Total Time Flooded (minutes) |
|---|---|---|---|---|---|---|---|---|---|
| 525.84 | 0.34 | 0.00 | 8.31 | 525.64 | 0.14 | 0 08:00 | 0 00:00 | 0.00 | 0.00 |

| SN | Element ID | Description | Data Source | Data Source ID | Rainfall Type | Rain Units | State | County | Return Period | Rainfall Depth | Rainfall Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | (years) | (inches) | |
| 1 | Rain Gage-01 | | Time Series | TS-02 | Cumulative | inches | Washington | Pierce | 100 | 4.05 | SCS Type IA 24-hr |

| SN | Element ID | Description | Area (ft²) | Drainage Node ID | Impervious Area Curve Number | Pervious Area Curve Number | Impervious Area (%) | Rain Gage ID | Total Precipitation (inches) | Total Runoff (inches) | Peak Runoff (cfs) | Time of Concentration (days hh:mm:ss) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ExistingUpstream | | 48294.00 | STCB#1307 | 98.00 | 86.00 | 67.00 | Rain Gage-01 | 4.04 | 3.39 | 0.83 | 0 00:15:00 |
| 2 | ProposedUpstream | | 20669.00 | STCB#1307 | 98.00 | 86.00 | 58.00 | Rain Gage-01 | 4.04 | 3.29 | 0.39 | 0 00:05:00 |

# Appendix C

## Special Reports and Studies

## Geotechnical Engineering Services Report

Pierce College Puyallup – Parking Lot Additions
Puyallup, Washington

*for*
**Washington State Department of Enterprise Services**

January 31, 2022

GeoEngineers
Earth Science + Technology

## Geotechnical Engineering Services Report

Pierce College Puyallup – Parking Lot Additions
Puyallup, Washington

*for*
**Washington State Department of Enterprise Services**

January 31, 2022

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

# Geotechnical Engineering Services Report

# Pierce College Puyallup – Parking Lot Additions
# Puyallup, Washington

**File No. 21342-003-00**

**January 31, 2022**

Prepared for:

Washington State Department of Enterprise Services
Division of Engineering & Architectural Services
206 General Administration Building
Olympia, Washington 98504-1012

Attention: Christopher Gizzi

Prepared by:

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1/31/22

Christopher R. Newton, PE
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GeoEngineers

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**LIST OF FIGURES**



**APPENDICES**

## 1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services for the Pierce College Puyallup – Parking Lot Additions project. The project site is located at 1601 39th Avenue SE in Puyallup, Washington, as shown on the Vicinity Map, Figure 1. This report is preceded by a draft report dated August 16, 2021.

Our project understanding is based on discussions with you and AHBL, Inc. (project civil engineer) and review of Design Development Plans dated June 19, 2021 and prepared by AHBL, Inc. (Development Plans). Specific plan sheets reviewed include C0.1, C2.1 through C2.4, and C3.1 through C3.3.

Parking lot additions are proposed in the northwest, southwest and southeast portions of campus. For the purposes of this report, we refer to these additions individually as the "NW Parking Lot," "SW Parking Lot," and "SE Parking Lot." The parking lots will be surfaced with asphalt concrete pavement (ACP). New luminaire poles are also planned for the parking lots.

Other site improvements include stormwater management facilities. A detention pond is planned for the NW Parking Lot, detention pipes for the SW Parking Lot, and a dispersion trench for the SE Parking Lot. Bioretention cell(s) are also planned for these parking lot additions. It is our understanding that these proposed stormwater management facilities will be designed in accordance with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (SWMMWW).

## 2.0 SCOPE OF SERVICES

Our services have been provided in general accordance with our proposal for this project dated May 17, 2021 and our Signed Agreement No. 2020-546 C(3) dated June 13, 2021. A complete list of our scope or services is provided in this proposal.

During this study, it was determined that additional services and information not included in the above scope was required to assess the presence of groundwater and groundwater elevations near the proposed NW Parking Lot detention pond. A groundwater monitoring well was installed near this location on January 3, 2022 in order to collect groundwater data during the wet weather months (defined by the City of Puyallup as December 21 through April 1). A summary well log and data collected from the monitoring well will be presented in a supplemental report that will be presented around spring, after collection of groundwater data.

## 3.0 SITE CONDITIONS

### 3.1. Surface Conditions

The proposed NW Parking Lot area is currently occupied by undeveloped forest land in the northwest portion of the campus, generally north-northwest of the Health Education Center building. The proposed SW Parking Lot area currently consists of a grass field and is located east of the Garnero Child Development Center building. The proposed SE Parking Lot area is in the southeast corner of campus and currently consists of paved driveways, parking stalls, and vegetated planters.

Site vegetation in forested areas of the site generally consists of mature coniferous and deciduous trees and a dense understory layer, including brush, small trees, fallen trees, and forest duff. Developed parts of the site are generally vegetated with grass, plants, and shrubs. Campus site topography generally slopes upward toward the south-southeast from approximate Elevation 509 feet in the northwest campus corner to Elevation 551 feet in the southeast campus corner. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

## 3.2. Literature Review

### 3.2.1. Geologic Maps

Our understanding of the site geology is based on review of the *Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington* (Schuster, et al. 2015). The geologic map indicates the campus is mostly underlain by "Vashon Till" ($Q_{gt}$). "Recessional outwash" ($Q_{go}$) is also mapped along the eastern edge of campus and surrounds the Vashon till (glacial till) and project vicinity. Glacial till is glacially consolidated and is described as a low permeability, highly compact mixture of sand, gravel, silt, and clay that can contain cobbles and boulders dispersed throughout. Recessional outwash is generally described as variably sorted silt, clay, sand, and gravel deposited by receding glacial ice, and is typically underlain at some depth by glacial till. Recessional outwash deposits are not glacially consolidated and are generally medium dense.

### 3.2.2. Soil Survey

We reviewed the Natural Resources Conservation Service (NRCS) Web Soil Survey (accessed June 23, 2021). According to the survey, the site is underlain by three subunits of Kapowsin gravelly ashy loam: 0 to 6 percent slopes; 6 to 15 percent slopes; and 30 to 65 percent slopes. Kapowsin gravelly ashy loam is described as moderately well drained with a very low capacity of the most limiting layer to transmit water and categorized as Hydrologic Soil Group B.

### 3.2.3. Water Well Information

We searched the Washington State Department of Natural Resources Interactive Geologic Information Portal on May 4, 2021 for water well log reports in the project vicinity. Based on our search, we found a water well log report dated May 28, 2002 (Ecology Well ID Tag No. AFR 833) near the southwest corner of the campus property. This well log reported the static groundwater level at about 411 feet below the top of the well. We interpret this static groundwater level to be representative of the regional groundwater table in the project vicinity.

## 3.3. Subsurface Conditions

### 3.3.1. Subsurface Explorations and Laboratory Testing

We explored subsurface conditions at the proposed parking lot areas described above by excavating eight test pits (TP-1 through TP-8). Three test pits (TP-1 through TP-3) were located in the NW Parking Lot area, two test pits (TP-4 and TP-5) were located in the SW Parking Lot area, and three test pits (TP-6 through TP-8) were located in the SE Parking Lot area. The approximate locations of the proposed parking lot areas and the test pits are shown on the attached Site Plan, Figure 2. A description of our subsurface exploration program and summary exploration logs are provided in Appendix A. Two small-scale pilot infiltration tests (PITs) were completed in TP-2 (PIT-1) and TP-6 (PIT-2). The test results and methodology for the PITs are discussed in further detail in the "Stormwater Infiltration" section of this report.

Selected samples collected from our test pits were tested in our laboratory to confirm field classifications and to evaluate pertinent engineering properties. Our laboratory testing program included grain-size distribution analyses and moisture content determinations. A summary of our laboratory testing program and the test results are provided in Appendix A.

### 3.3.2. Soil Conditions

We observed about 12 inches of forest duff and/or organic-rich soil at the surface in test pits TP-1 through TP-3. Approximately 6 inches of sod was observed at the surface in the remaining test pits (TP-4 through TP-8). Descriptions of soils encountered below these surface materials in each parking lot area are discussed in the sections below.

#### *3.3.2.1. NW Parking Lot Area*

Below the forest duff and/or organic-rich soil in TP-1 through TP-3, we observed what we interpret to be glacial till. Glacial till was typically comprised of silty sand with variable gravel content and gravel with silt and sand. The upper approximately 3 feet of glacial till was observed to be in a weathered, medium dense condition. Roots up to about 1½-inch diameter were noted in the upper 2 to 3 feet of the glacial till. Below the weathered zone, glacial till generally included occasional cobbles and was observed to be dense to very dense. Test pits TP-1 through TP-3 were completed in glacial till soils at depths ranging from about 5½ to 11½ feet below ground surface (bgs). TP-2 (PIT-1) was terminated in hard, sandy silt.

#### *3.3.2.2. SW Parking Lot Area*

Below the sod in TP-4 and TP-5, we observed silty sand with variable gravel and cobbles content and occasional deleterious debris. Debris observed included nails, rubber particles, asphalt fragments and plastic waste. We interpret this material as fill. Fill was typically in a medium dense to dense condition and extended to depths between 2 and 3½ feet bgs.

Underlying the fill, we observed what we interpret to be glacial till. Glacial till typically consisted of silty sand with variable gravel and cobbles content and sand. The upper approximately 1½ to 3 feet of glacial till was observed to be weathered and generally in the medium dense to dense range. Underlying the weathered zone, very dense conditions were observed. Test pits TP-4 and TP-5 were completed in glacial till soils at depths of about 9 and 10½ feet bgs, respectively.

#### *3.3.2.3. SE Parking Lot Area*

Below the sod in TP-6 (PIT-2) through TP-8, we observed what we interpret to be fill material extending to about 1 to 4 feet bgs. Fill material typically consisted of loose, silty sand to medium stiff, sandy silt with gravel and occasional deleterious debris including asphalt fragments, metal cans and carbonized wood. Underlying the fill in TP-7, we observed what we interpret to be an old topsoil horizon from about 3 to 3½ feet bgs, which consisted of silty sand with organic matter (roots). TP-8 was completed in fill material at a depth of approximately 4 feet bgs.

Underlying the fill in TP-6 (PIT-2) and the old topsoil horizon in TP-7, we observed what we interpret to be glacial till. Glacial till typically consisted of silty sand with variable gravel and cobbles content. The upper approximate 1½ feet in TP-6 (PIT-2) was observed to be weathered and in a medium dense condition. Dense soil conditions were observed beneath the weathered zone to the completed depth of about 4¼ feet bgs. The glacial till in TP-7 was observed to be weathered and in a medium dense to dense condition to the completed depth of about 8½ feet bgs.

### 3.3.3. Groundwater Conditions

We did not observe what we interpret to be the regional groundwater table in our explorations. However, we observed moderate seepage in TP-5 beginning around 3 feet bgs. The seepage rate was observed to increase to rapid at about 9½ feet bgs. Moderate seepage is defined as 1 to 3 gallons per minute (gpm) and rapid seepage is greater than 3 gpm. We interpret the seepage observed in TP-5 to be perched groundwater.

Based on our experience, it is not uncommon for glacial soils to contain isolated zones of perched groundwater. We anticipate that perched groundwater could be present in other areas at the proposed parking lots depending on soil conditions, rainfall amounts, irrigation activities and other factors. We anticipate that perched groundwater levels will generally be highest during the wet season, typically October through May. Static groundwater is not anticipated at excavation depths proposed.

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

## 4.1. Primary Geotechnical Considerations

Based on our understanding of the project, the explorations performed for this study, review of subsurface information near or within the project vicinity and our experience, it is our opinion that the proposed improvements can be designed and constructed generally as envisioned with regards to geotechnical considerations. A summary of the primary geotechnical considerations for the project is provided below and is followed by our detailed recommendations.

- Clearing and stripping depths for forest duff in the NW Parking Lot area will typically be on the order of about 12 inches. Abundant roots were observed to a depth of about 2 to 3 feet bgs, which may require greater clearing and stripping efforts when establishing subgrades. In the SW and SE Parking Lots, clearing and stripping depths will be on the order of 6 inches to remove sod.
- Most of the soils observed at the proposed parking lot areas contain a significant quantity of fines and, therefore, could be difficult or impossible to work with when wet or become easily disturbed if exposed to wet weather. Depending on the intended use of the material and the moisture/weather conditions, it may be difficult to re-use on-site soils as structural fill.
- Based on our experience, subsurface conditions observed in our explorations, and results from our infiltration testing, it is our opinion that stormwater infiltration within proposed development areas related to this study is generally infeasible. We provide additional discussion in the "Stormwater Infiltration" section below.

## 4.2. Luminaire Poles

### 4.2.1. Design Parameters

We understand that luminaire poles are planned for parking lot improvements. It is our opinion that Washington State Department of Transportation (WSDOT) Standard Plans may be used, as applicable, for design of luminaire poles. Recommended soil properties and design parameters are provided in Table 1 below. These values are based on our experience in the area and review of the 2021 WSDOT Geotechnical Design Manual (WSDOT GDM), Chapter 17, "Foundation Design for Signals, Signs, Noise Barriers, Culverts, and Buildings," specifically referencing Table 17.2. We recommend that this document be referenced and reviewed during the design and selection process for luminaire pole foundations. The WSDOT GDM, Chapter 17 also provides design guidance if foundations other than indicated in the Standard Plans are required.

The allowable lateral bearing pressure listed below is for foundations constructed in relatively flat ground conditions, which is anticipated for this project. Special design considerations for foundations constructed on or near slopes are provided in WSDOT GDM, Chapter 17. We should be consulted further if sloping conditions are anticipated around luminaire poles.

**TABLE 1. LUMINAIRE POLE DESIGN PARAMETERS**

| Proposed Parking Lot | Soil Unit Weight (pcf) | Soil Friction Angle (deg) | Allowable Lateral Bearing Pressure (psf) |
|---|---|---|---|
| Northwest | 125 | 34 | 2,500 |
| Southwest | 125 | 34 | 2,500 |
| Southeast | 120 | 32 | 1,900 |

#### 4.2.2. Construction and Additional Design Considerations

We present two conditions to consider when designing and constructing luminaire pole foundations (pole foundations).

- Condition #1, an excavation the same dimension of the designed pole foundation is developed, and the foundation is cast directly against undisturbed earth. Or,
- Condition #2, an excavation larger than the designed dimension of the pole foundation is developed, a corrugated metal pipe is placed into the excavation and the foundation concrete is cast inside the metal pipe. The corrugated metal pipe is left in place after pouring the foundation concrete. Any overexcavated area outside of the corrugated metal pipe is backfilled with controlled density fill (CDF) or structural fill.

Construction of foundation Condition #1 requires the sidewalls of the excavation to stay stable and not cave into the excavation. In the case of drilling installation methods, temporary steel casing or drill slurry can also be used if caving soil conditions are encountered. Excavations made for foundation Condition #2 should be in accordance with the “Temporary Excavations and Cut Slopes” section of this report if workers are expected to enter the excavation. Recommendations regarding backfilling around pole foundations are included in the “Backfill Placement and Compaction Around Luminaire Pole Foundations” section of this report.

In general, we expect that the majority of the luminaire pole foundations will be constructed in fill and/or weathered soil overlying glacial till. We expect that the majority of the excavations for the foundations will remain open for a short period of time. There could be sloughing and raveling in the upper approximate 5 feet or so, in the fill and/or weathered soils. The contractor should be prepared to use casing, as necessary, to stabilize the hole, especially within the upper approximate 5 feet.

## 4.3. Site Development and Earthwork

### 4.3.1. General

We anticipate that site development and earthwork will include clearing and grubbing, site grading, excavating for utilities and other improvements, establishing subgrades for structures and roadways, and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

### 4.3.2. Clearing and Stripping

We anticipate that clearing and stripping depths at the proposed NW Parking Lot area will be on the order of about 12 inches to remove forest duff and/or organic-rich soil. Roots were observed to about 3 feet bgs and mature trees were present in this area; therefore, it is likely that greater stripping depths will be required in areas of trees, heavier vegetation, or relatively lower lying areas. Clearing and stripping depths in the proposed SW and SE Parking Lot areas are anticipated to be on the order of about 6 inches to remove the sod.

During stripping operations excessive disturbance of surficial soils can occur, especially if left exposed to wet conditions. The site soils expected to be exposed after clearing and stripping have a relatively high fines content and can be easily disturbed during wet weather. Clearing and stripping at the site should be performed during dry weather and/or exposed soils should be promptly covered and protected to avoid excessive disturbance. Disturbed soils may require additional compaction or remediation during construction and grading.

Cobbles were encountered in our explorations. Although boulders were not encountered in our explorations, boulders are commonly present in glacial till soils in the project area. The contractor should be prepared to remove cobbles and boulders if encountered during grading or excavation. Boulders may be removed from the site or used in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

### 4.3.3. Erosion and Sedimentation Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce impacts to the project where erosion-prone areas are present. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;
- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;

- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan. Where sloped areas are present, some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

#### 4.3.4. Temporary Excavations and Cut Slopes

Based on observations made during excavation of our test pits and our experience with other projects in similar soil conditions, we anticipate that shallow or even moderately deep (about 10-foot) excavations that do not encounter groundwater seepage could maintain vertical slopes for extended periods of time with only minor caving. However, excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, “Excavation, Trenching and Shoring.” Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). We recommend contract documents specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety, and providing shoring, as required, to protect personnel and structures.

In general, we recommend that for planning purposes all temporary cut slopes be inclined no steeper than about 1½H to 1V (horizontal to vertical) if workers are required to enter the excavation. This guideline assumes all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surface surcharge loads are anticipated. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

#### 4.3.5. Permanent Cut and Fill Slopes

We recommend permanent slopes be constructed at a maximum inclination of 2H to 1V to manage erosion. Where 2H to 1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend fill slopes be overbuilt and subsequently cut back to expose well-compacted fill. Fill placement on existing slopes steeper than 5H to 1V should be benched into the slope face. The configuration of benches depends on the equipment being used and the inclination of the existing slope. Bench excavations should be level and extend into the slope face at least half the width of the compaction equipment used.

Exposed areas should be re-vegetated as soon as practical to reduce surface erosion and sloughing. Temporary protection should be used until permanent protection is established.

#### 4.3.6. Groundwater Handling Considerations

It is common within glacial deposits encountered at this campus and in general, sites with similar soil conditions, to encounter perched groundwater. The interface between more permeable and less permeable soil types such as the contact between fill and/or weathered glacial till and glacial till are common conditions where perched groundwater can be present, as such, perched groundwater could be encountered in other excavations outside of our test pit explorations, especially where more permeable sand and gravel seams may overlie less permeable materials.

Groundwater handling needs will typically be lower during the summer and early fall months. We anticipate that shallow perched groundwater can be handled adequately with sumps, pumps, and/or diversion ditches, as necessary. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

Based on our understanding of the proposed site improvements, we do not anticipate that the regional static groundwater table will be encountered during excavations for this project. Perched groundwater was observed in test pit TP-5 beginning around 3 feet bgs. Perched water or the presence of water was not noted in the other explorations. If it becomes necessary to complete deeper excavations near or around TP-5 and for the SW parking lot area, it may be necessary to consider higher volumes of water depending on the amount of rainfall and time of year. The use of larger pumps, storage tanks, and discharge permits could be necessary.

#### 4.3.7. Surface Drainage

Surface water from driveways and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not be connected to wall or foundation drains.

#### 4.3.8. Subgrade Preparation

Subgrades that will support structures, hardscapes and roadways should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping and before placing structural fill. We recommend that subgrades for hardscapes and roadways be evaluated, as appropriate, to identify areas of yielding or soft soil. Probing with a steel probe rod or proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

#### 4.3.9. Subgrade Protection and Wet Weather Considerations

Near-surface soils observed at the proposed parking lot areas contain a significant quantity of fines and will be susceptible to disturbance during periods of wet weather. The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any month of the year. It may be possible to conduct earthwork at the site during wet weather months provided appropriate measures are implemented to protect exposed soil. If earthwork is scheduled during the wet weather months, we offer the following recommendations:

- Measures should be implemented to remove or eliminate the accumulation of surface water from work areas. The ground surface in and around the work area should be sloped so that surface water is directed away and graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Protective surfacing such as placing asphalt-treated base (ATB), or haul roads made of quarry spalls or a layer of free-draining material such as well-graded pit-run sand and gravel may be considered to limit disturbance to completed areas. Minimum quarry spall thicknesses should be on the order of 12 to 18 inches. Typically, minimum gravel thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection.

## 4.4. Fill Materials

### 4.4.1. Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, structural fill consisting of material similar to "Select Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the WSDOT Standard Specifications will be appropriate.

Weather and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill. If earthwork activities are scheduled during the wet weather months or during prolonged periods of wet weather, we recommend that washed crushed rock or select granular fill, as described below, be used for structural fill.

If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable.

### 4.4.2. Select Granular Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), or 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

#### 4.4.3. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to "Gravel Backfill for Pipe Zone Bedding" described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

#### 4.4.4. Trench Backfill

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that trench backfill material consist of material similar to "Select Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the WSDOT Standard Specifications.

#### 4.4.5. On-Site Soil

Based on our subsurface explorations and experience, it is our opinion that existing site soils, excluding the forest duff and/or organic-rich soil and sod, may be considered for use as structural fill and trench backfill, provided that it can be adequately moisture conditioned, placed and compacted as recommended and does not contain organic or other deleterious material. Based on our experience, the fill material and glacial till at the site are extremely moisture sensitive and will be very difficult or impossible to properly compact when wet.

In addition, it is likely that existing soils will be above optimum moisture content (OMC) when excavated, unless earthwork activities take place in the middle of summer. Even then, the soil could still be above OMC when excavated. Soils placed and compacted above OMC are typically difficult to work with and may have trouble achieving adequate compaction. If earthwork occurs during a typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions or lack of drying space/time, we recommend the use of imported structural fill or select granular fill, as described above. We suggest we be contacted again should on-site material be considered for use as fill so that we can provide more specific review of the work and area being developed. Overall, we suggest that a provision for imported material be included in the project budget to account for the presence of fine-grained soil that is over-wet and cannot achieve compaction. We expect that this may be most prevalent for utility trench backfill but may also be relevant for general fills to achieve design grade.

### 4.5. Fill Placement and Compaction

#### 4.5.1. General

To obtain proper compaction, fill and backfill soil should be compacted near the OMC and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 8- to 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

#### 4.5.2. Area Fills and Pavement Bases

Fill placed to raise site grades and materials under pavements and should be placed on subgrades prepared as previously recommended. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the maximum dry density (MDD). Fill placed deeper than 2 feet below pavement sections should be compacted to at least 90 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically around 85 to 90 percent of the MDD.

#### 4.5.3. Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 90 percent of the MDD. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment as necessary.

#### 4.5.4. Backfill Placement and Compaction Around Luminaire Pole Foundations

Backfill in overexcavated areas and around pole foundations must be compacted in accordance with WSDOT Standard Specifications Section 2-09.3(1)E. If the overexcavated area is large enough for compaction equipment to access, import fill material or on-site material conforming to the specifications and discussion outlined above can be used to backfill the excavations. Backfill material around pole foundations must be compacted to at least 95 percent of the theoretical MDD per ASTM International (ASTM) D 1557.

Alternatively, CDF could be used to backfill the excavation in accordance with WSDOT Standard Specification Section 2-09.3(1)E. CDF is a self-compacting, cementitious, flowable material requiring no subsequent vibration or tamping to achieve consolidation. CDF is included as an option for backfilling around pole foundations in the WSDOT Standard Signal Foundation Plans. If the area to backfill is too small for compaction equipment to access, CDF should also be used. Additionally, we recommend that CDF be used to backfill any large voids created during excavation if compaction equipment cannot access the void area.

### 4.6. Stormwater Infiltration

#### 4.6.1. General

It is our understanding that stormwater infiltration facilities will be designed in general accordance with the Washington State Department of Ecology's 2014 SWMMWW. According to the SWMMWW, design infiltration rates in glacially consolidated soils (i.e., glacial till) should be determined via in-situ infiltration testing such as a PIT. The sections below further describe our methodology and provide recommended infiltration rates for design.

We developed design stormwater infiltration rates for the proposed NW and SE Parking Lots following general methodology presented in the SWMMWW and completed two small-scale PITs, PIT-1 and PIT-2. PIT-1 was completed during excavation of TP-2 and PIT-2 was completed during excavation of TP-6. PIT-1 was located approximately within the basal footprint of the planned detention pond for the proposed NW Parking Lot area. PIT-2 was located within a landscape planter in the vicinity of a planned bioretention cell for the proposed SE Parking Lot area.

A PIT was planned for TP-5 within the approximate basal footprint of the proposed detention pipes for the SW Parking Lot area; however, due to moderate to rapid groundwater seepage observed in the excavation, the PIT was unable to be completed. We provide further discussion on these detention pipes in the "Proposed SW Parking Lot Detention Pipe Design" section below.

The proposed dispersion trench in the SE Parking Lot area is currently located at the top of a slope near the east edge of College Way. We provide further discussion on this dispersion trench in the "Proposed SE Parking Lot Dispersion Trench" section below.

### 4.6.2. Pilot Infiltration Tests

#### *4.6.2.1. Methodology*

We completed the PITs generally following GeoEngineers' standard methodology for PITs, which is a synthesis of best practices and, in our opinion, meets the intended procedures for small-scale PITs set forth in the SWMMWW. Per the direction of the project civil engineer (AHBL), PIT-1 and PIT-2 were completed at depths of about 11 and 4 feet bgs, respectively. The approximate areas of the base of the PIT excavations were at least 16 square feet. Upon reaching the target depth for PIT-1, an extension ladder with a piezoelectric pressure transducer secured to near the bottom was lowered to the floor of the test pit to record water level readings during the PIT. Similarly, upon reaching the target depth for PIT-2, a graduated yard stick was driven into the floor of the test pit and a piezoelectric pressure transducer was secured to near the bottom of the yard stick. The piezoelectric pressure transducers were programmed to record water level readings at 20-second intervals.

GeoEngineers' PIT procedure consists of a 6-hour (minimum) saturation period where the water depth in the PIT is raised and lowered, over a small 1- to 3-inch interval, in a series of falling-head stages. Water level measurements collected by the pressure transducer during each falling-head stage are used to calculate the apparent infiltration rate for each stage. Manual water level measurements are also recorded in the event a transducer malfunctions during the test. The falling-head stage methodology is intended to fully saturate the soils below the base of the PIT while allowing for a direct measurement of when saturated or near-saturated conditions have been achieved. This is usually manifested by a progressive decline in the apparent infiltration rate until the rate approximately stabilizes. The stabilized rate corresponds to the saturated infiltration rate or the measured (initial) infiltration rate of the soil.

Generally, once a stabilized infiltration rate is observed and a minimum of 6 hours of saturation time has elapsed, the PIT is continued for one or more falling-head cycles or is left undisturbed until the water drains away completely. If left to drain away completely, the final drain-down period shows how infiltration changes over a continuous range of declining water depths.

Water was pumped into the PIT-1 excavation from a water truck, while a hose attached to a water hydrant was used to fill the PIT-2 excavation. PIT-1 and PIT-2 were filled with water to depths of about 16½ and

16 inches, respectively. The PITs completed for this study were only filled for one falling-head stage as they were observed to drain very slowly. At approximately 6 hours into each test, PIT-1 and PIT-2 had dropped about ½ inch and 1¾ inches, respectively. Based on the limited water level drops observed in the PITs over approximately 6 hours we elected to conclude the tests.

#### *4.6.2.2. Test Results*

We were able to download the transducer water level data from PIT-1, but the transducer used for PIT-2 did not record any water level data. Instead, we used our manual water level measurement to estimate the measured (initial) infiltration rate for PIT-2.

The SWMMWW recommends that correction factors be applied to the measured (initial) infiltration rate determined in the PIT to establish a long-term design infiltration rate. The correction factors account for uncertainties in site variability, testing procedures, and long-term reduction in permeability due to plugging. Table 2 below provides a summary of the correction factors outlined in the SWMMWW that are, in our opinion, appropriate for use at this site. The total correction factor is equal to the product of the individual factors.

**TABLE 2. CORRECTION FACTORS FOR FIELD INFILTRATION MEASUREMENTS**

| Correction Factor | Recommended Value |
|---|---|
| Site Variability and Number of Locations Tested | $CF_v$=0.33<br>Selected because of number of test locations |
| Test Method | Small-scale PIT, $CF_t$ = 0.50 |
| Degree of Influent Control to Prevent Siltation and Bio-buildup | $CF_m$= 0.9 |
| Total Correction Factor ($CF_v$ x $CF_t$ x $CF_m$) | $CF_T$= 0.15 |

The long-term design infiltration rate ($K_{sat\_design}$) is obtained by multiplying the measured (initial) infiltration rate ($K_{sat\_initial}$) by the total correction factor:

$$K_{sat\_design} = K_{sat\_initial} * CF_T$$

Table 3 summarizes the measured (initial) and long-term design infiltration rates for the PITs.

**TABLE 3. INFILTRATION RATE SUMMARY**

| Pilot Infiltration Test Number | Proposed Parking Lot | Approximate Depth of PIT (feet bgs) | Approximate Elevation of PIT[1] (feet; NAVD88) | Measured (Initial) Infiltration Rate ($K_{sat\_initial}$; in/hr) | Long-Term Design Infiltration Rate[2] ($K_{sat\_design}$; in/hr) |
|---|---|---|---|---|---|
| TP-2 (PIT-1) | Northwest | 11 | 504 | 0.10 | 0.015 |
| TP-6 (PIT-2) | Southeast | 4 | 532 | 0.29 | 0.043 |

Notes:

[1] Elevation should be considered approximate.

[2] Long-term design infiltration rate with appropriate correction factors applied.

#### *4.6.2.3. Discussion of PIT Results and Stormwater Infiltration Feasibility*

Based on the subsurface conditions observed in our explorations and the results of the PITs, it is our opinion that stormwater infiltration is generally infeasible at the proposed parking lot areas for this project. We take no issue with preliminary use of the long-term design infiltration values listed in Table 3 at this time, corresponding to the areas studied; however, it is our understanding that values below 0.3 inches per hour are also considered infeasible for infiltration, according to the City of Puyallup. Similar soil conditions were also noted within the other explorations completed for the project. As such, we ultimately recommend that infiltration not be considered as an option for stormwater management on this project. If a small amount of infiltration is absolutely necessary, we recommend we be consulted first to review proposed location, the proposed design, and overall use before final determination of design.

### 4.6.3. Additional Considerations

#### *4.6.3.1. General*

The SWMMWW indicates PITs should be completed between December 1st and April 1st (wet season). Testing during this time range is to help provide an accurate representation of soil saturation and groundwater information. However, based on previous explorations and work in the project vicinity and our review of regional groundwater conditions, the static groundwater levels are reported and expected to be well below the project excavation depths, even during the wet season. In addition, subsurface soils are fine-grained and dense at proposed infiltration locations and not expected to be different during the wet season. While there is a potential for the presence of seepage to be greater during the wetter times of the year, we conclude that the presence and condition of the glacial till is the primary controlling factor in infiltration rate design for depths proposed at this project. Because of this and based on review of groundwater data nearby, it is our opinion that the time of year of PIT completion is not a controlling factor for stormwater design.

We did not investigate the suitability of site soils for stormwater treatment purposes as part of this study. If soils at the site are to be used for stormwater treatment, additional testing and/or the use of soil amendments may be necessary.

#### *4.6.3.2. Proposed SW Parking Lot Detention Pipe Design*

TP-5 was completed approximately within the basal footprint of the proposed detention pipes area. Groundwater seepage was encountered about 3 feet bgs to the depth explored. Based on conditions observed in TP-5 and our other explorations, we expect that there could be times of year where the detention pipes may be constructed in the presence of seepage and at depths where there is a potential for the pipes to be surrounded by water. As such, we recommend that the proposed detention pipes be considered and checked for buoyancy effects. For the SW parking lot detention pipe design, we recommend the following considerations for review:

- Groundwater elevation assumed to be at 534 feet (NAVD88);
- Total soil unit weight (above groundwater): 125 pounds per cubic foot (pcf);
- Effective soil unit weight (below groundwater): 62.6 pcf;
- Follow detention pipe system manufacturer recommendations for mitigating buoyancy effects.

Based on our explorations, we conclude that design for this groundwater elevation and this condition is conservative and that seepage in this area will be intermittent, discontinuous, and variable in depth and location. As such, we do not expect the pipe in this area to become submerged and the soil to become fully saturated enough to represent the buoyant condition. If buoyancy becomes an issue at this elevation, we recommend that we re-evaluate our design and considerations presented above, including the effects of multiple groundwater depths, alternative backfill options and/or anchors or weight options for the pipe, should it be determined necessary.

#### *4.6.3.3. Proposed SE Parking Lot Dispersion Trench*

Per sheet C2.4 of the Development Plans, two dispersion trenches that are 50 and 20 feet long (system), respectively, are proposed on the east edge of College Way. This system will be located near the top of a slope that is more than 20 feet in height. The slope grade in the vicinity of the proposed trenches ranges between about 4H to 1V and 2.4H to 1V, which equates to about a 25 to 42 percent slope. The slope is densely forested and based on literature and our experience on campus, soils are likely to consist of dense glacial till or recessional outwash. We understand that this slope area east of College Way is regulated and not expected to be built upon or cleared.

We reviewed the "Design Criteria for Dispersion Trenches" subsection under section "3.1.2 Downspout Dispersion Systems (BMP T5.10B)" of the SWMMWW. Per criterion number 5, discharge points of these trenches should not be placed on or above slopes that are greater than 15 percent "without evaluation by a geotechnical engineer or qualified geologist and jurisdiction approval."

Based on our understanding of the subsurface and geologic conditions in the project vicinity, inclinations of the slope, and provided that the current vegetation of the down slope portion of the slope remains intact and the area remains uninhabited, it is our opinion that these proposed dispersion trenches can be constructed as envisioned at the top of the slope with limited risk. We provide the following additional considerations and recommendations:

- Based on nearby explorations, site geology, and review of the system, it is our opinion that the location and proposed use of the infiltration trench will not cause global instability or deep-seated slope failure.
- The current configuration of the slope is less steep than our recommendations for permanent slope construction; 2H to 1V.
- Near surface slope erosion and saturation at the outlets within the trench and downhill flooding could occur from the system. This will ultimately depend on volume, frequency, and flow rate of discharging stormwater from the trenches. Based on site review, slope inclinations and dense vegetative nature of the forest and the expected limited use and long term limited disturbance of the slope area, it is our opinion that this area can accommodate the additional influx of proposed dispersion trench water without causing excessive or significant surface or shallow failures.
- We recommend that this area be inspected yearly and maintained. We also suggest at a minimum that inspections be completed during the rainy season after periods of heavy precipitation to evaluate if maintenance is necessary. There could be some repairs and slope surface care that will need to be addressed over time. Options for additional slope surface care, should some erosion or issues be observed, could include placement of straw wattles or other similar erosion control products. Re-planting, energy dissipaters such as quarry spalls and/or silt fencing could also be placed near drain inlets/outlets to further slow water and the effects of erosion, should it seem to be an issue. Ultimately, we recommend that the SWMMWW be reviewed for guidance on incorporating permanent erosion control measures for the slope and the dispersion trench system.

## 4.7. Pavement Recommendations

### 4.7.1. General

Pavements for the proposed improvements will include new parking areas and driveways. Our recommended pavement sections provided below are based on our explorations and experience in the area. We understand ACP is planned for the proposed improvements.

The recommended pavement sections below may not be adequate for heavy construction traffic loads such as those imposed by concrete transit mixers, dump trucks or cranes. Additional pavement thickness may be necessary to prevent pavement damage during construction. An ATB section can also be used during construction to protect partially constructed pavement sections and pavement subgrades. The recommended sections assume final improvements surrounding the pavement areas will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not accumulate below the pavement section or pond on pavement surfaces. If pavements in parking areas slope inward (toward the center of the parking area) full depth curbs or other measures should be used to prevent water from entering and ponding on the subgrade and within the base section.

### 4.7.2. Construction Considerations

Existing pavements, hardscaping or other structural elements should be removed prior to placement of new pavement sections. Pavement subgrade should be prepared to a uniformly firm, dense and unyielding condition as previously described. Crushed surfacing base course (CSBC) and subbase should be moisture conditioned to near optimum moisture content and compacted to at least 95 percent of the MDD (ASTM D 1557).

Crushed surfacing base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications. Hot mix asphalt should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications.

Some areas of pavement may exhibit settlement and subsequent cracking over time. Cracks in the pavement will allow water to infiltrate to the underlying base course, which could increase the amount of pavement damage caused by traffic loads. To prolong the effective life of the pavement, cracks should be sealed as soon as possible.

### 4.7.3. Asphalt Concrete Pavement Design

#### *4.7.3.1. Standard-Duty ACP – Automobile Driveways and Parking Areas*

- 2 inches of hot mix asphalt, class ½ inch, PG 58-22
- 4 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.
- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the “Subgrade Preparation” and “Area Fills and Pavement Bases” sections of this report.

#### *4.7.3.2. Areas Subject to Occasional Heavy Truck Traffic*

- 3 inches of hot mix asphalt, class ½ inch, PG 58-22
- 6 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.
- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the “Subgrade Preparation” and “Area Fills and Pavement Bases” sections of this report.

#### *4.7.3.3. Temporary Construction Surfacing*

A temporary surfacing of ATB can be used to protect partially constructed pavement sections and pavement subgrades during construction. This can provide a relatively clean working surface, prevent construction traffic from damaging final paving surfaces and reduce subgrade repairs required for final paving. A 2-inch-thick section of ATB can be substituted for the upper 2 inches of CSBC in either the light-duty or heavy-duty pavement sections. Prior to placement of the final pavement surface sections, we recommend that any areas of ATB pavement failure be removed, and the subgrade repaired. If ATB is used and is serviceable when final pavements are constructed, the design asphalt concrete pavement thickness can be placed directly over the ATB.

Cement treatment of subgrades is sometimes used to create construction surfacing or to control soil moisture during wet weather construction. In our opinion cement treatment would not likely be cost effective for creating a wet weatherproof construction surface due to the high fines content in the soil. Cement treatment or cement stabilization would likely only be cost effective as an emergency or contingency action for reducing soil moisture in the on-site material if excavated and re-used as a structural fill. We estimate that it would take a significant amount of cement, likely on the order of 12 percent by weight, to create a firm and stable working surface that could handle wet weather construction. If used as a structural fill, likely on the order of 6 to 8 percent cement by weight would be required.

## 5.0 LIMITATIONS

We have prepared this report for the Washington State Department of Enterprise Services (DES) for the Pierce College Puyallup – Parking Lot Additions project located in Puyallup, Washington. DES may distribute copies of this report to owner’s authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled “Report Limitations and Guidelines for Use” for additional information pertaining to use of this report.

FIGURES

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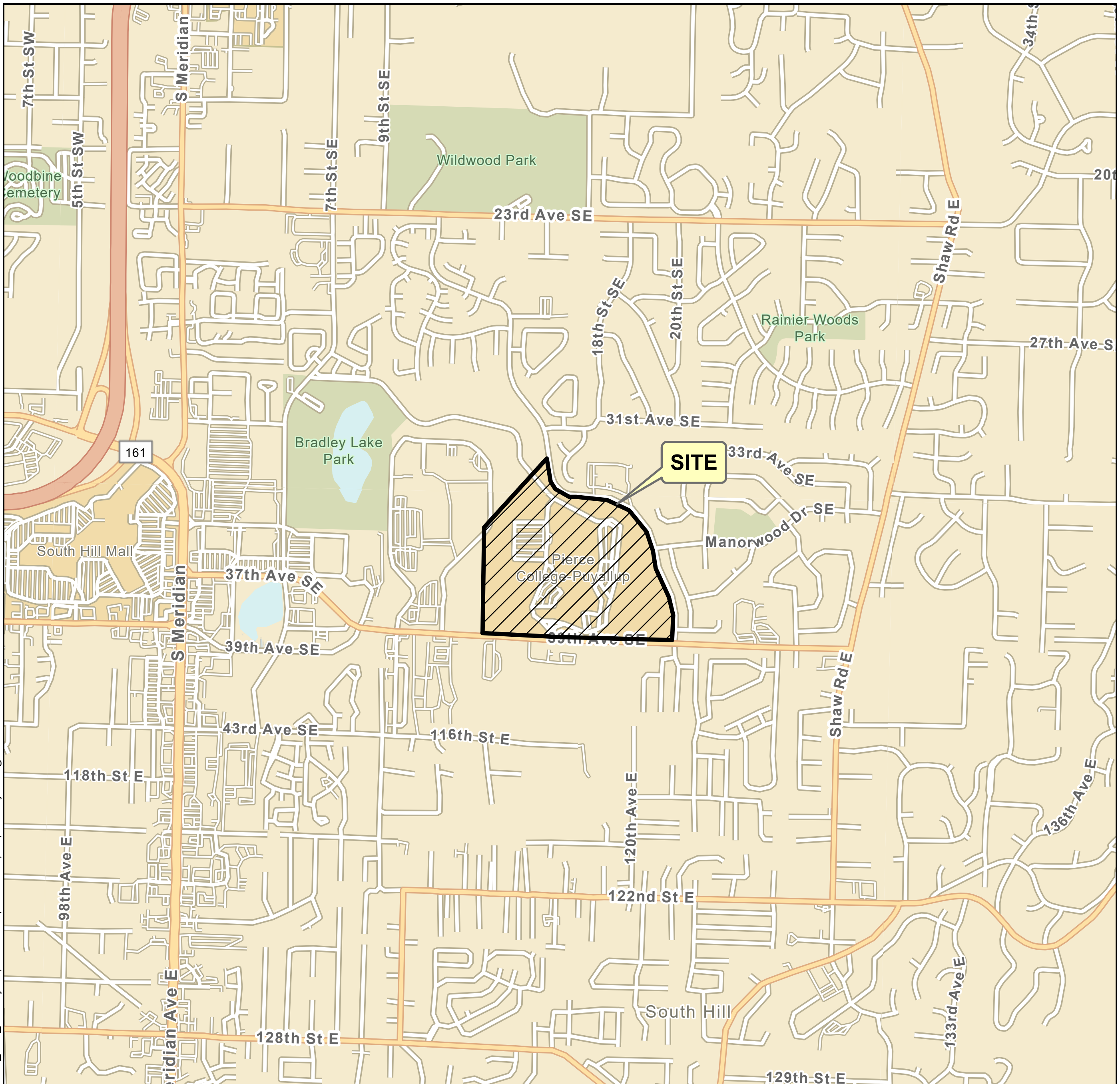


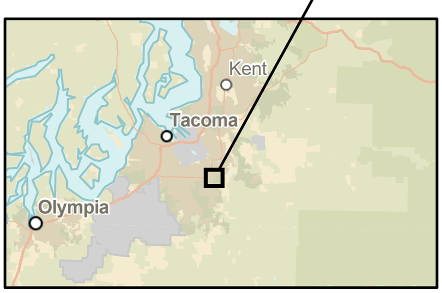


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Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

**Vicinity Map**

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

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**Figure 1**


## Legend

TP-1 Test Pit by GeoEngineers, Inc., 2021

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from AHBL, Inc., dated 06/24/2021.
Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, South Zone, NAD83, US Foot

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**Site Plan**

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

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**Figure 2**

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APPENDICES

GeoEngineers

# APPENDIX A
## Subsurface Explorations and Laboratory Testing

## APPENDIX A
## SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

### Subsurface Explorations

Subsurface conditions for the proposed Pierce College Puyallup – Parking Lot Additions project were explored by excavating eight test pits between June 17 and June 21, 2021 at the approximate locations shown on the Site Plan, Figure 2. Pilot infiltration tests (PITs) were completed at about 11 feet and 4 feet below ground surface (bgs) at TP-2 (PIT-1) and TP-6 (PIT-2), respectively. The test pits were excavated to depths between about 4 and 11½ feet bgs using an excavator provided and operated by Kelly's Excavating, Inc. under subcontract to GeoEngineers. After each test pit was completed, the excavation was backfilled using the generated material and compacted using the bucket of the excavator.

During the exploration program, our field representative obtained soil samples, classified the soils encountered, and maintained a detailed log of each exploration. The relative densities noted on the test pit logs are based on the difficulty of excavation and our experience and judgment. The samples were collected and retained in sealed plastic bags and then transported back to our office. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-9.

The locations of the test pits were determined using an electronic tablet equipped with global positioning system (GPS) software. The locations of the explorations should be considered approximate.

### Laboratory Testing

Soil samples obtained from the explorations were transported to GeoEngineers' laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classifications.

Our testing program consisted of the following:

- Three grain-size distribution analyses (sieve analyses [SA])
- Eight moisture content determinations (MC)

Tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures. The following sections provide a general description of the tests performed.

#### Sieve Analysis (SA)

Grain-size distribution analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method covers the quantitative determination of the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (μm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figure A-10 presents the results of our sieve analyses.

### Moisture Content (MC)

The moisture content of selected samples was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The results are presented on the test pit logs at the depth tested.

## SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS | | | SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN 50% RETAINED ON NO. 200 SIEVE | GRAVEL AND GRAVELLY SOILS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS<br>(LITTLE OR NO FINES) | | GW | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | | | GP | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | GRAVELS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | | | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| | SAND AND SANDY SOILS<br>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE | CLEAN SANDS<br>(LITTLE OR NO FINES) | | SW | WELL-GRADED SANDS, GRAVELLY SANDS |
| | | | | SP | POORLY-GRADED SANDS, GRAVELLY SAND |
| | | SANDS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | | | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS<br>MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS |
| | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | | | OH | ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY |
| HIGHLY ORGANIC SOILS | | | | PT | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS |

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

## ADDITIONAL MATERIAL SYMBOLS

| SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|
| | AC | Asphalt Concrete |
| | CC | Cement Concrete |
| | CR | Crushed Rock/ Quarry Spalls |
| | SOD | Sod/Forest Duff |
| | TS | Topsoil |

### Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

### Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

### Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

### Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

### Laboratory / Field Tests

| | |
|---|---|
| %F | Percent fines |
| %G | Percent gravel |
| AL | Atterberg limits |
| CA | Chemical analysis |
| CP | Laboratory compaction test |
| CS | Consolidation test |
| DD | Dry density |
| DS | Direct shear |
| HA | Hydrometer analysis |
| MC | Moisture content |
| MD | Moisture content and dry density |
| Mohs | Mohs hardness scale |
| OC | Organic content |
| PM | Permeability or hydraulic conductivity |
| PI | Plasticity index |
| PL | Point lead test |
| PP | Pocket penetrometer |
| SA | Sieve analysis |
| TX | Triaxial compression |
| UC | Unconfined compression |
| UU | Unconsolidated undrained triaxial compression |
| VS | Vane shear |

### Sheen Classification

| | |
|---|---|
| NS | No Visible Sheen |
| SS | Slight Sheen |
| MS | Moderate Sheen |
| HS | Heavy Sheen |

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

# Key to Exploration Logs

GeoEngineers

Figure A-1

| Date Excavated | 6/17/2021 | Total Depth (ft) | 6.5 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu PC120 Excavator | Caving not observed |

| Surface Elevation (ft) | 509 | Easting (X) | 1198929 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 671191 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | DUFF | 12 inches forest duff | | | |
| 508 | 1 | | | | SM | Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till) | | | Roots up to 1½-inch diameter |
| 507 | 2 | | 1 / MC | | | | 17 | | |
| 506 | 3 | | | | SM | Gray silty fine to medium sand with gravel (dense, moist) (glacial till) | | | |
| 505 | 4 | | | | | | | | |
| 504 | 5 | | | | | Grades to with occasional cobbles | | | |
| 503 | 6 | | 2 | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Date:1/28/22 Path:P:\21\21342003\GINT\2134200300.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

# Log of Test Pit TP-1

GEOENGINEERS

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/17/2021 | Total Depth (ft) | 11.5 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu PC120 Excavator | Caving not observed |

| Surface Elevation (ft) | 515 | Easting (X) | 1198837 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 671027 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 515–514 | 0–1 | | | | DUFF | 12 inches forest duff | | | |
| 514–512 | 1–3 | | 1 MC | | SM | Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till) | 16 | | Roots ¼- to 1½-inch diameter |
| 512–510 | 3–5 | | | | SM | Gray silty fine sand with occasional gravel (dense, moist) (glacial till) | | | |
| 510–505 | 5–10 | | 2 | | SM | Gray silty fine to medium sand with gravel and occasional cobbles (dense, moist) | | | |
| | ~7.7 | | | | | Grades to very dense | | | Increased excavation resistance |
| | ~9.2 | | | | | Grades to with occasional gravel | | | |
| 505–503.5 | 10–11.5 | | 3 SA | | ML | Dark gray sandy silt with occasional gravel (hard, moist) | 18 | 56 | PIT completed at approximately 11 feet bgs |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

## Log of Test Pit TP-2 (PIT-1)

GEOENGINEERS

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/17/2021 | Total Depth (ft) | 5.5 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu PC120 Excavator | Caving not observed |

| Surface Elevation (ft) | 509 | Easting (X) | 1199017 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 671023 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0–1 | | | | DUFF | 12 inches forest duff | | | |
| 508 | 1–3 | | | | SM | Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till) | | | Roots ¼- to ½-inch diameter to approximately 2 feet bgs |
| 507 | 2 | ✓ | 1 / MC | | | | 15 | | |
| 506 | 3–5.5 | | | | GP-GM | Gray fine to coarse gravel with silt, sand and occasional cobbles (dense, moist) (glacial till) | | | |
| 505 | 4 | | | | | | | | 3-inch lense of iron-oxide stained soil |
| 504 | 5 | ✓ | 2 | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.



## Log of Test Pit TP-3

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| | | | | |
|---|---|---|---|---|
| Date Excavated 6/18/2021 | Total Depth (ft) 9 | Logged By OA<br>Checked By CRN | Excavator Kelly's Excavating<br>Equipment Komatsu WB140 Backhoe | Groundwater not observed<br>Caving not observed |

| | | |
|---|---|---|
| Surface Elevation (ft) 537<br>Vertical Datum NAVD88 | Easting (X) 1198927<br>Northing (Y) 670105 | Coordinate System WA State Plane South<br>Horizontal Datum NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | SOD | Approximately 6 inches sod | | | |
| 536 | 1 | | | | SM | Brownish-gray silty fine to coarse sand with gravel, occasional cobbles and deleterious debris (dense, moist) (fill) | | | |
| 535 | 2 | | 1<br>MC | | | | 11 | | Deleterious debris consists of nails and rubber particles |
| 534 | 3 | | | | | | | | |
| 533 | 4 | | | | SM | Gray with occasional iron-oxide staining silty fine sand with occasional gravel (dense, moist) (weathered glacial till) | | | |
| 532 | 5 | | 2 | | SM | Brownish-gray silty fine to medium sand with gravel and occasional cobbles (very dense, moist) (glacial till) | | | |
| 531 | 6 | | 3 | | | | | | |
| 530 | 7 | | | | | | | | |
| 529 | 8 | | | | | | | | |
| 528 | 9 | | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

## Log of Test Pit TP-4

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/18/2021 | Total Depth (ft) | 10.5 | Logged By | OA | Checked By | CRN | Excavator | Kelly's Excavating | Equipment | Komatsu WB140 Backhoe | See "Remarks" section for groundwater observed<br>See "Remarks" section for caving observed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Surface Elevation (ft) | 539 | Easting (X) | 1199070 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 670068 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | SOD | Approximately 6 inches sod | | | |
| 538 | 1 | | | | SM | Brown silty fine to coarse sand with gravel, occasional cobbles and deleterious debris (medium dense, moist) (fill) | | | Deleterious debris consists of asphalt fragments and plastic waste |
| 537 | 2 | | 1 / MC | | | | 10 | | |
| | 2 | | 2 | | SM | Gray silty fine sand with occasional gravel (medium dense, moist) (weathered glacial till) | | | |
| 536 | 3 | | | | | Grades to wet | | | Moderate groundwater seepage observed from approximately 3 feet bgs to 9½ feet bgs |
| 535 | 4 | | | | | Grades to dense | | | |
| 534 | 5 | | 3 | | SM | Gray silty fine sand with occasional gravel (very dense, wet) (glacial till) | | | Minor caving observed at approximately 5 feet bgs |
| 533 | 6 | | | | | | | | |
| 532 | 7 | | | | | | | | |
| 531 | 7.5 | | | | SP | Dark gray fine sand, trace silt (very dense, wet) | | | |
| 530 | 9 | | 4 / SA | | | | 22 | 2 | Rapid groundwater seepage observed at approximately 9½ feet bgs |
| 529 | 10 | | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.



# Log of Test Pit TP-5

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/21/2021 | Total Depth (ft) | 4.25 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu WB140 Backhoe | Caving not observed |

| Surface Elevation (ft) | 536 | Easting (X) | 1199935 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 669625 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | SOD | Approximately 6 inches sod | | | |
| 535 | 1 | | 1 MC | | ML | Dark brown sandy silt with gravel and occasional deleterious debris (medium stiff, moist) (fill) | 18 | | Deleterious debris consists of asphalt fragments and metal cans. Fine roots (<¼-inch diameter) observed to bottom of test pit |
| 534 | 2 | | | | SM | Brownish-gray silty fine to medium sand with gravel, occasional cobbles and organic matter (roots) (medium dense, moist) (weathered glacial till) | | | |
| 533 | 3 | | 2 | | SM | Gray silty fine to medium sand with gravel, occasional cobbles and organic matter (roots) (dense, moist) (glacial till) | | | |
| 532 | 4 | | 3 SA | | | | 19 | 40 | PIT completed at approximately 4 feet bgs |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

# Log of Test Pit TP-6 (PIT-2)

GEOENGINEERS

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/21/2021 | Total Depth (ft) | 8.5 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu WB140 Backhoe | Caving not observed |

| Surface Elevation (ft) | 545 | Easting (X) | 1199872 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 669433 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | SOD | Approximately 6 inches sod | | | |
| 544 | 1 | | | | SM | Brown silty fine to medium sand with gravel (loose, moist) (fill) | | | |
| 543 | 2 | X | 1 MC | | | | 10 | | |
| 542 | 3 | X | 2 | | SM | Dark brown to black silty fine to medium sand with organic matter (roots) (loose, moist) (old topsoil horizon) | | | |
| 541 | 4 | X | 3 | | SM | Orangish-brown with occasional iron-oxide staining silty fine sand with occasional gravel and cobbles (medium dense, moist) (weathered glacial till) | | | |
| 540 | 5 | | | | | | | | |
| 539 | 6 | | | | | | | | |
| 538 | 7 | X | 4 | | | Grades to gray with iron-oxide staining, dense | | | |
| 537 | 8 | | | | | | | | |

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.



# Log of Test Pit TP-7

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

| Date Excavated | 6/21/2021 | Total Depth (ft) | 4 | Logged By | OA | Excavator | Kelly's Excavating | Groundwater not observed |
|---|---|---|---|---|---|---|---|---|
| | | | | Checked By | CRN | Equipment | Komatsu WB140 Backhoe | Caving not observed |

| Surface Elevation (ft) | 546 | Easting (X) | 1199869 | Coordinate System | WA State Plane South |
|---|---|---|---|---|---|
| Vertical Datum | NAVD88 | Northing (Y) | 669367 | Horizontal Datum | NAD83 (feet) |

| Elevation (feet) | Depth (feet) | SAMPLE: Testing Sample | SAMPLE: Sample Name / Testing | Graphic Log | Group Classification | MATERIAL DESCRIPTION | Moisture Content (%) | Fines Content (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | SOD | Approximately 6 inches sod | | | |
| 545 | 1 | | | | SM | Brown silty fine to medium sand with gravel, occasional cobbles, deleterious debris (wood fragments) and organic matter (roots) (loose, moist) (fill) | | | Roots (<¼-inch diameter) to approximately 3 feet bgs |
| 544 | 2 | | | | | | | | |
| 543 | 3 | | 1 / MC | | | | 19 | | |
| 542 | 4 | | | | | | | | 3-inch-diameter carbonized wood log observed at approximately 3½ feet bgs |

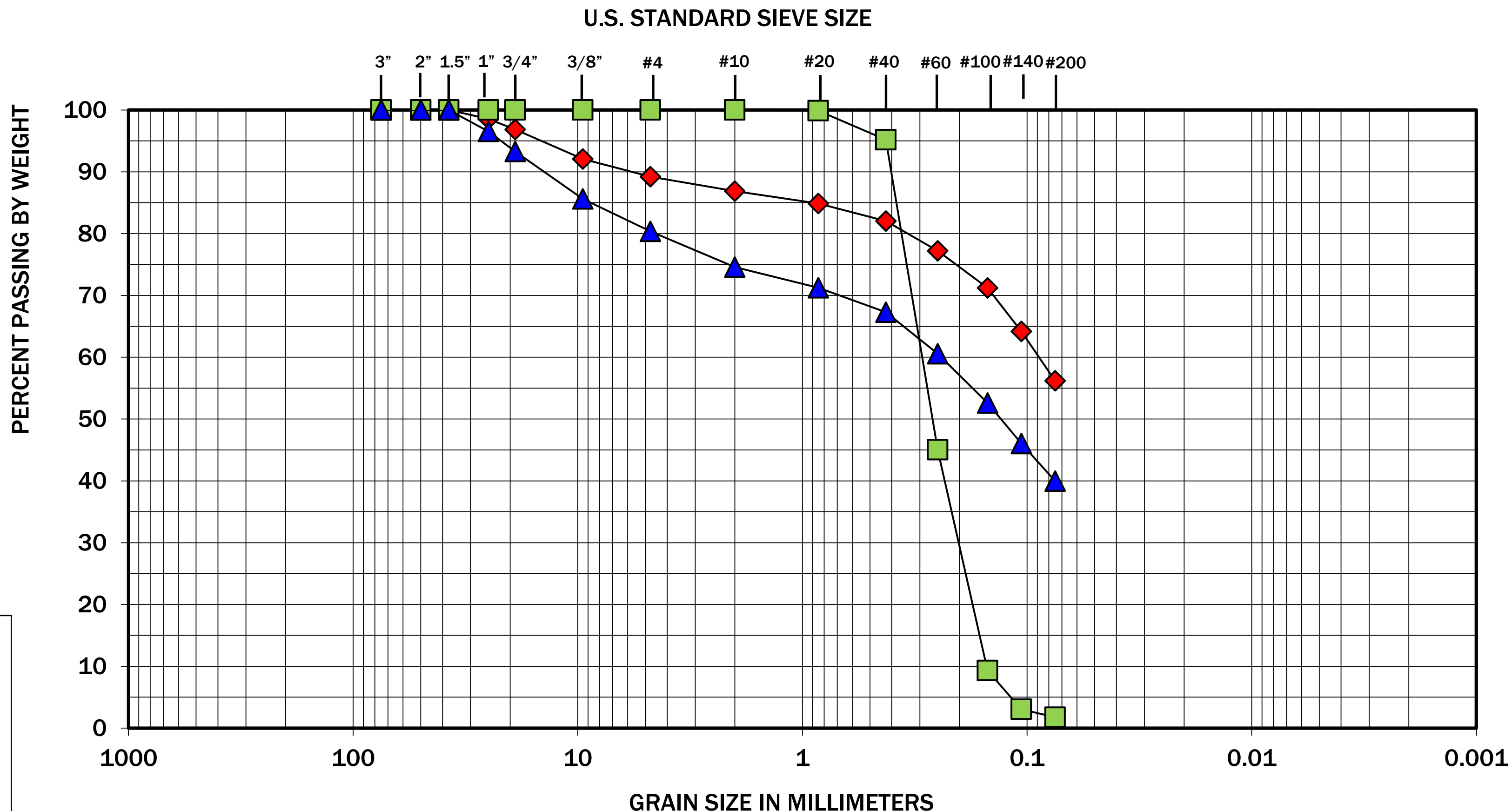
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

# Log of Test Pit TP-8

GEOENGINEERS

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Figure A-9
Sheet 1 of 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| Symbol | Test Pit Number | Depth (feet) | Moisture (%) | Soil Description |
|---|---|---|---|---|
| ◆ | TP-2 | 11 | 18 | Sandy silt (ML) |
| ■ | TP-5 | 9 | 22 | Poorly graded sand (SP) |
| ▲ | TP-6 | 4 | 19 | Silty sand with gravel (SM) |



The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

**Sieve Analysis Results**

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

GEOENGINEERS

**Figure A-10**

# APPENDIX B
## Report Limitations and Guidelines for Use

## APPENDIX B
## REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

### Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

### Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Washington State Department of Enterprise Services (DES) and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with DES signed on June 22, 2021 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

### A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the Pierce College Puyallup – Parking Lot Additions project in Puyallup, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

### Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

### Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

### Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

### Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

### Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

### Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

### A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

### Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

### Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and

- Encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

### Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

### Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

GeoEngineers

# PIERCE COLLEGE – PUYALLUP:
# PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

# PEIRCE COLLEGE – PUYALLUP
# PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

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JANUARY 2022

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# 1 INTRODUCTION

Grette Associates is under contract to prepare a critical areas report that summarizes the critical areas reconnaissance performed at Pierce College's Puyallup Campus[1] (Figure 1).

The purpose of this critical areas report is to document all wetlands that are located within 300 feet of the proposed parking lot expansion project locations (Appendix A) for conformance with Chapter 21.06 of the Puyallup Municipal Code (PMC).

# 2 FEATURE SUMMARY

A Grette Associates qualified wetland professional and a Grette Associates biologist visited the campus on November 17, 2021 to identify any wetlands or wildlife habitat conservation areas (FWHCAs) within 300 feet of the proposed project sites.

Grette Associates collected wetland delineation data and delineated two wetland features (Wetland A and Wetland B; Appendix A) that contained all three wetland criteria defined in the U.S. Army Corps of Engineers (USACE) *Federal Wetland Delineation Manual* (1987), and the USACE's *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010).

In addition, one probable wetland feature (Wetland C) was identified north of College Way. Wetland C was visually assessed for rating purposes only, given that a substantial development (College Way) is located between the wetland and the project sites which serves as a buffer interruption[2].

Wetlands were rated according to PMC 21.06.910 and the Washington State Department of Ecology's (Ecology) *Washington State Wetland Rating System for Western WA – 2014 Update* (Hruby 2014). Field datasheets and wetland rating forms are presented in Appendices B and C, respectively. A summary of the delineated wetlands is provided in Table 1.

No FWHCAs, as defined by PMC 21.06.1010, were identified within 300 feet of the proposed project sites.

**Table 1. Wetland delineation summary**

| Feature | Cowardin Class[1] | Hydrology Modifier | HGM Class | Wetland Category | Buffer Width[2] |
|---|---|---|---|---|---|
| A | PEM/FO | Seasonally Saturated | Slope | IV | 50 ft. |
| B | PFO | Seasonally Flooded and Saturated | Depressional | III | 80 ft. |
| C | PEM/FO | Seasonally Flooded and Saturated | Depressional | III | 150 ft. |

[1] Classification based on Cowardin et al. (1979).
[2] Buffers are based on PMC 21.06.930 and high land use intensity.

[1] The critical area assessment occurred within Pierce County parcels 0419034018, 0419023011, 0419023012, and 0419023013.

[2] While Chapter 21.06 of the PMC does not address buffer interruptions, Grette Associates was informed by the City's Planning Division (C. Beale, personal communication, December 13, 2021). According to the City's peer-review specialist, it is best available science that substantial development (e.g., paved roads) serve as a buffer interruption.

## 3 BACKGROUND

### 3.1 Local Critical Areas Inventory

The City of Puyallup's Public Data Viewer was queried to determine if there are any wetlands mapped in the vicinity of the proposed project sites. According the City's database, there is a wetland mapped in the vicinity of each proposed project site location (Appendix D).

### 3.2 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 within 300 feet of the proposed project sites (USFWS 2022). According to the NWI Interactive Online Mapper, there is a wetland feature mapped north of College Way in the general area where Wetland C was identified (Appendix D). No additional wetland features were identified in the vicinity of the proposed project sites.

### 3.3 Sensitive Wildlife and Plants

The Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species (PHS) database on-line mapper was queried to determine if state or federally listed fish or wildlife species occur near the proposed project sites (WDFW 2022). According to the PHS database, the wetland feature identified by NWI is the only mapped wetland in the vicinity of the proposed project sites (Appendix D).

The Washington Department of Natural Resources' (WDNR) Wetlands of High Conservation Value mapper was queried to determine if the general campus area occurs in a location reported to contain high quality natural heritage wetland occurrences or occurrences of natural heritage features commonly associated with wetlands (WDNR 2022a). According to WDNR's mapper, there are no records of rare plants or high-quality native ecosystems occurring on or in the vicinity of the campus (Appendix D).

### 3.4 State Water Classification System

The Washington Department of Natural Resources' (WDNR) Mapping Tool on-line mapper was queried to identify the water typing of any streams mapped by WDNR (WDNR 2022b). According to WDNR, no stream features are mapped in the vicinity of the campus (Appendix D).

### 3.5 Soil Information

According to the Natural Resources Conservation Service's (NRCS) Web Soil Survey (NRCS 2022a), the soils within the general assessed area consist of Everett very gravelly sandy loam (0-8 percent slopes), Kapowsin gravelly ashy loam (0-6 percent slopes), Kapowsin gravelly ashy loam (6-15 percent slopes), and Kapowsin gravelly ashy loam (30-65 percent slopes). According to the NRCS, these mapped soils are not listed as hydric.

## 4 METHODS

The areas in the vicinity of the project sites were traversed and data were collected to confirm wetland boundaries. The identified wetlands were delineated according to the procedures described in the USACE's *Federal Wetland Delineation Manual* (1987), and the USACE's *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010). Paired data plots and soil test pits were excavated to evaluate wetland and upland conditions. Guidance from the USACE's *Regional Supplement* was used to evaluate the data at each data point.

The boundary of the wetlands were established based on changes in vegetation, field indicators of hydric soils, water levels at or below 12 inches, topographic changes, and best professional judgment. Data plots were established in and adjacent to the wetlands. The locations of the wetland boundaries were defined by placement of florescent orange flagging tape. The location of each data plot was defined by the placement of pink flagging tape. The wetland boundary flagging was labeled alpha-numerically (i.e. A-2), where the letter designates the wetland and the number designates the specific flag angle point.

Plants were determined to be more or less associated with wetlands based on their wetland indicator (FAC) status. The percent dominance for each plant strata was determined using the 50-20 Rule, which is the recommended method for selecting dominant species from a plant community in instances where quantitative data are available (USACE 2010). In utilizing this rule, dominants are the most abundant species that individually or collectively accounts for more than 50 percent of the total coverage of vegetation in the stratum plus any other species that, by itself accounts for at least 20 percent of the total.

## 4.1 Hydrophytic Vegetation

The U.S. Fish and Wildlife Service (USFWS) and the NWI have established a rating system that has been applied to commonly occurring plant species on the basis of their frequency of occurrence in wetlands (Table 2). Species indicator status expresses the range in which plants may occur in wetlands and non-wetlands (uplands). Under this system, vegetation is considered hydrophytic when there is an indicator status of facultative (FAC), facultative wetland (FACW) or obligate wetland (OBL) (Table 2). The hydrophytic vegetation criterion for wetland determination is met when ***more than*** 50 percent of the dominant species in the plant community are FAC or wetter. The USACE's *National Wetland Plant List* (USACE 2020) was used to determine vegetation indicator status.

**Table 2. Definitions for USFWS plant indicator status**

| Plant Indicator Status Category | Indicator Status Abbreviation | Definition (Estimated Probability of Occurrence) |
|---|---|---|
| Obligate Upland | UPL | Occur rarely (<1 percent) in wetlands, and almost always (>99 percent) in uplands |
| Facultative Upland | FACU | Occur sometimes (1 percent to <33 percent) in wetlands, but occur more often (>67 percent to 99 percent) in uplands |
| Facultative | FAC | Similar likelihood (33 percent to 67 percent) of occurring in both wetlands and uplands |
| Facultative Wetland | FACW | Occur usually in wetlands (>67 percent to 99 percent), but also occur in uplands (1 percent to 33 percent) |
| Obligate Wetland | OBL | Occur almost always (>99 percent) in wetlands, but rarely occur in uplands (<1 percent) |
| Not Listed | NL | Not listed due to insufficient information to determine status |

### 4.2 Wetland Hydrology

Evidence of permanent or periodic inundation (water marks, drift lines, drainage patterns), or soil saturation to the surface for 14 consecutive days or more during the growing season meets the hydrology criterion. Oxidized root channels in the top 12 inches and hydrogen sulfide are primary indicators and water-stained leaves and geomorphic position are secondary indicators of wetland hydrology.

### 4.3 Hydric Soils

Soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil horizons are considered hydric soils. Field indicators include histosols, the presence of a histic epipedon, a sulfidic odor, low soil chroma, and gleying. Soil conditions were compared to the Field Indicators of Hydric Soils detailed in the USACE's *Regional Supplement*.

## 5 PRECIPITATION ANALYSIS

The McMillin Reservoir National Weather Station (NWS Station 455224) did not record any precipitation during the site assessment (NOAA 2022). In the 14 days preceding the site assessment, 6.54 inches of rainfall was recorded at the station (NOAA 2022).

The total precipitation recorded at the McMillin Reservoir station from October 1, 2021 through November 17, 2021 (15.98 inches) was approximately 147 percent of the normal rainfall (10.85 inches) that occurs during the same time (NOAA 2022).

Table 3 below presents an analysis of the appropriate NRCS WETS table (NRCS 2022b) for the three months preceding the field investigation.

**Table 3. WETS precipitation analysis**

| Preceding Month | WETS Rainfall Percentile (inches) | | Measured Rainfall[1] (inches) | Conditions[2] | Condition Value[3] | Month Weight | Value |
|---|---|---|---|---|---|---|---|
| | 30% | 70% | | | | | |
| November | 4.63 | 7.74 | 10.12 | Wet | 3 | 3 | 9 |
| October | 2.04 | 4.13 | 5.86 | Wet | 3 | 2 | 6 |
| September | 0.80 | 2.36 | 1.77 | Normal | 2 | 1 | 2 |
| | | | | | | Sum: | 17 |

[1] Observed rainfall for the month (NOAA 2022b)
[2] Dry conditions are below 30% WETS table value, Normal conditions are between 30% and 70% of the WETS table values, Wet conditions are above 70% of the WETS table value.
[3] Dry equals a value of 1, normal equals a value of 2, wet equals a value of 3
[4] Due to the timing of the site assessment, November precipitation results were included in this analysis.

Bins were established to determine the overall rainfall period during the field investigation; drier (sum is 6-9), normal (sum is 10-14), wet (sum is 15-18). A sum of 17 indicates that hydrologic conditions are wetter than normal at the time of the site assessment.

## 6 WETLAND RESULTS

Three wetland features were identified within 300 feet of the proposed project sites (Appendix A). Wetlands A and B were delineated according to the criteria defined in the

USACE's *Regional Supplement* (2010). Based on its location being situated north of College Way which serves as a buffer interruption (C. Beale, personal communication, December 13, 2021), Wetland C was visually evaluated for rating purposes only.

Grette Associates also evaluated an area adjacent to College Way that appears to have been previously graded and intended to capture and collect stormwater runoff from College Way (Appendix A). This area is largely devoid of groundcover and predominantly consists of vine maple (*Acer cicinatum*) and beaked hazelnut (*Corylus cornuta*). Red alder and black cottonwood (*Populus balsamiferia*) are established along the margins of this depressional area. In summary, this area did not contain hydric soil indicators (SP-1 and SP-2; Appendix C) and no evidence was present to suggest that the soils were problematic; therefore, this area did not meet wetland criteria as defined in the USACE's *Regional Supplement* (2010).

## 6.1 Wetland A

Wetland A is a palustrine emergent/scrub-shrub wetland that is situated in the northwest portion of the campus (Appendix A). Wetland A is hydrogeomorphically classified as a slope wetland (Appendix D).

Vegetation within the wetland predominantly consists of salmonberry (*Rubus spectabilis*, FAC) and Himalayan blackberry (*Rubus armeniacus*, FAC). Beneath the shrub canopy predominantly consists of slough sedge (*Carux obnupta*, OBL) and reed canarygrass (*Phalaris arundinacea*, FACW). The portion of the wetland that extends across the existing utility easement largely consists of a monoculture of reed canarygrass.

Soils observed within Wetland A consisted of a very dark gray (7.5YR3/1) silty clay. While no hydric soil indicators were observed (e.g., redox concentrations), it is Grette Associates' professional opinion that the soils evaluated meet the technical definition of a hydric soil (NRCS 2018). The vegetation observed passed the FAC-Neutral Test (USACE 2010) and the wetland is situated in a sloped area that contains a seasonally high groundwater table. Given these observations, the soils within the wetland are likely saturated, at a minimum, within 12 inches of the soil surface long enough during the growing season to develop anaerobic conditions.

Shallow surface water, surface soil saturation, and a high groundwater table were observed within Wetland A.

## 6.2 Wetland B

Wetland B is a palustrine forested wetland that is situated within the western portion of campus (Appendix A). Hydrogeomorphically, Wetland B is classified as a depressional wetland. Vegetation within the wetland predominately consists of red alder (*Alnus rubra*, FAC) and western red cedar (*Thuja plicata*, FAC). Beneath the forest canopy consists predominantly consists of a mix of native shrubs and emergent species.

Similar to Wetland A, no hydric soil indicators were observed within Wetland B; however, given the obligate emergent species[3], dark upper soil layer (10YR2/2), and primary wetland hydrology indicators observed, the soils within the wetland are likely saturated, at a

[3] (Slough sedge and skunk cabbage (*Lysichiton americanus*, OBL) were observed throughout portions of Wetland B.

minimum, within 12 inches of the soil surface long enough during the growing season to develop anaerobic conditions (NRCS 2018).

### 6.3 Wetland C

Wetland C is a palustrine emergent/forested wetland that is situated north of Collage Way (Appendix A). This feature contains both slope and depressional areas and is therefore hydrogeomorphically classified as a depressional wetland (Hruby 2014). As noted above, Wetland C was visually evaluated for rating purposes only.

### 6.4 Wetland Categorization

To determine the categorization of the wetlands based on function, the wetland classification guidelines in Ecology's wetland rating system (Hruby 2014) were used. Based on this guidance, each wetland was given a score for each of three functions: Water Quality, Hydrology, and Habitat (Table 4).

**Table 4. Wetland rating and categorization summary**

| Feature | Cowardin Class | HGM Class | Water Quality | Hydrology | Habitat | Total | Category |
|---|---|---|---|---|---|---|---|
| Wetland A | PEM/SS | Slope | 6 | 4 | 5 | 15 | IV |
| Wetland B | PFO | Depressional | 7 | 5 | 5 | 17 | III |
| Wetland C | PFO | Depressional | 7 | 5 | 6 | 18 | III |

Per Chapter 21.06 of the PMC, wetlands are subject to a buffer to protect the integrity and function of said feature. According to PMC 21.06.930, Category III wetlands providing less than moderate habitat function and with high land use intensity are subject to an 80-foot buffer. Category IV wetlands with a high land use intensity are subject to a 50-foot buffer.

### 6.5 Project Compliance

The proposed parking lot expansion project was designed to avoid wetland impacts and adheres to the applicable buffer development standards defined in PMC 21.06.930. Please refer to Appendix A for a detailed project layout.

## 7 REGULATORY CONSIDERATIONS

Wetlands are regulated by agencies at the local, state, and federal levels. At the local level, wetlands and their associated buffers in the City of Puyallup are regulated under the City's critical areas ordinance (Chapter 21.06 of the PMC).

At the state level, wetlands are regulated by the Washington State Department of Ecology through the Federal Clean Water Act (Section 401). The requirement for a Water Quality Certification from Ecology for wetland impacts is triggered by an applicant's applying for a federal Clean Water Act Section 404 permit from the Corps. Ecology may also issue an Administrative Order pursuant to Chapter 90.48 RCW (Water Pollution Control Act), allowing them wetland regulatory authority over Waters of the State without a federal nexus.

At the federal level, impacts (specifically dredging or filling) to wetlands are regulated by the Environmental Protection Agency through the US Army Corps of Engineers. The

USACE administers the federal Clean Water Act (Section 404) for projects involving dredging or filling in Waters of the US (lakes, streams, marine waters, and most non-isolated wetlands).

While it is the regulatory agencies that make the final determination regarding jurisdictional status, project proponents can infer jurisdiction using the guidance provided by each agency or local government. This inference can be used to design a project based on the anticipated regulatory constraints within the project area. However, it is the project proponent's responsibility to contact each potential regulating agency and confirm their regulatory status and requirements.

# 8 DISCLAIMER

The findings and conclusions documented in this report have been prepared for specific application to this proposed project site. They have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. Our work was also performed in accordance with the terms and conditions set forth in our proposal. The conclusions and recommendations presented in this report are professional opinions based on an interpretation of information currently available to us and are made within the operation scope, budget, and schedule of this project. No warranty, expressed or implied, is made. In addition, changes in government codes, regulations, or laws may occur. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

Wetland boundaries are based on conditions present at the time of the site visit and considered preliminary until the flagged wetland and/or drainage boundaries are validated by the appropriate jurisdictional agencies. Validation of the boundaries by the regulating agencies provide a certification, typically in writing, that the wetland boundaries verified are the boundaries that will be regulated by the agencies until a specific date or until the regulations are modified. Only the regulating agencies can provide this certification.

Since wetlands are dynamic communities affected by both natural and human activities, changes in wetland boundaries may be expected. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

# 9 BIOLOGIST QUALIFICATIONS

## 9.1 Janae Dinkins

Janae Dinkins is a Biologist with training in wetland delineation and ecologic restoration. Janae also has professional experience in stream and buffer restoration, marine aquatic sampling, mitigation monitoring, and fish and wildlife assessments.

Janae has earned Bachelors of Science degrees in Wildlife & Fisheries and Soil & Crop Sciences from Texas A&M University.

For a list of representative projects, please contact her at Grette Associates.

## 9.2 Chad Wallin

Chad Wallin is a Biologist with extensive training in wetland science and ecology restoration. Chad also has professional experience in stream and fish restoration, marine monitoring, mitigation monitoring, and fish and wildlife assessments.

Chad has earned a Bachelor's of Arts degree in Environmental Studies from the University of Washington along with certificates in ecology restoration and wetland science.

For a list of representative projects, please contact him at Grette Associates.

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# PIERCE COLLEGE – PUYALLUP CAMPUS PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

## APPENDIX A: WETLAND DELINEATION MAP


# PIERCE COLLEGE - PUYALLUP CAMPUS
# PARKING LOT EXPANSION PROJECT
# CRITICAL AREAS REPORT


Grette Associates LLC
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2102 North 30th Street, Suite A
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gretteassociates.com


CLIENT: MCGRANAHAN ARCHT.

PROJECT #: 3054.001
DESIGNED BY: CW DATE: 01/27/22
CHECKED BY: SM DATE: 01/27/22

DRAWING SCALE: 1"=100'

SITE ADDRESS: PUYALLUP, WA

## WETLAND DELINEATION MAP

SHEET 1 OF 3



Grette Associates LLC
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TACOMA, WA 98403
(253) 573-9300
gretteassociates.com


PROJECT #: 3054.001 DATE: 01/27/22
DESIGNED BY: CW DATE: 01/27/22
CHECKED BY: SM

CLIENT: MCGRANAHAN ARCHT.

**PIERCE COLLEGE - PUYALLUP CAMPUS PARKING LOT EXPANSION PROJECT CRITICAL AREAS REPORT**

DRAWING SCALE: 1"=100'

SITE ADDRESS: PUYALLUP, WA

**WETLAND DELINEATION MAP**

SHEET 2 OF 3


| SHEET 3 OF 3 | OVERVIEW MAP | PIERCE COLLEGE - PUYALLUP CAMPUS<br>PARKING LOT EXPANSION PROJECT<br>CRITICAL AREAS REPORT | Grette Associates LLC<br>ENVIRONMENTAL CONSULTANTS<br>2102 North 30th Street, Suite A<br>TACOMA, WA 98403<br>(253) 573-9300<br>gretteassociates.com |
|---|---|---|---|

| SITE ADDRESS: | DRAWING SCALE: | CLIENT: | PROJECT #:3054.001 | |
|---|---|---|---|---|
| PUYALLUP, WA | NOT TO SCALE | MCGRANAHAN ARCHT. | DESIGNED BY:CW | DATE:01/27/22 |
| | | | CHECKED BY:SM | DATE:01/27/22 |

# PIERCE COLLEGE – PUYALLUP CAMPUS
# PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

## APPENDIX B: WETLAND DATASHEETS

# WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Pierce College City/County: Pierce Puyallup Sampling Date: 11/17/21

Applicant/Owner: ______ State: WA Sampling Point: SP1

Investigator(s): JJD, CW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes ✓ No ____ | | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? Yes ____ No ✓ | | |
| Wetland Hydrology Present? Yes ✓ No ____ | | |

Remarks: Last 4/5 days has record rainfall + Flooding
Hydrology + soils may be presenting as false positives

Area appears to have been graded to collect runoff from Rd.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Cedar | 10 | Y | FAC |
| 2. Cotton Wood | 14 | N | FAC |
| 3. Alder | 10 | Y | FAC |
| 4. | | | |
| 50% 12 20% 4.8 | 24 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. Willow Sitka | 15 | Y | FAC |
| 2. Alder | 12 | N | FAC |
| 3. | | | |
| 4. | | | |
| 5. 50% 32.5 20% 13 | | | |
| | 65 | = Total Cover | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. Black Berry Himilayan | 2 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 2 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum 80%

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ✓ No ____

Remarks: Bare Ground covered by leaf litter

Cuscuta on old wood pile did not rep. Plot did not include

## SOIL

Sampling Point: SP1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/1 | 100 | | | | | Loam | w/wood debris |
| 6-16+ | 7.5YR 4/2 | 100 | | | | | Silty Loam | Light gravel. No redox observed |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ✓ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No ✓

Remarks:
Sample soils let out to dry for 20min. No redox observed lower soil layer

Layer 6-16+ no redox seen. F3 + All worked and did not meet

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ✓ No ___ Depth (inches): 1 in

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): Surface

**Wetland Hydrology Present?** Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
- High Water & Saturation could be false indicator due record high rainfall
- Area appears to have been graded to capture north of Rd.

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Pierce College City/County: Puyallup Sampling Date: 11/17/21

Applicant/Owner: ______ State: WA Sampling Point: 3P2

Investigator(s): JD, CW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Depressional area Local relief (concave, convex, none): Concave Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ✓ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ______ |
| Hydric Soil Present? | Yes ______ | No ✓ |
| Wetland Hydrology Present? | Yes ✓ | No ______ |

Is the Sampled Area within a Wetland? Yes ~~✓~~ No X

Remarks:

Hydric Soils were not observed
No redox seen Possible false positive Results Due to record rainfall

yes (due presence of 2 indicators but possible false positive

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Cedar Thuja plicata | 15 | Y | FAC |
| 2. Alder Alnus rubra | 15 | Y | FAC |
| 3. Cotton wood Populus balsamifera | 8 | Y | FAC |
| 4. | | | |
| 50% 19 20% 7.6 | 38 | = Total Cover | |

| Sapling/Shrub Stratum (Plot size: 15 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Cedar | 5 | N | FAC |
| 2. Vine Maple | 60 | Y | FAC |
| 3. Beaked Hazelnut | 3 | N | FACU |
| 4. Salmon Berry | 5 | N | FAC |
| 5. 50% 36.5 20% 14.6 | | | |
| | 73 | = Total Cover | |

| Herb Stratum (Plot size: 5 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Trailing Blackberry | 15 | Y | FACU |
| 2. Sword Fern | 5 | Y | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. 50% 10 20% 4 | | | |
| | 20 | = Total Cover | |

| Woody Vine Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum 80%

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species 70 | x 3 = 210 |
| FACU species 23 | x 4 = 92 |
| UPL species ______ | x 5 = ______ |
| Column Totals: 93 (A) | 302 (B) |

Prevalence Index = B/A = 3.24

**Hydrophytic Vegetation Indicators:**

- __ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- __ 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ✓ No ______

Remarks: Bare Ground Covered w/ leaf & Woody litter

~~Cedar Tree FAC~~
~~Vine maple Shrub FAC~~
~~Alder Tree FAC~~
~~Cotton wood Tree FAC~~
Trailing BB Herb FACU
Sword Fern Herb FACU

## SOIL

Sampling Point: SP 2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/1 | 100 | | | | | Loam | |
| 6-16+ | 7.5YR 4/2 | 100 | | | | | Silty loam | Boulder cobble, gravel |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**
Type: ______
Depth (inches): ______

**Hydric Soil Present?** Yes ___ No ✓

Remarks:
Exposed soil to dry, no redox seen, soil saturated (±20min) No redox observed
It would be expected to observe redox concentrations if hydro was persistent during the growing season

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No ✓ | Depth (inches): ___ |
| Water Table Present? | Yes ✓ | No ___ | Depth (inches): 1in |
| Saturation Present? (includes capillary fringe) | Yes ✓ | No ___ | Depth (inches): Surface |

**Wetland Hydrology Present?** Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland Hydrology observed but potentially false positive due to Recent Rainfall
~~FAC-Neutral Test~~
Fac-Neutral Test ~~and~~ Prevalence Index would support the possibility of false positive
- Area appears to have been constructed to capture runoff from Rd.

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Pierce College Wetland A City/County: Puyallup Pierce Sampling Date: 11/17/

Applicant/Owner: ____ State: WA Sampling Point: SP 3

Investigator(s): JLD Section, Township, Range: ____

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): ____

Subregion (LRR): ____ Lat: ____ Long: ____ Datum: ____

Soil Map Unit Name: ____ NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ No ____ | Is the Sampled Area within a Wetland? Yes ✓ No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: Record Rain fall Within last 4/5 days

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Alder | 65 | Y. | FAC |
| 2. Cedar Western Red | 15 | | FAC |
| 3. ~~[illegible]~~ | | | |
| 4. 50% 40 20% 16 | | | |
| | 80% = Total Cover | | |

160, 18, 2

| Sapling/Shrub Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Red Elderberry | 10% | | FAC |
| 2. Salmon berry | 45% | Y. | FAC |
| 3. Ceder | 25% | Y. | FAC |
| 4. Snowberry | 7% | | FACU |
| 5. 80% 43.5 20% 17.4 | | | |
| | 87 = Total Cover | | |

| Herb Stratum (Plot size: 5) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Reed Canary | 70% | Y. | FACW |
| 2. Sword fern | 8% | | FACU |
| 3. Himalayan Black Berry | 18 | | FAC |
| 4. Goats Beard | 2% | | FACU |
| 5. Carex spp | 40% | Y. | FACW |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. 80% 69 20% 27.6 | | | |
| | 138 = Total Cover | | |

| Woody Vine Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | ____ = Total Cover | | |

% Bare Ground in Herb Stratum 10%

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | 47 | x 2 = 94 |
| FAC species | 250 | x 3 = 750 |
| FACU species | 15 | x 4 = 60 |
| UPL species | | x 5 = |
| Column Totals: | 406 (A) | 904 (B) |

Prevalence Index = B/A = 2.2

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ✓ No ____

Remarks:
leaf litter and woody debris covered ground

## SOIL

3

Sampling Point: SP 3

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0 - 12 | 7.5 YR 3/1 | 100 | | | | | Silty clay | Sticky w/ Smooth texture throughout |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4) #5
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes X No ✓

Remarks: Soils are over Saturated record high rain fall within the area possible the features are washed out.

No Redox features observed

While soils were not observed to contain indicators, based on veg and secondary hydro indicators, it's assumed this area meets the tech. definition on a hydric soil

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ✓ | No ___ | Depth (inches): ___ |
| Water Table Present? | Yes ✓ | No ___ | Depth (inches): Surface |
| Saturation Present? (includes capillary fringe) | Yes ✓ | No ___ | Depth (inches): Surface |

**Wetland Hydrology Present?** Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Indicators are present,

Could be exaggerated by high rain fall of past 4/5 days

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Pierce College  City/County: Pierce Puyallup  Sampling Date: 11/17/21
Applicant/Owner: ______  State: ______  Sampling Point: SP 4 Upland
Investigator(s): SD  Section, Township, Range: ______
Landform (hillslope, terrace, etc.): hillslope  Local relief (concave, convex, none): Convex  Slope (%): ______
Subregion (LRR): ______  Lat: ______  Long: ______  Datum: ______
Soil Map Unit Name: ______  NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ✓ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes ______ No ✓ | | Is the Sampled Area within a Wetland? Yes ______ No ✓ |
| Hydric Soil Present? Yes ______ No ✓ | | |
| Wetland Hydrology Present? Yes ______ No ✓ | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Cedar | 45 | Y | FAC |
| 2. Hemlock | 30 | Y | FACU |
| 3. Alder | 15 | | FAC |
| 4. 50% 45 20% 18 | | | |
| | 90 = Total Cover | | |
| **Sapling/Shrub Stratum (Plot size: 15 ft)** | | | |
| 1. Salal | 80 | Y | FACU |
| 2. Cedar | 25 | | FAC |
| 3. Sword fern | 30 | | FACU |
| 4. Salmon Berry | 25 | | FAC |
| 5. Red Alder | 15 | | FAC |
| 50% 87.5 20% 35 | 175 = Total Cover | | |
| **Herb Stratum (Plot size: 5 ft)** | | | |
| 1. Trailing Black Berry | 85 | Y | FACU |
| 2. Himalayan Black Berry | 100 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 50% 42.5 20% 19 | 95 = Total Cover | | |
| **Woody Vine Stratum (Plot size: ______)** | | | |
| 1. | | | |
| 2. | | | |
| | ______ = Total Cover | | |

% Bare Ground in Herb Stratum 30 %

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 40% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | 185 | x 3 = 555 |
| FACU species | 175 | x 4 = 700 |
| UPL species | | x 5 = |
| Column Totals: | 360 (A) | 1255 (B) |

Prevalence Index = B/A = 3.4

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ______ No ✓

Remarks: Duff, woody debris, + leaf litter on ground
Failed Dominance test + Prevalence Index for confirmation

20
8

## SOIL

Sampling Point: 3P4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR 2/2 | 100 | | | | | loam | |
| 3-4 | 7.5YR 4/6 | 100 | | | | | loam | |
| 4-12+ | 10YR 4/6 | 100 | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): Surface

**Wetland Hydrology Present?** Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The top soil surface was moist could be due to recent record high rainfall of past 4/5 days

# WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Pierce College  City/County: Puyallup Pierce  Sampling Date: 11/17/21

Applicant/Owner: ____  State: WA  Sampling Point: SP 5

Investigator(s): JLD  Section, Township, Range: ____

Landform (hillslope, terrace, etc.): Depression Slope  Local relief (concave, convex, none): Concave  Slope (%): ____

Subregion (LRR): ____  Lat: ____  Long: ____  Datum: ____

Soil Map Unit Name: ____  NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ✓ | No ____ |
| Hydric Soil Present? | Yes ✓ | No ____ |
| Wetland Hydrology Present? | Yes ✓ | No ____ |

Is the Sampled Area within a Wetland? Yes ✓ No ____

Remarks: Record high Rainfall last 4/5 days
Skunk Cabbage good indicator of saturation ≥3 months

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Thuja plicata (western red cedar) | 85 | Y | FAC |
| 2. Hemlock (Western) Tsuga Heterophylla | 10 | N | FACU |
| 3. Alder (Red) Alnus Rubra | 10 | | FAC |
| 4. 50% 52.5 20% 21 | | | |
| | 105 | = Total Cover | |

| Sapling/Shrub Stratum (Plot size: 15 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salmon Berry | 25 | Y | FAC |
| 2. Cedar (Thuja plicata) | 10 | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. 50% 17.5 20% 7 | | | |
| | 35 | = Total Cover | |

| Herb Stratum (Plot size: 5 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Carex Spp. | 55 | Y | OBL |
| 2. Giant Horse tail | 20 | Y | FACW |
| 3. Skunk Cabbage | 5 | N | OBL |
| 4. Licorice Fern | 1 | N | UPL |
| 5. Sword Fern | 3 | N | FACU |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. 50% 42 20% ~~16.8~~ | | | |
| | 84 | = Total Cover | |

| Woody Vine Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: Dominant FAC = 3 OBL/FACW = 2
FACU = Ø

## SOIL Wetland B

Sampling Point: SP 5

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10YR 4/3 | | | | | | Loam | |
| 5-7 | 2.5YR 2/2 | | | | | | Silt loam | |
| 7-16+ | 10YR 2/2 | | | | | | Sandy Clay Loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ✓ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ✓ No ___

Remarks:
Based on the veg. and secondary hydro indicators observed, soils likely meet tech. definition of a hydric soils. Skunk cabbage and sedge throughout depression which suggests prolonged soil saturation during the growing season.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ✓ | No ___ | Depth (inches): Surface |
| Water Table Present? | Yes ✓ | No ___ | Depth (inches): 4in |
| Saturation Present? (includes capillary fringe) | Yes ✓ | No ___ | Depth (inches): Surface |

**Wetland Hydrology Present?** Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Record high rainfall within the last 4/5 days within the area. Could be exaggerating results but presence of Skunk cabbage good indicator of 73 months of saturated soils + high water table

## WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project Site: Pierce College - Puyallup City/County: Puyallup / WA Sampling Date: 11/17/21

Applicant/Owner: ______ State: ______ Sampling Point: SP 6

Investigator(s): CW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): ______ Slope (%): ±5%

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☒ (~~If~~ no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ☒ No ☐ | Is the Sampled Area within a Wetland? Yes ☐ No ☒ |
| Hydric Soil Present? | Yes ☐ No ☒ | |
| Wetland Hydrology Present? | Yes ☐ No ☒ | |

Remarks: Record rainfall w/ last 7 days.

### VEGETATION – Use scientific names of plants

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. THPL | 75% | Y | FAC |
| 2. ALRU | 10% | N | FAC |
| 3. | | | |
| 4. | | | |
| 50% = ______, 20% = ______ | 85% | = Total Cover | |
| **Sapling/Shrub Stratum (Plot size: 15')** | | | |
| 1. THPL | 20% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 50% = ______, 20% = ______ | 20% | = Total Cover | |
| **Herb Stratum (Plot size: 5')** | | | |
| 1. POMU | 10% | Y | FACU |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 50% = ______, 20% = ______ | 10% | = Total Cover | |
| **Woody Vine Stratum (Plot size: ______)** | | | |
| 1. | | | |
| 2. | | | |
| 50% = ______, 20% = ______ | | = Total Cover | |
| % Bare Ground in Herb Stratum 90% | | | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | ______ | x1 = | ______ |
| FACW species | ______ | x2 = | ______ |
| FAC species | ______ | x3 = | ______ |
| FACU species | ______ | x4 = | ______ |
| UPL species | ______ | x5 = | ______ |
| Column Totals: | ______ (A) | | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ ~~2~~ - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ☒ No ☐

Remarks:

Project Site: ____

## SOIL

Sampling Point: SP-6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-18" | 10YR 4/4 | 100% | | | | | loam | w/ gravel |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____

Depth (inches): ____

**Hydric Soils Present?** Yes ☐ No ☒

Remarks:
Soils dry

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D7)

**Field Observations:**

Surface Water Present? Yes ☐ No ☒ Depth (inches): ____

Water Table Present? Yes ☐ No ☒ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): ____

**Wetland Hydrology Present?** Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Soils dry. Approx. 24" above elevation of SP5

# PIERCE COLLEGE – PUYALLUP CAMPUS
# PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

## APPENDIX C: WETLAND RATING FORM

# RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A Date of site visit: 11/17/21

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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

**NOTE**: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map Google

## OVERALL WETLAND CATEGORY IV (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** | 6 | 4 | 5 | 15 |

**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 | ☑ |

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

## 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 undisturbed 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 undisturbed 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 undisturbed 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 sheetflow, 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).

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.

Wetland name or number A

☑ 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

## SLOPE WETLANDS

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

| S 1.0. Does the site have the potential to improve water quality? | |
|---|---|
| S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)*<br>Slope is 1% or less points = 3 ☐<br>Slope is > 1%-2% points = 2 ☑<br>Slope is > 2%-5% points = 1 ☐<br>Slope is greater than 5% points = 0 ☐ | 2 |
| S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0 | 0 |
| S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants:<br>Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.*<br>Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 ☐<br>Dense, uncut, herbaceous plants > ½ of area points = 3 ☑<br>Dense, woody, plants > ½ of area points = 2 ☐<br>Dense, uncut, herbaceous plants > ¼ of area points = 1 ☐<br>Does not meet any of the criteria above for plants points = 0 ☐ | 3 |
| Total for S 1 Add the points in the boxes above | 5 |

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

| S 2.0. Does the landscape have the potential to support the water quality function of the site? | |
|---|---|
| S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0 | 1 |
| S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1?<br>Other sources ________________ Yes = 1 No = 0 | 0 |
| Total for S 2 Add the points in the boxes above | 1 |

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

| S 3.0. Is the water quality improvement provided by the site valuable to society? | |
|---|---|
| S 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 | 0 |
| S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list.* Yes = 1 No = 0 | 1 |
| S 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 for the basin in which unit is found.* Yes = 2 No = 0 | 2 |
| Total for S 3 Add the points in the boxes above | 3 |

**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

## SLOPE WETLANDS

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

| | |
|---|---|
| S 4.0. Does the site have the potential to reduce flooding and stream erosion? | |
| S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > 1/8 in), or dense enough, to remain erect during surface flows.*<br>Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1<br>All other conditions points = 0 | 0 |

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

| | |
|---|---|
| S 5.0. Does the landscape have the potential to support the hydrologic functions of the site? | |
| S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0 | 1 |

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

| | |
|---|---|
| S 6.0. Are the hydrologic functions provided by the site valuable to society? | |
| S 6.1. Distance to the nearest areas downstream that have flooding problems:<br>The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2<br>Surface flooding problems are in a sub-basin farther down-gradient points = 1<br>No flooding problems anywhere downstream points = 0 | 0 |
| S 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 S 6 Add the points in the boxes above | 0 |

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

NOTES and FIELD OBSERVATIONS:

**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 or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

- [ ] Aquatic bed — 4 structures or more: points = 4
- [x] Emergent — 3 structures: points = 2
- [x] 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/ground-cover) that each cover 20% within the Forested polygon

**1**

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 or ¼ 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
- [x] Saturated only — 1 type present: points = 0
- [ ] Permanently flowing stream or river in, or adjacent to, the wetland
- [ ] Seasonally flowing stream in, or adjacent to, the wetland
- [ ] **Lake Fringe wetland** — **2 points**
- [ ] **Freshwater tidal wetland** — **2 points**

**0**

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, Canadian thistle***

If you counted: > 19 species — points = 2

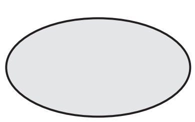
5 - 19 species — points = 1

< 5 species — points = 0

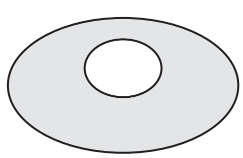
**1**

H 1.4. Interspersion of habitats

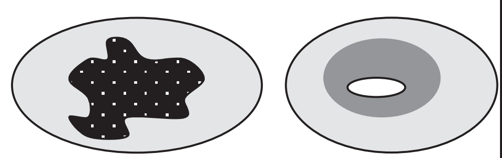
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always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



**None** = 0 points [ ]

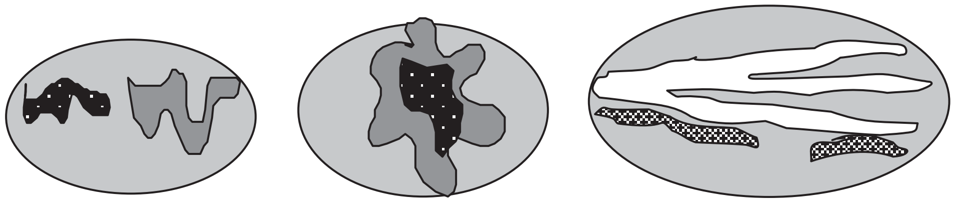


**Low** = 1 point [x]



**Moderate** = 2 points [ ]

All three diagrams in this row are **HIGH** = 3points [ ]



**1**

Wetland name or number A

| | |
|---|---|
| H 1.5. Special habitat features:<br>Check the habitat features that are present in the wetland. *The number of checks is the number of points.*<br>☑ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long).<br>☑ Standing snags (dbh > 4 in) within the wetland<br>☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)<br>☐ 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)*<br>☐ 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)*<br>☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*) | 2 |
| Total for H 1 — Add the points in the boxes above | 5 |

**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 that directly abuts wetland unit*).<br>*Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 %<br>If total accessible habitat is:<br>> $^{1}/_{3}$ (33.3%) of 1 km Polygon — points = 3<br>20-33% of 1 km Polygon — points = 2<br>10-19% of 1 km Polygon — points = 1<br>< 10% of 1 km Polygon — points = 0 | 3 |
| H 2.2. Undisturbed habitat in 1 km Polygon around the wetland.<br>*Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 %<br>Undisturbed habitat > 50% of Polygon — points = 3<br>Undisturbed habitat 10-50% and in 1-3 patches — points = 2<br>Undisturbed habitat 10-50% and > 3 patches — points = 1<br>Undisturbed habitat < 10% of 1 km Polygon — points = 0 | 1 |
| H 2.3. Land use intensity in 1 km Polygon: If<br>> 50% of 1 km Polygon is high intensity land use — points = (- 2)<br>≤ 50% of 1 km Polygon is high intensity — points = 0 | -2 |
| Total for H 2 — Add the points in the boxes above | 2 |

**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.*<br>Site meets ANY of the following criteria: — points = 2 ☐<br>☐ It has 3 or more priority habitats within 100 m (see next page)<br>☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)<br>☐ It is mapped as a location for an individual WDFW priority species<br>☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources<br>☐ 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<br>Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 ☑<br>Site does not meet any of the criteria above — points = 0 ☐ | 1 |

**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

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **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 (*full descriptions in WDFW PHS report*).

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

— **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) 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.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

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

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **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.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **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.

— **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.

— **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.

**Note:** All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number A

## CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

| Wetland Type<br>*Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.* | Category |
|---|---|
| **SC 1.0. Estuarine wetlands**<br>Does the wetland meet the following criteria for Estuarine wetlands?<br>— The dominant water regime is tidal,<br>— Vegetated, and<br>— 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?<br>☐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?<br>☐ — 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 page 25)<br>☐ — 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.<br>☐ — 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**<br><br>**Cat. II** |
| **SC 2.0. Wetlands of High Conservation Value (WHCV)**<br>SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐Yes **–** Go to **SC 2.2** ☐No **–** Go to **SC 2.3**<br>SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value?<br>☐Yes **= Category I** ☐No **= Not a WHCV**<br>SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland?<br>http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf<br>☐Yes **– Contact WNHP/WDNR and go to SC 2.4** ☐No **= Not a WHCV**<br>SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐Yes **= Category I** ☐No **= Not a WHCV** | **Cat. I** |
| **SC 3.0. Bogs**<br>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.***<br>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**<br>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 = **Is not a bog**<br>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 = **Is a Category I bog** ☐No – Go to **SC 3.4**<br>**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.<br>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?<br>☐Yes = **Is a Category I bog** ☐No **= Is not a bog** | **Cat. I** |

Wetland name or number A

<table>
<tr><td>

**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**

</td><td>**Cat. I**</td></tr>
<tr><td>

**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)*

☐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 on p. 100).

— 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**

</td><td>**Cat. I**<br><br>**Cat. II**</td></tr>
<tr><td>

**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

☐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**

</td><td>**Cat I**<br><br>**Cat. II**<br><br>**Cat. III**<br><br>**Cat. IV**</td></tr>
<tr><td>

**Category of wetland based on Special Characteristics**

If you answered No for all types, enter "Not Applicable" on Summary Form

</td><td>N/A</td></tr>
</table>

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Wetland name or number B

# RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland B Date of site visit: 11/17/22

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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

**NOTE**: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map Google

## 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 | 5 | 5 | 17 |

**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 | ☑ |

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

## 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 undisturbed 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 undisturbed 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 undisturbed 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 B

# 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 sheetflow, 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).

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.

Wetland name or number B

☑ 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 B

| DEPRESSIONAL AND FLATS WETLANDS<br>**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:<br>Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 ☑<br>Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 ☐<br>Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 ☐<br>Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1 ☐ | 3 |
| 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):<br>Wetland has persistent, ungrazed, plants > 95% of area points = 5 ☐<br>Wetland has persistent, ungrazed, plants > ½ of area points = 3 ☑<br>Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 ☐<br>Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0 ☐ | 3 |
| D 1.4. Characteristics of seasonal ponding or inundation:<br>*This is the area that is ponded for at least 2 months. See description in manual.*<br>Area seasonally ponded is > ½ total area of wetland points = 4 ☐<br>Area seasonally ponded is > ¼ total area of wetland points = 2 ☑<br>Area seasonally ponded is < ¼ total area of wetland points = 0 ☐ | 2 |
| Total for D 1 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 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?<br>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 | 0 |
| 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 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 | 3 |

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

Wetland name or number B

| DEPRESSIONAL AND FLATS WETLANDS<br>**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:<br>Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 ☑<br>Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 ☐<br>Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 ☐<br>Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0 ☐ | 4 |
| 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.*<br>Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 ☐<br>Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 ☐<br>Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 ☐<br>The wetland is a "headwater" wetland points = 3 ☐<br>Wetland is flat but has small depressions on the surface that trap water points = 1 ☑<br>Marks of ponding less than 0.5 ft (6 in) points = 0 ☐ | 1 |
| 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 wetland to the area of the wetland unit itself.*<br>The area of the basin is less than 10 times the area of the unit points = 5 ☐<br>The area of the basin is 10 to 100 times the area of the unit points = 3 ☑<br>The area of the basin is more than 100 times the area of the unit points = 0 ☐<br>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. The unit is 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.*<br>The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds):<br>• Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 ☐<br>• Surface flooding problems are in a sub-basin farther down-gradient. points = 1 ☐<br>Flooding from groundwater is an issue in the sub-basin. points = 1 ☐<br>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* No outlet observed points = 0 ☑<br>There are no problems with flooding downstream of the wetland. points = 0 ☐ | 0 |
| 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 | 0 |

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

Wetland name or number B

**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 or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

- ☐ 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/ground-cover) that each cover 20% within the Forested polygon

Score: 1

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 or ¼ 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
- ☐ Seasonally flowing stream in, or adjacent to, the wetland
- ☐ **Lake Fringe wetland** — **2 points**
- ☐ **Freshwater tidal wetland** — **2 points**

Score: 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, Canadian thistle***

If you counted: > 19 species — points = 2

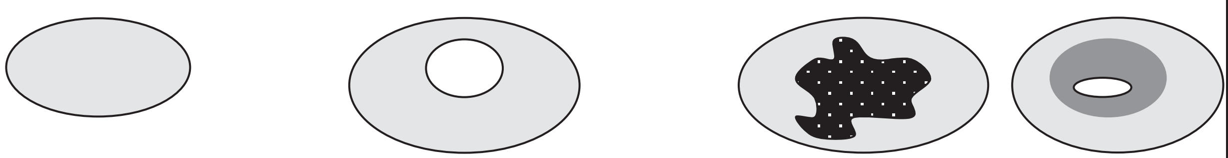
5 - 19 species — points = 1

< 5 species — points = 0

Score: 1

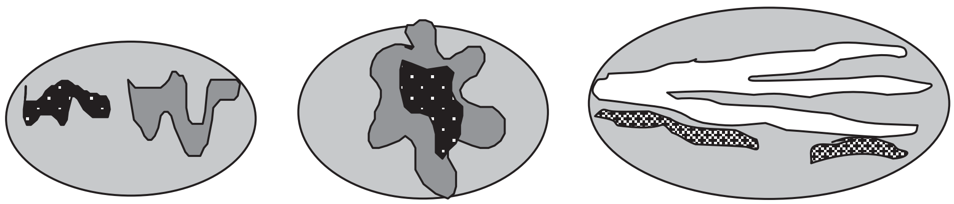
H 1.4. Interspersion of habitats

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** = 3points ☐



Score: 0

Wetland name or number B

| | |
|---|---|
| H 1.5. Special habitat features:<br>Check the habitat features that are present in the wetland. *The number of checks is the number of points.*<br>☑ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long).<br>☑ Standing snags (dbh > 4 in) within the wetland<br>☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)<br>☐ 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)*<br>☐ 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)*<br>☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*) | 2 |
| Total for H 1      Add the points in the boxes above | 5 |

**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 that directly abuts wetland unit*).<br>*Calculate:* % undisturbed habitat 0.00 **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 %<br>If total accessible habitat is:<br>> $^{1}/_{3}$ (33.3%) of 1 km Polygon points = 3<br>20-33% of 1 km Polygon points = 2<br>10-19% of 1 km Polygon points = 1<br>< 10% of 1 km Polygon points = 0 | 3 |
| H 2.2. Undisturbed habitat in 1 km Polygon around the wetland.<br>*Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 %<br>Undisturbed habitat > 50% of Polygon points = 3<br>Undisturbed habitat 10-50% and in 1-3 patches points = 2<br>Undisturbed habitat 10-50% and > 3 patches points = 1<br>Undisturbed habitat < 10% of 1 km Polygon points = 0 | 1 |
| H 2.3. Land use intensity in 1 km Polygon: If<br>> 50% of 1 km Polygon is high intensity land use points = (- 2)<br>≤ 50% of 1 km Polygon is high intensity points = 0 | -2 |
| Total for H 2      Add the points in the boxes above | 2 |

**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.*<br>Site meets ANY of the following criteria: points = 2 ☐<br>☐ It has 3 or more priority habitats within 100 m (see next page)<br>☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)<br>☐ It is mapped as a location for an individual WDFW priority species<br>☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources<br>☐ 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<br>Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 ☑<br>Site does not meet any of the criteria above points = 0 ☐ | 1 |

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

# WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **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 (*full descriptions in WDFW PHS report*).

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

— **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) 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.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

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

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **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.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **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.

— **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.

— **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.

**Note:** All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number B

## CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

| Wetland Type<br><br>*Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.* | Category |
|---|---|
| **SC 1.0. Estuarine wetlands**<br>Does the wetland meet the following criteria for Estuarine wetlands?<br>— The dominant water regime is tidal,<br>— Vegetated, and<br>— 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?<br>☐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?<br>☐ — 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 page 25)<br>☐ — 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.<br>☐ — 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**<br><br>**Cat. II** |
| **SC 2.0. Wetlands of High Conservation Value (WHCV)**<br>SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐Yes **–** Go to **SC 2.2** ☐No **–** Go to **SC 2.3**<br>SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value?<br>☐Yes **= Category I** ☐No **= Not a WHCV**<br>SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland?<br>http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf<br>☐Yes **– Contact WNHP/WDNR and go to SC 2.4** ☐No **= Not a WHCV**<br>SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐Yes **= Category I** ☐No **= Not a WHCV** | **Cat. I** |
| **SC 3.0. Bogs**<br>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.***<br>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**<br>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 = **Is not a bog**<br>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 = **Is a Category I bog** ☐No – Go to **SC 3.4**<br>**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.<br>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?<br>☐Yes = **Is a Category I bog** ☐No **=** **Is not a bog** | **Cat. I** |

| SC 4.0. Forested Wetlands | |
|---|---|
| Does the wetland have at least <u>1 contiguous acre</u> 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.***<br>☐— **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.<br>☐— **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).<br>☐Yes = **Category I** ☐No **= Not a forested wetland for this section** | **Cat. I** |
| **SC 5.0. Wetlands in Coastal Lagoons**<br>Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?<br>— 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<br>— 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)*<br>☐Yes – Go to **SC 5.1** ☐No = **Not a wetland in a coastal lagoon**<br>SC 5.1. Does the wetland meet all of the following three conditions?<br>— 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 on p. 100).<br>— 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.<br>— The wetland is larger than $^{1}/_{10}$ ac (4350 $ft^2$)<br>☐Yes = **Category I** ☐No = **Category II** | **Cat. I**<br><br>**Cat. II** |
| **SC 6.0. Interdunal Wetlands**<br>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.***<br>In practical terms that means the following geographic areas:<br>— Long Beach Peninsula: Lands west of SR 103<br>— Grayland-Westport: Lands west of SR 105<br>— Ocean Shores-Copalis: Lands west of SR 115 and SR 109<br>☐Yes – Go to **SC 6.1** ☐No = **not an interdunal wetland for rating**<br><br>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**<br>SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?<br>☐Yes = **Category II** ☐No – Go to **SC 6.3**<br>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?<br>☐Yes = **Category III** ☐No = **Category IV** | **Cat I**<br><br>**Cat. II**<br><br>**Cat. III**<br><br>**Cat. IV** |
| **Category of wetland based on Special Characteristics**<br>If you answered No for all types, enter "Not Applicable" on Summary Form | N/A |

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# RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland C Date of site visit: 11/17/21

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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

**NOTE**: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map Google

## 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 | 5 | 6 | 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 | ☑ |

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

## 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 undisturbed 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 undisturbed 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 undisturbed 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 C

# 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 sheetflow, 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).

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.

Wetland name or number C

☑ 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 C

| 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:<br>Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 ☐<br>Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 ☑<br>Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 ☐<br>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):<br>Wetland has persistent, ungrazed, plants > 95% of area points = 5 ☐<br>Wetland has persistent, ungrazed, plants > ½ of area points = 3 ☑<br>Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 ☐<br>Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0 ☐ | 3 |
| D 1.4. Characteristics of seasonal ponding or inundation:<br>*This is the area that is ponded for at least 2 months. See description in manual.*<br>Area seasonally ponded is > ½ total area of wetland points = 4 ☐<br>Area seasonally ponded is > ¼ total area of wetland points = 2 ☑<br>Area seasonally ponded is < ¼ total area of wetland points = 0 ☐ | 2 |
| Total for D 1 Add the points in the boxes above | 7 |

**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?<br>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 | 0 |
| 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 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 | 3 |

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

Wetland name or number C

| DEPRESSIONAL AND FLATS WETLANDS<br>**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:<br>Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 ☐<br>Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 ☑<br>Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 ☐<br>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.*<br>Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 ☐<br>Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 ☐<br>Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 ☐<br>The wetland is a "headwater" wetland points = 3 ☐<br>Wetland is flat but has small depressions on the surface that trap water points = 1 ☑<br>Marks of ponding less than 0.5 ft (6 in) points = 0 ☐ | 1 |
| 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 wetland to the area of the wetland unit itself.*<br>The area of the basin is less than 10 times the area of the unit points = 5 ☐<br>The area of the basin is 10 to 100 times the area of the unit points = 3 ☑<br>The area of the basin is more than 100 times the area of the unit points = 0 ☐<br>Entire wetland is in the Flats class points = 5 ☐ | 3 |
| Total for D 4 Add the points in the boxes above | 6 |

**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 | 0 |
| 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 | 1 |

**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. The unit is 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.*<br>The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds):<br>• Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 ☐<br>• Surface flooding problems are in a sub-basin farther down-gradient. points = 1 ☐<br>Flooding from groundwater is an issue in the sub-basin. points = 1 ☐<br>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* doesn't retain much surface water points = 0 ☑<br>There are no problems with flooding downstream of the wetland. points = 0 ☐ | 0 |
| 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 | 0 |

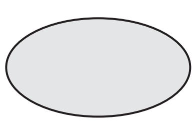
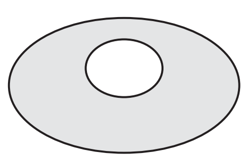
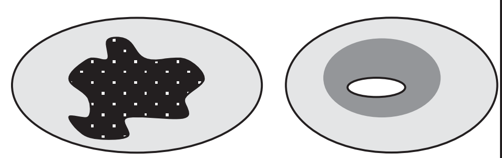
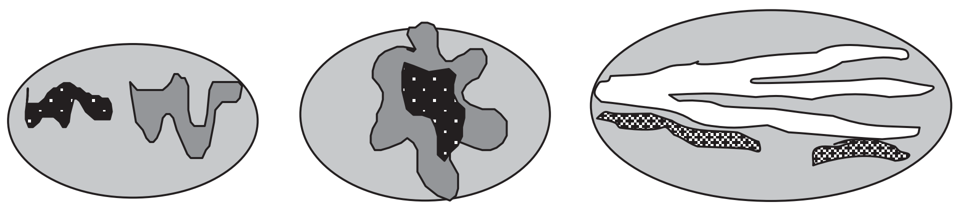
**Rating of Value** If score is: ☐ **2-4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

Wetland name or number C

**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 or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*<br>☐ Aquatic bed — 4 structures or more: points = 4<br>☑ Emergent — 3 structures: points = 2<br>☐ Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1<br>☑ Forested (areas where trees have > 30% cover) — 1 structure: points = 0<br>*If the unit has a Forested class, check if:*<br>☑ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon | 2 |
| H 1.2. Hydroperiods<br>Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).<br>☐ Permanently flooded or inundated — 4 or more types present: points = 3<br>☑ Seasonally flooded or inundated — 3 types present: points = 2<br>☐ Occasionally flooded or inundated — 2 types present: points = 1<br>☑ Saturated only — 1 type present: points = 0<br>☐ Permanently flowing stream or river in, or adjacent to, the wetland<br>☐ Seasonally flowing stream in, or adjacent to, the wetland<br>☐ **Lake Fringe wetland** — **2 points**<br>☐ **Freshwater tidal wetland** — **2 points** | 1 |
| H 1.3. Richness of plant species<br>Count the number of plant species in the wetland that cover at least 10 $ft^2$.<br>*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, Canadian thistle***<br>If you counted: > 19 species — points = 2<br>5 - 19 species — points = 1<br>< 5 species — points = 0 | 1 |
| H 1.4. Interspersion of habitats<br>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.*<br><br>**None** = 0 points ☐<br><br>**Low** = 1 point ☑<br><br>**Moderate** = 2 points ☐<br>All three diagrams in this row are **HIGH** = 3points ☐<br> | 1 |

Wetland name or number C

| | |
|---|---|
| H 1.5. Special habitat features:<br>Check the habitat features that are present in the wetland. *The number of checks is the number of points.*<br>☑ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long).<br>☑ Standing snags (dbh > 4 in) within the wetland<br>☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)<br>☐ 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)*<br>☐ 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)*<br>☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*) | 2 |
| Total for H 1      Add the points in the boxes above | 7 |

**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 that directly abuts wetland unit*).<br>*Calculate:* % undisturbed habitat 0.00 + [(% moderate and low intensity land uses)/2]___ = 0.00 %<br>If total accessible habitat is:<br>> $^1/_3$ (33.3%) of 1 km Polygon — points = 3<br>20-33% of 1 km Polygon — points = 2<br>10-19% of 1 km Polygon — points = 1<br>< 10% of 1 km Polygon — points = 0 | 3 |
| H 2.2. Undisturbed habitat in 1 km Polygon around the wetland.<br>*Calculate:* % undisturbed habitat___ + [(% moderate and low intensity land uses)/2]___ = 0.00 %<br>Undisturbed habitat > 50% of Polygon — points = 3<br>Undisturbed habitat 10-50% and in 1-3 patches — points = 2<br>Undisturbed habitat 10-50% and > 3 patches — points = 1<br>Undisturbed habitat < 10% of 1 km Polygon — points = 0 | 1 |
| H 2.3. Land use intensity in 1 km Polygon: If<br>> 50% of 1 km Polygon is high intensity land use — points = (- 2)<br>≤ 50% of 1 km Polygon is high intensity — points = 0 | -2 |
| Total for H 2      Add the points in the boxes above | 2 |

**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.*<br>Site meets ANY of the following criteria: — points = 2 ☐<br>☐ It has 3 or more priority habitats within 100 m (see next page)<br>☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)<br>☐ It is mapped as a location for an individual WDFW priority species<br>☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources<br>☐ 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<br>Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 ☑<br>Site does not meet any of the criteria above — points = 0 ☐ | 1 |

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

Wetland name or number C

# WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **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 (*full descriptions in WDFW PHS report*).

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

— **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) 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.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

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

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **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.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **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.

— **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.

— **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.

**Note:** All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

## CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

| **Wetland Type**<br>*Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.* | **Category** |
|---|---|
| **SC 1.0. Estuarine wetlands**<br>Does the wetland meet the following criteria for Estuarine wetlands?<br>— The dominant water regime is tidal,<br>— Vegetated, and<br>— 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?<br>☐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?<br>☐— 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 page 25)<br>☐— 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.<br>☐— 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**<br><br>**Cat. II** |
| **SC 2.0. Wetlands of High Conservation Value (WHCV)**<br>SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐Yes – Go to **SC 2.2** ☐No – Go to **SC 2.3**<br>SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value?<br>☐Yes = **Category I** ☐No = **Not a WHCV**<br>SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland?<br>http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf<br>☐Yes – **Contact WNHP/WDNR and go to SC 2.4** ☐No = **Not a WHCV**<br>SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐Yes = **Category I** ☐No = **Not a WHCV** | **Cat. I** |
| **SC 3.0. Bogs**<br>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.***<br>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**<br>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 = **Is not a bog**<br>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 = **Is a Category I bog** ☐No – Go to **SC 3.4**<br>**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.<br>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?<br>☐Yes = **Is a Category I bog** ☐No = **Is not a bog** | **Cat. I** |

Wetland name or number C

| | |
|---|---|
| **SC 4.0. Forested Wetlands**<br>Does the wetland have at least <u>1 contiguous acre</u> 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.***<br>☐— **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.<br>☐— **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).<br>☐Yes = **Category I** ☐No **= Not a forested wetland for this section** | **Cat. I** |
| **SC 5.0. Wetlands in Coastal Lagoons**<br>Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?<br>— 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<br>— 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)*<br>☐Yes – Go to **SC 5.1** ☐No = **Not a wetland in a coastal lagoon**<br>SC 5.1. Does the wetland meet all of the following three conditions?<br>— 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 on p. 100).<br>— 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.<br>— The wetland is larger than $^1/_{10}$ ac (4350 $ft^2$)<br>☐Yes = **Category I** ☐No = **Category II** | **Cat. I**<br><br>**Cat. II** |
| **SC 6.0. Interdunal Wetlands**<br>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.***<br>In practical terms that means the following geographic areas:<br>— Long Beach Peninsula: Lands west of SR 103<br>— Grayland-Westport: Lands west of SR 105<br>— Ocean Shores-Copalis: Lands west of SR 115 and SR 109<br>☐Yes – Go to **SC 6.1** ☐No = **not an interdunal wetland for rating**<br><br>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**<br>SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?<br>☐Yes = **Category II** ☐No – Go to **SC 6.3**<br>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?<br>☐Yes = **Category III** ☐No = **Category IV** | **Cat I**<br><br>**Cat. II**<br><br>**Cat. III**<br><br>**Cat. IV** |
| **Category of wetland based on Special Characteristics**<br>If you answered No for all types, enter "Not Applicable" on Summary Form | N/A |

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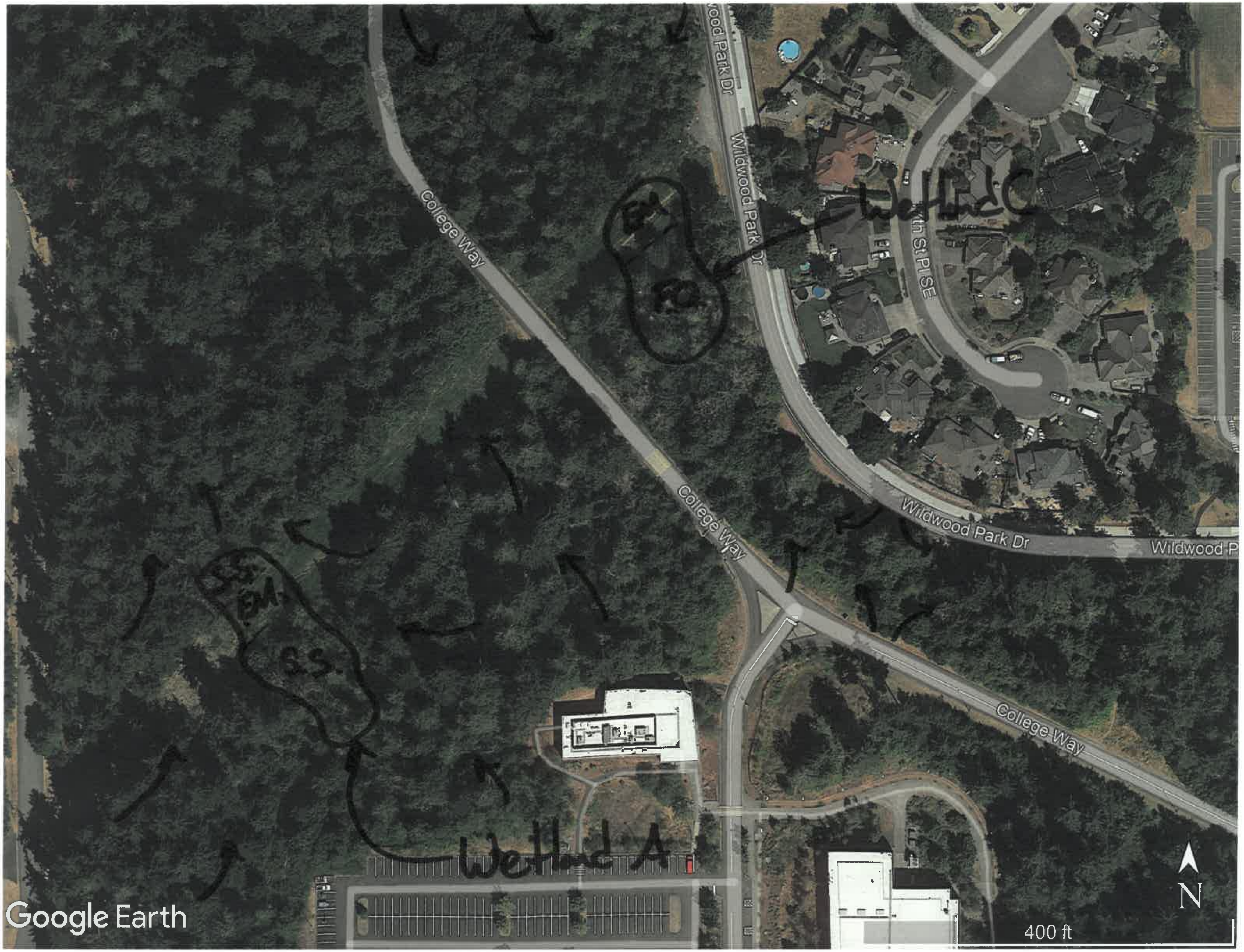

College Way
Wildwood Park Dr
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th St Pl SE
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EM
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Wetland A
Google Earth
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400 ft


College Way
Wetland B
FO
FO
Google Earth
N
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23rd Ave SE
23rd Ave SE
23rd Ave SE
512
Shaw Rd E
Shaw Rd E
37th Ave SE
39th Ave SE
9th Ave SW
S Meridian
ridian
Well 1B
Well 1C
Well 1A
1K
Google Earth
4000 ft
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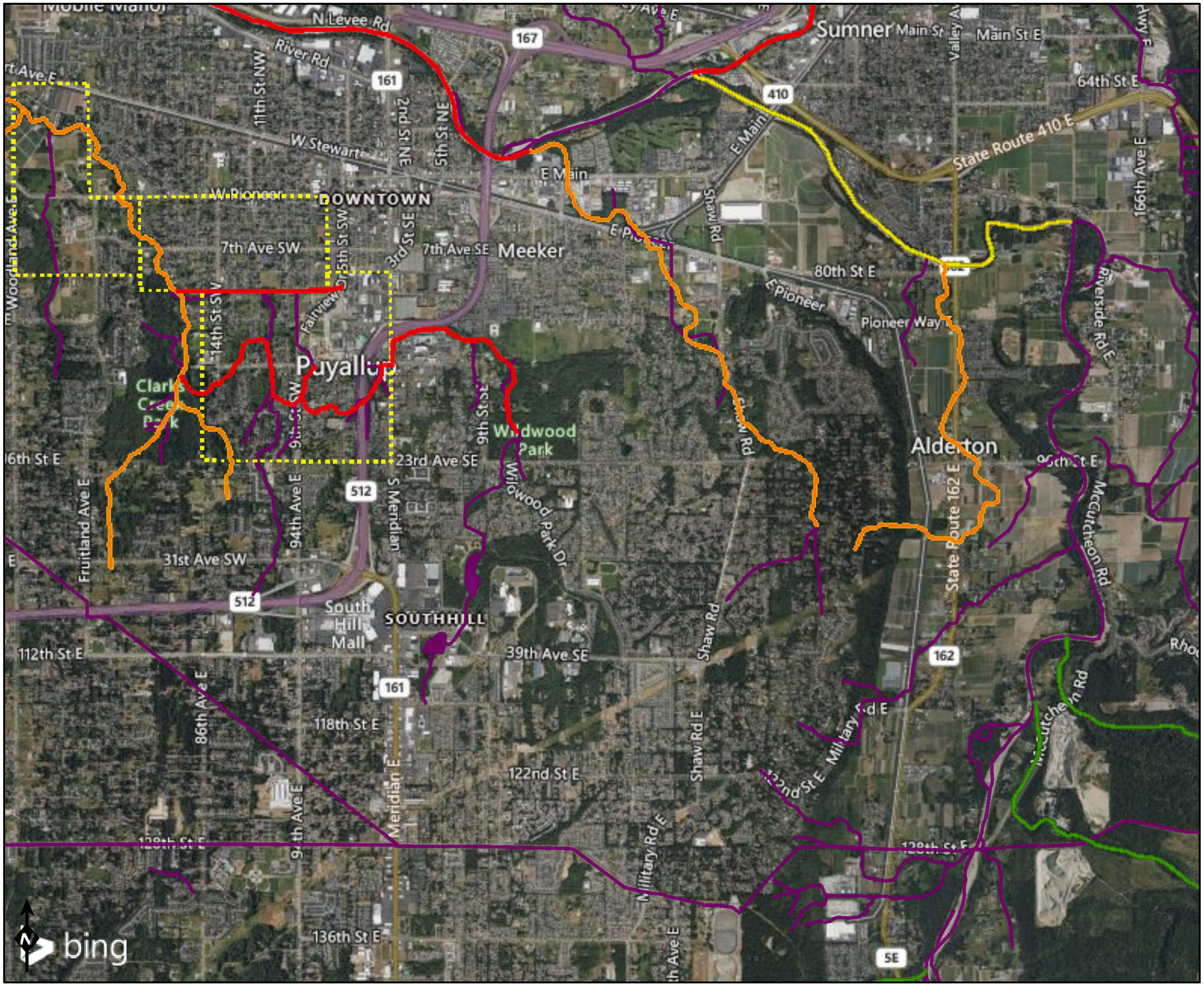
January 6, 2022

# Water Quality Atlas




## Assessed Water/Sediment

Water

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Sediment

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

## Water Quality Standards

- All Standards

Miles 0 0.5 1 2



DEPARTMENT OF ECOLOGY State of Washington

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<br>Sediment<br>Fecal Coliform | EPA approved and<br>Has an implementation plan | Donovan Gray<br>360-407-6407 |
| Clover Creek | Dissolved Oxygen<br>Fecal Coliform<br>Temperature | Under development | Donovan Gray<br>360-407-6407 |
| Commencement Bay | Dioxin | EPA approved | Donovan Gray<br>360-407-6407 |
| Nisqually Watershed Tributaries<br>Tributaries:<br>• McAllister Creek<br>• Ohop Creek<br>• Red Salmon Creek<br>• Lynch Creek<br>• Wash Creek<br>• Unnamed Tributary to West Red Salmon Creek<br>• Little McAllister Creek<br>• Medicine Creek mouth | Fecal Coliform<br>Dissolved Oxygen | EPA approved and<br>Has an implementation plan | Donovan Gray<br>360-407-6407 |
| Puyallup River | Fecal Coliform | EPA approved and | Donovan Gray |

| | | | |
|---|---|---|---|
| Watershed | | Has implementation plan | 360-407-6407 |
| Puyallup River Watershed | Multi-parameter<br>Ammonia-N<br>BOD (5-day) | EPA approved | Donovan Gray<br>360-407-6407 |
| Puyallup River:<br>Upper White River | Sediment<br>Temperature | EPA approved | Donovan Gray<br>360-407-6407 |
| Puyallup River:<br>Lower White River | pH | Under development | Donovan Gray<br>360-407-6407 |
| South Prairie Creek | Fecal Coliform<br>Temperature | EPA approved and<br>Has an implementation plan | Donovan Gray<br>360-407-6407 |
| Wapato Lake | Total Phosphorus | EPA approved | Donovan Gray<br>360-407-6407 |

To request ADA accommodation, call Ecology at 360-407-7668, 711 (relay service), or 877-833-6341 (TTY). More about our accessibility services.

# PIERCE COLLEGE – PUYALLUP CAMPUS
# PARKING LOT EXPANSION PROJECT

## CRITICAL AREAS REPORT

## APPENDIX D: QUERIED DATABASE FIGURES

# City of Puyallup Public Data Vi

## Data layers

- Utilities
- Transportation
- Recreation
- Environment
  - City Maintained Street Trees
  - Regulated Flood plain
  - Seclusion Areas
  - General Habitat Areas
  - Potential Landslide

Maxar | Jennifer Recco, GIS Coordinator, City of Puyallup;... Powered by Esri

## Legend

**Environment**

**Wetlands**

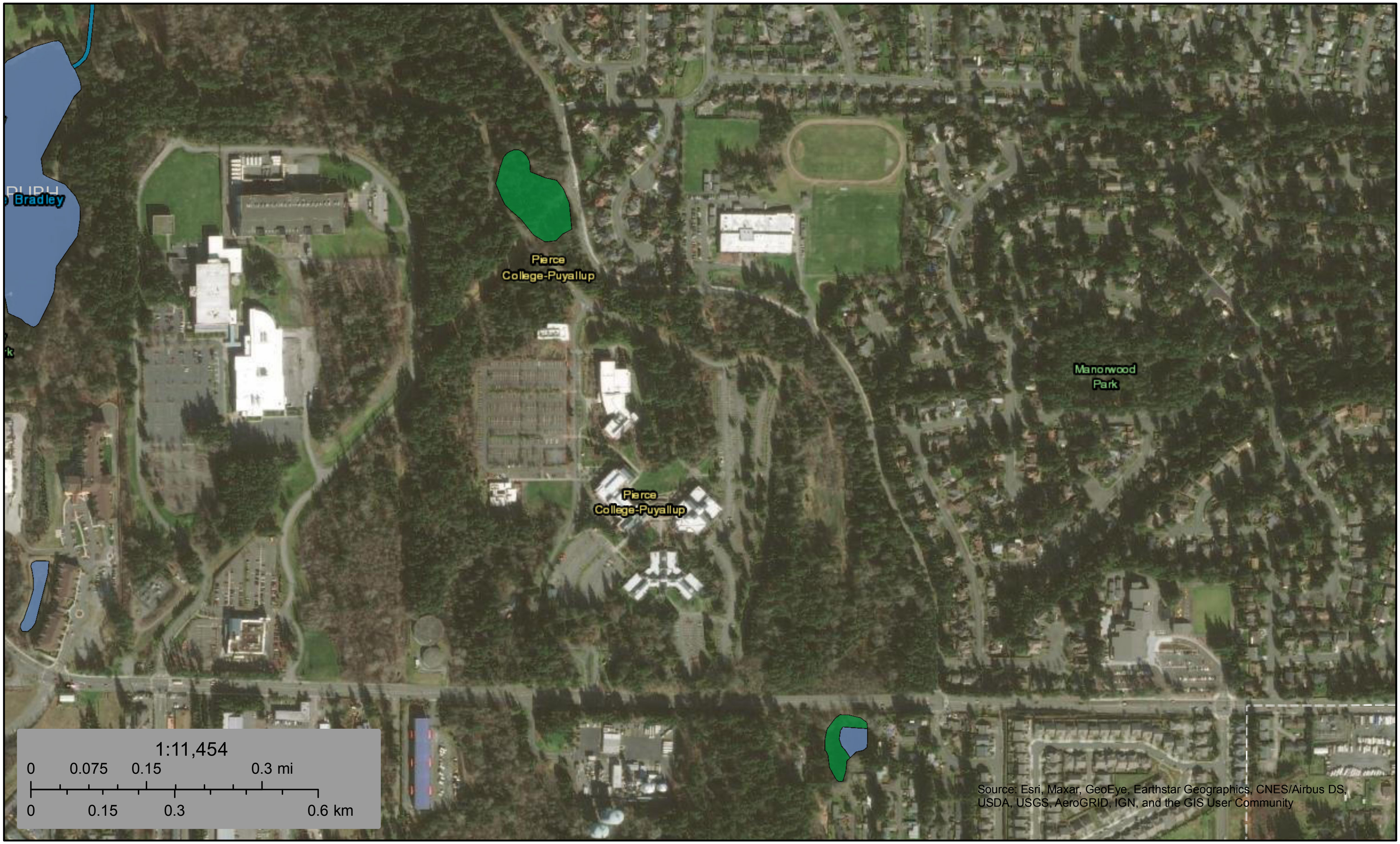
Status Code

- Field-verif Delineate
- Field-verif
- Unverified
- Unverified
- Unverified
- Buffer
- Mitigation

U.S. Fish and Wildlife Service

National Wetlands Inventory

# Wetlands



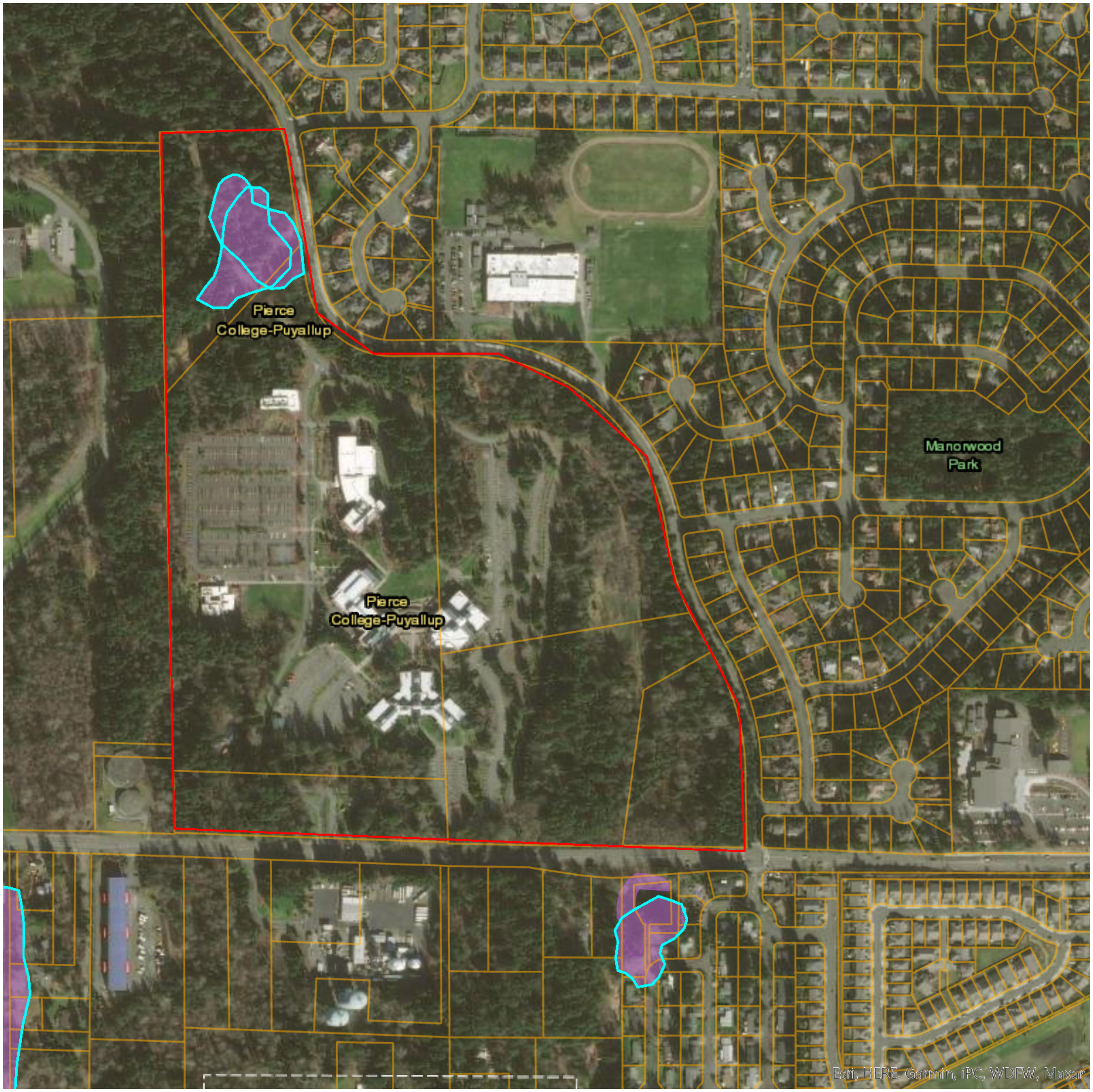

January 26, 2022

**Wetlands**

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

# Priority Habitats and Species on the Web




**Report Date: 01/26/2022**

## PHS Species/Habitats Overview:

| Occurence Name | Federal Status | State Status | Sensitive Location |
|---|---|---|---|
| Wetlands | N/A | N/A | No |
| Waterfowl Concentrations | N/A | N/A | No |
| Freshwater Forested/Shrub Wetland | N/A | N/A | No |

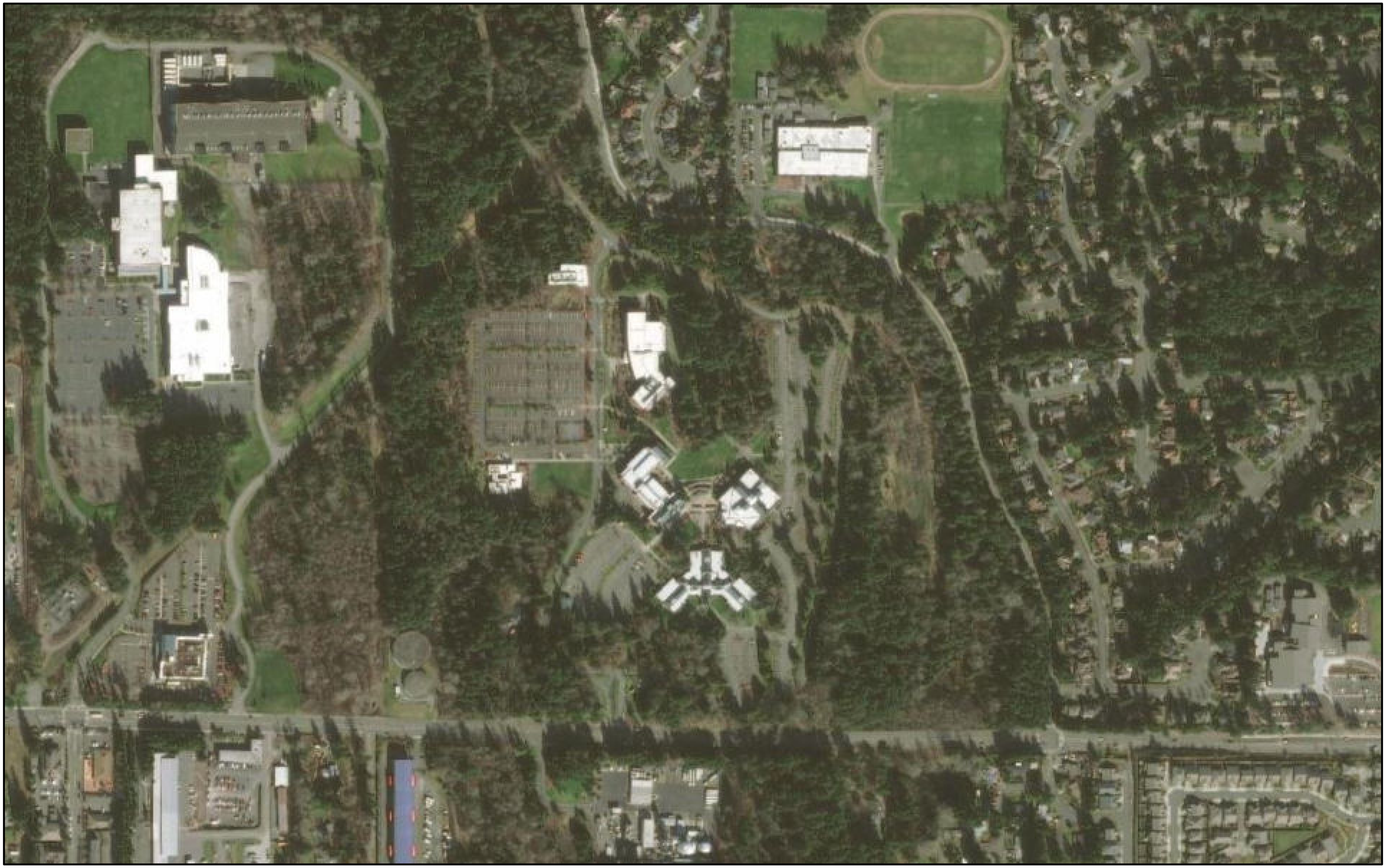
# PHS Species/Habitats Details:

| Wetlands | |
|---|---|
| Priority Area | Aquatic Habitat |
| Site Name | SOUTH PUYALLUP WETLANDS |
| Accuracy | 1/4 mile (Quarter Section) |
| Notes | POTHOLE WETLANDS IN SOUTH PUYALLUP AREA |
| Source Record | 902560 |
| Source Dataset | PHSREGION |
| Source Name | NAUER, DON WDW |
| Source Entity | WA Dept. of Fish and Wildlife |
| Federal Status | N/A |
| State Status | N/A |
| PHS Listing Status | PHS Listed Occurrence |
| Sensitive | N |
| SGCN | N |
| Display Resolution | AS MAPPED |
| ManagementRecommendations | http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html |
| Geometry Type | Polygons |

| Waterfowl Concentrations | |
|---|---|
| Priority Area | Regular Concentration |
| Site Name | PIERCE COUNTY - NON FARM |
| Accuracy | 1/4 mile (Quarter Section) |
| Notes | SMALL WATERFOWL CONCENTRATION AREAS, NON AGRICULTURAL. |
| Source Record | 902564 |
| Source Dataset | PHSREGION |
| Source Name | NAUER, DON WDW |
| Source Entity | WA Dept. of Fish and Wildlife |
| Federal Status | N/A |
| State Status | N/A |
| PHS Listing Status | PHS LISTED OCCURRENCE |
| Sensitive | N |
| SGCN | N |
| Display Resolution | AS MAPPED |
| ManagementRecommendations | http://wdfw.wa.gov/publications/pub.php?id=00026 |
| Geometry Type | Polygons |

| Freshwater Forested/Shrub Wetland | |
|---|---|
| Priority Area | Aquatic Habitat |
| Site Name | N/A |
| Accuracy | NA |
| Notes | Wetland System: Freshwater Forested/Shrub Wetland - NWI Code: PFO1C |
| Source Dataset | NWIWetlands |
| Source Name | Not Given |
| Source Entity | US Fish and Wildlife Service |
| Federal Status | N/A |
| State Status | N/A |
| PHS Listing Status | PHS Listed Occurrence |
| Sensitive | N |
| SGCN | N |
| Display Resolution | AS MAPPED |
| ManagementRecommendations | http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html |
| Geometry Type | Polygons |

# WA Wetlands of High Conservation Value



1/26/2022, 3:14:04 PM

Counties

1:9,028

0 0.05 0.1 0.2 mi

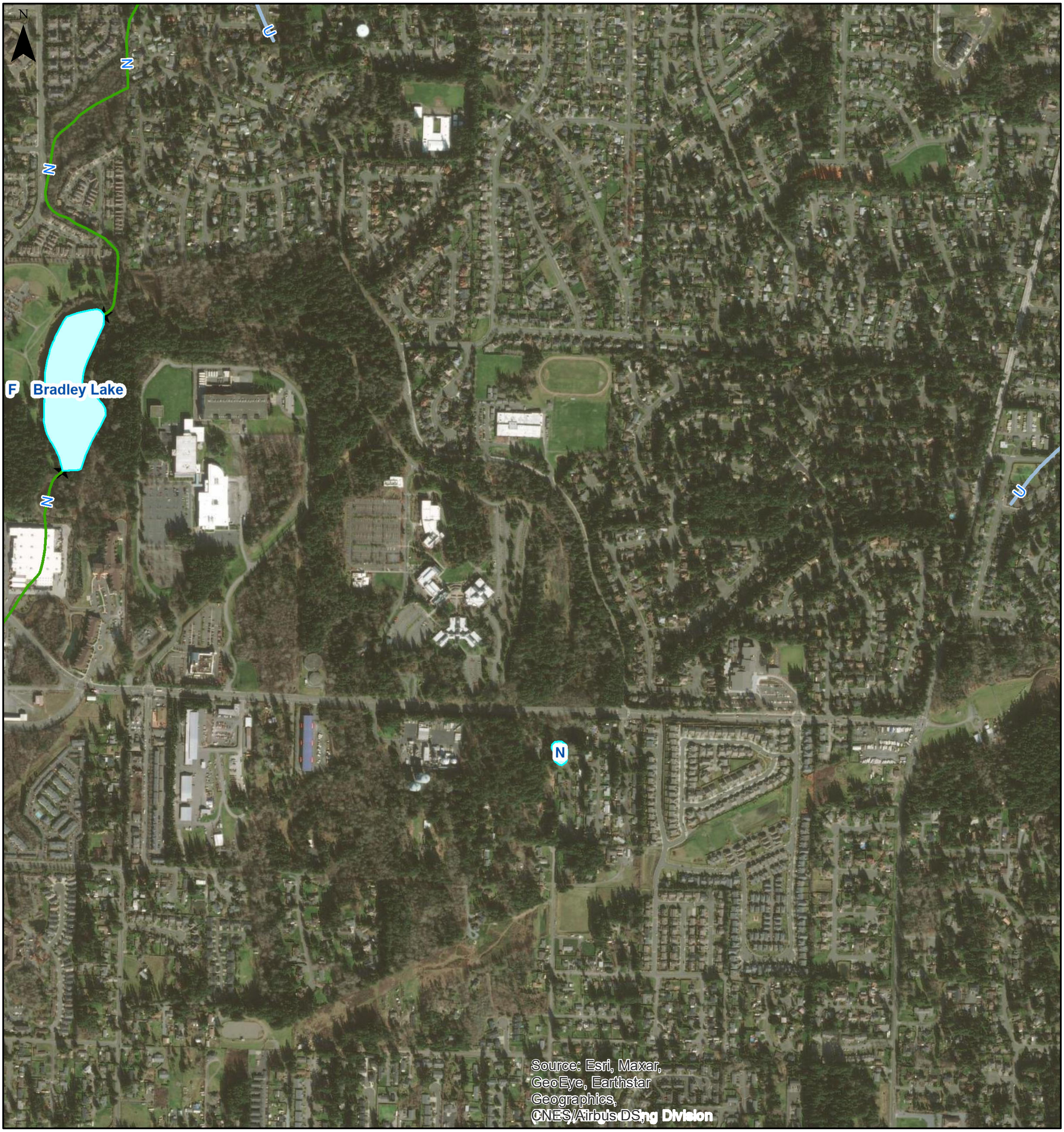
0 0.07 0.15 0.3 km

Maxar

Washington Natural Heritage Program

Washington State Department of Natural Resources | Washington Natural Heritage Program http://www.dnr.wa.gov/natural-heritage-program | Maxar |

# Forest Practices Activity Map - Application #_____________




**Map Symbols**

- Harvest Boundary
- Road Construction
- Stream
- RMZ / WMZ Buffers
- Rock Pit
- Landing
- Waste Area
- Clumped WRTS/GRTS
- Existing Structure

**Additional Information**

**Legal Description**

**S10 T19.0N R04.0E, S03 T19.0N R04.0E**
**S02 T19.0N R04.0E, S11 T19.0N R04.0E**

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

Extreme care was used during the compilation of this map to ensure its accuracy. However, due to changes in data and the need to rely on outside information, the Department of Natural Resources cannot accept responsibility for errors or omissions, and therefore, there are no warranties that accompany this material.

0 0.25 Miles

Date: 1/26/2022 Time: 3:16:27 PM

Soil Map—Pierce County Area, Washington


Map Scale: 1:4,980 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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 17, Aug 31, 2021

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

Date(s) aerial images were photographed: Jul 18, 2020—Aug 2, 2020

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 |
|---|---|---|---|
| 13B | Everett very gravelly sandy loam, 0 to 8 percent slopes | 12.7 | 15.3% |
| 19B | Kapowsin gravelly ashy loam, 0 to 6 percent slopes | 5.6 | 6.8% |
| 19C | Kapowsin gravelly ashy loam, 6 to 15 percent slopes | 43.6 | 52.7% |
| 19E | Kapowsin gravelly ashy loam, 30 to 65 percent slopes | 20.8 | 25.1% |
| **Totals for Area of Interest** | | **82.7** | **100.0%** |

GeoEngineers
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

October 31, 2022

Washington State Department of Enterprise Services
Division of Engineering & Architectural Services
206 General Administration Building
Olympia, Washington 98504-1012

Attention: Dennis Flynn

Subject: Supplemental Groundwater Information Addendum #1
Pierce College Puyallup – Northwest Parking Lot Additions
Puyallup, Washington
File No. 21342-003-00

## INTRODUCTION

This addendum presents additional groundwater monitoring information collected for the Pierce College Puyallup – Parking Lot Additions project in Puyallup, Washington, and is intended to supplement our Geotechnical Engineering Services Report for the same project, dated January 31, 2022 (Geotechnical Report). Our services have been provided in general accordance with our Additional Service Agreement #1 for this project dated December 22, 2021 and our Signed Agreement No. 2020-546 C dated March 16, 2022. Reference to this study should include review and full inclusion of our January 31, 2022 Geotechnical Report. This addendum and our report should be provided and reviewed together for all our geotechnical information, conclusions, and recommendations presented by us on this project.

The City of Puyallup (City) requested, and in general accordance with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (SWMMWW), that groundwater monitoring data be collected during the wet season (defined by City as December 21 through April 1) in the vicinity of the former proposed detention pond to be located near the future northwest parking lot. We facilitated drilling and installation of a groundwater monitoring well (MW-1) at the site on January 3, 2022. MW-1 was placed in the vicinity of the former proposed stormwater detention system. The location of the well is shown on the Site Plan, Figure 1. We understand that due to site constraints and other factors, the northwest stormwater facility design was changed to an underground detention pipe system. The underground system will be located beneath the western portion of the proposed northwest parking lot. The bottom of the facility is planned to be between about Elevation 506.5 and 507 feet. As part of the system change, the parking lot layout was elongated toward the west to northwest.

In the following sections, we discuss the subsurface conditions encountered during drilling, present the groundwater monitoring data collected, and provide additional conclusions and recommendations for design of the northwest stormwater facility.

## SUBSURFACE CONDITIONS

During drilling for MW-1, we advanced through about 12 inches of forest duff and/or organic-rich soil at the surface. Underlying the forest duff, we encountered what we interpret to be glacial till. The upper approximate 4½ feet was weathered and generally consisted of medium dense silty sand. Beneath the weathered zone, soil generally consisted of dense to very dense silty sand with gravel, very dense gravel with silt and sand, and very stiff to hard silt with varying sand content. A more detailed description of our interpretation of geologic and subsurface conditions at the project site and additional exploration logs are provided in our Geotechnical Report. Our exploration and laboratory testing program and summary exploration log for this study is included in Appendix A.

We encountered groundwater at about 21 feet below ground surface (bgs) during drilling. After constructing the monitoring well, we measured groundwater at about 9¾ feet bgs. Based on subsurface soil conditions (soil lithology and soil moisture conditions), followed by the subsequent rise in groundwater level (approximate 11-foot rise after well construction), it is our opinion that artesian groundwater conditions are present in the vicinity of MW-1. It should be noted that our other geotechnical studies in the project vicinity on campus have documented near surface perched groundwater seepage, but it was not interpreted to be a regional groundwater table at the depths noted or an artesian condition.

## GROUNDWATER MONITORING

We installed a pressure transducer data logger within MW-1 to record groundwater levels at regular time intervals. The data logger was programmed to collect a groundwater reading once a day at 12:00 between January 4 and May 18, 2022. Groundwater data collected was compiled and correlated to an elevation versus date presented in the Groundwater Hydrograph, Figure 2.

The maximum and average groundwater elevations are presented in Table 1 below.

**TABLE 1. GROUNDWATER ELEVATION SUMMARY**

| Date and Time of Maximum Elevation | Approx. Maximum Elevation (feet, NAVD88[1]) | Approx. Average Elevation (feet, NAVD88[1]) |
|---|---|---|
| 1/17/22 12:00 | 506.0 | 504.5 |

Notes:

[1] The North American Vertical Datum 1988.

## CONCLUSIONS AND RECOMMENDATION

### Design Considerations

- We recommend that Elevation 506 feet be considered the limiting elevation for the bottom of the stormwater system for storage considerations.
- Buoyancy effects should be considered as a part of the detention system design. As such, we suggest that an initial and assumed groundwater elevation of 508 feet (NAVD88) be considered as a target groundwater elevation for buoyancy calculation checks. This is somewhat conservative. If

it is found that buoyancy effects at this groundwater elevation is a concern, we should be contacted and provided an opportunity to review and assist with the design.

- Total soil unit weight (above groundwater) may be considered to be 125 pounds per cubic foot (pcf).
- Effective soil unit weight (below groundwater) may be considered to be 62.6 pcf.
- Follow detention pipe system manufacturer recommendations for mitigating buoyancy effects.

### Construction Considerations

Based on proposed design elevations, expect to encounter water below about Elevation 506 feet during excavation and construction. This will occur from either near surface seepage and/or artesian conditions, as described above. Artesian conditions may temporarily cause the base of the excavation to "float" and/or become unstable and/or disturbed. We expect that artesian conditions should subside shortly after excavation and just be wet. If the excavation takes place in mid- to late-summer, we expect the upward artesian seepage to be less prominent and the basal soils could potentially be dryer and less difficult to manage.

Subgrade stabilization below the bottom of the stormwater system may be necessary during construction. As such, we recommend budgeting and planning for at least 12 inches of subgrade over-excavation and replacement with quarry spalls (Washington State Department of Transportation [WSDOT] Standard Specification 9-13.1(5)), aside from any design base materials already in the project plans and specifications. Ultimately, base and subgrade conditions will have to be observed during excavation to determine if this, or other means of stabilization, are necessary.

## LIMITATIONS

We have prepared this letter for the exclusive use of the Washington State Department of Enterprise Services (DES) and their authorized agents for the Pierce College Puyallup – Parking Lot Additions project located in Puyallup, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this letter was prepared. The conclusions, recommendations, and opinions presented in this letter are based on our professional knowledge, judgment, and experience. No warranty, express or implied, applies to the services or this letter.

Except for described and modified herein, the conclusions and recommendations and limitations presented in our January 31, 2022 Geotechnical Report remain unchanged and still apply to this project. Please refer to Appendix A titled "Report Limitations and Guidelines for Use" in our Geotechnical Report for additional information pertaining to use of this letter.

We trust that this letter meets your needs. If you have any questions regarding this letter, please contact us.

Sincerely,
GeoEngineers, Inc.

DENNIS JOHN THOMPSON
STATE OF WASHINGTON
38397
REGISTERED
PROFESSIONAL ENGINEER
10/31/22

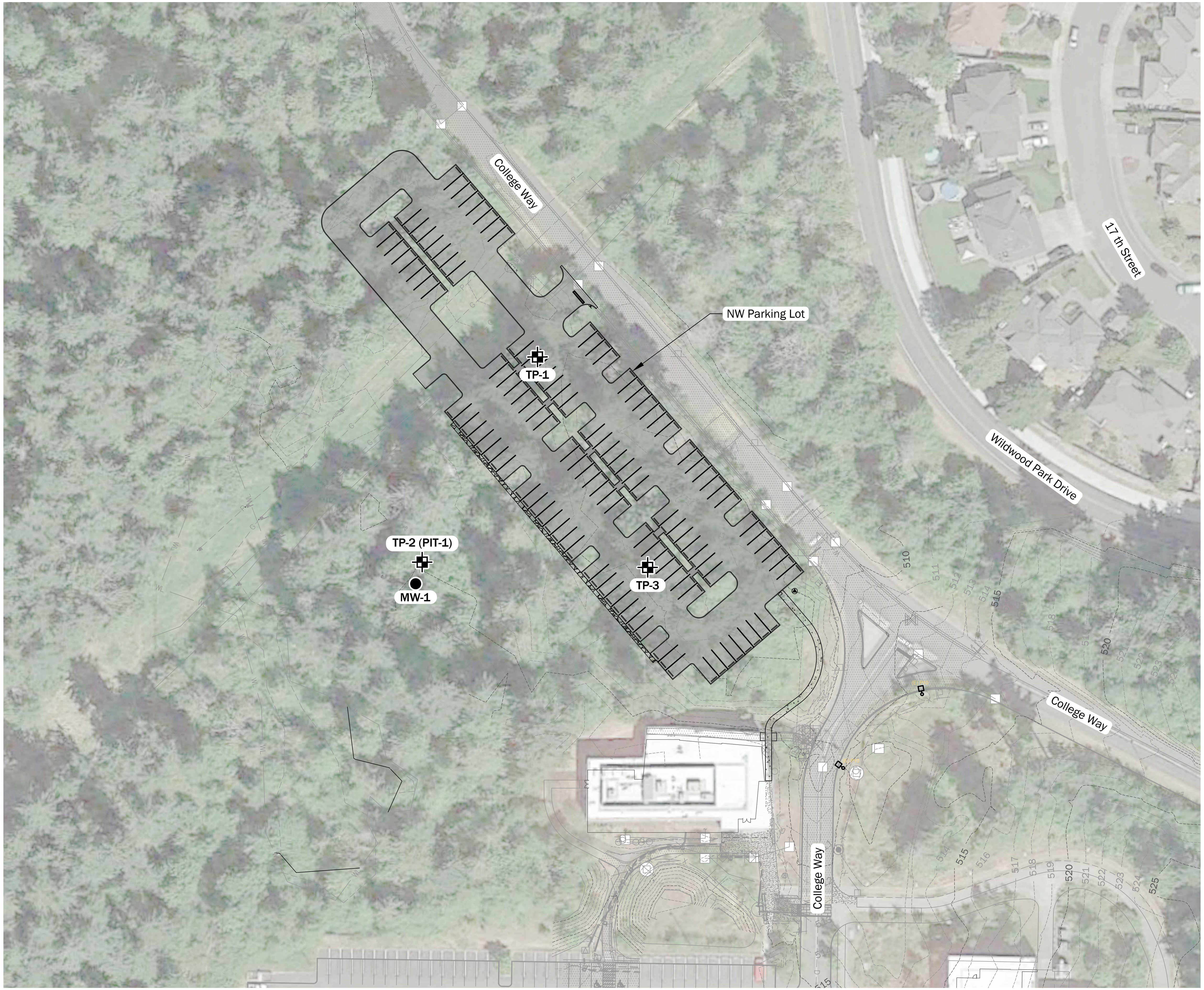
Christopher R. Newton, PE
Geotechnical Engineer

Dennis (D.J.) Thompson, PE
Associate Geotechnical Engineer

CRN:DJT:leh

Attachments:
Figure 1. Site Plan
Figure 2. Groundwater Hydrograph
Appendix A. Subsurface Explorations and Laboratory Testing
- Figure A-1 – Key to Exploration Logs
- Figure A-2 – Log of Monitoring Well
- Figures A-3 and A-4 – Sieve Analysis Results

1 copy submitted electronically




**Legend**

MW-1 ● Monitoring Well by GeoEngineers, Inc., 2022

TP-1 ⊕ Test Pit by GeoEngineers, Inc., 2021

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from AHBL, Inc., received on 10/06/2022.
Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, South Zone, NAD83, US Foot

N W E S

80 0 80
Feet

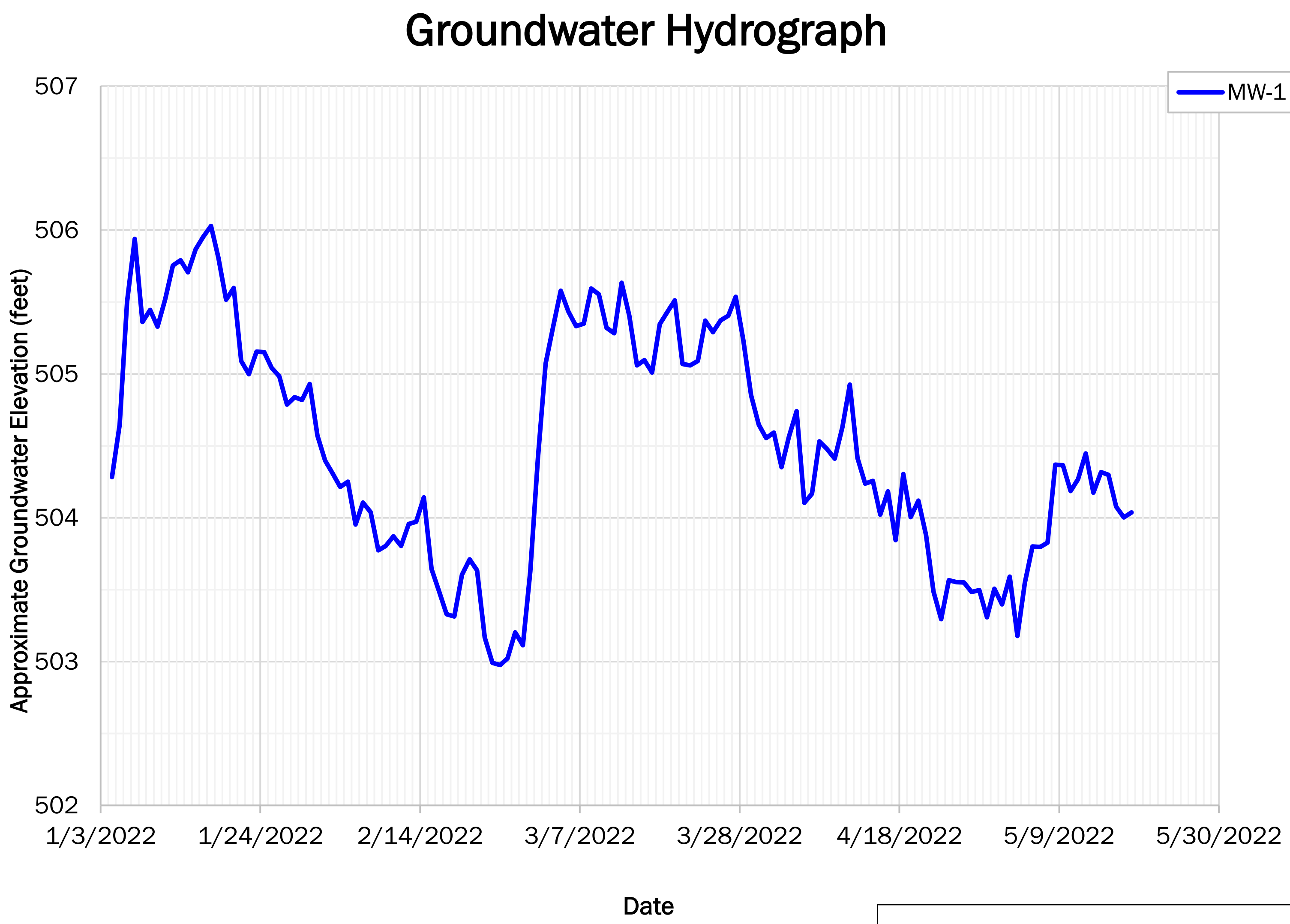
**Site Plan**

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

GEOENGINEERS

**Figure 1**

21342-003-00 Date Exported 07/21/22




Note:
1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

| Groundwater Hydrograph | |
| --- | --- |
| Pierce College Puyallup - Parking Lot Additions<br>Puyallup, Washington | |
| GeoEngineers | Figure 2 |

# APPENDIX A
## Subsurface Explorations and Laboratory Testing

# APPENDIX A
# SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

## Subsurface Explorations

Subsurface conditions were explored by advancing one hollow-stem auger boring on January 3, 2022. Subsurface exploratory services were provided by Holocene Drilling, Inc. under subcontract to GeoEngineers, Inc. The boring was advanced to a nominal depth of about 25¼ feet below surrounding site grade. A groundwater monitoring well was installed with a pressure transducer at this boring.

The boring was located in the field using an electronic tablet equipped with a global positioning system (GPS) software application. The exploration coordinates were approximated using publicly available aerial imagery and coordinate software. The exploration location is included on the Site Plan, Figure 1. The location and elevation of the exploration should be considered approximate.

Our field representative collected samples, classified the soils, maintained a detailed log of the exploration, and observed groundwater conditions. The samples were obtained with a standard split spoon sampler in general accordance with ASTM International (ASTM) D 1586. Field blow counts are presented on the logs. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. A summary log of the exploration is included as Figure A-2.

## Laboratory Testing

Soil samples obtained from the boring were transported to GeoEngineers laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classification.

Our testing program consisted of the following:

- Five – Particle-size distribution analyses (sieve analyses (SA))
- One – Moisture content determination (MC)

Tests were performed in general accordance with test methods of ASTM or other applicable procedures. The following sections provide a general description of the tests performed.

### Sieve Analysis

Particle-size analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method determines quantitatively the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (μm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figures A-3 and A-4 present the results of our sieve analyses.

### Moisture Content

The moisture content of a selected sample was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The test results are shown on the exploration log at the respective sample depth.

## SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS | | | SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN 50% RETAINED ON NO. 200 SIEVE | GRAVEL AND GRAVELLY SOILS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS<br>(LITTLE OR NO FINES) | | GW | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | | | GP | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES |
| | | GRAVELS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | | | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| | SAND AND SANDY SOILS<br>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE | CLEAN SANDS<br>(LITTLE OR NO FINES) | | SW | WELL-GRADED SANDS, GRAVELLY SANDS |
| | | | | SP | POORLY-GRADED SANDS, GRAVELLY SAND |
| | | SANDS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | | | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS<br>MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS |
| | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | | | OH | ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY |
| HIGHLY ORGANIC SOILS | | | | PT | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS |

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

## ADDITIONAL MATERIAL SYMBOLS

| SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|
| | AC | Asphalt Concrete |
| | CC | Cement Concrete |
| | CR | Crushed Rock/ Quarry Spalls |
| | SOD | Sod/Forest Duff |
| | TS | Topsoil |

### Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

### Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

### Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

### Sampler Symbol Descriptions

2.4-inch I.D. split barrel / Dames & Moore (D&M)

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

### Laboratory / Field Tests

| | |
|---|---|
| %F | Percent fines |
| %G | Percent gravel |
| AL | Atterberg limits |
| CA | Chemical analysis |
| CP | Laboratory compaction test |
| CS | Consolidation test |
| DD | Dry density |
| DS | Direct shear |
| HA | Hydrometer analysis |
| MC | Moisture content |
| MD | Moisture content and dry density |
| Mohs | Mohs hardness scale |
| OC | Organic content |
| PM | Permeability or hydraulic conductivity |
| PI | Plasticity index |
| PL | Point lead test |
| PP | Pocket penetrometer |
| SA | Sieve analysis |
| TX | Triaxial compression |
| UC | Unconfined compression |
| UU | Unconsolidated undrained triaxial compression |
| VS | Vane shear |

### Sheen Classification

| | |
|---|---|
| NS | No Visible Sheen |
| SS | Slight Sheen |
| MS | Moderate Sheen |
| HS | Heavy Sheen |

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

# Key to Exploration Logs

GEOENGINEERS

Figure A-1

| Drilled | Start 1/3/2022 | End 1/3/2022 | Total Depth (ft) | 25.25 | Logged By OA / Checked By CRN | Driller | Holocene Drilling, Inc. | Drilling Method | Hollow-stem Auger |
|---|---|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Hammer Data | Autohammer 140 (lbs) / 30 (in) Drop | Drilling Equipment | Diedrich D-50 Turbo (track-mounted) |
| Surface Elevation (ft) / Vertical Datum | 514.55 / NAVD88 | Top of Casing Elevation (ft) | 518.29 |
| Easting (X) / Northing (Y) | 1198829 / 671013 | Horizontal Datum | WA State Plane South NAD83 (feet) |

DOE Well I.D.: BNP-056
A 2-in well was installed on 1/3/2022 to a depth of 25 ft.

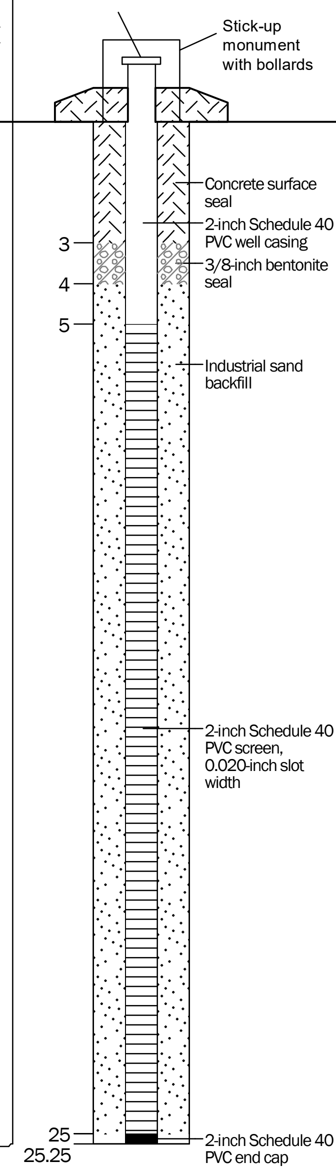
Groundwater

| Date Measured | Depth to Water (ft) | Elevation (ft) |
|---|---|---|
| 1/3/2022 | 9.75 | 504.80 |

Notes: Groundwater observed at approximately 21 feet below ground surface during drilling

| Elevation (feet) | Depth (feet) | Recovered (in) | Blows/foot | Sample Name / Testing | Group Classification | Material Description | Moisture Content (%) | Fines Content (%) |
|---|---|---|---|---|---|---|---|---|
| | 0 | | | | Duff | Forest duff | | |
| | | | | | SM | Gray with moderate oxidation staining silty fine to medium sand with occasional gravel (medium dense, moist) (weathered glacial till) | | |
| 510 | | 16 | 26 | 1 / MC | | | 20 | |
| | 5 | 10 | 42 | 2 | SM | Gray silty fine sand with gravel (dense, moist) (glacial till) | | |
| | | 8 | 78/9" | 3 / SA | | Grades to very dense, includes approximate 1-inch thick layer of wet, fine to medium sand | 12 | 43 |
| 505 | | | | | ML | Gray silt with sand (hard, moist) | | |
| | 10 | 17 | 85/11" | 4 / SA | | | 17 | 71 |
| 500 | | | | | ML | Gray sandy silt and includes approximate 1-inch-thick layer of wet, fine to medium sand (very stiff, near wet) | | |
| | 15 | 12 | 22 | 5 / SA | | | 19 | 51 |
| 495 | | | | | SM | Gray silty fine sand with gravel (very dense, wet) | | |
| | 20 | 6 | 50/6" | 6 / SA | | | 15 | 34 |
| 490 | | | | | GW-GM | Gray fine to coarse gravel with silt and sand (very dense, wet) | | |
| | 25 | 3 | 50/3" | 7 / SA | | | 8 | 8 |

WELL LOG



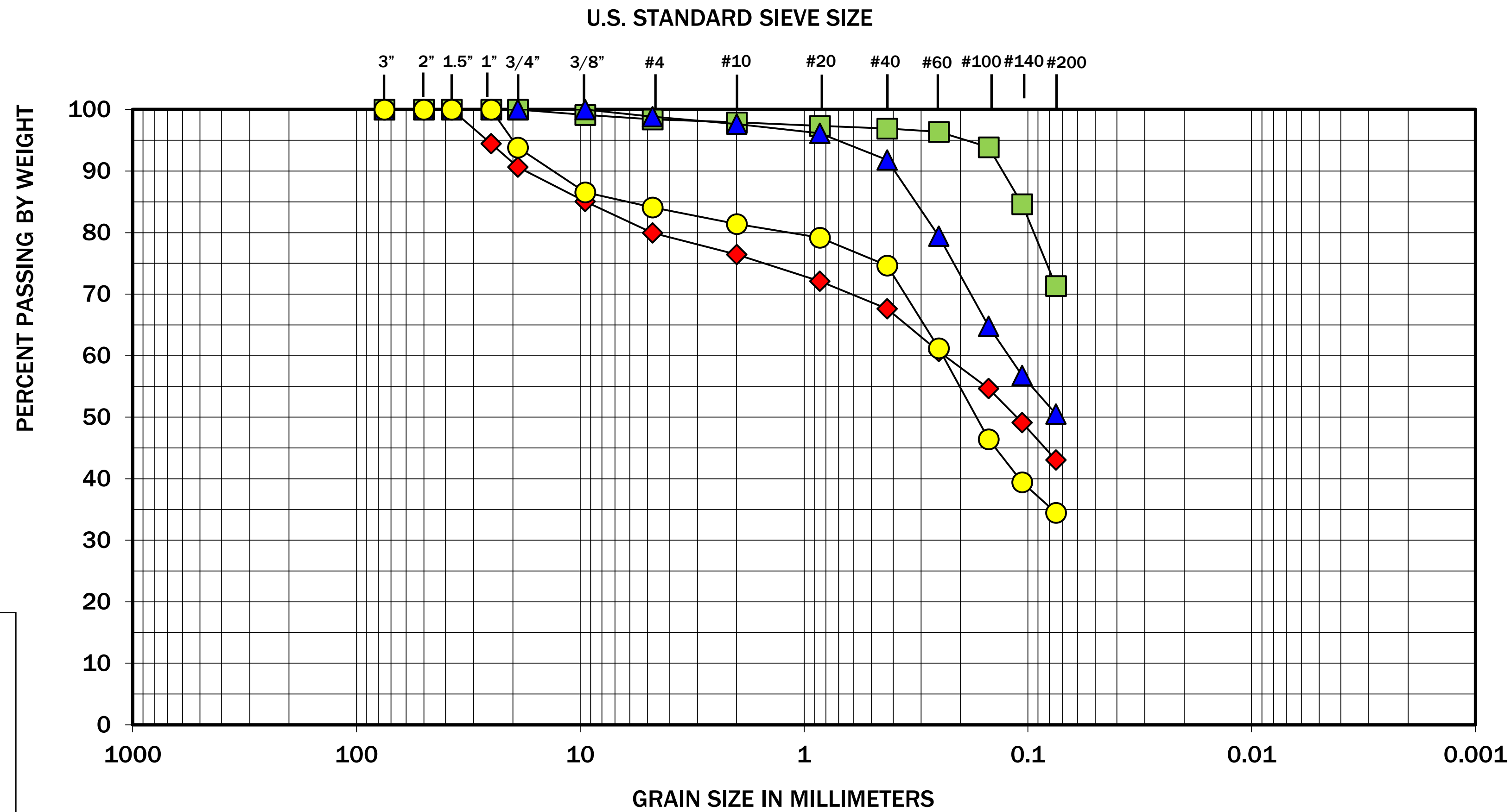

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.



## Log of Monitoring Well MW-1

GEOENGINEERS

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| Symbol | Boring Number | Depth (feet) | Moisture (%) | Soil Description |
|---|---|---|---|---|
| ◆ (red diamond) | MW-1 | 7.5 | 12 | Silty sand with gravel (SM) |
| ■ (green square) | MW-1 | 10 | 17 | Silt with sand (ML) |
| ▲ (blue triangle) | MW-1 | 15 | 19 | Sandy silt (ML) |
| ● (yellow circle) | MW-1 | 20 | 15 | Silty sand with gravel (SM) |

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Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

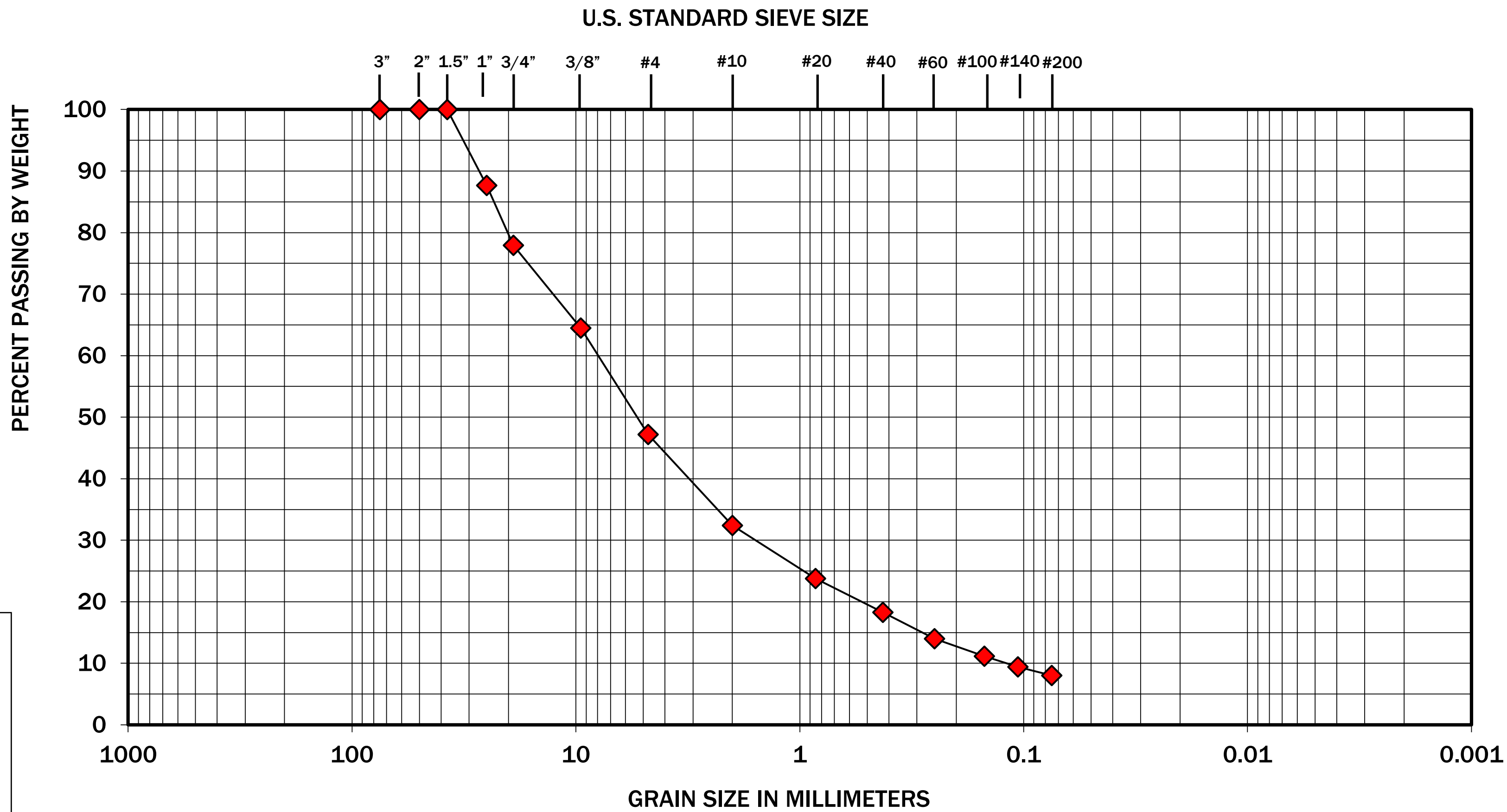
GeoEngineers

**Sieve Analysis Results**

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

**Figure A-3**

21342-003-00 Date Exported: 1/14/22




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| Symbol | Boring Number | Depth (feet) | Moisture (%) | Soil Description |
|---|---|---|---|---|
| ◆ | MW-1 | 25 | 8 | Well-graded gravel with silt and sand (GW-GM) |



The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

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GEOENGINEERS

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

**Sieve Analysis Results**

**Figure A-4**

# Appendix D

## Operation and Maintenance Manual

***Private Stormwater Facilities Operation & Maintenance Manual***

*PREPARED FOR:*

McGranahan Architects
Contact: Mr. Andy Hartung
2111 Pacific Avenue, Suite 100
Tacoma, WA 98402

*PROJECT:*

Pierce College Puyallup
Campus Parking Expansion
Puyallup, WA
2200718.12

*PREPARED BY:*

Claire Hovde
Project Engineer

*REVIEWED BY:*

William J. Fierst, PE
Principal

*DATE*

February 2022
Revised November 2022

## *Table of Contents*

# *Appendices*

**Maintenance Checklists**

**Annual Inspection Report**

## 1.0 Introduction

The Pierce College Puyallup Campus maintenance staff shall be responsible for maintaining properly functioning stormwater control facilities. This report presents a maintenance program that meets City of Puyallup maintenance requirements. The private stormwater facilities for this project include a system of catch basins and pipes to collect surface runoff and route it through bioretention facilities for stormwater treatment prior to either routing to a detention facility or a level spreader.

It is vitally important that the proponent/owner maintain these facilities in a timely and conscientious manner to ensure the facilities function as designed. Siltation, debris, or lack of maintenance can reduce the capabilities of the conveyance system which can lead to localized flooding. If bioretention facilities are not maintained in accordance with the attached maintenance checklist, onsite stormwater can contribute to negative water quality to downstream waterbodies of the state.

## 2.0 Responsibility

The private stormwater facilities will be owned and maintained by Pierce College Puyallup Campus maintenance personnel.

Property Owner:

Pierce College Puyallup Campus
1601 39th Avenue SE
Puyallup, WA 98374
(253) 840-8400

## 3.0 Schedule

Maintenance of the stormwater facilities shall follow the schedule as specified in the attached maintenance checklists and as recommended by the media filter manufacturer guidelines. Additional maintenance may be required to respond to unusual storm events or reduced performance of the treatment system. A copy of the Pierce County-recommended maintenance schedule is attached and may be photocopied and used as inspection records. An annual inspection report must be submitted to the City of Puyallup in accordance with the Maintenance Agreement.

It is recommended that the dispersion trench and the area directly downstream be inspected yearly and maintained. It is also recommended that the dispersion trench and area downstream be inspected after heavy precipitation events during the rainy season to evaluate if maintenance is necessary.

## 4.0 Cost

The following is an estimate of the average annual cost of maintenance for the stormwater control facilities within the scope of this project.

| | |
|---|---|
| Vactor truck @ $200/hour x 12 hours | $2,400 |
| Personnel @ $25/hour x 12 hours | $300 |
| Dumping Fees @ $50/ton x 12 tons | $600 |
| Sweep Parking Lots Once Yearly | $1,500 |
| **Total Estimated Annual Cost** | **$4,800** |

## 5.0 Vegetation Management Plan

The attached maintenance schedule provides guidance on vegetation control and management. Irrigation and other maintenance as necessary shall be provided to ensure that vegetation remains viable and that a hardy root structure forms in the first year. Vegetation planting shall be provided as described in the construction documents

## 6.0 Instructions for Person Maintaining Stormwater System

The attached Maintenance Checklists specify maintenance schedules for stormwater facilities onsite. Plan to complete a checklist for all system components per the following schedule:

1. Monthly from November through April;
2. Once in late summer (preferably September); and
3. After any major storm event (items marked "S" only).

Using photocopies of the attached pages, check off the problems that are noted each time the item is inspected. Document comments on problems found and the corrective action taken. The Inspection Checklist sheets should be kept on file and used to prepare the annual report required by Pierce County, due on or before May 15 of each year. Use the Pierce County suggested inspection frequency at the left of each item as an inspection guide.

As described in Section 3.0 of this report, it is recommended that the dispersion trench and the area directly downstream be inspected yearly and after heavy precipitation events during the rainy season. If erosion or other issues are observed, additional slope surface care may be provided by placing straw wattles or other similar erosion control devices. Replanting, energy dissipators, and/or silt fence may be placed near drain outlets to further slow water and the effects of erosion. The owner shall ensure the current vegetation of the down slope portion of the dispersion area remains intact and the area remains uninhabited.

## 7.0 Conclusion

This Maintenance Manual is developed for the operation of the Pierce College Puyallup Campus Parking Expansion private stormwater systems. This Maintenance document has been prepared within the guidelines of the City of Puyallup Construction Standards. If this plan is implemented, the Owner can expect the stormwater system to function as designed.

AHBL, Inc.

Claire Hovde
Project Engineer

CFH/ACP/lsk

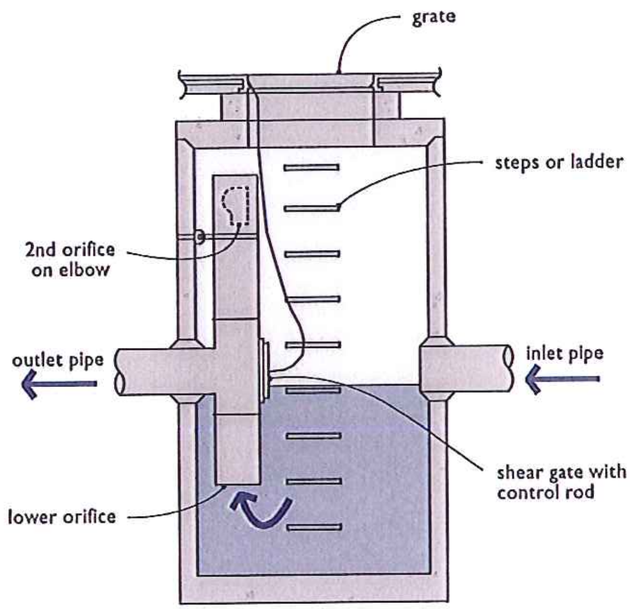
February 2022
Revised November 2022

Q:\2020\2200718\WORDPROC\Reports\20221110 Rpt (O&M) 2200718.12.docx

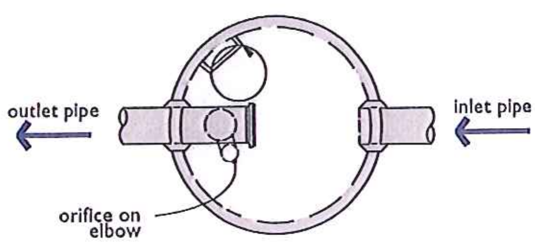
# *Maintenance Checklists*

## 3.4 Control Structure/Flow Restrictor

Control structures/flow restrictors are located on the outlet pipe of a detention system. The control structure is typically a Type 2 concrete catch basin (see Section 3.5 for catch basin description) with a riser (vertical pipe). The control structure reduces the discharge rate of stormwater from a detention facility. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or vee shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. This can result in flooding of the stormwater system and/or an increase in the rate of discharge from the site potentially damaging downstream property.




BIRD'S-EYE VIEW




SECTION PROFILE

# Control Structure/Flow Restrictor Checklist

| Frequency | Drainage System Feature | Date ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
|---|---|---|---|---|---|---|---|---|
| M | General | | | | | Trash and Debris (Includes Sediment) | Material exceeds 25% of sump depth or 1 foot below orifice plate. | Control structure orifice is not blocked. All trash and debris removed. |
| A | General | | | | | Structural Damage | Structure is not securely attached to manhole wall. | Structure securely attached to wall and outlet pipe. |
| A | General | | | | | Structural Damage | Structure is not in upright position (allow up to 10% from plumb). | Structure in correct position. |
| A | General | | | | | Structural Damage | Connections to outlet pipe are not watertight and show signs of rust. | Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. |
| A | General | | | | | Structural Damage | Any holes--other than designed holes--in the structure. | Structure has no holes other than designed holes. |
| A | Cleanout Gate | | | | | Damaged or Missing | Cleanout gate is not watertight or is missing. | Gate is watertight and works as designed. |
| A | Cleanout Gate | | | | | Damaged or Missing | Gate cannot be moved up and down by one maintenance person. | Gate moves up and down easily and is watertight. |
| A | Cleanout Gate | | | | | Damaged or Missing | Chain/rod leading to gate is missing or damaged. | Chain is in place and works as designed. |
| A | Cleanout Gate | | | | | Damaged or Missing | Gate is rusted over 50% of its surface area. | Gate is repaired or replaced to meet design standards. |
| A | Orifice Plate | | | | | Damaged or Missing | Control device is not working properly due to missing, out of place, or bent orifice plate. | Plate is in place and works as designed. |
| M,S | Orifice Plate | | | | | Obstructions | Any trash, debris, sediment, or vegetation blocking the plate. | Plate is free of all obstructions and works as designed. |
| | Overflow Pipe | | | | | Obstructions | Any trash or debris blocking (or having the potential of blocking) the overflow pipe. | Pipe is free of all obstructions and works as designed. |
| A | Manhole | | | | | Cover Not in Place | Cover is missing or only partially in place. Any open manhole requires maintenance. | Manhole is closed. |

## Control Structure/Flow Restrictor Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| A | Manhole | | | | | Locking Mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids). | Mechanism opens with proper tools. |
| A | Manhole | | | | | Cover Difficult to Remove | One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance. | Cover can be removed and reinstalled by one maintenance person. |
| A | Manhole | | | | | Ladder Rungs Unsafe | Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks. | Ladder meets design standards. Allows maintenance person safe access. |

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

Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.5 Catch Basins

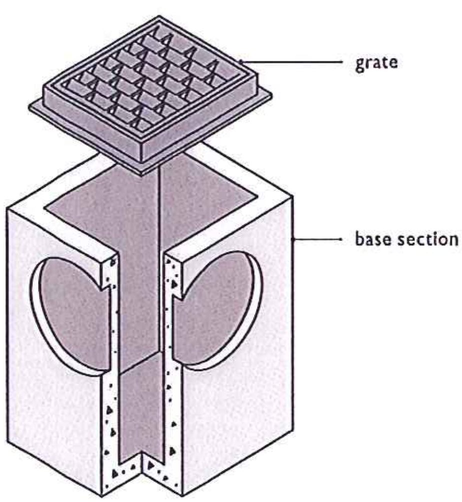
Catch basins are underground concrete structures typically provided with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two catch basin types.

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.

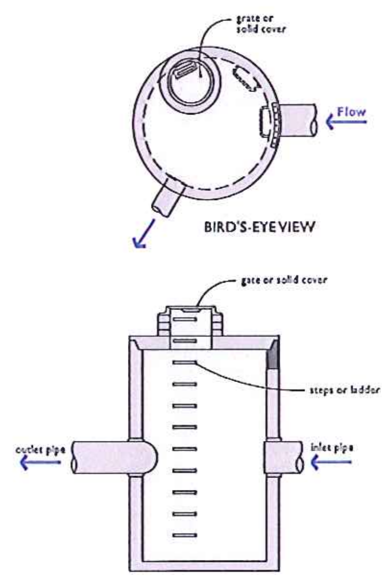
Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter of 4 feet to 8 feet. Type 2 catch basins are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Type 2 catch basins 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**




SIDE PROFILE

**Type 2**

## Catch Basins Checklist

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| A | 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. |
| M,S | 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. |
| M | 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. |
| M | 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. |
| M | 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. |
| M | 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 6 inches clearance from the sediment surface to the invert of the lowest pipe. | No sediment in the catch basin |
| A | 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. |

## Catch Basins Checklist (Continued)

| Frequency | Drainage System Feature | Date ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
|---|---|---|---|---|---|---|---|---|
| A | 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. |
| A | General | | | | | Fractures or Cracks in Basin Walls/ Bottom | Maintenance person judges that structure is unsound. | Basin replaced or repaired to design standards. |
| A | 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. |
| A | General | | | | | Settlement / Misalignment | If failure of basin has created a safety, function, or design problem. | Basin replaced or repaired to design standards. |
| M | General | | | | | Vegetation | Vegetation growing across and blocking more than 10% of the basin opening. | No vegetation blocking opening to basin. |
| M | 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. |
| M | 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. |
| A | 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 |
| A | 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. |
| A | 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. |

# Catch Basins Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| A | 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. |
| | Grates | | | | | Grate opening Unsafe | Grate with opening wider than 7/8 inch. | Grate opening meets design standards. |
| M,S | Grates | | | | | Trash and Debris | Trash and debris that is blocking more than 20% of grate surface inletting capacity. | Grate free of trash and debris. |
| A | 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.

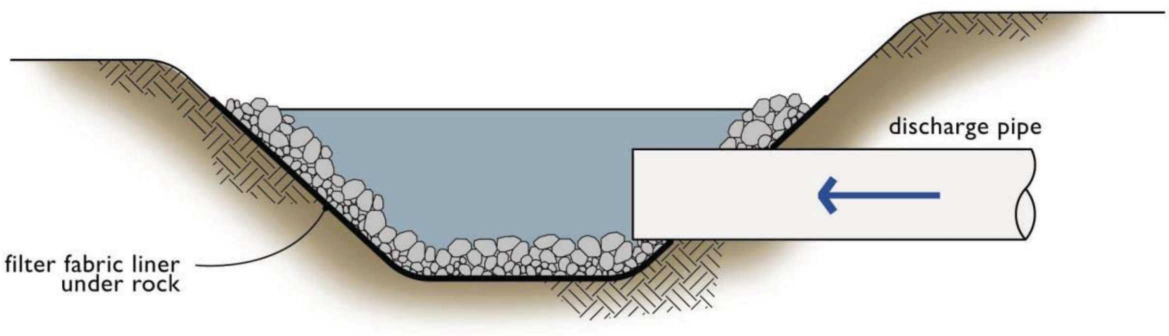
Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.7 Energy Dissipaters

Energy dissipaters are provided on the inlet and outlet to a closed pipe system to prevent erosion at these locations. Design of an energy dissipater can vary significantly from highly engineered systems (concrete or rock gabion structures) to the more commonly used rock pad. The rock pad is typically constructed of 4- to 12-inch diameter rocks a minimum of 12 inches thick and is often lined with filter fabric. The rock pad should extend above the top of the pipe a minimum of 1 foot.



# Energy Dissipaters Checklist

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **Drainage System Feature** | ✓ | ✓ | ✓ | ✓ | **Problem** | **Conditions to Check For** | **Conditions That Should Exist** |
| External: | | | | | | | | |
| M | Rock Pad | | | | | Missing or Moved 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. |
| M | Rock Pad | | | | | Erosion | Soil erosion in or adjacent to rock pad. | Rock pad replaced to design standards. |
| M | Dispersion Trench | | | | | Pipe Plugged with Sediment | Accumulated sediment that exceeds 20% of the design depth. | Pipe cleaned/flushed so that it matches design. |
| M | Dispersion Trench | | | | | Not Discharging Water Properly | Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage. | Trench redesigned or rebuilt to standards. |
| M | Dispersion Trench | | | | | Perforations Plugged. | Over 1/2 of perforations in pipe are plugged with debris and sediment. | Perforated pipe cleaned or replaced. |
| M | Dispersion Trench | | | | | Water Flows Out Top of "Distributor" Catch Basin. | Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage. | Facility rebuilt or redesigned to standards. |
| M | Dispersion Trench | | | | | Receiving Area Over-Saturated | Water in receiving area is causing or has potential of causing landslide problems. | No danger of landslides. |
| Internal: | | | | | | | | |
| M | Manhole/ Chamber | | | | | Worn or Damaged Post, Baffles, Side of Chamber | Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound. | Structure replaced to design standards. |
| M | Manhole/ Chamber | | | | | 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. |
| M | Manhole/ Chamber | | | | | 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. |
| M | Manhole/ Chamber | | | | | 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. |

## Energy Dissipaters Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| Internal (Continued): | | | | | | | | |
| M | Manhole/ Chamber | | | | | 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. There shall be a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe. | No sediment in the catch basin |
| A | Manhole/ Chamber | | | | | 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. |
| A | Manhole/ Chamber | | | | | 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. |
| A | Manhole/ Chamber | | | | | Fractures or Cracks in Basin Walls/ Bottom | Maintenance person judges that structure is unsound. | Basin replaced or repaired to design standards. |
| A | Manhole/ Chamber | | | | | 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. |
| A | Manhole/ Chamber | | | | | Settlement / Misalignment | If failure of basin has created a safety, function, or design problem. | Basin replaced or repaired to design standards. |
| M | Manhole/ Chamber | | | | | 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. |
| A | 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 |

# Energy Dissipaters Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Frequency** | **Drainage System Feature** | ✓ | ✓ | ✓ | ✓ | **Problem** | **Conditions to Check For** | **Conditions That Should Exist** |
| Internal (Continued): | | | | | | | | |
| A | 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. |
| A | 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. |

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

Comments:

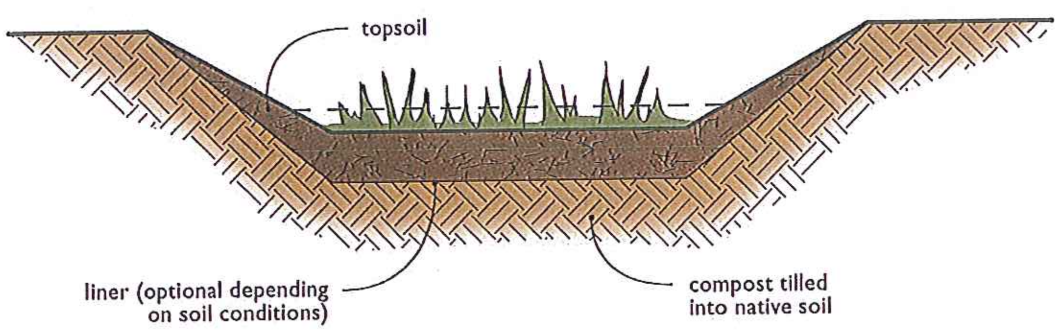
<u>Key</u>:
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.8 Typical Biofiltration Swale

Biofiltration swales are engineered grass-lined open channels with moderate centerline slope similar in appearance to typical ditches.

Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the biofilter.

Biofiltration swales provide stormwater quality control (treatment), but do not provide stormwater quantity control (detention/retention).



# Typical Biofiltration Swale Checklist

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| M | General | | | | | Sediment Accumulation on Grass | Sediment depth exceeds 2 inches. | Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased. |
| M | General | | | | | Standing Water | When water stands in the swale between storms and does not drain freely. | Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale. |
| M | General | | | | | Flow spreader | Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width. | Level the spreader and clean so that flows are spread evenly over entire swale width. |
| M | General | | | | | Constant Baseflow | When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom. | Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale. |
| M | General | | | | | Poor Vegetation Coverage | When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom. | Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil. |
| M | General | | | | | Vegetation | When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over. | Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings. |

# Typical Biofiltration Swale Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| M | General | | | | | Excessive Shading | Grass growth is poor because sunlight does not reach swale. | If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes. |
| M | General | | | | | Inlet/Outlet | Inlet/outlet areas clogged with sediment and/or debris. | Remove material so that there is no clogging or blockage in the inlet and outlet area. |
| M | General | | | | | Trash and Debris Accumulation | Trash and debris accumulated in the bio-swale. | Remove trash and debris from bioswale. |
| M | General | | | | | Erosion/Scouring | Eroded or scoured swale bottom 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, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals. |

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

Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.19 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 |
| M | 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. |
| M,S | 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. |
| M | 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. |
| A | Fences | | | | | Damaged parts | Posts out of plumb more than 6 inches. | Posts plumb to within 1-1/2 inches of plumb. |
| A | Fences | | | | | Damaged parts | Top rails bent more than 6 inches. | Top rail free of bends greater than 1 inch. |
| A | 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. |
| A | Fences | | | | | Damaged parts | Missing or loose tension wire. | Tension wire in place and holding fabric. |
| A | 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. |
| A | 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. |
| A | 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. |
| M | Fences | | | | | Openings in fabric | Openings in fabric are such that an 8-inch diameter ball could fit through. | No openings in fabric. |

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

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

## 3.20 Gates

Gates typically consist of a chain link gate for fenced stormwater facilities to provide safety and allow vehicle and/or personnel access to the facility.

## Gates Checklist

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| M | General | | | | | Damaged or missing components | Gate is broken, jammed, or missing. | Pond has a functioning gate to allow entry of people and maintenance equipment such as mowers and backhoe. If a lock is used, make sure the County field staff has a key. |
| M | General | | | | | Damaged or missing components | Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person. | Hinges intact and lubed. Gate is working freely. |
| A | General | | | | | Damaged or missing components | Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment. | Gate is aligned and vertical. |
| A | General | | | | | Damaged or missing components | Missing stretcher bands, and ties. | Stretcher bar, bands, and ties in place. |

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

Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.21 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

| Frequency | Drainage System Feature | Date ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
|---|---|---|---|---|---|---|---|---|
| M | 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. |
| M | 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. |
| M,S | General | | | | | Trash or litter | See Ponds Checklist. | See Ponds Checklist. |
| M,S | 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. |
| A | 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. |
| M | 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. |
| A | 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.

Comments:

<u>Key</u>:
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).

## 3.26 Inlet/Outlet Stormwater 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 |
| M | 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. |
| M | General | | | | | Pipe dented or broken | Inlet/outlet piping damaged or broken and in need of repair. | Pipe repaired and/or replaced. |
| M | 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. |
| M | Erosion | | | | | Erosion | Eroded or scoured areas due to flow channelization, 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. |
| M | 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. |
| M | Pipe outfall | | | | | Erosion | Soil erosion in or adjacent to rock pad. | Rock pad replaced to design standards. |

# Inlet/Outlet Storm Pipe Checklist (Continued)

| | | Date | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | Drainage System Feature | ✓ | ✓ | ✓ | ✓ | Problem | Conditions to Check For | Conditions That Should Exist |
| M | 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. |
| M | 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. |
| M | 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.

Comments:

Key:
(A) Annual (March or April preferred)
(M) Monthly (see schedule)
(S) After major storms (use 1-inch in 24 hours as a guideline)

# *Annual Inspection Report*

**Annual Inspection Report**

City of Puyallup – Stormwater BMP Facilities Inspection and Maintenance Log

Return Form to:
Stormwater Engineer/ City of Puyallup
333 South Meridian
Puyallup, WA 98371

Facility Name: ____________________________________________________________

Address: _________________________________________________________________

Begin Date: ____________________________ End Date: ______________________________

| Date | BMP ID# | BMP facility Description | Inspected By | Cause for Inspection | Exceptions Noted | Notes / Actions Taken |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
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**Instructions:**

Record all inspections and maintenance for all treatment BMP's on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the Annual Independent Inspector Report to the City, and start a new log at that time. Checklists provided should be used prior to filling out this form. If you have any questions on how to complete your inspection, please contact City staff.

**BMP ID #-** always use ID# from the Operation and Maintenance Manual.
**Inspected by-** Note all Inspections and maintenance on this form, including the required independent annual inspection.
**Cause for Inspection-** Note if the inspection is routine, pre-rainy season, post storm, annual, or in response to a noted problem or complaint.
**Exceptions Noted-** Note any condition that requires correction or indicates a need for maintenance.
**Notes / Actions Taken-** Describe any maintenance done and need for follow up.