C.E.S. NW Inc.
Civil Engineering & Surveying

PRELIMINARY STORM DRAINAGE REPORT FOR SUNSET POINTE

REVISED SEPTEMBER 2024
FEBRUARY 2018

PREPARED FOR:

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FOR

Sunset Pointe
Puyallup, Washington

Revised September 2024
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Prepared for:
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REPORT #04148.7

FREDERICK B BROWN
STATE OF WASHINGTON
33710
REGISTERED
PROFESSIONAL ENGINEER

9.19.2024

This analysis is based on data and records either supplied to, or obtained by, C.E.S. NW, Inc. These documents are referenced within the text of the analysis. The analysis has been prepared utilizing procedures and practices within the standard accepted practices of the industry.

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STORM DRAINAGE

1. Project Overview

This preliminary report accompanies the preliminary plat plans prepared for the Sunset Pointe project which are submitted to the City of Puyallup for review and approval. This document provides site information, and the analysis used to prepare the preliminary storm drainage design. The *Washington State Department of Ecology Stormwater Management Manual for Western Washington, 2019* (Manual), as adopted by Resolution 2464 by the City of Puyallup, June 20, 2022, establishes the methodology and design criteria used for this project.

The Sunset Pointe project proposes an 18-lot plat on parcels 0420353027 and 0420357011, with an area totaling approximately 9.18 acres. An offsite parcel, 0420353009, is proposed as a natural vegetation area for full dispersion of surfaces from this project. The existing site address is 2301 23rd Street SE, Puyallup WA, and a Vicinity Map has been included in Appendix A of this report. A project summary is as follows:

Permit Applied for – Major Plat - Preliminary
Address – 2301 23rd Street SE Puyallup, WA 98372
Parcel Numbers – 0420353027 & 0420357011
Legal description – Parcel C: That portion of the southwest quarter of Section 35, Township 20 North, Range 4 East, W.M., more particularly described as follows:

Commencing at the southwest corner of the southwest quarter of said Section 35, Thence east along the south line thereof a distance of 1,974.60 feet; Thence North 01º06'54" East 615.92 feet to the northeast corner of Lot 10, Stonegate, as shown on the Plat thereof recorded under Auditor's No. 9507200366 and to the true Point of Beginning; Thence North 87º01'41" West 292.30 fee; Thence North 61º33'32" West 44.88 feet; Thence North 15º57'28" West 243.13 feet; Thence North 00º48'44" West 226.43 feet; Thence North 27º29'55" West 143.38 feet; Thence South 88º56'26" East 145.92 feet; Thence North 28º41'48" East 80.82 feet; Thence North 51º21'11" west 132.18 feet to a point on the north line of the south half of the southwest quarter of said Section 35; Thence South 89º22'06" East along said line a distance of 605.46 feet to the northwest corner of Lot 2, Short Plat No. 8105200168; Thence south along the west line of said Short Plat 750.69 feet, more or less, to the true Point of Beginning. (also known as revised Parcel D of Boundary Line Adjustment No. 9507170491).

Parcel D: That portion of Lot 2, as shown on Short Plat No. 8105200168, in Puyallup, Pierce County Washington, Described as follows: Beginning at the northwest corner of Lot 1 of said short plat; Thence along the north line of said Lot 1, North 89º49'07" East 4.70 fee; Thence North 00º22'05" West 78 feet; Thence 00º49'54" West 128.70 feet; Thence 00º32'11" West 325.48 feet to the north line of said Lot 2; Thence along the said North line thereof North 89º29'52" West 11.33 feet to the Point of Beginning.

Situated in the County of Pierce, State of Washington.

The site is accessed from two public roadways 23rd Street Place SE from the south and 19th Avenue SE from the west. According to Figure 2.2 of Volume I in the SMMWW, the project must evaluate all minimum requirements, see Section 5 of this report for a detailed discussion of each minimum requirement. As mapped by the City of Puyallup, the project exists within two drainage basins: Shaw Road basin to the south and State Highway basin to the north. These are further delineated into sub-basins for analyzing the dispersion trench for the proposed roadway, sizing full dispersion BMPs for the State Highway Basin, and stream man-made ponds located within the central portion of the site for the hydroperiod analysis calculations.

2. Existing Conditions Summary

The existing parcels are located northeast of the Plat of Stonegate and west of Kodiak Estates Division III. The site is accessed from 19th Ave. SE from the east and 23rd St. Pl. SE from the south. The existing parcels are approximately 9.18 acres and are irregular in shape. Currently, the site is within the Single-Family Residential (RS-10) zoning district. There are three interconnected ponds which bisect the site. These ponds are connected to Tract C and E of the plat of Stonegate and they are drained by an existing 12" culvert pipe which outfalls to the closed conveyance system within Kodiak Estates Division III. The outlet for Pond 'C' will be upgraded with a new type 2 48-inch structure with a birdcage prior to being conveyed through Kodiak Estates Division III (see P2). An existing 10 feet wide gravel road crosses the site from the northwest corner to the south of the property line, which will be improved to 10 feet wide surface with two-foot gravel shoulders in a fifteen-foot right-of-way along with this project. There were five existing structures onsite, which helped form the onsite ponds, the buildings were demolished in approximately 2017. The remaining area of the site consists of pasture areas and a mix of native second-growth conifer and deciduous trees primarily around the perimeter of the three connected stream corridor.

The site soils have been mapped as Everett gravelly sandy Loam (13B) and Kitsap silt loam (20B, 20C) as determined by the National Cooperative Soil Survey of Natural Resources Conservation Service (NRCS). These soils are classified as type A and C, respectively. Type A soils have a low runoff potential and Type C soils have a moderate to high erosion potential. A description of these soils and a copy of the soil map for this site have been included in Appendix A of this report. A geotechnical engineer's report was prepared by Earth Solutions NW, LLC. (ESNW) on January 11, 2018 and updated on April 5, 2023. They performed 25 onsite soil explorations where they encountered native soils generally consistent with Vashon Drift, classified as gravelly sands and loams. ESNW performed two small scale-PIT tests (TP-201 and 202) and the sieve analysis of the native soils, they measured an infiltration rate of zero-inches per hour. It is ESNW's opinion, infiltration is not feasible for this project. A copy of the updated geotechnical engineer's reports can be found in Appendix D.

Federal Emergency Management Agency (FEMA) has prepared flood insurance maps identifying floodplains within the City of Puyallup. The parcel and the proposed improvements are located within Zone X, which is considered out of the 100-year floodplain. A copy of the FIRM Panel 53053C0342E can be found in *Appendix "B"* of this report.

3. Off-site Analysis Report

A quarter mile downstream analysis is required by the City of Puyallup. The project site is located within two City delineated drainage basins Shaw Road which drains through Kodiak Estates Division III to the east and State Highway which flows northerly. Lots 1 through 8 and improvements to 19th Ave SE are fully dispersed to the north (State Highway Basin) onto parcel 0420353009. The driveways for Lots 9 through 18 and the improvements to 23rd Street Place SE are collected in the roadway storm conveyance system, treated prior to dispersing in the revegetated Tract 'B'. The roof area for these lots will be dispersed in the rear of the lots. The pervious area will be amended soils and the rear of the lots revegetated to forest conditions. The following is a qualitative analysis of the existing conditions:

Upstream Areas

The State Highway Basin (Lots 1-9) does not have any upstream flows contributing to the on-site. Shaw Road Basin (Lots 9-18) have upstream flows from Lots 114 through 127 and Tract 'B' which drains through the buffer within the proposed development.

State Highway Basin Downstream Analysis

The fully dispersed runoff flows through parcel 0420353009 through a native vegetation easement for the full ¼ mile. This drainage path consists of a variety of native vegetation including conifers and deciduous trees. Please refer to the downstream map in Appendix B.

Shaw Road Basin Downstream Analysis

The runoff which drains towards the onsite buffer area ultimately discharges into Kodiak Estates Division III's closed conveyance system. This system is comprised of 12-inch, 15-inch and 18-inch circular pipes. The runoff from the project proceeds between Lots 26 and 27 in a 12-inch pipe where it proceeds into 19th Ave SE and combines with runoff from Brookmonte Dr SE approximately 480-feet downstream. The runoff then proceeds within Brookmonte Dr SE for another 150-feet where it turns east within an 18-inch pipe in 20th Ave Ct SE. The runoff proceeds downstream for another 450-feet within 18-inch pipe where it outfalls into the public stormwater facility within Tract A of Kodiak Estates Division III. The runoff concludes it's ¼ mile downstream path within this facility. The 2019 Western Washington Stormwater Manual, indicates when dispersion trenches are utilized with a flowpath of twenty-five (25) feet to fifty (50) feet, Ecology allows the roof area to be modeled as 50% landscaped/ 50% impervious. Therefore, roof area for Lots 16-19 was reduced by 50%. The results indicate the 100 year flowrate contributing to Tract 'A' and 'E' decreased by 0.03 cfs (see Appendix C for more information). The impacts to the downstream conveyance system is negligible. Please refer to the downstream map in Appendix B.

4. Permanent Stormwater Control Plan

Existing Site Hydrology

Section 2 of this report describes the existing site conditions in detail. The existing site is divided into three sub-basins: State Highway basin, Shaw Road basin and a pre-developed Recharge basin. The pre-developed State Highway basin is 1.90-acres (not including the native vegetation easement area). The overall Shaw Road basin is approximately 7.46-acres, including the Buffer Recharge basin. The Recharge basin is approximately 6.0-acres onsite which includes the buffer area. The west basin which is approximately 1.07-acres which sheet flows towards Lots 27-29 of Kodiak Estates Division III. The northwest basin is approximately 0.36-acres which sheet flows towards Lots 25-26 of Kodiak Estates Division III. The Shaw Road Basin combine within a ¼ mile downstream of the site. The existing basins will be analyzed a forested conditions to determine for existing conditions, except the Recharge Basin will be modeled with existing conditions and is summarized as follows:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Northside of Buffer	Pasture	C, Pasture, Mod	0.964
Gravel	Gravel Roadway	Roadway, Flat	0.272
Buildings	Buildings	Roof, Flat	0.383
Southside of Buffer	Pastures	C, Pasture, Mod	2.026
Buffer Area	Pasture	C, Pasture, Mod	2.38
Total			**6.025**

Table 4.1– Pre-Developed Recharge Basin

The Pre-Developed Basin Maps can be found in Appendix B of this report.

Developed Site Hydrology

The project is divided into two major basins, the State Highway basin and the Shaw Road basin. The Shaw Road basin is divided into smaller basin: the Recharge Basin; Roadway Basin, West Basin and the Northwest Basin. The roof area for the proposed development was estimated to be 3,000 square feet for each lot and the driveway (patio, etc.) is 1,000 square feet for each lot.

<u>*State Highway Basin*</u>

The developed basin is approximately 2.41-acres (not including the native vegetation easement area). The following is a summary of the developed basin:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Yards	Lawn	C, Pasture, Flat	1.14
Roads	Roadway	Roadway, Flat	0.531
Roof	3,000 per Lot	Roof, Flat	0.551
Driveways	1,000 per Lot	Driveway, Flat	0.184
Total			**2.41**

Table 4.1 – Developed State Highway Basin

The improvements to the State Highway basin are fully dispersed to a 11.13-acres native vegetation easement across parcel 0420353009. The impervious area is 1.27-acres, the overall area is 13.54-acres. Therefore, the impervious area for the Shaw Road is approximately 9.4% and provides 100-foot flowpath which meets the requirements of BMP T5.30 for Full Dispersion.

<u>*Shaw Road Basin*</u>

Recharge Basin

A hydroperiod analysis was prepared due to the presence of amphibians. According to the manual in Section I-3.4.8, the project must attempt to meet both flow control (MR7) and wetland protection (MR8), however if it is unable to meet both, the wetland protection standard will be prioritized. The recharge basin consists of the following in developed conditions:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Gravel	Pathway	Roadway, Mod	0.07
Rear Yards (Lots 1, 3-8	Lawn	C, Pasture, Mod	0.70
Roofs	Roofs Lots 9-18	Roof, Flat	0.69
Rear Yards	Lawn	C, Pasture, Mod	0.54
Rear Yards	Forest	C, Forest, Mod	0.84
Buffer Area	Buffer	C, Pasture, Mod	2.38
Total			**5.22**

Table 4.2– Developed Recharge Basin

The rear yards of Lots 9 through 12 will be collected in an interceptor trench as well as the roof area for Lots 9 – 13 will be tightlined via the trench and discharge to the buffer. The roof area for Lots 15-18 will be tightlined and conveyed to a dispersal trench in the rear of Lot 15 to be dispersed in a re-vegetated forested area. The roof area for Lot 14 has a separate dispersal trench for its roof area.

Roadway Basin

The roadway improvement basin consists of the right-of-way of 23rd Street Place SE, extended, and the driveways for Lots 9-18, lawn area for Lots 16-18 are contributing to the basin. The southern portion of 23rd Street Place SE, existing cul-de-sac, will be removed and the roadway will be extended to the southern portion of the site. The area of the existing cul-de-sac will be collected and conveyed to existing catch basin located near address 2112 23rd Street Place SE (See Appendix C). The flowrates between the developed roadway and existing cul-de-sac are similar. The remaining roadway improvements in 23rd Place Street SE basin will be collected, treated and discharge to a dispersal trench, which has a 100-foot vegetated flowpath to meet flow control requirements. The following is a summary:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Forest	Rear of Lots 16-18	C, Forest, Flat	0.23
Lawn	Lawn	C, Pasture, Flat	0.08
Lawn	Lawn	C, Pasture, Mod	0.24
Roadway	Roads, Sidewalk	Roads, Flat	0.27
Driveways	Driveways (Lots 9-18)	Driveways, Mod	0.23
Total			**1.05**

Table 4.3 –Developed Roadway Basin

West Basin

The west basin is the area which under pre-existing conditions, flows towards Lots 28-29 of Kodiak Estates. The following is a summary of the developed conditions:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Rear of Lots 9-13	Forest	C, Forest, Mod	0.36
Total			**0.36**

Table 4.4 – Developed West Basin

Northwest Basin

The northwest basin is the area, under pre-existing conditions, which sheet flows towards Lots 25-26 of Kodiak Estates. The following is a summary of the developed conditions:

Sub-Basin	Description	WWHM Land-use	Area (ac)
Rear of Lot 8	Forest	C, Forest, Mod	0.12
Total			**0.12**

Table 4.5 – Developed Northwest Basin

The Post Developed Basin Maps can be found in Appendix B of this report.

Facility Sizing

State Highway Basin

The State Highway basin is being fully dispersed to a 10.74-acre native vegetation easement in accordance with BMP T5.30 for roadway dispersion BMPs. The runoff from Lots 1-8, access tracts and 19th Avenue SE are collected within the roadway and dispersed with flow dispersal trenches to the native vegetation easement. A single dispersal trench is allowed to disperse 0.50-cfs of runoff. The basin's 100-year event is 1.38-cfs; therefore, three 50-foot long flow dispersal trenches are provided to fully disperse the runoff from the roadway's collection system. Using flow modeling credits the fully dispersed basin results in an increase of 0.05-cfs increase during the 100-year reoccurrence interval. Sizing and capacity calculations will be provided as part of the final engineering submittal. WWHM Modeling results is provided in Appendix C.

Shaw Road Basin

The Recharge basin is being discharged towards the buffer to maintain the hydroperiods to the buffer. According to the manual in section I-3.4.8 the project must attempt to meet both the conservation flow control standard (MR 7) and the wetland protection standard (MR 8), however if it is unable to meet both, the wetland protection standard will be prioritized. The project proposes to naturally discharge the runoff into Tract A and E (the onsite buffer) to maintain the hydrology.

The Roadway Basin is being collected, treated and conveyed to a trench to be fully dispersed onto the 100-foot vegetated flowpath with amended soils. The amended soils will absorb the flows. The 100-year flowrate discharge through the dispersal trench is 0.42 cfs. The combined discharge from the recharge and the roadway basin is 0.57 cfs for the developed 100-year flowrate to the buffer area with a 50% reduction of the roof area for Lots 16-19. The West and Northwest Basins will sheet flow as they did in the existing conditions. Computer modeling results are provided in Appendix C.

Water Quality System

Water Quality treatment will be provided for the proposed roadway and driveways in the Shaw Road Basin via a storm cartridge system. The State Highway Basin treatment will be provided through full dispersion.

Buffer Recharge

As mentioned in the Critical Areas Assessment prepared by Habitat Technologies, the onsite ponds were created through previous development activities of Stream A which bisects the site. Since these ponds are non-depressional. Basin maps delineating the areas onsite tributary to the buffer is provided in Appendix B. These basins were analyzed with WWHM to determine the volumes which will flow through the buffer area and downstream monthly. A summary of this analysis is provided in Table 4.6 below:

Month	Pre-developed Volume Summary (ac-ft)	Post Developed Volume Summary (ac-ft)	Percent
January	1.0971	0.9664	88.1
February	0.9454	0.8322	88.0
March	0.7053	0.6271	88.9
April	0.3191	0.2925	91.7
May	0.1080	0.1047	96.9
June	0.0387	0.0422	109.0
July	0.0079	0.0096	122.6

August	0.0008	0.0015	182.5
September	0.0060	0.0093	154.3
October	0.0737	0.0875	118.7
November	0.5991	0.5492	91.7
December	1.0717	0.9470	88.4

Table 4.6 – Buffer Recharge Summary

Eight months meet the monthly standard, but the drier summer months (July through October) exceed the monthly standard. The drier summer months have minimal flow volumes and are difficult to meet the 15 percent requirement. The WWHM computer results are included in Appendix C of this report.

The following is the summary of the Buffer Recharge Basin and the Roadway Basin contributing to the onsite ponds in Tract A and E:

Month	Pre-developed Volume Summary (ac-ft)	Post Developed Volume Summary (ac-ft)	Percent
January	1.0971	1.1567	105.4
February	0.9454	0.9907	104.8
March	0.7053	0.7494	106.3
April	0.3191	0.3552	111.3
May	0.1080	0.1341	124.2
June	0.0387	0.0572	147.8
July	0.0079	0.0130	165.0
August	0.0008	0.0020	249.0
September	0.0060	0.0126	208.5
October	0.0737	0.1280	173.5
November	0.5991	0.7161	119.5
December	1.0717	1.1547	107.7

Table 4.7 – Combined Summary

Five months meet the monthly standard, but the drier months (May through September) exceed the monthly standard. The drier months have minimal flows and are difficult to meet the fifteen percent requirement. The WWHM computer results are included in Appendix C of this report.

5. Discussion of Minimum Requirements

The following is a summary of the minimum requirements as described in Chapter 2 of Volume I of the SMMWW. Each minimum requirement must be considered per Figure 2.4.1 flowchart.

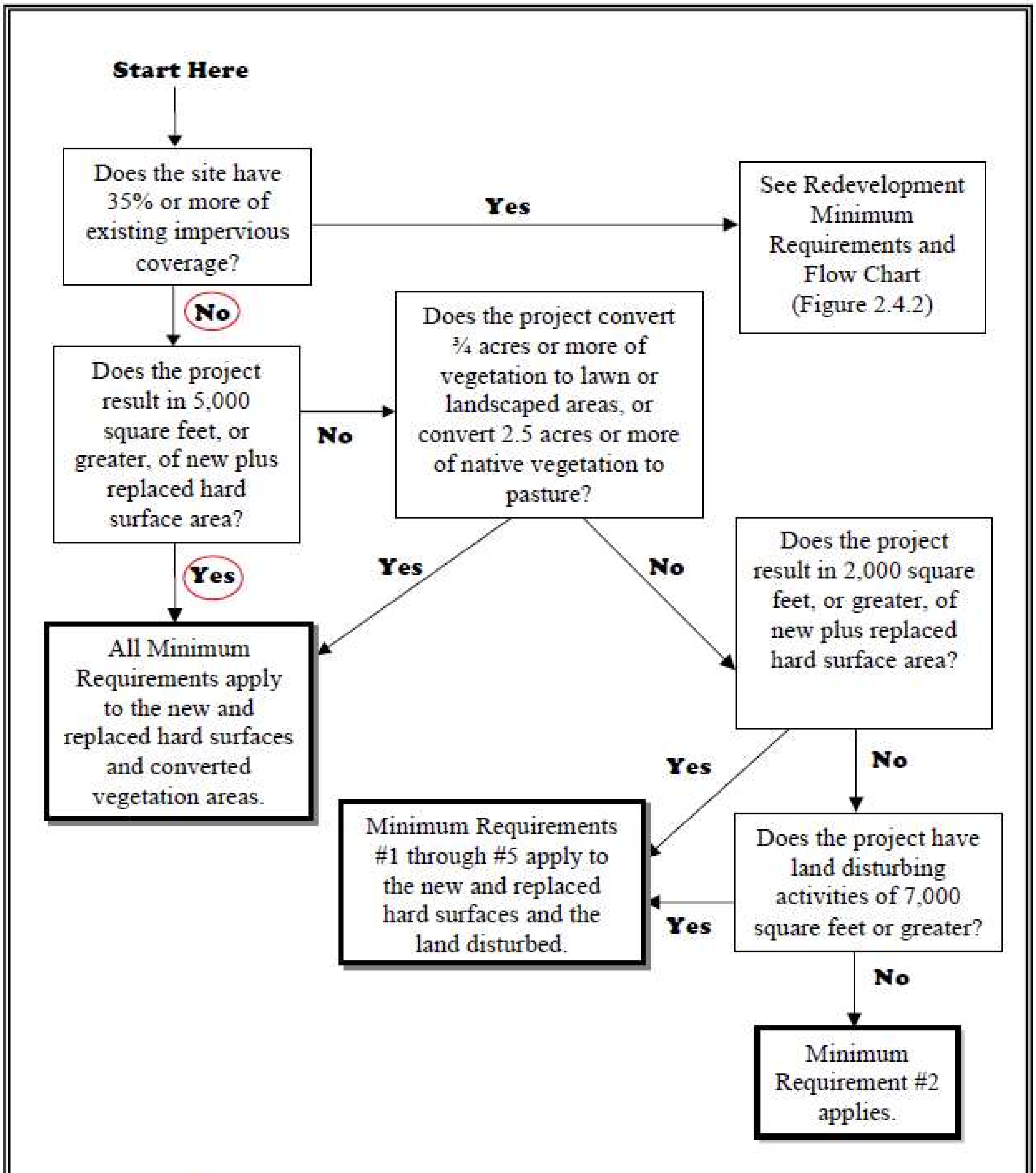


Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

5.1 Minimum Requirement #1: Preparation of a Stormwater Site Plan

The Stormwater Site Plan is prepared per Chapter 3, Volume I of the SMMWW 2014. Each required Section and Appendix is provided in this document.

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

A SWPP Plan will be prepared for this project at the time of final engineer plan, and all thirteen (13) elements will be addressed in the document.

5.3 Minimum Requirement #3: Source Control of Pollution

Permanent source control BMPs are required for the development's daily operations, and the stormwater facilities must be maintained as described in the Operations and Maintenance Manual will be prepared for this project during the final engineering submittal. Preliminary Maintenance Schedules can be found in Appendix E.

5.4 Minimum Requirement #4: Preservation of Natural Drainage System and Outfalls

Projects are to maintain the natural drainage patterns and locations to the maximum extent possible. The project is located within two drainage basins, Shaw Road and State Highway, as delineated by the City of Puyallup each within their own threshold discharge area. The runoff in the Shaw Road basin discharges to the onsite buffer area which flows offsite towards the east through Kodiak Estates Division III. The project proposes maintaining the hydroperiod to the buffer area and dispersing the flows of the roadway improvement basin. The runoff in the State Highway basin discharges as sheet flow north across parcel 0420353009. The project proposes to fully disperse the improvements within this basin with the use of roadway dispersion BMPs. A downstream analysis is provided for each basin in Section 3 of this report. Calculations are provided in Section 5 of this report.

5.5 Minimum Requirement #5: Onsite Stormwater Management

City requires projects to implement onsite stormwater management BMPs when feasible. This project must meet minimum requirement #1-11; therefore, it evaluates List #2 of the Manual for onsite stormwater management compliance. The site is separated into two drainage basins, the Shaw Road basin which flows through the Kodiak Estates Division III and the State Highway drainage basin which flows through parcel 0420353009. Soil amendments and perforated stub-outs are provided in the Shaw Road basins, and soil amendments and full dispersion is proposed in the State Highway basin. The BMPs in List #2 is discussed for each drainage basin as follows:

State Highway

Lawn and Landscape Areas

- Soil Preservation and Amendment (Ecology BMP T5.13)
  All disturbed pervious areas that are not converted to impervious surfaces will apply soil amendment per Ecology BMP T5.13.

Roof Areas

- Full dispersion of BMP T5.30 is deemed feasible for this basin. Runoff will be dispersed to parcel 0420353009 with the use of roadway dispersion BMPs. Facility sizing calculations are provided in Section 4 of this report. Since this BMP is deemed feasible no other BMPs are required.

Other Hard Surface

- Full dispersion of BMP T5.30 is deemed feasible for this basin. Runoff will be dispersed to parcel 0420353009 with the use of roadway dispersion BMPs. Facility sizing calculations are provided in Section 4 of this report. Since this BMP is deemed feasible no other BMPs are required.

Shaw Road

Lawn and Landscape Areas

- Soil Preservation and Amendment (Ecology BMP T5.13)
  All disturbed pervious areas that are not converted to impervious surfaces will apply soil amendment per Ecology BMP T5.13.

Roof Areas

- Full dispersion of BMP T5.30 is deemed infeasible in this basin since there is not enough area available to accommodate the natural preservation requirements of this BMP.
- Downspout full infiltration was deemed infeasible since a zero-inches per hour infiltration rate was measured onsite and the sieve samples indicated high fines.
- Bioretention facility was deemed infeasible since a zero-inches per hour infiltration rate was measured onsite and the sieve samples indicated high fines.

- Downspout dispersion system was deemed infeasible onsite due to the lack of available dispersion flow paths due to the depth of the lots.
- Perforated Stub-out connections are deemed feasible and proposed for all lots within this basin.

Other Hard Surface

- Full dispersion of BMP T5.30 is deemed infeasible in this basin since there is not enough area available to accommodate the natural preservation requirements of this BMP.
- Permeable Pavement BMP was deemed infeasible since a 0-inch per hour infiltration rate was measured onsite.
- Bioretention BMP was deemed infeasible since a 0-inch per hour infiltration rate was measured onsite.
- Sheet Flow Dispersion was deemed infeasible for driveways since the flow path of 10-20 feet is not available to meet this requirement.

5.6 Minimum Requirement #6: Runoff Treatment

Runoff treatment is provided in the Shaw Road basin for the roadway and driveways with the use of a stormwater cartridge system prior to the flows being dispersed.

5.7 Minimum Requirement #7: Flow Control

For the Shaw Road basin, the recharge basin is maintaining the hydroperiod to the buffer area. The roadway basin is being treated and discharged to a dispersal trench with a 100-foot vegetated flow path to meet flow control prior to discharge to the existing ponds. The west and northwest basin will sheet flow towards Kodiak Estates Division as it has historically. Facility sizing calculations are provided in Section 4 of this report. Runoff is fully dispersed within the State Highway basin; therefore, this basin does not exceed flow control thresholds.

5.8 Minimum Requirement #8: Wetlands Protection

Projects that discharge to a wetland meeting this requirement in conjunction with minimum requirements #6 and #7. According to the manual in Section I-3.4.8, the project must attempt to meet both flow control (MR7) and wetland protection (MR8), however if it is unable to meet both, the wetland protection standard will be prioritized. A detailed discussion is shown in section 4 of this report. A hydrologic analysis has been prepared as discussed in Section 4 of this report.

Modeling results is provided in Appendix C. A Critical Areas Assessment Report has been prepared and can be found in Appendix D.

5.9 Minimum Requirement #9: Basin/Watershed Planning

The project is located within two drainage basins as delineated by the City of Puyallup: State Highway and Shaw Road basins. Due to the hydroperiod analysis, a flow control facility is not being proposed for the basins. The State Highway and Shaw Road basins are applying onsite BMPs. The project will not adversely affect these two basins.

5.10 Minimum Requirement #10: Operation and Maintenance

An Operation and Maintenance Manual will be prepared as part of the final engineering submittal. Preliminary Maintenance Schedules can be found in *Appendix "E"*.

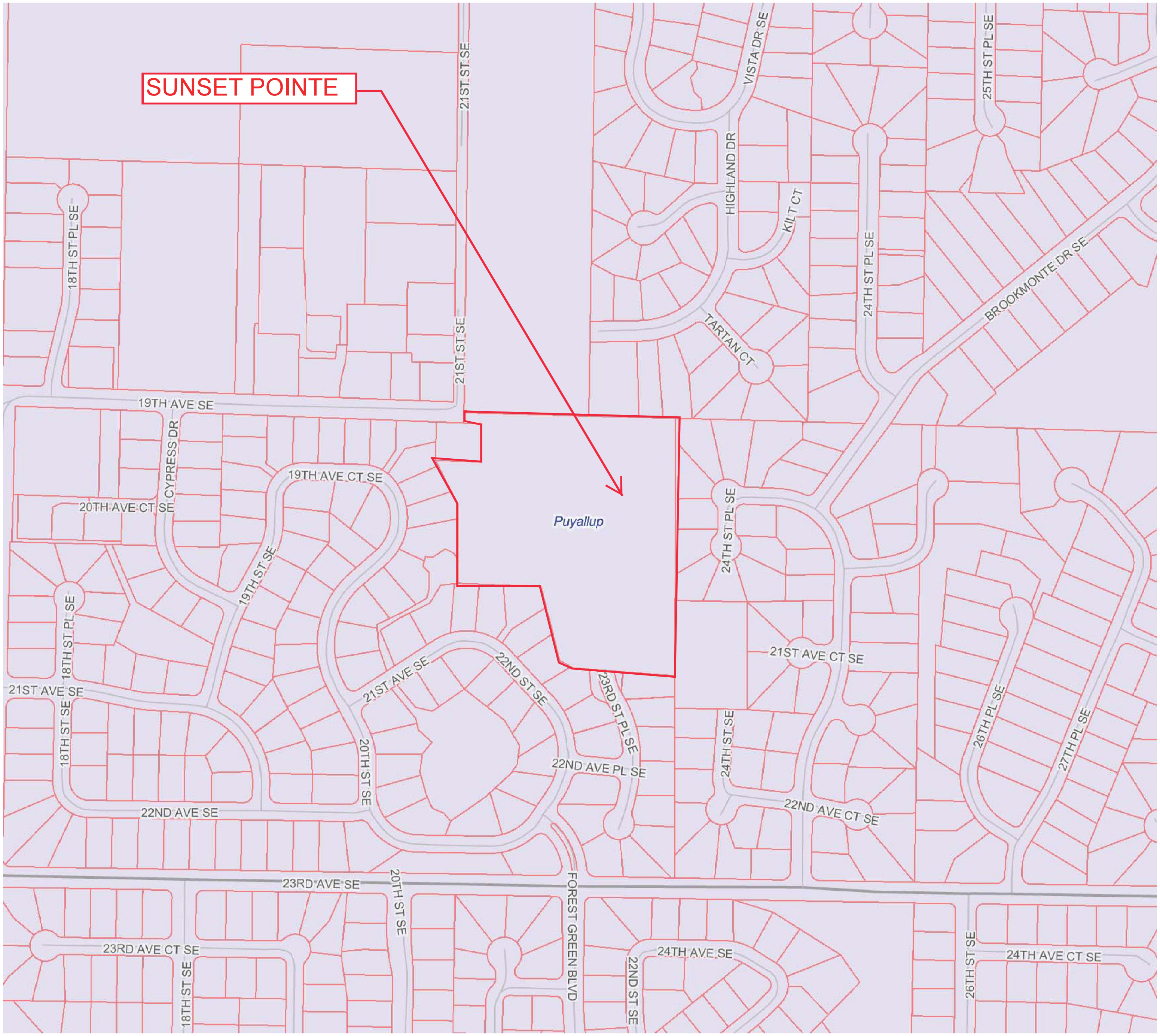
5.11 Minimum Requirement #11: Off-Site Analysis and Mitigation

An Offsite Analysis is prepared within this document and can be found in Section 3 of this report.

APPENDIX A

General Exhibits

VICINITY MAP



SUNSET POINTE

Vicinity Map

Legend

Tax Parcels
- **Base Parcel**
- **Condominium**
- **Other**

Roads
- **Interstate**
- **Limited Access State Routes**
- **Other State Routes**
- **Ramps**
- **Major Arterial**
- **Collector**
- **Local Access**
- **Unknown**

Pierce County Basemap
- **Unincorporated County**
- **Tacoma**
- **Lakewood, Edgewood, Bonney Lake, Buckley, South Prairie**
- **Steilacoom, Fircrest, Fife, Gig Harbor, Orting, Eatonville, Roy, Carbonado, Wilkeson, Mt Rainier**
- **University Place, Puyallup, Auburn**
- **DuPont, Milton, Sumner**
- **Fort Lewis, McChord, McNeil Island**
- **Water**

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Scale 1:5,000
0 210 420 ft.

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SOILS MAP

Soil Map—Pierce County Area, Washington
(SUNSET POINTE)

Map Scale: 1:1,760 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

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

SOIL DESCRIPTION

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 13, Feb 22, 2018

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1D	Alderwood gravelly sandy loam, 15 to 30 percent slopes	0.0	0.3%
13B	Everett very gravelly sandy loam, 0 to 8 percent slopes	5.4	55.7%
20B	Kitsap silt loam, 2 to 8 percent slopes	3.3	33.5%
20C	Kitsap silt loam, 8 to 15 percent slopes	1.0	9.9%
PITS	Pits	0.1	0.6%
Totals for Area of Interest		**9.8**	**100.0%**

Pierce County Area, Washington

1D—Alderwood gravelly sandy loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t627
Elevation: 0 to 1,000 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Alderwood

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

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

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No

Minor Components

Everett

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

Indianola

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

Shalcar

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

Norma

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

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 13, Feb 22, 2018

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: Kames, moraines, eskers
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
Natural 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 storage in profile: 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 (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Convex, linear
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 13, Feb 22, 2018

Pierce County Area, Washington

20B—Kitsap silt loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2hpt
Elevation: 0 to 590 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kitsap and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Glaciolacustrine deposits

Typical profile

H1 - 0 to 10 inches: ashy silt loam
H2 - 10 to 32 inches: silty clay loam
H3 - 32 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 16 to 23 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Forage suitability group: Soils with Few Limitations (G002XS501WA)
Hydric soil rating: No

Minor Components

Bellingham

Percent of map unit: 3 percent
Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 13, Feb 22, 2018

Pierce County Area, Washington

20C—Kitsap silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2hpv
Elevation: 0 to 590 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kitsap and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Glaciolacustrine deposits

Typical profile

H1 - 0 to 10 inches: ashy silt loam
H2 - 10 to 32 inches: silty clay loam
H3 - 32 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 16 to 23 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Forage suitability group: Soils with Moderate Limitations (G002XS601WA)
Hydric soil rating: No

Minor Components

Bellingham

Percent of map unit: 2 percent
Landform: Depressions

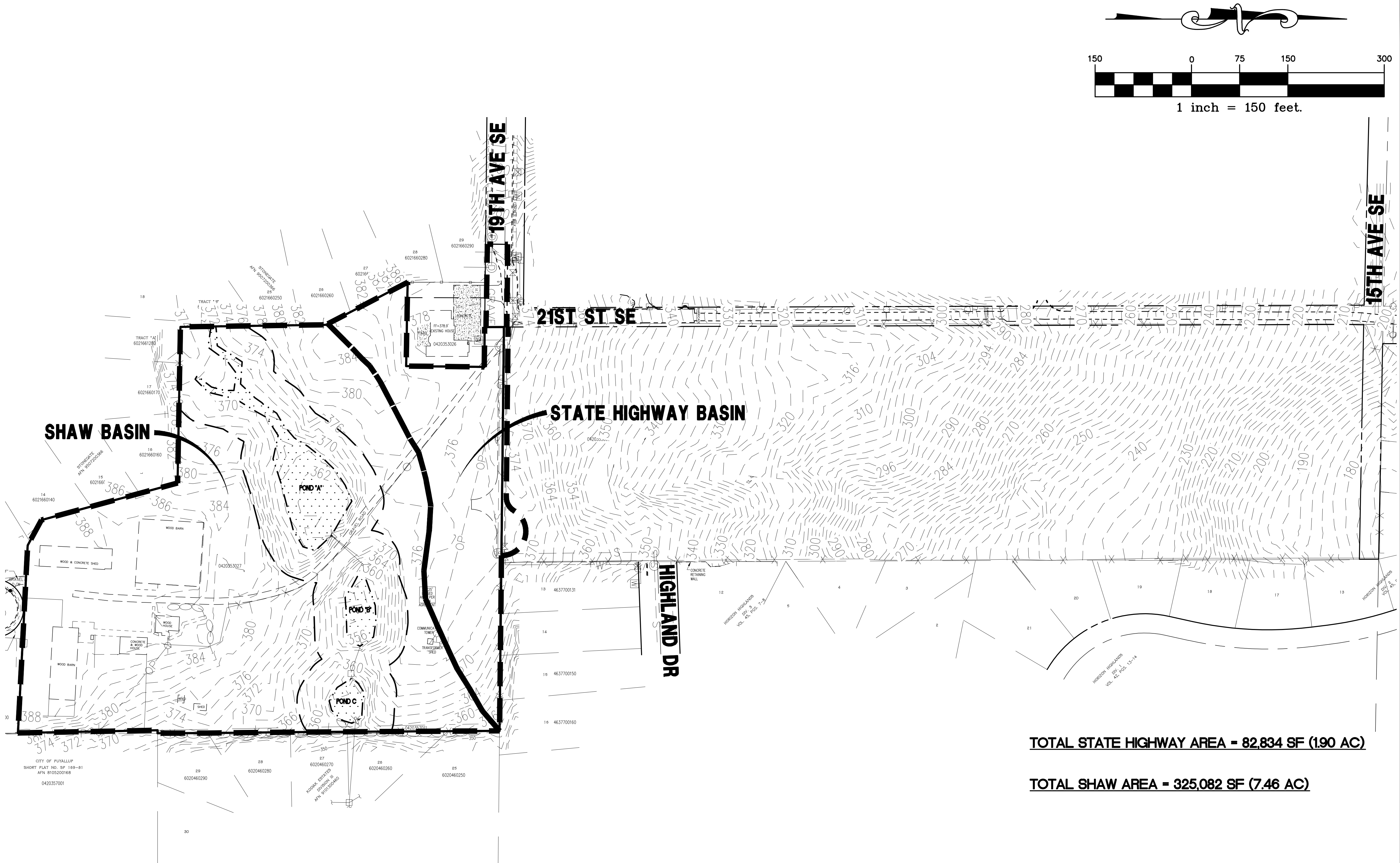
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 13, Feb 22, 2018

APPENDIX B

Basin Exhibits



TOTAL STATE HIGHWAY AREA = 82,834 SF (1.90 AC)

TOTAL SHAW AREA = 325,082 SF (7.46 AC)

C.E.S. NW INC.
CIVIL ENGINEERING & SURVEYING
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PUYALLUP, WA 98372
PH: (253) 848-4282
ceservices@cesnwinc.com

Project:

SUNSET POINTE

EXISTING OVERALL BASINS
SHAW / STATE HIGHWAY

Client:

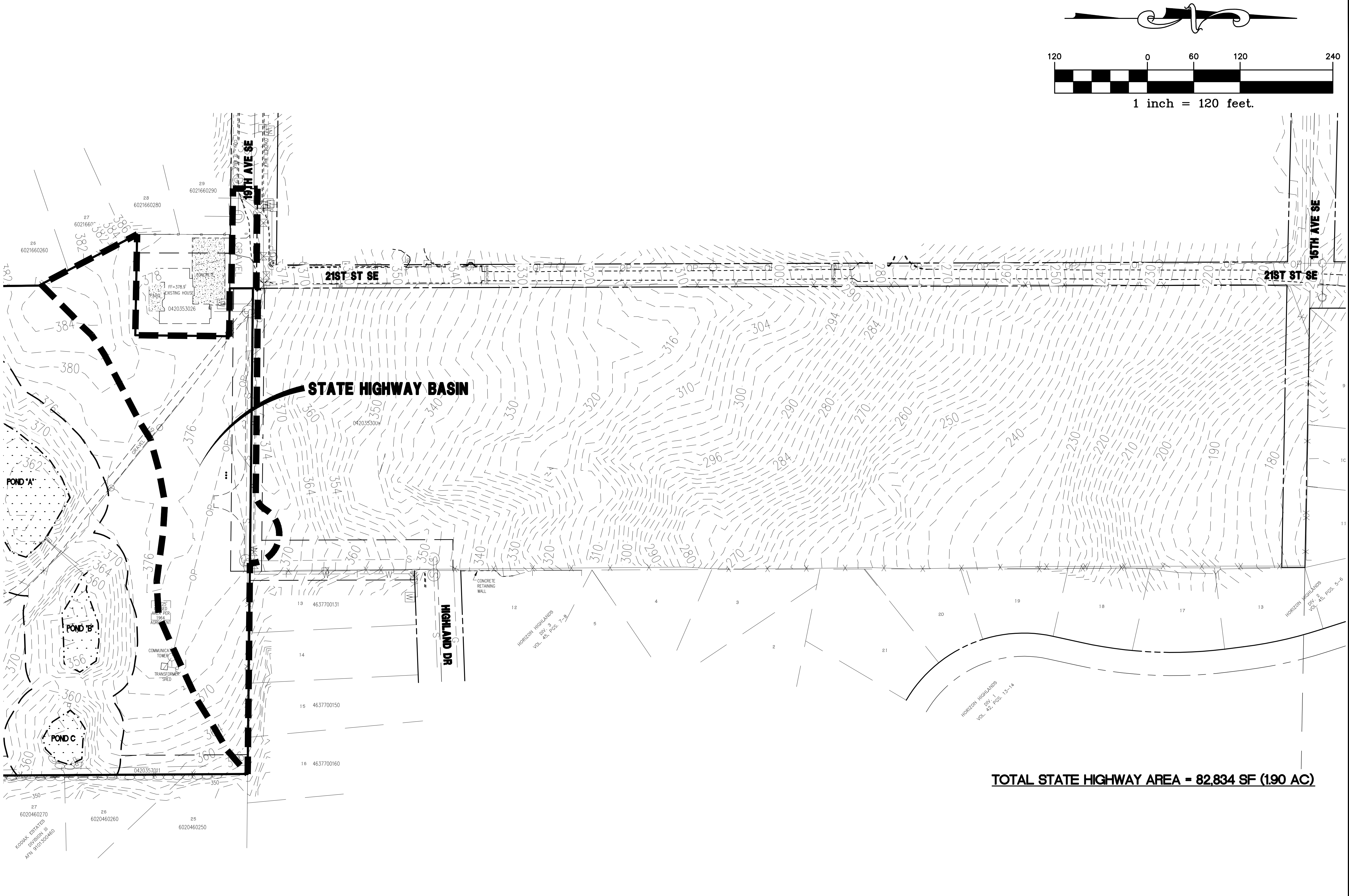
PETER Y CHEN AND BETH LIU
4709 MEMORY LANE WEST, UNIVERSITY PLACE, WA 98466

Designed:	FBB
Drawn:	JEH
Checked:	FBB
Scale:	1"-150"
Date:	5/15/23
Job No.:	04148

Sheet No.:

B1

1 of 1 Sheets



C.E.S. NW INC.
CIVIL ENGINEERING & SURVEYING

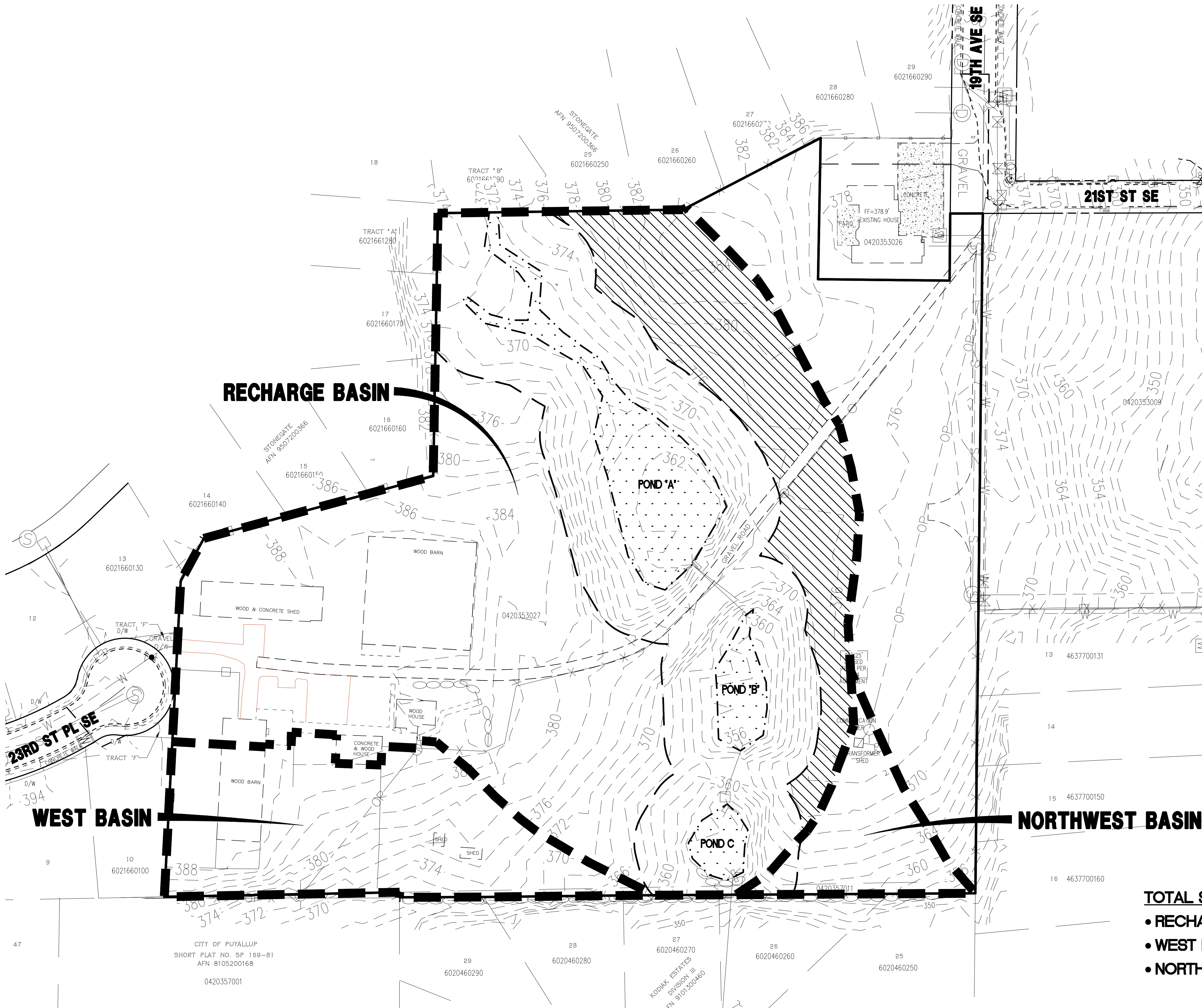
429 – 29TH ST. NE, SUITE D
PUYALLUP, WA 98372
PH: (253) 848-4282
ceservices@cesnwinc.com

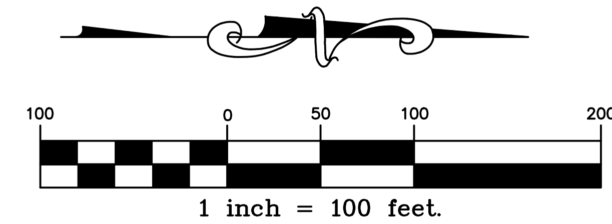
Project:
SUNSET POINTE
EXISTING STATE HIGHWAY BASIN

Client:
PETER Y CHEN AND BETH LIU
4709 MEMORY LANE WEST, UNIVERSITY PLACE, WA 98466

Designed:	FBB
Drawn:	JEH
Checked:	FBB
Scale:	1"-120"
Date:	5/15/23
Job No.:	04148

Sheet No.:
B2
1 of 1 Sheets





TOTAL SHAW AREA = 325,082 SF (7.46 AC)

- RECHARGE BASIN = 262,455 (6.03 AC)
- WEST BASIN = 46,611 (1.07 AC)
- NORTHWEST BASIN = 15,979 (0.37 AC)

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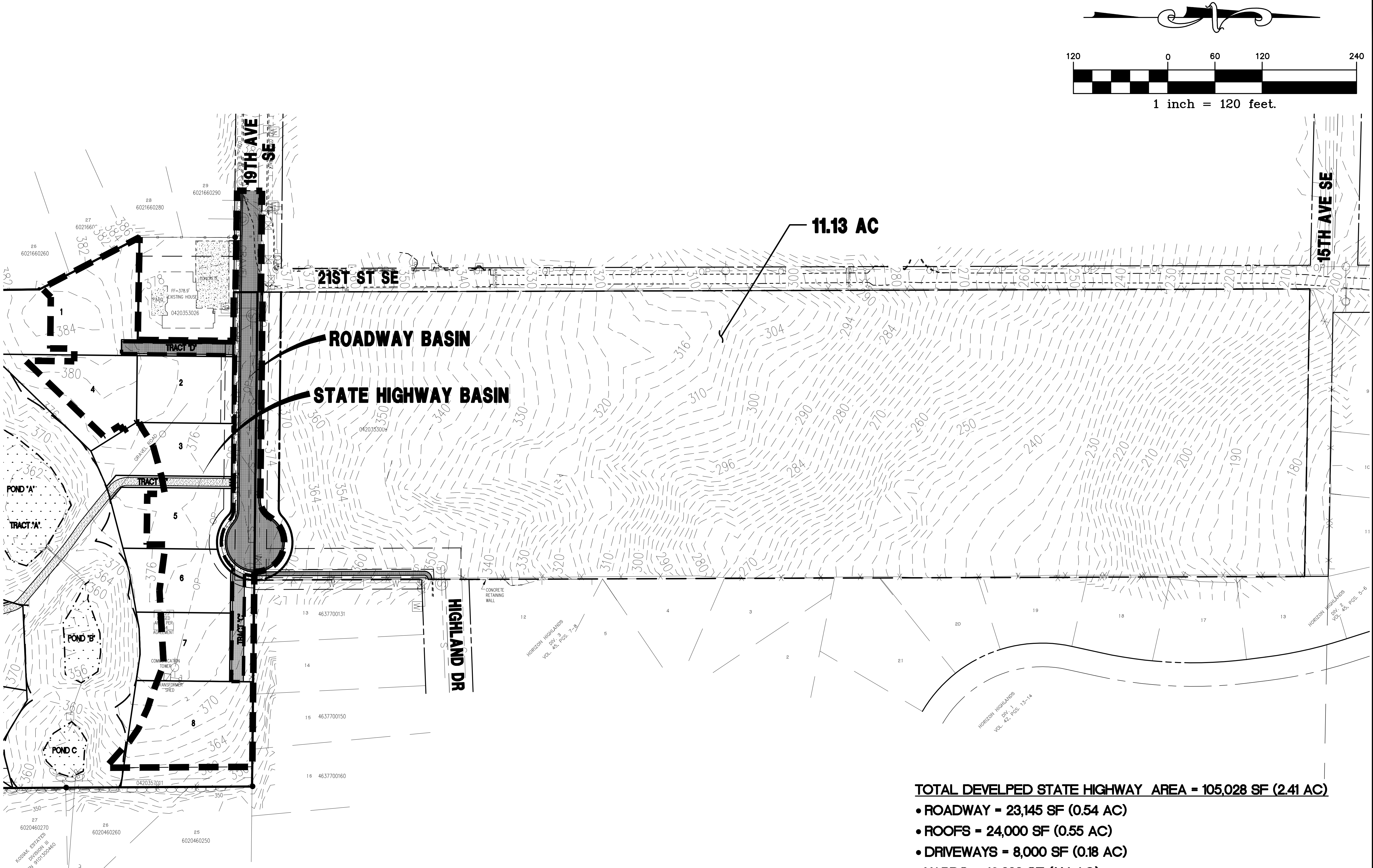
Project:
SUNSET POINTE
EXISTING SHAW BASIN

Client:
PETER Y CHEN AND BETH LIU
4709 MEMORY LANE WEST, UNIVERSITY PLACE, WA 98466

Designed:	FBB
Drawn:	JEH
Checked:	FBB
Scale:	1"-100"
Date:	5/15/23
Job No.:	04148

Sheet No.:
B3

1 of 1 Sheets



TOTAL DEVELPED STATE HIGHWAY AREA = 105,028 SF (2.41 AC)

- ROADWAY = 23,145 SF (0.54 AC)
- ROOFS = 24,000 SF (0.55 AC)
- DRIVEWAYS = 8,000 SF (0.18 AC)
- YARDS = 49,883 SF (1.14 AC)

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Project:
SUNSET POINTE
DEVELOPED STATE HIGHWAY BASIN

Client:
PETER Y CHEN AND BETH LIU
4709 MEMORY LANE WEST, UNIVERSITY PLACE, WA 98466

Designed:	FBB
Drawn:	JEH
Checked:	FBB
Scale:	1"-120"
Date:	5/15/23
Job No.:	04148

Sheet No.:
B4
1 of 1 Sheets

TOTAL ROADWAY AREA = 45,823 SF (1.05 AC)

- ROADWAY = 11,826 (0.27 AC)
- DRIVEWAYS = 10,000 (0.23 AC)
- LAWN = 14,000 (0.32 AC)
- FOREST = 9,997 (0.23 AC)

TOTAL RECHARGE AREA = 227,818 (5.23 AC)

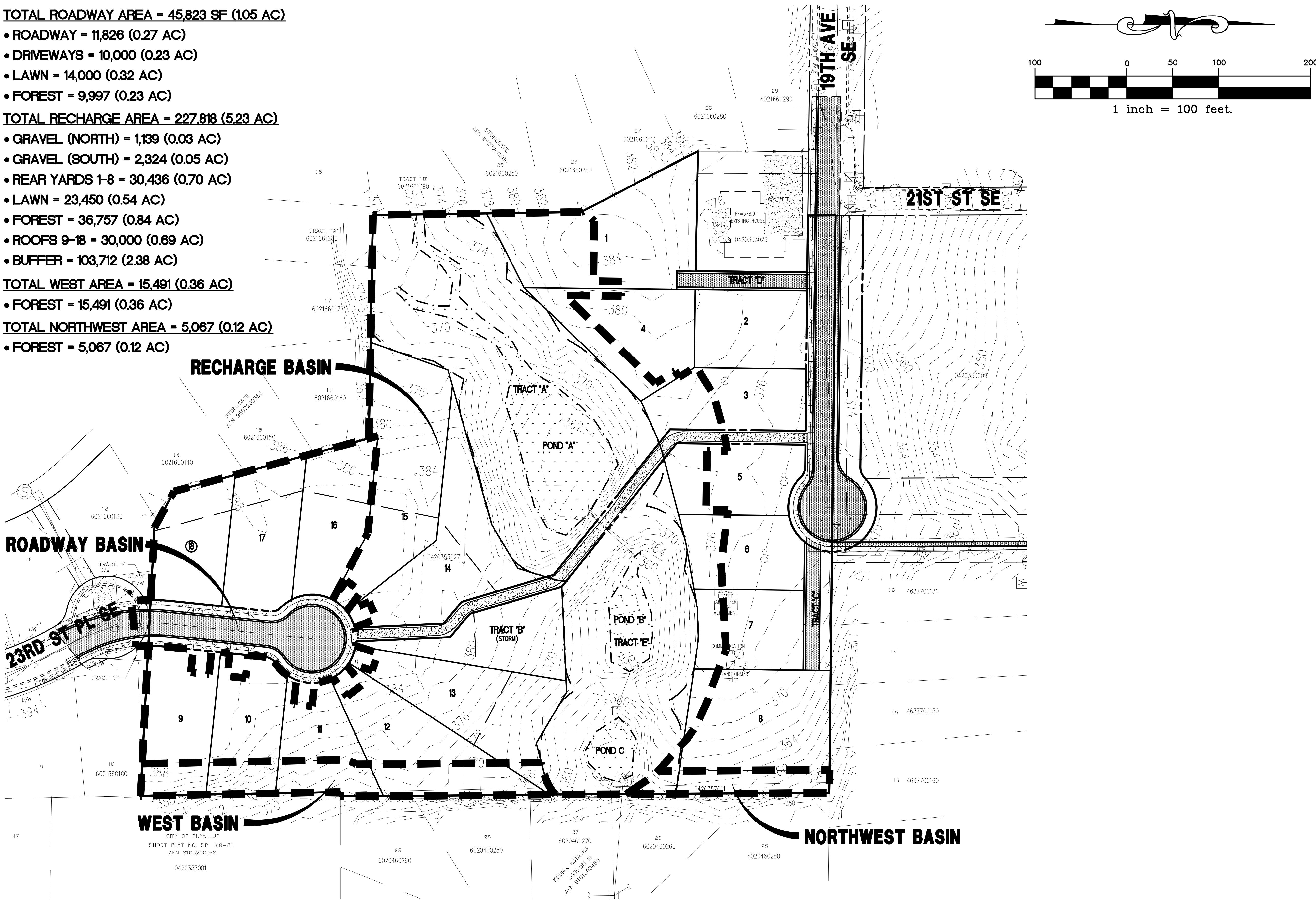
- GRAVEL (NORTH) = 1,139 (0.03 AC)
- GRAVEL (SOUTH) = 2,324 (0.05 AC)
- REAR YARDS 1-8 = 30,436 (0.70 AC)
- LAWN = 23,450 (0.54 AC)
- FOREST = 36,757 (0.84 AC)
- ROOFS 9-18 = 30,000 (0.69 AC)
- BUFFER = 103,712 (2.38 AC)

TOTAL WEST AREA = 15,491 (0.36 AC)

- FOREST = 15,491 (0.36 AC)

TOTAL NORTHWEST AREA = 5,067 (0.12 AC)

- FOREST = 5,067 (0.12 AC)



C.E.S. NW INC.
CIVIL ENGINEERING & SURVEYING

429 – 29TH ST. NE, SUITE D
PUYALLUP, WA 98372
PH: (253) 848-4282
ceservices@cesnwinc.com

Project: SUNSET POINTE
DEVELOPED SHAW BASIN

Client: PETER Y CHEN AND BETH LIU
4709 MEMORY LANE WEST, UNIVERSITY PLACE, WA 98466

Designed:	FBB
Drawn:	JEH
Checked:	FBB
Scale:	1"-100'
Date:	9/17/24
Job No.:	04148

Sheet No.: B5

1 of 1 Sheets

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Pierce County GIS, WA DNR, WSDOT, USFWS, Washington State Department of Ecology, and Puget Sound Regional Council. This information was compiled at scales of 1:1,200 to 1:24,000 during the time period 1996-2012.

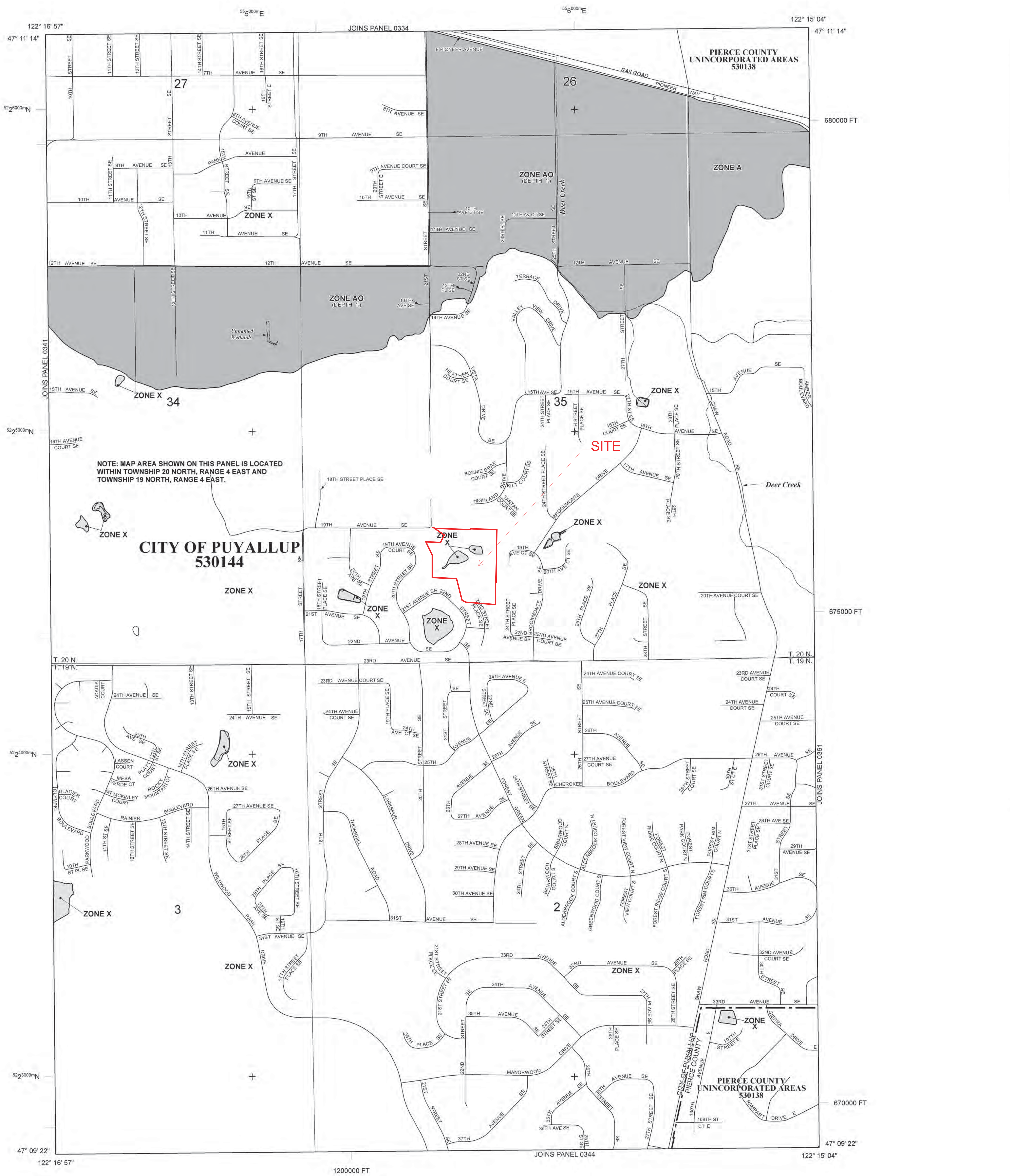
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 10
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
March 7, 2017

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0342E

FIRM

FLOOD INSURANCE RATE MAP

PIERCE COUNTY, WASHINGTON

AND INCORPORATED AREAS

PANEL 342 OF 1375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PIERCE COUNTY	530138	0342	E
PUYALLUP, CITY OF	530144	0342	E

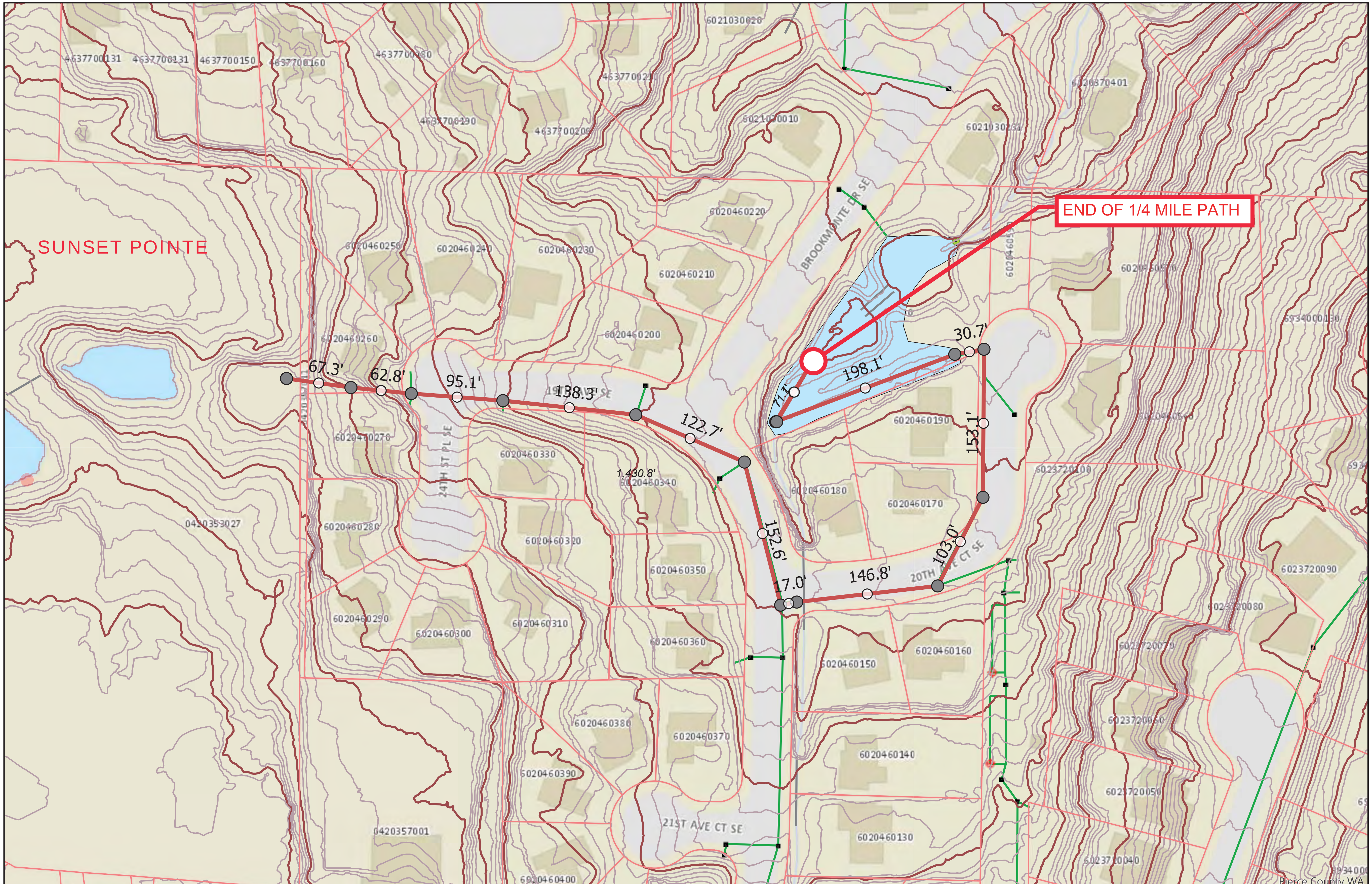
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 53053C0342E

EFFECTIVE DATE MARCH 7, 2017

Federal Emergency Management Agency

Shaw Road 1/4 Mile Path



Legend

Tax Parcels

- Base Parcel

Contours - 2017

- 10' Contour Line
- 2' Contour Line
- Drainage - Control Structures - Puyallup
- Drainage - Manholes - Puyallup
- Drainage - Inlets - Puyallup
- Drainage - Culverts - Puyallup
- Drainage - Channels - Puyallup
- Drainage - Pipes - Puyallup
- Drainage - Stormwater Facilities - Puyallup

0 20 40 80 Feet

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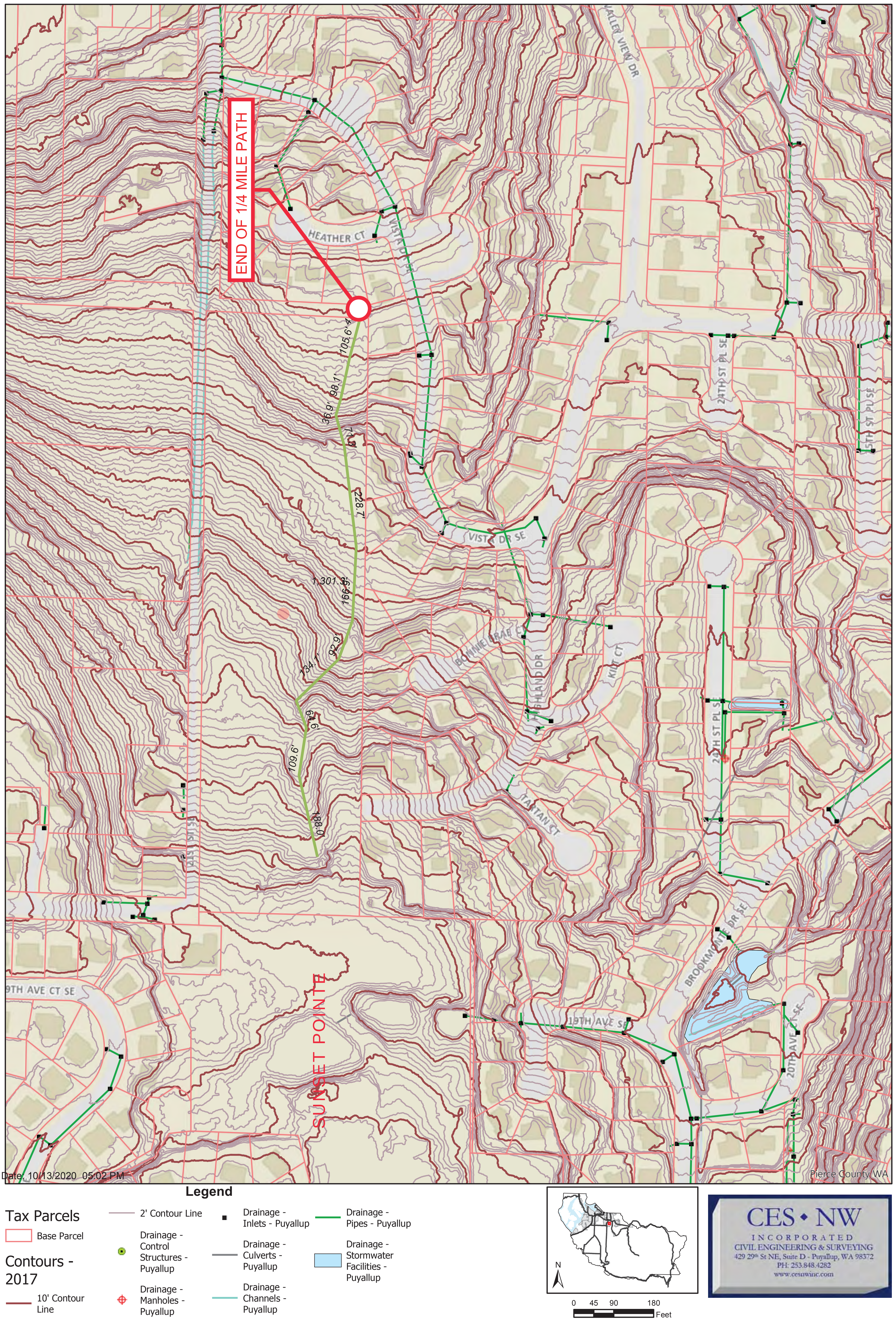
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County assumes no liability for variations ascertained by actual survey. ALL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

Date: 10/13/2020 08:08 PM

State Highway 1/4 Mile Path



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APPENDIX C

Computer Printouts

STATE HIGHWAY BASIN

WWHM2012
PROJECT REPORT

Project Name: North Basin Dispersion
Site Name: South Basin
Site Address: 2301 23rd Street SE
City : Puyallup, WA
Report Date: 5/22/2023
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

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

High Flow Threshold for POC 2: 50 year

PREDEVELOPED LAND USE

Name : Pre-Dev 19th
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.9
Pervious Total	1.9

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.9

Element Flows To:

Surface	Interflow	Groundwater

Name : Pre-Dev 19th

Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.9

Pervious Total 1.9

Impervious Land Use	acre

Impervious Total 0

Basin Total 1.9

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Post Dev
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.14

Pervious Total 1.14

Impervious Land Use	acre
ROADS FLAT	0.54
ROOF TOPS FLAT	0.551
DRIVEWAYS FLAT	0.184

Impervious Total 1.275

Basin Total 2.415

Element Flows To:

Surface	Interflow	Groundwater

Name : Modelling Credits
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**2.415**
Pervious Total	**2.415**

Impervious Land Use	**acre**
Impervious Total	**0**
Basin Total	**2.415**

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.9
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.14
Total Impervious Area:1.275

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.043345
5 year	0.067109
10 year	0.080905
25 year	0.095886
50 year	0.105541
100 year	0.113928

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.471902
5 year	0.633742
10 year	0.75141
25 year	0.912502
50 year	1.041822
100 year	1.179383

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

Year	Predeveloped	Mitigated
1902	0.035	0.541
1903	0.026	0.600
1904	0.053	0.737
1905	0.022	0.307
1906	0.011	0.346
1907	0.067	0.496
1908	0.048	0.389
1909	0.047	0.461
1910	0.066	0.462
1911	0.043	0.510
1912	0.165	0.975
1913	0.067	0.356
1914	0.017	1.526
1915	0.028	0.324
1916	0.043	0.575
1917	0.015	0.228
1918	0.046	0.458
1919	0.036	0.302
1920	0.044	0.396
1921	0.048	0.352
1922	0.048	0.542
1923	0.038	0.372
1924	0.019	0.665
1925	0.023	0.294
1926	0.043	0.540
1927	0.030	0.463
1928	0.033	0.349
1929	0.068	0.655
1930	0.042	0.690
1931	0.040	0.342
1932	0.031	0.373
1933	0.034	0.373
1934	0.088	0.621
1935	0.040	0.313
1936	0.036	0.437
1937	0.061	0.555
1938	0.036	0.319
1939	0.003	0.384
1940	0.039	0.691
1941	0.024	0.756
1942	0.059	0.540
1943	0.030	0.517
1944	0.066	0.737
1945	0.047	0.549
1946	0.030	0.450
1947	0.020	0.334
1948	0.091	0.463
1949	0.079	0.706
1950	0.023	0.390
1951	0.030	0.603
1952	0.120	0.762
1953	0.108	0.694

1954	0.038	0.387
1955	0.033	0.348
1956	0.018	0.322
1957	0.057	0.377
1958	0.114	0.499
1959	0.072	0.506
1960	0.021	0.374
1961	0.071	1.040
1962	0.039	0.449
1963	0.019	0.331
1964	0.020	0.970
1965	0.080	0.462
1966	0.023	0.371
1967	0.037	0.534
1968	0.038	0.433
1969	0.036	0.401
1970	0.055	0.463
1971	0.084	0.458
1972	0.055	1.403
1973	0.072	0.806
1974	0.043	0.605
1975	0.090	0.672
1976	0.048	0.689
1977	0.021	0.279
1978	0.079	0.517
1979	0.023	0.511
1980	0.046	0.510
1981	0.042	0.467
1982	0.020	0.380
1983	0.072	0.532
1984	0.032	0.522
1985	0.051	0.605
1986	0.043	0.316
1987	0.084	0.518
1988	0.051	0.321
1989	0.047	0.302
1990	0.054	0.396
1991	0.043	0.557
1992	0.056	0.534
1993	0.058	0.592
1994	0.085	0.439
1995	0.019	0.327
1996	0.095	0.448
1997	0.038	0.393
1998	0.046	0.488
1999	0.005	0.519
2000	0.034	0.448
2001	0.019	0.353
2002	0.069	0.692
2003	0.053	0.385
2004	0.047	0.552
2005	0.099	1.076
2006	0.027	0.495
2007	0.029	0.562
2008	0.046	0.459
2009	0.030	0.347
2010	0.026	0.449

2011	0.024	0.463
2012	0.036	0.453
2013	0.027	0.423
2014	0.019	0.402
2015	0.037	0.699
2016	0.015	0.434
2017	0.065	0.670
2018	0.118	0.472
2019	0.121	0.695
2020	0.036	0.514
2021	0.059	0.440
2022	0.024	0.683
2023	0.050	0.856
2024	0.125	1.028
2025	0.044	0.449
2026	0.071	0.507
2027	0.027	0.551
2028	0.023	0.214
2029	0.048	0.376
2030	0.088	0.749
2031	0.029	0.233
2032	0.017	0.373
2033	0.026	0.472
2034	0.026	0.359
2035	0.100	0.515
2036	0.053	0.371
2037	0.014	0.497
2038	0.047	0.507
2039	0.006	0.943
2040	0.025	0.385
2041	0.034	0.476
2042	0.103	0.549
2043	0.048	0.603
2044	0.065	0.426
2045	0.043	0.352
2046	0.051	0.384
2047	0.037	0.458
2048	0.050	0.376
2049	0.044	0.558
2050	0.032	0.435
2051	0.045	0.629
2052	0.027	0.452
2053	0.048	0.381
2054	0.059	0.795
2055	0.024	0.438
2056	0.021	0.600
2057	0.033	0.300
2058	0.040	0.563
2059	0.070	0.710

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

Rank	**Predeveloped**	**Mitigated**
1	0.1651	1.5257
2	0.1252	1.4028
3	0.1205	1.0760

4	0.1197	1.0396
5	0.1180	1.0282
6	0.1141	0.9746
7	0.1076	0.9700
8	0.1026	0.9429
9	0.1002	0.8559
10	0.0992	0.8059
11	0.0945	0.7945
12	0.0913	0.7622
13	0.0895	0.7560
14	0.0882	0.7485
15	0.0879	0.7374
16	0.0849	0.7368
17	0.0845	0.7101
18	0.0840	0.7061
19	0.0802	0.6989
20	0.0794	0.6948
21	0.0789	0.6938
22	0.0722	0.6924
23	0.0719	0.6910
24	0.0715	0.6903
25	0.0715	0.6892
26	0.0708	0.6827
27	0.0698	0.6719
28	0.0692	0.6696
29	0.0680	0.6649
30	0.0672	0.6554
31	0.0665	0.6289
32	0.0664	0.6206
33	0.0657	0.6053
34	0.0651	0.6046
35	0.0645	0.6027
36	0.0610	0.6027
37	0.0593	0.6005
38	0.0591	0.6000
39	0.0590	0.5922
40	0.0577	0.5749
41	0.0568	0.5628
42	0.0559	0.5619
43	0.0555	0.5578
44	0.0552	0.5574
45	0.0536	0.5550
46	0.0533	0.5524
47	0.0533	0.5514
48	0.0526	0.5493
49	0.0511	0.5493
50	0.0511	0.5421
51	0.0506	0.5413
52	0.0497	0.5405
53	0.0496	0.5402
54	0.0484	0.5345
55	0.0481	0.5339
56	0.0480	0.5320
57	0.0480	0.5221
58	0.0479	0.5188
59	0.0476	0.5182
60	0.0475	0.5173

61	0.0474	0.5169
62	0.0474	0.5153
63	0.0473	0.5144
64	0.0470	0.5114
65	0.0469	0.5101
66	0.0460	0.5097
67	0.0457	0.5073
68	0.0457	0.5067
69	0.0457	0.5063
70	0.0452	0.4991
71	0.0445	0.4970
72	0.0443	0.4959
73	0.0437	0.4949
74	0.0435	0.4881
75	0.0431	0.4756
76	0.0430	0.4724
77	0.0430	0.4716
78	0.0428	0.4668
79	0.0427	0.4632
80	0.0426	0.4629
81	0.0425	0.4627
82	0.0420	0.4627
83	0.0404	0.4621
84	0.0403	0.4620
85	0.0396	0.4607
86	0.0393	0.4594
87	0.0388	0.4582
88	0.0381	0.4577
89	0.0381	0.4577
90	0.0379	0.4532
91	0.0377	0.4520
92	0.0375	0.4502
93	0.0370	0.4490
94	0.0366	0.4489
95	0.0364	0.4488
96	0.0363	0.4484
97	0.0359	0.4481
98	0.0358	0.4400
99	0.0357	0.4389
100	0.0356	0.4380
101	0.0348	0.4368
102	0.0342	0.4353
103	0.0341	0.4344
104	0.0336	0.4333
105	0.0333	0.4260
106	0.0333	0.4228
107	0.0328	0.4021
108	0.0324	0.4011
109	0.0317	0.3963
110	0.0309	0.3958
111	0.0305	0.3929
112	0.0303	0.3900
113	0.0303	0.3893
114	0.0299	0.3875
115	0.0299	0.3847
116	0.0290	0.3846
117	0.0286	0.3842

118	0.0281	0.3840
119	0.0271	0.3815
120	0.0270	0.3799
121	0.0269	0.3774
122	0.0268	0.3759
123	0.0265	0.3755
124	0.0265	0.3743
125	0.0263	0.3734
126	0.0258	0.3731
127	0.0252	0.3730
128	0.0245	0.3722
129	0.0244	0.3709
130	0.0240	0.3707
131	0.0238	0.3586
132	0.0234	0.3556
133	0.0234	0.3533
134	0.0233	0.3523
135	0.0232	0.3519
136	0.0231	0.3492
137	0.0220	0.3484
138	0.0214	0.3468
139	0.0212	0.3457
140	0.0210	0.3421
141	0.0201	0.3338
142	0.0198	0.3309
143	0.0196	0.3274
144	0.0193	0.3236
145	0.0189	0.3222
146	0.0187	0.3208
147	0.0186	0.3191
148	0.0186	0.3157
149	0.0176	0.3125
150	0.0174	0.3067
151	0.0172	0.3022
152	0.0149	0.3016
153	0.0146	0.2997
154	0.0143	0.2938
155	0.0114	0.2787
156	0.0059	0.2334
157	0.0046	0.2279
158	0.0030	0.2141

Stream Protection Duration
POC #1
The Facility FAILED

Facility FAILED duration standard for 1+ flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0217	55678	381710	685	Fail
0.0225	51273	371295	724	Fail
0.0234	47185	361545	766	Fail
0.0242	43462	352237	810	Fail
0.0251	40105	343373	856	Fail
0.0259	37190	335063	900	Fail
0.0268	34431	326864	949	Fail

0.0276	31889	318997	1000	Fail
0.0284	29551	311739	1054	Fail
0.0293	27495	304704	1108	Fail
0.0301	25634	297778	1161	Fail
0.0310	23867	291130	1219	Fail
0.0318	22304	284870	1277	Fail
0.0327	20892	278665	1333	Fail
0.0335	19551	272460	1393	Fail
0.0344	18288	266699	1458	Fail
0.0352	17102	261048	1526	Fail
0.0361	15961	255563	1601	Fail
0.0369	14903	250411	1680	Fail
0.0378	13955	245480	1759	Fail
0.0386	13063	240439	1840	Fail
0.0395	12271	235564	1919	Fail
0.0403	11518	230854	2004	Fail
0.0412	10787	226201	2096	Fail
0.0420	10083	221824	2199	Fail
0.0429	9413	217503	2310	Fail
0.0437	8792	213348	2426	Fail
0.0445	8233	209304	2542	Fail
0.0454	7728	205204	2655	Fail
0.0462	7224	201271	2786	Fail
0.0471	6781	197392	2910	Fail
0.0479	6399	193625	3025	Fail
0.0488	6094	190024	3118	Fail
0.0496	5817	186589	3207	Fail
0.0505	5512	183044	3320	Fail
0.0513	5230	179664	3435	Fail
0.0522	4963	176340	3553	Fail
0.0530	4739	173182	3654	Fail
0.0539	4485	169969	3789	Fail
0.0547	4292	166867	3887	Fail
0.0556	4097	163764	3997	Fail
0.0564	3869	160828	4156	Fail
0.0573	3648	157836	4326	Fail
0.0581	3474	154956	4460	Fail
0.0589	3312	152130	4593	Fail
0.0598	3162	149471	4727	Fail
0.0606	3018	146812	4864	Fail
0.0615	2916	144263	4947	Fail
0.0623	2791	141715	5077	Fail
0.0632	2677	139222	5200	Fail
0.0640	2526	136729	5412	Fail
0.0649	2410	134291	5572	Fail
0.0657	2302	131964	5732	Fail
0.0666	2200	129582	5890	Fail
0.0674	2097	127366	6073	Fail
0.0683	1978	125095	6324	Fail
0.0691	1875	122879	6553	Fail
0.0700	1765	120718	6839	Fail
0.0708	1683	118613	7047	Fail
0.0717	1594	116508	7309	Fail
0.0725	1524	114569	7517	Fail
0.0733	1458	112574	7721	Fail
0.0742	1378	110635	8028	Fail
0.0750	1306	108696	8322	Fail

0.0759	1248	106812	8558	Fail
0.0767	1191	104984	8814	Fail
0.0776	1135	103156	9088	Fail
0.0784	1083	101383	9361	Fail
0.0793	1032	99610	9652	Fail
0.0801	981	97838	9973	Fail
0.0810	929	96120	10346	Fail
0.0818	869	94403	10863	Fail
0.0827	819	92796	11330	Fail
0.0835	770	91189	11842	Fail
0.0844	708	89638	12660	Fail
0.0852	663	88142	13294	Fail
0.0861	626	86591	13832	Fail
0.0869	583	85095	14596	Fail
0.0878	539	83600	15510	Fail
0.0886	500	82270	16454	Fail
0.0894	456	80830	17725	Fail
0.0903	416	79500	19110	Fail
0.0911	380	78226	20585	Fail
0.0920	351	76841	21892	Fail
0.0928	318	75566	23762	Fail
0.0937	296	74292	25098	Fail
0.0945	276	72963	26435	Fail
0.0954	263	71744	27279	Fail
0.0962	246	70470	28646	Fail
0.0971	231	69251	29978	Fail
0.0979	216	68143	31547	Fail
0.0988	203	66979	32994	Fail
0.0996	180	65871	36595	Fail
0.1005	157	64819	41285	Fail
0.1013	141	63766	45224	Fail
0.1022	127	62714	49381	Fail
0.1030	113	61606	54518	Fail
0.1038	104	60497	58170	Fail
0.1047	99	59556	60157	Fail
0.1055	89	58503	65733	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 BMP Flow and Volume for POC #1
On-line facility volume: 0.2178 **acre-feet**
On-line facility target flow: 0.2341 **cfs.**
Adjusted for 15 min: 0.2341 **cfs.**
Off-line facility target flow: 0.134 **cfs.**
Adjusted for 15 min: 0.134 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs	Volume Through	Infiltration Volume	Cumulative Volume	Percent	Water Quality	Percent	Comment

Volume Infiltrated	Water Quality Treated	Treatment (ac-ft)	Facility (ac-ft)	(ac-ft.)	Infiltration Credit
Total Volume Infiltrated		0.00	0.00	0.00	0.00
0.00	0%	No Treat. Credit			

Compliance with LID Standard 8
Duration Analysis Result = Failed

Stream Protection Duration

Predeveloped Landuse Totals for POC #2
Total Pervious Area:1.9
Total Impervious Area:0

Mitigated Landuse Totals for POC #2
Total Pervious Area:2.415
Total Impervious Area:0

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	0.043345
5 year	0.067109
10 year	0.080905
25 year	0.095886
50 year	0.105541
100 year	0.113928

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	Flow(cfs)
2 year	0.055093
5 year	0.0853
10 year	0.102835
25 year	0.121876
50 year	0.134148
100 year	0.144809

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1902	0.035	0.044
1903	0.026	0.034
1904	0.053	0.068
1905	0.022	0.028
1906	0.011	0.015
1907	0.067	0.085
1908	0.048	0.061
1909	0.047	0.060
1910	0.066	0.084
1911	0.043	0.055
1912	0.165	0.210
1913	0.067	0.085

1914	0.017	0.022
1915	0.028	0.036
1916	0.043	0.054
1917	0.015	0.019
1918	0.046	0.058
1919	0.036	0.045
1920	0.044	0.055
1921	0.048	0.061
1922	0.048	0.061
1923	0.038	0.048
1924	0.019	0.024
1925	0.023	0.030
1926	0.043	0.054
1927	0.030	0.039
1928	0.033	0.042
1929	0.068	0.086
1930	0.042	0.054
1931	0.040	0.051
1932	0.031	0.039
1933	0.034	0.044
1934	0.088	0.112
1935	0.040	0.051
1936	0.036	0.046
1937	0.061	0.078
1938	0.036	0.045
1939	0.003	0.004
1940	0.039	0.050
1941	0.024	0.030
1942	0.059	0.075
1943	0.030	0.038
1944	0.066	0.083
1945	0.047	0.060
1946	0.030	0.038
1947	0.020	0.025
1948	0.091	0.116
1949	0.079	0.101
1950	0.023	0.029
1951	0.030	0.038
1952	0.120	0.152
1953	0.108	0.137
1954	0.038	0.048
1955	0.033	0.042
1956	0.018	0.022
1957	0.057	0.072
1958	0.114	0.145
1959	0.072	0.092
1960	0.021	0.027
1961	0.071	0.091
1962	0.039	0.049
1963	0.019	0.024
1964	0.020	0.025
1965	0.080	0.102
1966	0.023	0.030
1967	0.037	0.047
1968	0.038	0.048
1969	0.036	0.045
1970	0.055	0.070

1971	0.084	0.107
1972	0.055	0.071
1973	0.072	0.091
1974	0.043	0.055
1975	0.090	0.114
1976	0.048	0.061
1977	0.021	0.027
1978	0.079	0.100
1979	0.023	0.029
1980	0.046	0.058
1981	0.042	0.053
1982	0.020	0.026
1983	0.072	0.091
1984	0.032	0.041
1985	0.051	0.065
1986	0.043	0.054
1987	0.084	0.107
1988	0.051	0.065
1989	0.047	0.060
1990	0.054	0.068
1991	0.043	0.055
1992	0.056	0.071
1993	0.058	0.073
1994	0.085	0.108
1995	0.019	0.025
1996	0.095	0.120
1997	0.038	0.048
1998	0.046	0.058
1999	0.005	0.006
2000	0.034	0.043
2001	0.019	0.024
2002	0.069	0.088
2003	0.053	0.067
2004	0.047	0.060
2005	0.099	0.126
2006	0.027	0.034
2007	0.029	0.036
2008	0.046	0.058
2009	0.030	0.038
2010	0.026	0.033
2011	0.024	0.030
2012	0.036	0.046
2013	0.027	0.034
2014	0.019	0.024
2015	0.037	0.046
2016	0.015	0.019
2017	0.065	0.083
2018	0.118	0.150
2019	0.121	0.153
2020	0.036	0.046
2021	0.059	0.075
2022	0.024	0.031
2023	0.050	0.063
2024	0.125	0.159
2025	0.044	0.057
2026	0.071	0.090
2027	0.027	0.034

2028	0.023	0.030
2029	0.048	0.061
2030	0.088	0.112
2031	0.029	0.037
2032	0.017	0.022
2033	0.026	0.034
2034	0.026	0.033
2035	0.100	0.127
2036	0.053	0.068
2037	0.014	0.018
2038	0.047	0.060
2039	0.006	0.007
2040	0.025	0.032
2041	0.034	0.043
2042	0.103	0.130
2043	0.048	0.062
2044	0.065	0.082
2045	0.043	0.055
2046	0.051	0.064
2047	0.037	0.048
2048	0.050	0.063
2049	0.044	0.056
2050	0.032	0.040
2051	0.045	0.057
2052	0.027	0.034
2053	0.048	0.060
2054	0.059	0.075
2055	0.024	0.031
2056	0.021	0.027
2057	0.033	0.042
2058	0.040	0.050
2059	0.070	0.089

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	**Predeveloped**	**Mitigated**
1	0.1651	0.2098
2	0.1252	0.1591
3	0.1205	0.1532
4	0.1197	0.1522
5	0.1180	0.1499
6	0.1141	0.1450
7	0.1076	0.1367
8	0.1026	0.1304
9	0.1002	0.1273
10	0.0992	0.1261
11	0.0945	0.1201
12	0.0913	0.1161
13	0.0895	0.1138
14	0.0882	0.1120
15	0.0879	0.1117
16	0.0849	0.1079
17	0.0845	0.1074
18	0.0840	0.1068
19	0.0802	0.1020
20	0.0794	0.1009

21	0.0789	0.1003
22	0.0722	0.0918
23	0.0719	0.0914
24	0.0715	0.0909
25	0.0715	0.0908
26	0.0708	0.0900
27	0.0698	0.0887
28	0.0692	0.0879
29	0.0680	0.0865
30	0.0672	0.0854
31	0.0665	0.0846
32	0.0664	0.0844
33	0.0657	0.0835
34	0.0651	0.0827
35	0.0645	0.0820
36	0.0610	0.0776
37	0.0593	0.0754
38	0.0591	0.0752
39	0.0590	0.0750
40	0.0577	0.0733
41	0.0568	0.0722
42	0.0559	0.0710
43	0.0555	0.0705
44	0.0552	0.0701
45	0.0536	0.0681
46	0.0533	0.0678
47	0.0533	0.0678
48	0.0526	0.0669
49	0.0511	0.0650
50	0.0511	0.0649
51	0.0506	0.0643
52	0.0497	0.0632
53	0.0496	0.0631
54	0.0484	0.0616
55	0.0481	0.0611
56	0.0480	0.0610
57	0.0480	0.0610
58	0.0479	0.0609
59	0.0476	0.0605
60	0.0475	0.0604
61	0.0474	0.0603
62	0.0474	0.0602
63	0.0473	0.0601
64	0.0470	0.0597
65	0.0469	0.0596
66	0.0460	0.0584
67	0.0457	0.0581
68	0.0457	0.0581
69	0.0457	0.0581
70	0.0452	0.0575
71	0.0445	0.0565
72	0.0443	0.0563
73	0.0437	0.0555
74	0.0435	0.0553
75	0.0431	0.0548
76	0.0430	0.0547
77	0.0430	0.0546

78	0.0428	0.0544
79	0.0427	0.0543
80	0.0426	0.0542
81	0.0425	0.0540
82	0.0420	0.0534
83	0.0404	0.0514
84	0.0403	0.0512
85	0.0396	0.0504
86	0.0393	0.0499
87	0.0388	0.0493
88	0.0381	0.0484
89	0.0381	0.0484
90	0.0379	0.0481
91	0.0377	0.0480
92	0.0375	0.0476
93	0.0370	0.0470
94	0.0366	0.0465
95	0.0364	0.0462
96	0.0363	0.0461
97	0.0359	0.0456
98	0.0358	0.0454
99	0.0357	0.0454
100	0.0356	0.0453
101	0.0348	0.0442
102	0.0342	0.0435
103	0.0341	0.0434
104	0.0336	0.0427
105	0.0333	0.0423
106	0.0333	0.0423
107	0.0328	0.0416
108	0.0324	0.0412
109	0.0317	0.0403
110	0.0309	0.0392
111	0.0305	0.0387
112	0.0303	0.0385
113	0.0303	0.0385
114	0.0299	0.0380
115	0.0299	0.0380
116	0.0290	0.0369
117	0.0286	0.0363
118	0.0281	0.0357
119	0.0271	0.0344
120	0.0270	0.0343
121	0.0269	0.0342
122	0.0268	0.0341
123	0.0265	0.0337
124	0.0265	0.0337
125	0.0263	0.0335
126	0.0258	0.0329
127	0.0252	0.0320
128	0.0245	0.0311
129	0.0244	0.0311
130	0.0240	0.0305
131	0.0238	0.0303
132	0.0234	0.0298
133	0.0234	0.0298
134	0.0233	0.0296

135	0.0232	0.0295
136	0.0231	0.0293
137	0.0220	0.0280
138	0.0214	0.0272
139	0.0212	0.0270
140	0.0210	0.0267
141	0.0201	0.0256
142	0.0198	0.0252
143	0.0196	0.0249
144	0.0193	0.0245
145	0.0189	0.0240
146	0.0187	0.0238
147	0.0186	0.0237
148	0.0186	0.0236
149	0.0176	0.0223
150	0.0174	0.0221
151	0.0172	0.0219
152	0.0149	0.0190
153	0.0146	0.0186
154	0.0143	0.0181
155	0.0114	0.0145
156	0.0059	0.0075
157	0.0046	0.0059
158	0.0030	0.0038

Stream Protection Duration
POC #2
The Facility FAILED

Facility FAILED duration standard for 1+ flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0217	55678	92519	166	Fail
0.0225	51273	85760	167	Fail
0.0234	47185	79389	168	Fail
0.0242	43462	73683	169	Fail
0.0251	40105	68475	170	Fail
0.0259	37190	63822	171	Fail
0.0268	34431	59445	172	Fail
0.0276	31889	55456	173	Fail
0.0284	29551	51944	175	Fail
0.0293	27495	48692	177	Fail
0.0301	25634	45595	177	Fail
0.0310	23867	42753	179	Fail
0.0318	22304	40171	180	Fail
0.0327	20892	37805	180	Fail
0.0335	19551	35595	182	Fail
0.0344	18288	33567	183	Fail
0.0352	17102	31551	184	Fail
0.0361	15961	29678	185	Fail
0.0369	14903	28060	188	Fail
0.0378	13955	26520	190	Fail
0.0386	13063	25124	192	Fail
0.0395	12271	23767	193	Fail
0.0403	11518	22520	195	Fail
0.0412	10787	21396	198	Fail

0.0420	10083	20288	201	Fail
0.0429	9413	19279	204	Fail
0.0437	8792	18282	207	Fail
0.0445	8233	17357	210	Fail
0.0454	7728	16443	212	Fail
0.0462	7224	15545	215	Fail
0.0471	6781	14759	217	Fail
0.0479	6399	14027	219	Fail
0.0488	6094	13318	218	Fail
0.0496	5817	12665	217	Fail
0.0505	5512	12027	218	Fail
0.0513	5230	11457	219	Fail
0.0522	4963	10881	219	Fail
0.0530	4739	10327	217	Fail
0.0539	4485	9762	217	Fail
0.0547	4292	9257	215	Fail
0.0556	4097	8787	214	Fail
0.0564	3869	8321	215	Fail
0.0573	3648	7922	217	Fail
0.0581	3474	7534	216	Fail
0.0589	3312	7147	215	Fail
0.0598	3162	6798	214	Fail
0.0606	3018	6498	215	Fail
0.0615	2916	6244	214	Fail
0.0623	2791	6011	215	Fail
0.0632	2677	5778	215	Fail
0.0640	2526	5551	219	Fail
0.0649	2410	5324	220	Fail
0.0657	2302	5105	221	Fail
0.0666	2200	4908	223	Fail
0.0674	2097	4730	225	Fail
0.0683	1978	4532	229	Fail
0.0691	1875	4360	232	Fail
0.0700	1765	4226	239	Fail
0.0708	1683	4053	240	Fail
0.0717	1594	3877	243	Fail
0.0725	1524	3700	242	Fail
0.0733	1458	3549	243	Fail
0.0742	1378	3415	247	Fail
0.0750	1306	3298	252	Fail
0.0759	1248	3180	254	Fail
0.0767	1191	3064	257	Fail
0.0776	1135	2974	262	Fail
0.0784	1083	2880	265	Fail
0.0793	1032	2786	269	Fail
0.0801	981	2695	274	Fail
0.0810	929	2572	276	Fail
0.0818	869	2482	285	Fail
0.0827	819	2390	291	Fail
0.0835	770	2303	299	Fail
0.0844	708	2225	314	Fail
0.0852	663	2152	324	Fail
0.0861	626	2057	328	Fail
0.0869	583	1967	337	Fail
0.0878	539	1884	349	Fail
0.0886	500	1794	358	Fail
0.0894	456	1730	379	Fail

0.0903	416	1657	398	Fail
0.0911	380	1590	418	Fail
0.0920	351	1532	436	Fail
0.0928	318	1481	465	Fail
0.0937	296	1426	481	Fail
0.0945	276	1359	492	Fail
0.0954	263	1306	496	Fail
0.0962	246	1261	512	Fail
0.0971	231	1209	523	Fail
0.0979	216	1174	543	Fail
0.0988	203	1127	555	Fail
0.0996	180	1086	603	Fail
0.1005	157	1048	667	Fail
0.1013	141	1007	714	Fail
0.1022	127	967	761	Fail
0.1030	113	929	822	Fail
0.1038	104	882	848	Fail
0.1047	99	840	848	Fail
0.1055	89	797	895	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 BMP Flow and Volume for POC #2
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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

RECHARGE BASIN

WWHM2012
PROJECT REPORT

Project Name: Wetland 2023.05.19
Site Name: Sunset Pointe
Site Address: 2301 23rd Ave Ne
City : Puyallup
Report Date: 5/22/2023
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Building Roof Areas
Bypass: No

Impervious Land Use	acre
ROOF TOPS FLAT	0.383

Element Flows To:

Outlet 1	Outlet 2
Pasture	

Name : Pasture
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	2.026

Element Flows To:

Surface	Interflow	Groundwater
Buffer Area	Buffer Area	Buffer Area

Name : Gravel
Bypass: No

Impervious Land Use	acre
ROADS FLAT	0.272

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Northside of Bufffer
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.964**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Buffer Area
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**2.38**

Element Flows To:

Surface	**Interflow**	**Groundwater**

MITIGATED LAND USE

Name : Buffer Area
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**2.38**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Rear Yards of Lots 1, 3-8
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.71**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Gravel Path (north of Buffer)
Bypass: No

Impervious Land Use	**acre**
ROADS MOD	**0.023**

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Roof Area lots 9-15
Bypass: No

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.482**

Element Flows To:

Outlet 1	**Outlet 2**
Lawn Lots 9-15	

Name : Lawn Lots 9-15
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.543**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Forest Lots 9-15	Forest Lots 9-15	Forest Lots 9-15

Name : Forest Lots 9-15
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**.394**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Gravel Path South of Buffer
Bypass: No

Impervious Land Use	**acre**
ROADS MOD	**0.053**

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Tract B Forest
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**.446**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Roof Lots 16-18
Bypass: No

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.207**

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:5.37
Total Impervious Area:0.655

Mitigated Landuse Totals for POC #1
Total Pervious Area:4.473
Total Impervious Area:0.765

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.112872
5 year	0.193671
10 year	0.264542
25 year	0.37753
50 year	0.481219
100 year	0.603897

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.097715
5 year	0.16574
10 year	0.224884
25 year	0.318502
50 year	0.403877
100 year	0.504383

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

Year	Predeveloped	Mitigated
1902	0.095	0.078
1903	0.081	0.069
1904	0.332	0.259
1905	0.075	0.066
1906	0.031	0.028
1907	0.156	0.139
1908	0.110	0.097
1909	0.095	0.088
1910	0.147	0.135
1911	0.115	0.100
1912	1.091	0.879
1913	0.186	0.157
1914	0.049	0.042
1915	0.094	0.084
1916	0.112	0.094
1917	0.041	0.037
1918	0.139	0.120
1919	0.116	0.096
1920	0.113	0.101
1921	0.131	0.114
1922	0.179	0.154
1923	0.108	0.094
1924	0.065	0.055
1925	0.072	0.061
1926	0.101	0.091
1927	0.067	0.060
1928	0.085	0.074
1929	0.148	0.137

1930	0.097	0.086
1931	0.098	0.087
1932	0.086	0.075
1933	0.112	0.093
1934	0.268	0.227
1935	0.111	0.099
1936	0.109	0.092
1937	0.147	0.137
1938	0.117	0.096
1939	0.024	0.022
1940	0.120	0.106
1941	0.051	0.047
1942	0.195	0.167
1943	0.086	0.075
1944	0.225	0.200
1945	0.120	0.102
1946	0.106	0.096
1947	0.060	0.051
1948	0.202	0.177
1949	0.206	0.179
1950	0.068	0.060
1951	0.082	0.070
1952	0.585	0.475
1953	0.282	0.253
1954	0.108	0.092
1955	0.083	0.071
1956	0.056	0.048
1957	0.144	0.122
1958	0.299	0.254
1959	0.250	0.221
1960	0.055	0.049
1961	0.258	0.212
1962	0.102	0.086
1963	0.063	0.054
1964	0.104	0.087
1965	0.197	0.170
1966	0.061	0.054
1967	0.134	0.114
1968	0.122	0.103
1969	0.091	0.080
1970	0.138	0.123
1971	0.214	0.178
1972	0.142	0.125
1973	0.210	0.178
1974	0.127	0.113
1975	0.351	0.310
1976	0.225	0.185
1977	0.062	0.052
1978	0.203	0.179
1979	0.069	0.058
1980	0.124	0.110
1981	0.111	0.097
1982	0.060	0.051
1983	0.194	0.160
1984	0.097	0.087
1985	0.205	0.165
1986	0.119	0.103

1987	0.264	0.226
1988	0.104	0.092
1989	0.114	0.098
1990	0.136	0.114
1991	0.112	0.096
1992	0.122	0.112
1993	0.140	0.121
1994	0.191	0.166
1995	0.069	0.060
1996	0.278	0.236
1997	0.080	0.073
1998	0.126	0.113
1999	0.045	0.037
2000	0.116	0.099
2001	0.047	0.044
2002	0.353	0.285
2003	0.144	0.122
2004	0.105	0.098
2005	0.497	0.406
2006	0.074	0.064
2007	0.081	0.073
2008	0.122	0.101
2009	0.091	0.076
2010	0.075	0.063
2011	0.059	0.052
2012	0.109	0.102
2013	0.072	0.061
2014	0.064	0.055
2015	0.237	0.198
2016	0.043	0.039
2017	0.135	0.119
2018	0.360	0.301
2019	0.397	0.337
2020	0.113	0.101
2021	0.137	0.115
2022	0.068	0.061
2023	0.120	0.107
2024	0.936	0.762
2025	0.133	0.109
2026	0.175	0.154
2027	0.090	0.074
2028	0.065	0.058
2029	0.110	0.096
2030	0.198	0.174
2031	0.073	0.062
2032	0.052	0.047
2033	0.075	0.065
2034	0.081	0.070
2035	0.247	0.217
2036	0.129	0.115
2037	0.045	0.039
2038	0.145	0.130
2039	0.029	0.024
2040	0.091	0.077
2041	0.090	0.076
2042	0.264	0.231
2043	0.146	0.127

2044	0.167	0.135
2045	0.119	0.105
2046	0.151	0.124
2047	0.105	0.093
2048	0.129	0.109
2049	0.104	0.094
2050	0.076	0.070
2051	0.172	0.154
2052	0.084	0.071
2053	0.141	0.119
2054	0.351	0.270
2055	0.066	0.060
2056	0.070	0.057
2057	0.104	0.088
2058	0.111	0.092
2059	0.184	0.165

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

Rank	Predeveloped	Mitigated
1	1.0909	0.8794
2	0.9355	0.7616
3	0.5848	0.4746
4	0.4975	0.4060
5	0.3967	0.3368
6	0.3602	0.3102
7	0.3530	0.3011
8	0.3509	0.2849
9	0.3508	0.2704
10	0.3316	0.2594
11	0.2990	0.2544
12	0.2818	0.2533
13	0.2780	0.2355
14	0.2678	0.2312
15	0.2643	0.2265
16	0.2638	0.2259
17	0.2582	0.2208
18	0.2499	0.2169
19	0.2474	0.2120
20	0.2371	0.1996
21	0.2248	0.1979
22	0.2246	0.1849
23	0.2141	0.1795
24	0.2099	0.1788
25	0.2064	0.1783
26	0.2050	0.1782
27	0.2032	0.1767
28	0.2015	0.1745
29	0.1983	0.1704
30	0.1971	0.1666
31	0.1952	0.1657
32	0.1941	0.1653
33	0.1907	0.1647
34	0.1864	0.1595
35	0.1839	0.1572
36	0.1793	0.1540

37	0.1748	0.1540
38	0.1718	0.1535
39	0.1672	0.1388
40	0.1562	0.1374
41	0.1508	0.1370
42	0.1479	0.1353
43	0.1473	0.1350
44	0.1471	0.1299
45	0.1460	0.1268
46	0.1448	0.1246
47	0.1443	0.1243
48	0.1437	0.1226
49	0.1423	0.1219
50	0.1405	0.1217
51	0.1398	0.1212
52	0.1391	0.1197
53	0.1385	0.1189
54	0.1374	0.1188
55	0.1355	0.1152
56	0.1350	0.1146
57	0.1343	0.1143
58	0.1334	0.1142
59	0.1311	0.1139
60	0.1294	0.1132
61	0.1287	0.1132
62	0.1272	0.1125
63	0.1260	0.1098
64	0.1245	0.1092
65	0.1219	0.1088
66	0.1218	0.1067
67	0.1216	0.1057
68	0.1202	0.1047
69	0.1199	0.1026
70	0.1198	0.1026
71	0.1192	0.1018
72	0.1192	0.1016
73	0.1172	0.1014
74	0.1160	0.1007
75	0.1160	0.1007
76	0.1153	0.1005
77	0.1140	0.0991
78	0.1134	0.0985
79	0.1131	0.0985
80	0.1121	0.0984
81	0.1120	0.0972
82	0.1118	0.0969
83	0.1112	0.0964
84	0.1112	0.0964
85	0.1110	0.0963
86	0.1105	0.0962
87	0.1098	0.0959
88	0.1095	0.0941
89	0.1094	0.0941
90	0.1084	0.0935
91	0.1076	0.0928
92	0.1057	0.0928
93	0.1055	0.0924

94	0.1052	0.0924
95	0.1045	0.0922
96	0.1043	0.0921
97	0.1038	0.0907
98	0.1038	0.0880
99	0.1019	0.0879
100	0.1014	0.0874
101	0.0975	0.0874
102	0.0966	0.0873
103	0.0966	0.0862
104	0.0954	0.0857
105	0.0949	0.0841
106	0.0940	0.0802
107	0.0911	0.0778
108	0.0909	0.0774
109	0.0908	0.0763
110	0.0902	0.0760
111	0.0897	0.0754
112	0.0863	0.0747
113	0.0858	0.0744
114	0.0851	0.0738
115	0.0840	0.0729
116	0.0835	0.0728
117	0.0824	0.0712
118	0.0813	0.0709
119	0.0812	0.0705
120	0.0810	0.0702
121	0.0797	0.0697
122	0.0763	0.0695
123	0.0750	0.0659
124	0.0748	0.0655
125	0.0745	0.0641
126	0.0739	0.0631
127	0.0725	0.0617
128	0.0722	0.0614
129	0.0717	0.0611
130	0.0697	0.0607
131	0.0694	0.0605
132	0.0689	0.0602
133	0.0683	0.0602
134	0.0678	0.0596
135	0.0673	0.0583
136	0.0661	0.0580
137	0.0654	0.0571
138	0.0653	0.0555
139	0.0644	0.0552
140	0.0627	0.0541
141	0.0616	0.0537
142	0.0610	0.0524
143	0.0604	0.0523
144	0.0598	0.0508
145	0.0594	0.0507
146	0.0555	0.0490
147	0.0554	0.0484
148	0.0516	0.0472
149	0.0509	0.0471
150	0.0487	0.0443

151	0.0466	0.0425
152	0.0452	0.0389
153	0.0447	0.0387
154	0.0428	0.0367
155	0.0414	0.0365
156	0.0314	0.0284
157	0.0286	0.0236
158	0.0237	0.0221

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0564	131189	87367	66	Pass
0.0607	111798	73073	65	Pass
0.0650	91743	58725	64	Pass
0.0693	78724	49534	62	Pass
0.0736	68143	42044	61	Pass
0.0779	59168	35650	60	Pass
0.0822	49462	29130	58	Pass
0.0865	43262	24858	57	Pass
0.0908	38105	21257	55	Pass
0.0951	32083	17363	54	Pass
0.0993	28083	14986	53	Pass
0.1036	24692	12864	52	Pass
0.1079	21573	11213	51	Pass
0.1122	18194	9562	52	Pass
0.1165	16050	8360	52	Pass
0.1208	14171	7462	52	Pass
0.1251	12210	6526	53	Pass
0.1294	10875	5895	54	Pass
0.1337	9762	5220	53	Pass
0.1380	8604	4685	54	Pass
0.1423	7662	4104	53	Pass
0.1465	7058	3665	51	Pass
0.1508	6582	3272	49	Pass
0.1551	5900	2825	47	Pass
0.1594	5409	2490	46	Pass
0.1637	4963	2183	43	Pass
0.1680	4540	1905	41	Pass
0.1723	4013	1624	40	Pass
0.1766	3642	1410	38	Pass
0.1809	3329	1255	37	Pass
0.1852	2950	1080	36	Pass
0.1894	2667	976	36	Pass
0.1937	2383	879	36	Pass
0.1980	1978	754	38	Pass
0.2023	1771	666	37	Pass
0.2066	1602	574	35	Pass
0.2109	1472	452	30	Pass
0.2152	1326	339	25	Pass
0.2195	1212	285	23	Pass
0.2238	1102	218	19	Pass

0.2281	995	185	18	Pass
0.2324	897	164	18	Pass
0.2366	835	142	17	Pass
0.2409	766	122	15	Pass
0.2452	636	81	12	Pass
0.2495	493	61	12	Pass
0.2538	411	45	10	Pass
0.2581	334	37	11	Pass
0.2624	284	34	11	Pass
0.2667	244	29	11	Pass
0.2710	227	29	12	Pass
0.2753	200	26	13	Pass
0.2796	177	25	14	Pass
0.2838	156	24	15	Pass
0.2881	125	23	18	Pass
0.2924	93	22	23	Pass
0.2967	60	22	36	Pass
0.3010	47	21	44	Pass
0.3053	34	20	58	Pass
0.3096	33	20	60	Pass
0.3139	32	19	59	Pass
0.3182	27	19	70	Pass
0.3225	27	19	70	Pass
0.3268	26	19	73	Pass
0.3310	25	19	76	Pass
0.3353	24	19	79	Pass
0.3396	24	18	75	Pass
0.3439	23	18	78	Pass
0.3482	23	17	73	Pass
0.3525	21	17	80	Pass
0.3568	20	17	85	Pass
0.3611	19	17	89	Pass
0.3654	19	15	78	Pass
0.3697	19	15	78	Pass
0.3740	18	14	77	Pass
0.3782	18	13	72	Pass
0.3825	18	13	72	Pass
0.3868	18	13	72	Pass
0.3911	18	13	72	Pass
0.3954	18	13	72	Pass
0.3997	17	13	76	Pass
0.4040	17	13	76	Pass
0.4083	17	12	70	Pass
0.4126	17	12	70	Pass
0.4169	17	12	70	Pass
0.4211	17	12	70	Pass
0.4254	15	12	80	Pass
0.4297	14	12	85	Pass
0.4340	14	12	85	Pass
0.4383	14	12	85	Pass
0.4426	14	12	85	Pass
0.4469	14	12	85	Pass
0.4512	14	12	85	Pass
0.4555	13	12	92	Pass
0.4598	13	12	92	Pass
0.4641	13	12	92	Pass
0.4683	13	11	84	Pass

0.4726	13	11	84	Pass
0.4769	13	10	76	Pass
0.4812	13	10	76	Pass

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.**

Wetlands Input Volume
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	1.0971	0.9664	88.1	Pass
Feb	0.9454	0.8322	88.0	Pass
Mar	0.7053	0.6271	88.9	Pass
Apr	0.3191	0.2925	91.7	Pass
May	0.1080	0.1047	96.9	Pass
Jun	0.0387	0.0422	109.0	Pass
Jul	0.0079	0.0096	122.6	Fail
Aug	0.0008	0.0015	182.5	Fail
Sep	0.0060	0.0093	154.3	Fail
Oct	0.0737	0.0875	118.7	Fail
Nov	0.5991	0.5492	91.7	Pass
Dec	1.0717	0.9470	88.4	Pass

Day	Series 1	Series 2	Percent	Pass/Fail
Jan1	0.0319	0.0283	88.9	Pass
2	0.0328	0.0292	89.1	Pass
3	0.0371	0.0326	87.9	Pass
4	0.0362	0.0314	86.8	Pass
5	0.0340	0.0299	87.8	Pass
6	0.0339	0.0299	88.3	Pass
7	0.0341	0.0300	88.1	Pass
8	0.0323	0.0284	88.0	Pass
9	0.0327	0.0290	88.7	Pass
10	0.0329	0.0291	88.5	Pass
11	0.0340	0.0299	88.0	Pass
12	0.0328	0.0288	87.8	Pass
13	0.0355	0.0313	88.2	Pass
14	0.0398	0.0348	87.2	Pass
15	0.0404	0.0350	86.5	Pass
16	0.0393	0.0343	87.1	Pass
17	0.0386	0.0339	87.7	Pass
18	0.0415	0.0365	88.0	Pass
19	0.0432	0.0377	87.3	Pass
20	0.0424	0.0369	87.1	Pass
21	0.0362	0.0320	88.3	Pass
22	0.0346	0.0310	89.8	Pass
23	0.0367	0.0326	89.0	Pass

24	0.0382	0.0335	87.7	Pass
25	0.0354	0.0309	87.5	Pass
26	0.0355	0.0314	88.5	Pass
27	0.0344	0.0303	88.1	Pass
28	0.0321	0.0284	88.4	Pass
29	0.0284	0.0253	89.3	Pass
30	0.0277	0.0250	90.2	Pass
31	0.0315	0.0280	89.0	Pass
Feb1	0.0346	0.0303	87.5	Pass
2	0.0337	0.0292	86.8	Pass
3	0.0336	0.0294	87.5	Pass
4	0.0289	0.0256	88.7	Pass
5	0.0327	0.0292	89.3	Pass
6	0.0344	0.0300	87.0	Pass
7	0.0336	0.0294	87.4	Pass
8	0.0337	0.0294	87.4	Pass
9	0.0303	0.0267	88.2	Pass
10	0.0298	0.0264	88.7	Pass
11	0.0290	0.0258	88.9	Pass
12	0.0303	0.0267	88.2	Pass
13	0.0312	0.0274	87.9	Pass
14	0.0307	0.0269	87.7	Pass
15	0.0310	0.0275	88.5	Pass
16	0.0369	0.0325	88.1	Pass
17	0.0414	0.0359	86.7	Pass
18	0.0436	0.0377	86.5	Pass
19	0.0442	0.0382	86.4	Pass
20	0.0389	0.0340	87.3	Pass
21	0.0343	0.0306	89.2	Pass
22	0.0320	0.0288	89.9	Pass
23	0.0285	0.0257	90.2	Pass
24	0.0299	0.0270	90.2	Pass
25	0.0322	0.0284	88.1	Pass
26	0.0326	0.0287	88.1	Pass
27	0.0339	0.0297	87.5	Pass
28	0.0331	0.0290	87.6	Pass
29	0.0291	0.0256	87.9	Pass
Mar1	0.0269	0.0241	89.6	Pass
2	0.0264	0.0236	89.6	Pass
3	0.0254	0.0227	89.6	Pass
4	0.0254	0.0226	89.1	Pass
5	0.0251	0.0224	89.2	Pass
6	0.0238	0.0211	88.7	Pass
7	0.0215	0.0194	90.2	Pass
8	0.0237	0.0213	90.2	Pass
9	0.0255	0.0225	88.1	Pass
10	0.0245	0.0215	87.9	Pass
11	0.0247	0.0219	88.7	Pass
12	0.0252	0.0223	88.6	Pass
13	0.0246	0.0217	88.3	Pass
14	0.0243	0.0216	88.7	Pass
15	0.0231	0.0205	88.7	Pass
16	0.0212	0.0189	89.2	Pass
17	0.0195	0.0176	90.1	Pass
18	0.0178	0.0161	90.3	Pass
19	0.0177	0.0160	90.6	Pass
20	0.0173	0.0156	89.8	Pass

21	0.0177	0.0158	89.5	Pass
22	0.0214	0.0190	88.7	Pass
23	0.0226	0.0195	86.6	Pass
24	0.0219	0.0191	87.3	Pass
25	0.0213	0.0188	88.1	Pass
26	0.0210	0.0187	89.2	Pass
27	0.0215	0.0191	88.6	Pass
28	0.0210	0.0187	89.1	Pass
29	0.0224	0.0199	88.9	Pass
30	0.0223	0.0197	88.5	Pass
31	0.0213	0.0189	88.7	Pass
Apr1	0.0177	0.0159	89.9	Pass
2	0.0140	0.0129	92.6	Pass
3	0.0131	0.0123	94.5	Pass
4	0.0140	0.0129	92.6	Pass
5	0.0142	0.0129	90.5	Pass
6	0.0135	0.0121	90.1	Pass
7	0.0131	0.0118	90.3	Pass
8	0.0140	0.0126	89.9	Pass
9	0.0143	0.0127	89.0	Pass
10	0.0146	0.0130	89.1	Pass
11	0.0133	0.0120	90.1	Pass
12	0.0129	0.0117	90.8	Pass
13	0.0106	0.0097	92.3	Pass
14	0.0083	0.0080	95.9	Pass
15	0.0071	0.0069	97.5	Pass
16	0.0066	0.0065	98.8	Pass
17	0.0072	0.0068	95.0	Pass
18	0.0065	0.0061	94.5	Pass
19	0.0075	0.0070	93.5	Pass
20	0.0093	0.0082	89.1	Pass
21	0.0088	0.0078	88.7	Pass
22	0.0082	0.0075	90.5	Pass
23	0.0096	0.0087	90.5	Pass
24	0.0096	0.0085	89.2	Pass
25	0.0077	0.0070	91.4	Pass
26	0.0064	0.0061	95.9	Pass
27	0.0060	0.0058	97.1	Pass
28	0.0054	0.0053	97.9	Pass
29	0.0048	0.0047	98.9	Pass
30	0.0048	0.0048	99.1	Pass
May1	0.0070	0.0066	94.0	Pass
2	0.0077	0.0069	89.9	Pass
3	0.0072	0.0065	90.9	Pass
4	0.0068	0.0063	92.9	Pass
5	0.0070	0.0065	92.9	Pass
6	0.0064	0.0059	92.6	Pass
7	0.0056	0.0054	95.0	Pass
8	0.0048	0.0046	96.7	Pass
9	0.0035	0.0036	101.3	Pass
10	0.0027	0.0029	106.2	Pass
11	0.0025	0.0026	105.1	Pass
12	0.0022	0.0023	103.5	Pass
13	0.0024	0.0024	100.5	Pass
14	0.0022	0.0022	100.0	Pass
15	0.0018	0.0020	106.1	Pass
16	0.0024	0.0025	103.6	Pass

17	0.0029	0.0028	97.4	Pass
18	0.0025	0.0025	98.7	Pass
19	0.0020	0.0021	106.4	Pass
20	0.0023	0.0024	103.8	Pass
21	0.0022	0.0023	101.1	Pass
22	0.0022	0.0022	100.2	Pass
23	0.0022	0.0022	98.5	Pass
24	0.0022	0.0021	97.7	Pass
25	0.0023	0.0022	96.1	Pass
26	0.0021	0.0020	96.8	Pass
27	0.0021	0.0020	97.5	Pass
28	0.0019	0.0019	99.0	Pass
29	0.0021	0.0021	100.2	Pass
30	0.0020	0.0020	100.8	Pass
31	0.0018	0.0019	106.5	Pass
Jun1	0.0019	0.0021	106.4	Pass
2	0.0026	0.0026	99.0	Pass
3	0.0023	0.0023	97.9	Pass
4	0.0021	0.0021	102.2	Pass
5	0.0024	0.0025	100.6	Pass
6	0.0022	0.0022	101.3	Pass
7	0.0022	0.0022	100.6	Pass
8	0.0019	0.0020	102.1	Pass
9	0.0023	0.0024	102.0	Pass
10	0.0024	0.0024	100.3	Pass
11	0.0021	0.0022	102.5	Pass
12	0.0015	0.0017	110.1	Pass
13	0.0012	0.0014	117.5	Pass
14	0.0009	0.0012	124.3	Fail
15	0.0008	0.0010	126.2	Fail
16	0.0007	0.0009	129.9	Fail
17	0.0006	0.0008	132.4	Fail
18	0.0008	0.0010	119.2	Pass
19	0.0008	0.0009	116.1	Pass
20	0.0006	0.0008	124.4	Fail
21	0.0006	0.0007	126.3	Fail
22	0.0005	0.0007	135.8	Fail
23	0.0006	0.0008	128.8	Fail
24	0.0007	0.0008	117.8	Pass
25	0.0005	0.0007	129.2	Fail
26	0.0004	0.0006	148.4	Fail
27	0.0004	0.0006	141.6	Fail
28	0.0004	0.0005	137.3	Fail
29	0.0004	0.0005	129.1	Fail
30	0.0005	0.0005	117.7	Pass
Jul1	0.0006	0.0007	110.9	Pass
2	0.0006	0.0006	109.8	Pass
3	0.0004	0.0005	127.4	Fail
4	0.0003	0.0004	151.3	Fail
5	0.0002	0.0004	161.2	Fail
6	0.0002	0.0003	177.8	Fail
7	0.0002	0.0003	159.1	Fail
8	0.0002	0.0003	148.4	Fail
9	0.0002	0.0003	162.8	Fail
10	0.0001	0.0002	181.8	Fail
11	0.0001	0.0002	155.7	Fail
12	0.0005	0.0005	105.6	Pass

13	0.0006	0.0006	92.1	Pass
14	0.0007	0.0007	97.8	Pass
15	0.0006	0.0006	104.3	Pass
16	0.0004	0.0005	118.4	Pass
17	0.0003	0.0004	134.8	Fail
18	0.0004	0.0004	115.5	Pass
19	0.0003	0.0003	114.0	Pass
20	0.0002	0.0002	123.7	Fail
21	0.0001	0.0002	133.8	Fail
22	0.0001	0.0001	152.9	Fail
23	0.0001	0.0001	182.0	Fail
24	0.0000	0.0001	211.9	Fail
25	0.0000	0.0001	210.2	Fail
26	0.0000	0.0000	180.6	Fail
27	0.0000	0.0000	154.5	Fail
28	0.0000	0.0000	143.6	Fail
29	0.0000	0.0000	145.2	Fail
30	0.0000	0.0000	150.8	Fail
31	0.0000	0.0000	132.2	Fail
Aug1	0.0000	0.0000	112.5	Pass
2	0.0000	0.0000	106.2	Pass
3	0.0000	0.0000	107.4	Pass
4	0.0000	0.0000	159.4	Fail
5	0.0000	0.0000	194.5	Fail
6	0.0000	0.0000	212.3	Fail
7	0.0000	0.0000	213.9	Fail
8	0.0000	0.0000	200.4	Fail
9	0.0000	0.0000	188.1	Fail
10	0.0000	0.0000	127.6	Fail
11	0.0000	0.0000	119.7	Pass
12	0.0000	0.0000	150.7	Fail
13	0.0000	0.0000	179.9	Fail
14	0.0000	0.0000	161.2	Fail
15	0.0000	0.0000	138.1	Fail
16	0.0000	0.0000	127.9	Fail
17	0.0000	0.0000	128.8	Fail
18	0.0000	0.0000	141.3	Fail
19	0.0000	0.0000	167.9	Fail
20	0.0000	0.0000	177.9	Fail
21	0.0000	0.0000	188.7	Fail
22	0.0000	0.0000	166.2	Fail
23	0.0000	0.0000	132.8	Fail
24	0.0000	0.0001	130.3	Fail
25	0.0000	0.0001	159.9	Fail
26	0.0001	0.0001	181.4	Fail
27	0.0001	0.0001	199.4	Fail
28	0.0001	0.0001	210.1	Fail
29	0.0001	0.0002	247.5	Fail
30	0.0001	0.0002	303.8	Fail
31	0.0005	0.0006	116.5	Pass
Sep1	0.0006	0.0006	101.7	Pass
2	0.0005	0.0005	113.6	Pass
3	0.0003	0.0004	139.5	Fail
4	0.0002	0.0004	176.3	Fail
5	0.0001	0.0003	218.8	Fail
6	0.0001	0.0002	264.5	Fail
7	0.0001	0.0002	281.0	Fail

8	0.0001	0.0001	251.7	Fail
9	0.0001	0.0001	248.5	Fail
10	0.0000	0.0001	269.2	Fail
11	0.0000	0.0001	301.6	Fail
12	0.0000	0.0001	318.8	Fail
13	0.0000	0.0001	328.0	Fail
14	0.0000	0.0001	248.7	Fail
15	0.0000	0.0001	183.7	Fail
16	0.0000	0.0001	141.1	Fail
17	0.0001	0.0001	136.9	Fail
18	0.0001	0.0001	160.3	Fail
19	0.0001	0.0002	206.6	Fail
20	0.0001	0.0002	208.9	Fail
21	0.0002	0.0004	156.0	Fail
22	0.0007	0.0007	100.6	Pass
23	0.0006	0.0007	104.6	Pass
24	0.0005	0.0006	134.0	Fail
25	0.0003	0.0006	179.6	Fail
26	0.0002	0.0005	228.4	Fail
27	0.0002	0.0004	257.2	Fail
28	0.0001	0.0004	285.2	Fail
29	0.0001	0.0003	350.0	Fail
30	0.0002	0.0004	251.5	Fail
Oct1	0.0004	0.0006	150.9	Fail
2	0.0004	0.0006	168.1	Fail
3	0.0003	0.0006	225.6	Fail
4	0.0003	0.0006	249.6	Fail
5	0.0003	0.0006	240.7	Fail
6	0.0018	0.0020	107.8	Pass
7	0.0024	0.0023	96.1	Pass
8	0.0022	0.0023	104.4	Pass
9	0.0022	0.0025	110.1	Pass
10	0.0018	0.0023	124.2	Fail
11	0.0016	0.0022	138.8	Fail
12	0.0014	0.0021	148.2	Fail
13	0.0011	0.0018	159.3	Fail
14	0.0010	0.0017	167.1	Fail
15	0.0010	0.0016	156.9	Fail
16	0.0015	0.0019	131.1	Fail
17	0.0017	0.0020	123.2	Fail
18	0.0023	0.0026	112.4	Pass
19	0.0022	0.0026	117.3	Pass
20	0.0024	0.0029	123.3	Fail
21	0.0026	0.0032	124.1	Fail
22	0.0028	0.0034	123.1	Fail
23	0.0026	0.0034	130.4	Fail
24	0.0030	0.0038	126.5	Fail
25	0.0031	0.0039	127.3	Fail
26	0.0043	0.0050	118.0	Pass
27	0.0059	0.0064	107.3	Pass
28	0.0070	0.0072	103.9	Pass
29	0.0071	0.0073	104.0	Pass
30	0.0072	0.0077	106.4	Pass
31	0.0094	0.0094	100.0	Pass
Nov1	0.0086	0.0086	99.1	Pass
2	0.0094	0.0093	98.4	Pass
3	0.0093	0.0090	97.3	Pass

4	0.0084	0.0085	102.0	Pass
5	0.0077	0.0083	107.6	Pass
6	0.0086	0.0092	107.4	Pass
7	0.0096	0.0098	102.3	Pass
8	0.0095	0.0097	102.7	Pass
9	0.0111	0.0110	99.3	Pass
10	0.0129	0.0124	96.4	Pass
11	0.0147	0.0138	93.9	Pass
12	0.0161	0.0148	92.4	Pass
13	0.0175	0.0162	92.5	Pass
14	0.0187	0.0171	91.3	Pass
15	0.0189	0.0174	92.1	Pass
16	0.0215	0.0197	91.7	Pass
17	0.0211	0.0193	91.1	Pass
18	0.0219	0.0198	90.6	Pass
19	0.0247	0.0223	90.2	Pass
20	0.0258	0.0229	88.7	Pass
21	0.0258	0.0230	89.0	Pass
22	0.0272	0.0244	89.4	Pass
23	0.0326	0.0290	89.1	Pass
24	0.0367	0.0321	87.5	Pass
25	0.0396	0.0344	86.9	Pass
26	0.0367	0.0320	87.1	Pass
27	0.0331	0.0295	89.2	Pass
28	0.0312	0.0281	90.3	Pass
29	0.0310	0.0282	90.8	Pass
30	0.0329	0.0293	89.0	Pass
Dec1	0.0327	0.0290	88.6	Pass
2	0.0351	0.0311	88.6	Pass
3	0.0378	0.0330	87.4	Pass
4	0.0381	0.0333	87.3	Pass
5	0.0379	0.0332	87.6	Pass
6	0.0367	0.0323	88.2	Pass
7	0.0346	0.0309	89.2	Pass
8	0.0319	0.0287	89.9	Pass
9	0.0291	0.0266	91.4	Pass
10	0.0321	0.0290	90.2	Pass
11	0.0336	0.0298	88.7	Pass
12	0.0338	0.0297	87.9	Pass
13	0.0333	0.0295	88.5	Pass
14	0.0346	0.0306	88.4	Pass
15	0.0347	0.0306	88.2	Pass
16	0.0366	0.0323	88.2	Pass
17	0.0353	0.0309	87.4	Pass
18	0.0315	0.0279	88.5	Pass
19	0.0322	0.0288	89.5	Pass
20	0.0346	0.0305	88.2	Pass
21	0.0371	0.0324	87.3	Pass
22	0.0369	0.0321	87.0	Pass
23	0.0339	0.0297	87.7	Pass
24	0.0325	0.0289	89.0	Pass
25	0.0332	0.0297	89.3	Pass
26	0.0376	0.0332	88.1	Pass
27	0.0361	0.0315	87.3	Pass
28	0.0351	0.0309	88.1	Pass
29	0.0365	0.0322	88.2	Pass
30	0.0338	0.0296	87.6	Pass

31 0.0327 0.0291 88.9 Pass

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

WWHM2012
PROJECT REPORT

Project Name: Overall Wetland 2024.09.18
Site Name: Sunset Pointe
Site Address: 2301 23rd Ave Ne
City : Puyallup
Report Date: 9/19/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Building Roof Areas
Bypass: No

Impervious Land Use	acre
ROOF TOPS FLAT	0.383

Element Flows To:

Outlet 1	Outlet 2
Pasture	

Name : Pasture
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	2.026

Element Flows To:

Surface	Interflow	Groundwater
Buffer Area	Buffer Area	Buffer Area

Name : Gravel
Bypass: No

Impervious Land Use	acre
ROADS FLAT	0.272

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Northside of Bufffer
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.964**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Buffer Area
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**2.38**

Element Flows To:

Surface	**Interflow**	**Groundwater**

MITIGATED LAND USE

Name : Buffer Area
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**2.38**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Rear Yards of Lots 1, 3-8
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.71**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Gravel Path (north of Buffer)
Bypass: No

Impervious Land Use	**acre**
ROADS MOD	**0.023**

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Roof Area lots 9-14
Bypass: No

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.413**

Element Flows To:

Outlet 1	**Outlet 2**
Lawn Lots 9-15	

Name : Lawn Lots 9-15
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.543**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Forest Lots 9-15	Forest Lots 9-15	Forest Lots 9-15

Name : Forest Lots 9-15
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**.394**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Gravel Path South of Buffer
Bypass: No

Impervious Land Use	**acre**
ROADS MOD	**0.053**

Element Flows To:

Outlet 1	**Outlet 2**
Buffer Area	

Name : Tract B Forest
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**.446**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Buffer Area	Buffer Area	Buffer Area

Name : Roof Lots 15-18
Bypass: No

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.137**

Element Flows To:

Outlet 1	**Outlet 2**
Lawn (50/50)	

Name : Forest Lot 16-18
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	**.23**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Lawn 16-18	Lawn 16-18	Lawn 16-18

Name : Lawn 16-18
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	**.32**

Element Flows To:

Surface	Interflow	Groundwater
23rd Onsite	23rd Onsite	

Name : 23rd Onsite
Bypass: No

Impervious Land Use	acre
ROADS FLAT	**0.27**

Element Flows To:

Outlet 1	Outlet 2
Tract B Forest	

Name : Driveways Lots 9-18
Bypass: No

Impervious Land Use	acre
DRIVEWAYS MOD	**0.23**

Element Flows To:

Outlet 1	Outlet 2
23rd Onsite	

Name : Lawn (50/50)
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	**.137**

Element Flows To:

Surface	Interflow	Groundwater
Buffer Area	Buffer Area	Buffer Area

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:5.37
Total Impervious Area:0.655

Mitigated Landuse Totals for POC #1
Total Pervious Area:5.16
Total Impervious Area:1.126

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.112872
5 year	0.193671
10 year	0.264542
25 year	0.37753
50 year	0.481219
100 year	0.603897

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.102017
5 year	0.175111
10 year	0.240653
25 year	0.347321
50 year	0.447146
100 year	0.567241

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

Year	Predeveloped	Mitigated
1902	0.095	0.090
1903	0.081	0.074
1904	0.332	0.246
1905	0.075	0.070
1906	0.031	0.028
1907	0.156	0.142
1908	0.110	0.101
1909	0.095	0.088
1910	0.147	0.133
1911	0.115	0.106
1912	1.091	1.121
1913	0.186	0.172
1914	0.049	0.046
1915	0.094	0.092
1916	0.112	0.099
1917	0.041	0.035
1918	0.139	0.136

1919	0.116	0.110
1920	0.113	0.105
1921	0.131	0.126
1922	0.179	0.151
1923	0.108	0.098
1924	0.065	0.056
1925	0.072	0.068
1926	0.101	0.090
1927	0.067	0.059
1928	0.085	0.081
1929	0.148	0.131
1930	0.097	0.089
1931	0.098	0.088
1932	0.086	0.084
1933	0.112	0.103
1934	0.268	0.233
1935	0.111	0.110
1936	0.109	0.106
1937	0.147	0.130
1938	0.117	0.107
1939	0.024	0.022
1940	0.120	0.117
1941	0.051	0.048
1942	0.195	0.192
1943	0.086	0.082
1944	0.225	0.200
1945	0.120	0.107
1946	0.106	0.094
1947	0.060	0.052
1948	0.202	0.180
1949	0.206	0.186
1950	0.068	0.061
1951	0.082	0.076
1952	0.585	0.561
1953	0.282	0.274
1954	0.108	0.107
1955	0.083	0.073
1956	0.056	0.053
1957	0.144	0.130
1958	0.299	0.275
1959	0.250	0.232
1960	0.055	0.050
1961	0.258	0.219
1962	0.102	0.094
1963	0.063	0.057
1964	0.104	0.085
1965	0.197	0.180
1966	0.061	0.053
1967	0.134	0.107
1968	0.122	0.106
1969	0.091	0.082
1970	0.138	0.128
1971	0.214	0.200
1972	0.142	0.127
1973	0.210	0.182
1974	0.127	0.110
1975	0.351	0.343

1976	0.225	0.180
1977	0.062	0.056
1978	0.203	0.185
1979	0.069	0.068
1980	0.124	0.116
1981	0.111	0.111
1982	0.060	0.055
1983	0.194	0.174
1984	0.097	0.091
1985	0.205	0.162
1986	0.119	0.111
1987	0.264	0.230
1988	0.104	0.097
1989	0.114	0.101
1990	0.136	0.120
1991	0.112	0.097
1992	0.122	0.119
1993	0.140	0.125
1994	0.191	0.172
1995	0.069	0.068
1996	0.278	0.254
1997	0.080	0.072
1998	0.126	0.120
1999	0.045	0.042
2000	0.116	0.111
2001	0.047	0.045
2002	0.353	0.313
2003	0.144	0.134
2004	0.105	0.100
2005	0.497	0.439
2006	0.074	0.071
2007	0.081	0.080
2008	0.122	0.113
2009	0.091	0.086
2010	0.075	0.070
2011	0.059	0.057
2012	0.109	0.094
2013	0.072	0.067
2014	0.064	0.063
2015	0.237	0.192
2016	0.043	0.038
2017	0.135	0.119
2018	0.360	0.335
2019	0.397	0.335
2020	0.113	0.104
2021	0.137	0.124
2022	0.068	0.065
2023	0.120	0.110
2024	0.936	0.981
2025	0.133	0.124
2026	0.175	0.161
2027	0.090	0.082
2028	0.065	0.061
2029	0.110	0.099
2030	0.198	0.182
2031	0.073	0.065
2032	0.052	0.052

2033	0.075	0.069
2034	0.081	0.069
2035	0.247	0.228
2036	0.129	0.117
2037	0.045	0.039
2038	0.145	0.126
2039	0.029	0.026
2040	0.091	0.085
2041	0.090	0.080
2042	0.264	0.242
2043	0.146	0.136
2044	0.167	0.156
2045	0.119	0.114
2046	0.151	0.141
2047	0.105	0.099
2048	0.129	0.115
2049	0.104	0.094
2050	0.076	0.068
2051	0.172	0.154
2052	0.084	0.079
2053	0.141	0.137
2054	0.351	0.231
2055	0.066	0.060
2056	0.070	0.063
2057	0.104	0.095
2058	0.111	0.102
2059	0.184	0.156

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

Rank	Predeveloped	Mitigated
1	1.0909	1.1214
2	0.9355	0.9813
3	0.5848	0.5608
4	0.4975	0.4386
5	0.3967	0.3432
6	0.3602	0.3355
7	0.3530	0.3347
8	0.3509	0.3134
9	0.3508	0.2749
10	0.3316	0.2744
11	0.2990	0.2541
12	0.2818	0.2461
13	0.2780	0.2418
14	0.2678	0.2329
15	0.2643	0.2323
16	0.2638	0.2312
17	0.2582	0.2298
18	0.2499	0.2282
19	0.2474	0.2187
20	0.2371	0.2005
21	0.2248	0.1999
22	0.2246	0.1917
23	0.2141	0.1915
24	0.2099	0.1859
25	0.2064	0.1853

26	0.2050	0.1824
27	0.2032	0.1822
28	0.2015	0.1804
29	0.1983	0.1802
30	0.1971	0.1799
31	0.1952	0.1740
32	0.1941	0.1723
33	0.1907	0.1716
34	0.1864	0.1623
35	0.1839	0.1606
36	0.1793	0.1562
37	0.1748	0.1557
38	0.1718	0.1545
39	0.1672	0.1509
40	0.1562	0.1415
41	0.1508	0.1410
42	0.1479	0.1374
43	0.1473	0.1361
44	0.1471	0.1357
45	0.1460	0.1342
46	0.1448	0.1330
47	0.1443	0.1305
48	0.1437	0.1302
49	0.1423	0.1295
50	0.1405	0.1281
51	0.1398	0.1269
52	0.1391	0.1258
53	0.1385	0.1255
54	0.1374	0.1251
55	0.1355	0.1237
56	0.1350	0.1235
57	0.1343	0.1199
58	0.1334	0.1195
59	0.1311	0.1194
60	0.1294	0.1193
61	0.1287	0.1170
62	0.1272	0.1169
63	0.1260	0.1165
64	0.1245	0.1154
65	0.1219	0.1136
66	0.1218	0.1129
67	0.1216	0.1109
68	0.1202	0.1105
69	0.1199	0.1105
70	0.1198	0.1102
71	0.1192	0.1101
72	0.1192	0.1098
73	0.1172	0.1096
74	0.1160	0.1075
75	0.1160	0.1075
76	0.1153	0.1074
77	0.1140	0.1072
78	0.1134	0.1064
79	0.1131	0.1061
80	0.1121	0.1057
81	0.1120	0.1054
82	0.1118	0.1041

83	0.1112	0.1031
84	0.1112	0.1019
85	0.1110	0.1012
86	0.1105	0.1007
87	0.1098	0.1000
88	0.1095	0.0991
89	0.1094	0.0990
90	0.1084	0.0989
91	0.1076	0.0984
92	0.1057	0.0974
93	0.1055	0.0974
94	0.1052	0.0946
95	0.1045	0.0944
96	0.1043	0.0943
97	0.1038	0.0943
98	0.1038	0.0938
99	0.1019	0.0925
100	0.1014	0.0915
101	0.0975	0.0898
102	0.0966	0.0896
103	0.0966	0.0887
104	0.0954	0.0878
105	0.0949	0.0878
106	0.0940	0.0856
107	0.0911	0.0849
108	0.0909	0.0848
109	0.0908	0.0837
110	0.0902	0.0820
111	0.0897	0.0820
112	0.0863	0.0817
113	0.0858	0.0810
114	0.0851	0.0801
115	0.0840	0.0796
116	0.0835	0.0790
117	0.0824	0.0759
118	0.0813	0.0735
119	0.0812	0.0733
120	0.0810	0.0720
121	0.0797	0.0713
122	0.0763	0.0704
123	0.0750	0.0703
124	0.0748	0.0694
125	0.0745	0.0690
126	0.0739	0.0685
127	0.0725	0.0684
128	0.0722	0.0681
129	0.0717	0.0676
130	0.0697	0.0666
131	0.0694	0.0650
132	0.0689	0.0649
133	0.0683	0.0632
134	0.0678	0.0627
135	0.0673	0.0613
136	0.0661	0.0610
137	0.0654	0.0603
138	0.0653	0.0593
139	0.0644	0.0571

140	0.0627	0.0571
141	0.0616	0.0556
142	0.0610	0.0556
143	0.0604	0.0549
144	0.0598	0.0531
145	0.0594	0.0527
146	0.0555	0.0522
147	0.0554	0.0516
148	0.0516	0.0503
149	0.0509	0.0476
150	0.0487	0.0457
151	0.0466	0.0450
152	0.0452	0.0416
153	0.0447	0.0392
154	0.0428	0.0385
155	0.0414	0.0352
156	0.0314	0.0283
157	0.0286	0.0261
158	0.0237	0.0220

Stream Protection Duration
POC #1
The Facility FAILED

Facility FAILED duration standard for 1+ flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0564	131189	128973	98	Pass
0.0607	111798	109305	97	Pass
0.0650	91743	89472	97	Pass
0.0693	78724	76674	97	Pass
0.0736	68143	65816	96	Pass
0.0779	59168	56786	95	Pass
0.0822	49462	47528	96	Pass
0.0865	43262	40841	94	Pass
0.0908	38105	35207	92	Pass
0.0951	32083	29562	92	Pass
0.0993	28083	25800	91	Pass
0.1036	24692	22199	89	Pass
0.1079	21573	19036	88	Pass
0.1122	18194	16000	87	Pass
0.1165	16050	14083	87	Pass
0.1208	14171	12377	87	Pass
0.1251	12210	10471	85	Pass
0.1294	10875	9352	85	Pass
0.1337	9762	8515	87	Pass
0.1380	8604	7800	90	Pass
0.1423	7662	6975	91	Pass
0.1465	7058	6354	90	Pass
0.1508	6582	5800	88	Pass
0.1551	5900	5073	85	Pass
0.1594	5409	4649	85	Pass
0.1637	4963	4240	85	Pass
0.1680	4540	3765	82	Pass
0.1723	4013	3168	78	Pass
0.1766	3642	2829	77	Pass

0.1809	3329	2479	74	Pass
0.1852	2950	2159	73	Pass
0.1894	2667	1921	72	Pass
0.1937	2383	1709	71	Pass
0.1980	1978	1474	74	Pass
0.2023	1771	1337	75	Pass
0.2066	1602	1220	76	Pass
0.2109	1472	1123	76	Pass
0.2152	1326	997	75	Pass
0.2195	1212	885	73	Pass
0.2238	1102	785	71	Pass
0.2281	995	629	63	Pass
0.2324	897	466	51	Pass
0.2366	835	404	48	Pass
0.2409	766	348	45	Pass
0.2452	636	297	46	Pass
0.2495	493	279	56	Pass
0.2538	411	250	60	Pass
0.2581	334	219	65	Pass
0.2624	284	191	67	Pass
0.2667	244	165	67	Pass
0.2710	227	140	61	Pass
0.2753	200	108	54	Pass
0.2796	177	85	48	Pass
0.2838	156	44	28	Pass
0.2881	125	37	29	Pass
0.2924	93	35	37	Pass
0.2967	60	32	53	Pass
0.3010	47	31	65	Pass
0.3053	34	29	85	Pass
0.3096	33	28	84	Pass
0.3139	32	26	81	Pass
0.3182	27	25	92	Pass
0.3225	27	24	88	Pass
0.3268	26	24	92	Pass
0.3310	25	24	96	Pass
0.3353	24	22	91	Pass
0.3396	24	21	87	Pass
0.3439	23	21	91	Pass
0.3482	23	19	82	Pass
0.3525	21	19	90	Pass
0.3568	20	19	95	Pass
0.3611	19	19	100	Pass
0.3654	19	19	100	Pass
0.3697	19	19	100	Pass
0.3740	18	19	105	Pass
0.3782	18	19	105	Pass
0.3825	18	19	105	Pass
0.3868	18	18	100	Pass
0.3911	18	17	94	Pass
0.3954	18	17	94	Pass
0.3997	17	17	100	Pass
0.4040	17	17	100	Pass
0.4083	17	17	100	Pass
0.4126	17	17	100	Pass
0.4169	17	17	100	Pass
0.4211	17	17	100	Pass

0.4254	15	17	113	Fail
0.4297	14	17	121	Fail
0.4340	14	17	121	Fail
0.4383	14	17	121	Fail
0.4426	14	16	114	Fail
0.4469	14	16	114	Fail
0.4512	14	16	114	Fail
0.4555	13	16	123	Fail
0.4598	13	15	115	Fail
0.4641	13	14	107	Pass
0.4683	13	14	107	Pass
0.4726	13	14	107	Pass
0.4769	13	12	92	Pass
0.4812	13	11	84	Pass

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.

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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

ROADWAY BASIN

WWHM2012
PROJECT REPORT

Project Name: Roadway
Site Name: Sunset
Site Address: 2301 23rd
City : Puyallup
Report Date: 6/25/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.009
Pervious Total	**0.009**

Impervious Land Use	acre
ROADS FLAT	0.149
Impervious Total	**0.149**
Basin Total	**0.158**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.046
Pervious Total	0.046

Impervious Land Use	acre
ROADS FLAT	0.1
Impervious Total	0.1
Basin Total	0.146

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.009
Total Impervious Area:0.149

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.046
Total Impervious Area:0.1

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.053546
5 year	0.071826
10 year	0.085106
25 year	0.103273
50 year	0.117847
100 year	0.133343

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.036445
5 year	0.048897
10 year	0.057944
25 year	0.070323
50 year	0.080255
100 year	0.090815

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

Year	Predeveloped	Mitigated
1902	0.063	0.042
1903	0.070	0.047
1904	0.080	0.056
1905	0.036	0.024
1906	0.040	0.027
1907	0.053	0.037
1908	0.044	0.030
1909	0.054	0.036
1910	0.051	0.035
1911	0.058	0.039
1912	0.097	0.070
1913	0.042	0.028
1914	0.178	0.120
1915	0.036	0.025
1916	0.067	0.045
1917	0.027	0.018
1918	0.053	0.036
1919	0.034	0.023
1920	0.044	0.030
1921	0.038	0.026
1922	0.059	0.041
1923	0.041	0.028
1924	0.078	0.052
1925	0.033	0.023
1926	0.063	0.042
1927	0.054	0.036
1928	0.038	0.027
1929	0.076	0.051
1930	0.081	0.054
1931	0.039	0.026
1932	0.042	0.029
1933	0.041	0.028
1934	0.067	0.047
1935	0.036	0.024
1936	0.049	0.034
1937	0.065	0.044
1938	0.037	0.025
1939	0.045	0.030
1940	0.081	0.054
1941	0.088	0.059
1942	0.060	0.041
1943	0.059	0.040
1944	0.085	0.057
1945	0.064	0.043
1946	0.050	0.035
1947	0.039	0.026
1948	0.053	0.036
1949	0.082	0.055
1950	0.046	0.031
1951	0.070	0.047
1952	0.080	0.056
1953	0.074	0.052

1954	0.043	0.030
1955	0.041	0.027
1956	0.038	0.025
1957	0.043	0.029
1958	0.054	0.038
1959	0.054	0.038
1960	0.044	0.029
1961	0.121	0.081
1962	0.052	0.035
1963	0.039	0.026
1964	0.112	0.075
1965	0.052	0.035
1966	0.042	0.029
1967	0.059	0.041
1968	0.050	0.034
1969	0.045	0.031
1970	0.051	0.035
1971	0.050	0.035
1972	0.163	0.110
1973	0.094	0.063
1974	0.069	0.047
1975	0.071	0.050
1976	0.076	0.052
1977	0.033	0.022
1978	0.055	0.039
1979	0.059	0.040
1980	0.057	0.039
1981	0.054	0.037
1982	0.044	0.030
1983	0.059	0.041
1984	0.059	0.040
1985	0.067	0.046
1986	0.034	0.024
1987	0.061	0.041
1988	0.036	0.024
1989	0.035	0.024
1990	0.043	0.030
1991	0.065	0.044
1992	0.062	0.042
1993	0.069	0.046
1994	0.048	0.033
1995	0.037	0.025
1996	0.050	0.034
1997	0.044	0.030
1998	0.053	0.037
1999	0.061	0.041
2000	0.050	0.034
2001	0.041	0.028
2002	0.074	0.052
2003	0.043	0.029
2004	0.064	0.043
2005	0.125	0.084
2006	0.058	0.039
2007	0.065	0.044
2008	0.053	0.036
2009	0.040	0.027
2010	0.052	0.035

2011	0.054	0.036
2012	0.051	0.035
2013	0.048	0.033
2014	0.047	0.032
2015	0.077	0.053
2016	0.051	0.034
2017	0.078	0.052
2018	0.047	0.034
2019	0.070	0.051
2020	0.057	0.039
2021	0.048	0.033
2022	0.080	0.054
2023	0.100	0.067
2024	0.105	0.075
2025	0.052	0.035
2026	0.059	0.040
2027	0.064	0.043
2028	0.025	0.017
2029	0.041	0.029
2030	0.087	0.059
2031	0.026	0.018
2032	0.044	0.029
2033	0.055	0.037
2034	0.042	0.028
2035	0.054	0.038
2036	0.043	0.029
2037	0.058	0.039
2038	0.055	0.038
2039	0.110	0.074
2040	0.043	0.030
2041	0.055	0.037
2042	0.064	0.043
2043	0.070	0.047
2044	0.048	0.033
2045	0.039	0.027
2046	0.043	0.030
2047	0.053	0.036
2048	0.044	0.029
2049	0.065	0.044
2050	0.049	0.033
2051	0.069	0.048
2052	0.053	0.035
2053	0.045	0.030
2054	0.088	0.061
2055	0.050	0.034
2056	0.070	0.047
2057	0.034	0.023
2058	0.066	0.044
2059	0.083	0.056

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

Rank	Predeveloped	Mitigated
1	0.1780	0.1195
2	0.1631	0.1097
3	0.1253	0.0842

4	0.1211	0.0814
5	0.1116	0.0755
6	0.1101	0.0752
7	0.1054	0.0739
8	0.0999	0.0700
9	0.0966	0.0671
10	0.0942	0.0632
11	0.0883	0.0606
12	0.0879	0.0593
13	0.0874	0.0587
14	0.0852	0.0575
15	0.0830	0.0564
16	0.0825	0.0557
17	0.0807	0.0555
18	0.0806	0.0554
19	0.0797	0.0542
20	0.0797	0.0541
21	0.0796	0.0535
22	0.0782	0.0532
23	0.0777	0.0525
24	0.0770	0.0524
25	0.0763	0.0521
26	0.0758	0.0519
27	0.0740	0.0518
28	0.0737	0.0513
29	0.0713	0.0507
30	0.0704	0.0502
31	0.0704	0.0477
32	0.0702	0.0473
33	0.0701	0.0473
34	0.0700	0.0471
35	0.0691	0.0470
36	0.0690	0.0469
37	0.0687	0.0468
38	0.0673	0.0464
39	0.0671	0.0461
40	0.0669	0.0451
41	0.0658	0.0441
42	0.0651	0.0437
43	0.0650	0.0437
44	0.0648	0.0437
45	0.0646	0.0435
46	0.0644	0.0432
47	0.0643	0.0432
48	0.0642	0.0431
49	0.0641	0.0431
50	0.0632	0.0424
51	0.0631	0.0424
52	0.0624	0.0419
53	0.0606	0.0412
54	0.0605	0.0411
55	0.0598	0.0408
56	0.0594	0.0407
57	0.0594	0.0407
58	0.0593	0.0406
59	0.0592	0.0401
60	0.0591	0.0401

61	0.0591	0.0400
62	0.0586	0.0397
63	0.0581	0.0394
64	0.0580	0.0393
65	0.0577	0.0391
66	0.0572	0.0390
67	0.0569	0.0388
68	0.0552	0.0387
69	0.0551	0.0383
70	0.0550	0.0381
71	0.0549	0.0378
72	0.0543	0.0376
73	0.0541	0.0373
74	0.0540	0.0371
75	0.0539	0.0370
76	0.0539	0.0369
77	0.0538	0.0365
78	0.0535	0.0363
79	0.0535	0.0363
80	0.0534	0.0361
81	0.0534	0.0361
82	0.0534	0.0359
83	0.0532	0.0359
84	0.0532	0.0359
85	0.0528	0.0354
86	0.0525	0.0353
87	0.0521	0.0352
88	0.0520	0.0351
89	0.0520	0.0351
90	0.0515	0.0351
91	0.0510	0.0349
92	0.0508	0.0347
93	0.0506	0.0346
94	0.0504	0.0345
95	0.0503	0.0344
96	0.0502	0.0342
97	0.0499	0.0341
98	0.0497	0.0341
99	0.0496	0.0340
100	0.0495	0.0337
101	0.0489	0.0337
102	0.0483	0.0334
103	0.0481	0.0333
104	0.0481	0.0331
105	0.0476	0.0329
106	0.0471	0.0327
107	0.0470	0.0315
108	0.0456	0.0308
109	0.0449	0.0306
110	0.0448	0.0303
111	0.0445	0.0303
112	0.0444	0.0301
113	0.0442	0.0300
114	0.0439	0.0300
115	0.0439	0.0299
116	0.0436	0.0297
117	0.0436	0.0296

118	0.0436	0.0296
119	0.0435	0.0295
120	0.0433	0.0295
121	0.0433	0.0294
122	0.0433	0.0293
123	0.0433	0.0293
124	0.0432	0.0293
125	0.0427	0.0291
126	0.0421	0.0287
127	0.0419	0.0286
128	0.0417	0.0285
129	0.0415	0.0284
130	0.0413	0.0282
131	0.0413	0.0281
132	0.0412	0.0279
133	0.0412	0.0277
134	0.0407	0.0273
135	0.0405	0.0272
136	0.0404	0.0271
137	0.0392	0.0269
138	0.0389	0.0265
139	0.0389	0.0265
140	0.0387	0.0264
141	0.0384	0.0262
142	0.0379	0.0259
143	0.0376	0.0253
144	0.0370	0.0252
145	0.0366	0.0248
146	0.0364	0.0248
147	0.0362	0.0245
148	0.0356	0.0243
149	0.0355	0.0240
150	0.0352	0.0237
151	0.0338	0.0236
152	0.0337	0.0231
153	0.0336	0.0230
154	0.0328	0.0225
155	0.0325	0.0218
156	0.0266	0.0179
157	0.0262	0.0179
158	0.0250	0.0168

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0268	4957	1120	22	Pass
0.0277	4364	980	22	Pass
0.0286	3813	853	22	Pass
0.0295	3374	734	21	Pass
0.0305	2995	641	21	Pass
0.0314	2668	566	21	Pass
0.0323	2385	504	21	Pass

0.0332	2134	449	21	Pass
0.0341	1937	387	19	Pass
0.0351	1725	334	19	Pass
0.0360	1542	291	18	Pass
0.0369	1397	255	18	Pass
0.0378	1270	226	17	Pass
0.0387	1143	199	17	Pass
0.0397	1049	176	16	Pass
0.0406	967	157	16	Pass
0.0415	869	133	15	Pass
0.0424	791	123	15	Pass
0.0433	730	113	15	Pass
0.0443	648	102	15	Pass
0.0452	593	92	15	Pass
0.0461	541	87	16	Pass
0.0470	495	76	15	Pass
0.0479	463	65	14	Pass
0.0489	429	60	13	Pass
0.0498	393	58	14	Pass
0.0507	349	56	16	Pass
0.0516	318	53	16	Pass
0.0525	289	47	16	Pass
0.0535	263	45	17	Pass
0.0544	244	38	15	Pass
0.0553	223	37	16	Pass
0.0562	208	33	15	Pass
0.0571	193	31	16	Pass
0.0581	175	30	17	Pass
0.0590	163	29	17	Pass
0.0599	149	25	16	Pass
0.0608	136	24	17	Pass
0.0617	131	23	17	Pass
0.0627	124	22	17	Pass
0.0636	116	21	18	Pass
0.0645	105	21	20	Pass
0.0654	95	19	20	Pass
0.0663	90	18	20	Pass
0.0673	84	17	20	Pass
0.0682	79	16	20	Pass
0.0691	75	15	20	Pass
0.0700	72	13	18	Pass
0.0709	63	13	20	Pass
0.0719	61	13	21	Pass
0.0728	56	13	23	Pass
0.0737	56	13	23	Pass
0.0746	54	11	20	Pass
0.0755	54	9	16	Pass
0.0764	49	9	18	Pass
0.0774	46	9	19	Pass
0.0783	42	8	19	Pass
0.0792	42	8	19	Pass
0.0801	38	7	18	Pass
0.0810	35	7	20	Pass
0.0820	33	6	18	Pass
0.0829	32	6	18	Pass
0.0838	30	6	20	Pass
0.0847	30	5	16	Pass

0.0856	29	5	17	Pass
0.0866	29	5	17	Pass
0.0875	27	5	18	Pass
0.0884	25	5	20	Pass
0.0893	23	5	21	Pass
0.0902	22	5	22	Pass
0.0912	22	5	22	Pass
0.0921	21	5	23	Pass
0.0930	20	5	25	Pass
0.0939	19	5	26	Pass
0.0948	17	5	29	Pass
0.0958	16	4	25	Pass
0.0967	15	4	26	Pass
0.0976	15	4	26	Pass
0.0985	15	3	20	Pass
0.0994	15	3	20	Pass
0.1004	14	3	21	Pass
0.1013	14	3	21	Pass
0.1022	13	3	23	Pass
0.1031	13	3	23	Pass
0.1040	13	3	23	Pass
0.1050	12	2	16	Pass
0.1059	11	2	18	Pass
0.1068	11	2	18	Pass
0.1077	11	2	18	Pass
0.1086	11	2	18	Pass
0.1096	11	2	18	Pass
0.1105	10	1	10	Pass
0.1114	10	1	10	Pass
0.1123	9	1	11	Pass
0.1132	9	1	11	Pass
0.1142	9	1	11	Pass
0.1151	9	1	11	Pass
0.1160	8	1	12	Pass
0.1169	8	1	12	Pass
0.1178	8	1	12	Pass

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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8

Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

WWHM2012
PROJECT REPORT

Project Name: 23rd Flow 2024.06.25
Site Name: Sunset
Site Address: 2301 23rd
City : Puyallup
Report Date: 6/25/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Existing
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.177
Pervious Total	1.177

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.177

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Forest
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	.23

Element Flows To:

Surface	Interflow	Groundwater
Yard 16-18L	Yard 16-18L	Yard 16-18L

Name : Yard 16-18L
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.32

Element Flows To:

Surface	Interflow	Groundwater
Roadway	Roadway	

Name : Driveways
Bypass: No

Impervious Land Use	acre
DRIVEWAYS FLAT	0.23

Element Flows To:

Outlet 1	Outlet 2
Roadway	

Name : Roadway
Bypass: No

Impervious Land Use	acre
ROADS FLAT	0.27

Element Flows To:

Outlet 1	Outlet 2

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.177
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.55
Total Impervious Area:0.5

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.026851
5 year	0.041573
10 year	0.050119
25 year	0.059399
50 year	0.06538
100 year	0.070576

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.170064
5 year	0.228153
10 year	0.270355
25 year	0.328094
50 year	0.374419
100 year	0.423675

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

Year	Predeveloped	Mitigated
1902	0.022	0.187
1903	0.016	0.210
1904	0.033	0.255
1905	0.014	0.113
1906	0.007	0.123
1907	0.041	0.181
1908	0.030	0.139
1909	0.029	0.174
1910	0.041	0.173
1911	0.027	0.176
1912	0.102	0.361
1913	0.042	0.126
1914	0.011	0.556
1915	0.017	0.115
1916	0.026	0.209
1917	0.009	0.086
1918	0.028	0.160
1919	0.022	0.099
1920	0.027	0.139
1921	0.029	0.126
1922	0.030	0.180
1923	0.024	0.143
1924	0.011	0.243
1925	0.015	0.101
1926	0.026	0.205

1927	0.019	0.172
1928	0.020	0.132
1929	0.042	0.235
1930	0.026	0.260
1931	0.025	0.121
1932	0.019	0.139
1933	0.021	0.135
1934	0.055	0.225
1935	0.025	0.119
1936	0.023	0.152
1937	0.038	0.193
1938	0.022	0.119
1939	0.002	0.148
1940	0.024	0.257
1941	0.015	0.265
1942	0.037	0.192
1943	0.019	0.191
1944	0.041	0.271
1945	0.029	0.205
1946	0.019	0.162
1947	0.012	0.126
1948	0.057	0.167
1949	0.049	0.256
1950	0.014	0.119
1951	0.019	0.190
1952	0.074	0.288
1953	0.067	0.255
1954	0.023	0.143
1955	0.021	0.112
1956	0.011	0.116
1957	0.035	0.137
1958	0.071	0.185
1959	0.045	0.191
1960	0.013	0.132
1961	0.044	0.381
1962	0.024	0.162
1963	0.012	0.117
1964	0.012	0.327
1965	0.050	0.168
1966	0.015	0.134
1967	0.023	0.188
1968	0.023	0.137
1969	0.022	0.147
1970	0.034	0.166
1971	0.052	0.173
1972	0.034	0.514
1973	0.045	0.279
1974	0.027	0.217
1975	0.055	0.252
1976	0.030	0.247
1977	0.013	0.103
1978	0.049	0.195
1979	0.014	0.183
1980	0.028	0.175
1981	0.026	0.173
1982	0.012	0.136
1983	0.044	0.197

1984	0.020	0.189
1985	0.032	0.218
1986	0.027	0.114
1987	0.052	0.172
1988	0.032	0.118
1989	0.029	0.104
1990	0.033	0.135
1991	0.027	0.201
1992	0.035	0.187
1993	0.036	0.219
1994	0.053	0.164
1995	0.012	0.114
1996	0.059	0.167
1997	0.024	0.144
1998	0.028	0.174
1999	0.003	0.192
2000	0.021	0.170
2001	0.012	0.130
2002	0.043	0.254
2003	0.033	0.140
2004	0.029	0.207
2005	0.061	0.378
2006	0.017	0.170
2007	0.018	0.201
2008	0.028	0.161
2009	0.019	0.129
2010	0.016	0.171
2011	0.015	0.155
2012	0.022	0.170
2013	0.017	0.138
2014	0.012	0.144
2015	0.023	0.254
2016	0.009	0.148
2017	0.040	0.250
2018	0.073	0.178
2019	0.075	0.240
2020	0.022	0.192
2021	0.037	0.163
2022	0.015	0.244
2023	0.031	0.308
2024	0.078	0.377
2025	0.028	0.151
2026	0.044	0.179
2027	0.017	0.199
2028	0.014	0.082
2029	0.030	0.140
2030	0.054	0.266
2031	0.018	0.088
2032	0.011	0.129
2033	0.016	0.164
2034	0.016	0.132
2035	0.062	0.189
2036	0.033	0.132
2037	0.009	0.183
2038	0.029	0.183
2039	0.004	0.340
2040	0.016	0.144

2041	0.021	0.172
2042	0.064	0.201
2043	0.030	0.215
2044	0.040	0.155
2045	0.027	0.133
2046	0.031	0.139
2047	0.023	0.177
2048	0.031	0.143
2049	0.027	0.204
2050	0.020	0.160
2051	0.028	0.233
2052	0.017	0.153
2053	0.029	0.141
2054	0.037	0.265
2055	0.015	0.161
2056	0.013	0.216
2057	0.021	0.112
2058	0.025	0.206
2059	0.043	0.229

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

Rank	**Predeveloped**	**Mitigated**
1	0.1023	0.5557
2	0.0775	0.5141
3	0.0747	0.3808
4	0.0742	0.3780
5	0.0731	0.3773
6	0.0707	0.3612
7	0.0666	0.3400
8	0.0636	0.3271
9	0.0621	0.3081
10	0.0614	0.2879
11	0.0585	0.2793
12	0.0566	0.2708
13	0.0555	0.2661
14	0.0546	0.2655
15	0.0545	0.2649
16	0.0526	0.2599
17	0.0523	0.2565
18	0.0521	0.2565
19	0.0497	0.2552
20	0.0492	0.2546
21	0.0489	0.2535
22	0.0448	0.2535
23	0.0446	0.2517
24	0.0443	0.2505
25	0.0443	0.2471
26	0.0439	0.2437
27	0.0432	0.2429
28	0.0429	0.2400
29	0.0421	0.2350
30	0.0416	0.2326
31	0.0412	0.2290
32	0.0411	0.2246
33	0.0407	0.2186

34	0.0403	0.2183
35	0.0400	0.2174
36	0.0378	0.2156
37	0.0367	0.2147
38	0.0366	0.2105
39	0.0366	0.2094
40	0.0357	0.2074
41	0.0352	0.2061
42	0.0346	0.2051
43	0.0344	0.2050
44	0.0342	0.2043
45	0.0332	0.2012
46	0.0330	0.2008
47	0.0330	0.2006
48	0.0326	0.1988
49	0.0317	0.1968
50	0.0316	0.1949
51	0.0313	0.1931
52	0.0308	0.1921
53	0.0307	0.1917
54	0.0300	0.1917
55	0.0298	0.1915
56	0.0297	0.1911
57	0.0297	0.1897
58	0.0297	0.1892
59	0.0295	0.1892
60	0.0294	0.1881
61	0.0294	0.1872
62	0.0293	0.1868
63	0.0293	0.1855
64	0.0291	0.1834
65	0.0290	0.1827
66	0.0285	0.1825
67	0.0283	0.1814
68	0.0283	0.1795
69	0.0283	0.1785
70	0.0280	0.1776
71	0.0276	0.1768
72	0.0274	0.1759
73	0.0270	0.1749
74	0.0269	0.1744
75	0.0267	0.1736
76	0.0267	0.1735
77	0.0266	0.1727
78	0.0265	0.1727
79	0.0264	0.1724
80	0.0264	0.1724
81	0.0263	0.1719
82	0.0260	0.1706
83	0.0250	0.1696
84	0.0250	0.1696
85	0.0246	0.1696
86	0.0243	0.1682
87	0.0240	0.1674
88	0.0236	0.1671
89	0.0236	0.1660
90	0.0235	0.1642

91	0.0234	0.1637
92	0.0232	0.1634
93	0.0229	0.1624
94	0.0227	0.1617
95	0.0225	0.1613
96	0.0225	0.1605
97	0.0222	0.1604
98	0.0221	0.1604
99	0.0221	0.1547
100	0.0221	0.1547
101	0.0215	0.1532
102	0.0212	0.1519
103	0.0211	0.1505
104	0.0208	0.1483
105	0.0206	0.1482
106	0.0206	0.1472
107	0.0203	0.1444
108	0.0201	0.1441
109	0.0196	0.1435
110	0.0191	0.1435
111	0.0189	0.1431
112	0.0188	0.1426
113	0.0188	0.1413
114	0.0185	0.1400
115	0.0185	0.1398
116	0.0180	0.1394
117	0.0177	0.1394
118	0.0174	0.1390
119	0.0168	0.1388
120	0.0167	0.1382
121	0.0167	0.1374
122	0.0166	0.1371
123	0.0164	0.1361
124	0.0164	0.1355
125	0.0163	0.1353
126	0.0160	0.1343
127	0.0156	0.1334
128	0.0152	0.1324
129	0.0151	0.1319
130	0.0148	0.1318
131	0.0148	0.1315
132	0.0145	0.1301
133	0.0145	0.1291
134	0.0144	0.1289
135	0.0144	0.1261
136	0.0143	0.1257
137	0.0136	0.1256
138	0.0132	0.1234
139	0.0132	0.1214
140	0.0130	0.1194
141	0.0125	0.1188
142	0.0123	0.1186
143	0.0121	0.1181
144	0.0120	0.1173
145	0.0117	0.1158
146	0.0116	0.1154
147	0.0115	0.1143

148	0.0115	0.1139
149	0.0109	0.1135
150	0.0108	0.1124
151	0.0107	0.1120
152	0.0092	0.1042
153	0.0090	0.1030
154	0.0088	0.1011
155	0.0071	0.0993
156	0.0036	0.0885
157	0.0029	0.0859
158	0.0019	0.0819

Stream Protection Duration
POC #1
The Facility FAILED

Facility FAILED duration standard for 1+ flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0134	55733	268638	482	Fail
0.0140	51229	259220	506	Fail
0.0145	47201	250577	530	Fail
0.0150	43512	242267	556	Fail
0.0155	40127	234068	583	Fail
0.0160	37213	226422	608	Fail
0.0166	34437	218888	635	Fail
0.0171	31922	211907	663	Fail
0.0176	29534	205093	694	Fail
0.0181	27512	198722	722	Fail
0.0187	25634	192462	750	Fail
0.0192	23889	186589	781	Fail
0.0197	22293	180661	810	Fail
0.0202	20908	175177	837	Fail
0.0208	19551	169803	868	Fail
0.0213	18293	164595	899	Fail
0.0218	17097	159720	934	Fail
0.0223	15966	154845	969	Fail
0.0229	14903	150302	1008	Fail
0.0234	13961	145870	1044	Fail
0.0239	13063	141659	1084	Fail
0.0244	12277	137504	1120	Fail
0.0250	11512	133405	1158	Fail
0.0255	10787	129693	1202	Fail
0.0260	10083	125926	1248	Fail
0.0265	9413	122325	1299	Fail
0.0271	8787	118779	1351	Fail
0.0276	8233	115344	1400	Fail
0.0281	7734	112131	1449	Fail
0.0286	7230	108918	1506	Fail
0.0292	6787	105871	1559	Fail
0.0297	6399	102824	1606	Fail
0.0302	6100	99887	1637	Fail
0.0307	5812	96951	1668	Fail
0.0313	5514	94181	1708	Fail
0.0318	5230	91522	1749	Fail
0.0323	4966	88973	1791	Fail

0.0328	4734	86370	1824	Fail
0.0334	4486	83987	1872	Fail
0.0339	4293	81605	1900	Fail
0.0344	4099	79389	1936	Fail
0.0349	3869	77173	1994	Fail
0.0355	3648	75012	2056	Fail
0.0360	3474	72852	2097	Fail
0.0365	3312	70857	2139	Fail
0.0370	3162	68918	2179	Fail
0.0376	3019	67090	2222	Fail
0.0381	2915	65317	2240	Fail
0.0386	2793	63489	2273	Fail
0.0391	2677	61716	2305	Fail
0.0397	2526	59943	2373	Fail
0.0402	2412	58337	2418	Fail
0.0407	2303	56619	2458	Fail
0.0412	2200	55124	2505	Fail
0.0418	2097	53700	2560	Fail
0.0423	1979	52276	2641	Fail
0.0428	1875	50797	2709	Fail
0.0433	1768	49428	2795	Fail
0.0439	1683	48093	2857	Fail
0.0444	1594	46841	2938	Fail
0.0449	1525	45556	2987	Fail
0.0454	1459	44304	3036	Fail
0.0460	1378	43118	3129	Fail
0.0465	1306	41911	3209	Fail
0.0470	1248	40808	3269	Fail
0.0475	1191	39706	3333	Fail
0.0481	1135	38598	3400	Fail
0.0486	1083	37600	3471	Fail
0.0491	1031	36515	3541	Fail
0.0496	982	35490	3614	Fail
0.0502	929	34487	3712	Fail
0.0507	870	33562	3857	Fail
0.0512	818	32620	3987	Fail
0.0517	770	31794	4129	Fail
0.0523	708	30936	4369	Fail
0.0528	663	30105	4540	Fail
0.0533	626	29296	4679	Fail
0.0538	583	28504	4889	Fail
0.0544	540	27739	5136	Fail
0.0549	500	26963	5392	Fail
0.0554	456	26249	5756	Fail
0.0559	417	25573	6132	Fail
0.0565	380	24914	6556	Fail
0.0570	351	24216	6899	Fail
0.0575	318	23628	7430	Fail
0.0580	296	22986	7765	Fail
0.0586	276	22398	8115	Fail
0.0591	263	21800	8288	Fail
0.0596	246	21263	8643	Fail
0.0601	231	20736	8976	Fail
0.0607	216	20221	9361	Fail
0.0612	203	19723	9715	Fail
0.0617	180	19235	10686	Fail
0.0622	154	18725	12159	Fail

0.0628	142	18210	12823	Fail
0.0633	126	17761	14096	Fail
0.0638	112	17324	15467	Fail
0.0643	104	16886	16236	Fail
0.0649	99	16493	16659	Fail
0.0654	89	16055	18039	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 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
Total Volume Infiltrated		0.00	0.00	0.00	0.00	0.00	0%	No Treat. Credit	
Compliance with LID Standard 8									
Duration Analysis Result = Failed									

Perlnd and Implnd Changes

No changes have been made.

WEST BASIN

WWHM2012
PROJECT REPORT

Project Name: Flow Analysis - West
Site Name: Sunset
Site Address: 2301 23rd
City : Puyallup
Report Date: 5/22/2023
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Pre-West
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.072
Pervious Total	1.072

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.072

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Post West
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Mod	.355

Pervious Total 0.355

Impervious Land Use	**acre**

Impervious Total 0

Basin Total 0.355

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.072
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.355
Total Impervious Area:0

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.024456
5 year	0.037864
10 year	0.045648
25 year	0.0541
50 year	0.059547
100 year	0.06428

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.008099
5 year	0.012539
10 year	0.015117
25 year	0.017916
50 year	0.019719
100 year	0.021287

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

Year	Predeveloped	Mitigated
1902	0.020	0.006
1903	0.015	0.005
1904	0.030	0.010
1905	0.012	0.004
1906	0.006	0.002
1907	0.038	0.012
1908	0.027	0.009
1909	0.026	0.009
1910	0.037	0.012
1911	0.024	0.008
1912	0.093	0.031
1913	0.038	0.013
1914	0.010	0.003
1915	0.016	0.005
1916	0.024	0.008
1917	0.008	0.003
1918	0.026	0.009
1919	0.020	0.007
1920	0.025	0.008
1921	0.027	0.009
1922	0.027	0.009
1923	0.021	0.007
1924	0.010	0.003
1925	0.013	0.004
1926	0.024	0.008
1927	0.017	0.006
1928	0.018	0.006
1929	0.038	0.013
1930	0.024	0.008
1931	0.023	0.008
1932	0.017	0.006
1933	0.019	0.006
1934	0.050	0.016
1935	0.023	0.008
1936	0.021	0.007
1937	0.034	0.011
1938	0.020	0.007
1939	0.002	0.001
1940	0.022	0.007
1941	0.013	0.004
1942	0.033	0.011
1943	0.017	0.006
1944	0.037	0.012
1945	0.027	0.009
1946	0.017	0.006
1947	0.011	0.004
1948	0.052	0.017
1949	0.045	0.015
1950	0.013	0.004
1951	0.017	0.006
1952	0.068	0.022
1953	0.061	0.020
1954	0.021	0.007
1955	0.019	0.006

1956	0.010	0.003
1957	0.032	0.011
1958	0.064	0.021
1959	0.041	0.013
1960	0.012	0.004
1961	0.040	0.013
1962	0.022	0.007
1963	0.011	0.004
1964	0.011	0.004
1965	0.045	0.015
1966	0.013	0.004
1967	0.021	0.007
1968	0.021	0.007
1969	0.020	0.007
1970	0.031	0.010
1971	0.048	0.016
1972	0.031	0.010
1973	0.041	0.013
1974	0.024	0.008
1975	0.051	0.017
1976	0.027	0.009
1977	0.012	0.004
1978	0.045	0.015
1979	0.013	0.004
1980	0.026	0.009
1981	0.024	0.008
1982	0.011	0.004
1983	0.040	0.013
1984	0.018	0.006
1985	0.029	0.010
1986	0.024	0.008
1987	0.047	0.016
1988	0.029	0.010
1989	0.026	0.009
1990	0.030	0.010
1991	0.024	0.008
1992	0.032	0.010
1993	0.033	0.011
1994	0.048	0.016
1995	0.011	0.004
1996	0.053	0.018
1997	0.021	0.007
1998	0.026	0.009
1999	0.003	0.001
2000	0.019	0.006
2001	0.011	0.003
2002	0.039	0.013
2003	0.030	0.010
2004	0.027	0.009
2005	0.056	0.019
2006	0.015	0.005
2007	0.016	0.005
2008	0.026	0.009
2009	0.017	0.006
2010	0.015	0.005
2011	0.014	0.004
2012	0.020	0.007

2013	0.015	0.005
2014	0.011	0.003
2015	0.021	0.007
2016	0.008	0.003
2017	0.037	0.012
2018	0.067	0.022
2019	0.068	0.023
2020	0.020	0.007
2021	0.033	0.011
2022	0.014	0.005
2023	0.028	0.009
2024	0.071	0.023
2025	0.025	0.008
2026	0.040	0.013
2027	0.015	0.005
2028	0.013	0.004
2029	0.027	0.009
2030	0.050	0.016
2031	0.016	0.005
2032	0.010	0.003
2033	0.015	0.005
2034	0.015	0.005
2035	0.057	0.019
2036	0.030	0.010
2037	0.008	0.003
2038	0.027	0.009
2039	0.003	0.001
2040	0.014	0.005
2041	0.019	0.006
2042	0.058	0.019
2043	0.027	0.009
2044	0.036	0.012
2045	0.025	0.008
2046	0.029	0.009
2047	0.021	0.007
2048	0.028	0.009
2049	0.025	0.008
2050	0.018	0.006
2051	0.026	0.008
2052	0.015	0.005
2053	0.027	0.009
2054	0.033	0.011
2055	0.014	0.005
2056	0.012	0.004
2057	0.019	0.006
2058	0.022	0.007
2059	0.039	0.013

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

Rank	**Predeveloped**	**Mitigated**
1	0.0931	0.0308
2	0.0706	0.0234
3	0.0680	0.0225
4	0.0676	0.0224
5	0.0666	0.0220

6	0.0644	0.0213
7	0.0607	0.0201
8	0.0579	0.0192
9	0.0565	0.0187
10	0.0560	0.0185
11	0.0533	0.0177
12	0.0515	0.0171
13	0.0505	0.0167
14	0.0497	0.0165
15	0.0496	0.0164
16	0.0479	0.0159
17	0.0477	0.0158
18	0.0474	0.0157
19	0.0453	0.0150
20	0.0448	0.0148
21	0.0445	0.0147
22	0.0408	0.0135
23	0.0406	0.0134
24	0.0403	0.0134
25	0.0403	0.0134
26	0.0399	0.0132
27	0.0394	0.0130
28	0.0390	0.0129
29	0.0384	0.0127
30	0.0379	0.0126
31	0.0375	0.0124
32	0.0374	0.0124
33	0.0371	0.0123
34	0.0367	0.0122
35	0.0364	0.0121
36	0.0344	0.0114
37	0.0335	0.0111
38	0.0334	0.0110
39	0.0333	0.0110
40	0.0325	0.0108
41	0.0321	0.0106
42	0.0315	0.0104
43	0.0313	0.0104
44	0.0311	0.0103
45	0.0302	0.0100
46	0.0301	0.0100
47	0.0301	0.0100
48	0.0297	0.0098
49	0.0289	0.0096
50	0.0288	0.0095
51	0.0285	0.0094
52	0.0281	0.0093
53	0.0280	0.0093
54	0.0273	0.0090
55	0.0271	0.0090
56	0.0271	0.0090
57	0.0271	0.0090
58	0.0270	0.0089
59	0.0269	0.0089
60	0.0268	0.0089
61	0.0268	0.0089
62	0.0267	0.0088

63	0.0267	0.0088
64	0.0265	0.0088
65	0.0264	0.0088
66	0.0259	0.0086
67	0.0258	0.0085
68	0.0258	0.0085
69	0.0258	0.0085
70	0.0255	0.0085
71	0.0251	0.0083
72	0.0250	0.0083
73	0.0246	0.0082
74	0.0245	0.0081
75	0.0243	0.0080
76	0.0243	0.0080
77	0.0243	0.0080
78	0.0241	0.0080
79	0.0241	0.0080
80	0.0241	0.0080
81	0.0240	0.0079
82	0.0237	0.0078
83	0.0228	0.0076
84	0.0227	0.0075
85	0.0224	0.0074
86	0.0222	0.0073
87	0.0219	0.0072
88	0.0215	0.0071
89	0.0215	0.0071
90	0.0214	0.0071
91	0.0213	0.0071
92	0.0211	0.0070
93	0.0209	0.0069
94	0.0206	0.0068
95	0.0205	0.0068
96	0.0205	0.0068
97	0.0203	0.0067
98	0.0202	0.0067
99	0.0201	0.0067
100	0.0201	0.0067
101	0.0196	0.0065
102	0.0193	0.0064
103	0.0193	0.0064
104	0.0190	0.0063
105	0.0188	0.0062
106	0.0188	0.0062
107	0.0185	0.0061
108	0.0183	0.0061
109	0.0179	0.0059
110	0.0174	0.0058
111	0.0172	0.0057
112	0.0171	0.0057
113	0.0171	0.0057
114	0.0169	0.0056
115	0.0169	0.0056
116	0.0164	0.0054
117	0.0161	0.0053
118	0.0158	0.0052
119	0.0153	0.0051

120	0.0152	0.0050
121	0.0152	0.0050
122	0.0151	0.0050
123	0.0149	0.0049
124	0.0149	0.0049
125	0.0149	0.0049
126	0.0146	0.0048
127	0.0142	0.0047
128	0.0138	0.0046
129	0.0138	0.0046
130	0.0135	0.0045
131	0.0135	0.0045
132	0.0132	0.0044
133	0.0132	0.0044
134	0.0131	0.0043
135	0.0131	0.0043
136	0.0130	0.0043
137	0.0124	0.0041
138	0.0121	0.0040
139	0.0120	0.0040
140	0.0118	0.0039
141	0.0113	0.0038
142	0.0112	0.0037
143	0.0111	0.0037
144	0.0109	0.0036
145	0.0107	0.0035
146	0.0105	0.0035
147	0.0105	0.0035
148	0.0105	0.0035
149	0.0099	0.0033
150	0.0098	0.0033
151	0.0097	0.0032
152	0.0084	0.0028
153	0.0082	0.0027
154	0.0080	0.0027
155	0.0064	0.0021
156	0.0033	0.0011
157	0.0026	0.0009
158	0.0017	0.0006

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0122	55733	2332	4	Pass
0.0127	51284	2018	3	Pass
0.0132	47185	1710	3	Pass
0.0137	43456	1475	3	Pass
0.0141	40165	1268	3	Pass
0.0146	37207	1102	2	Pass
0.0151	34448	940	2	Pass
0.0156	31900	780	2	Pass
0.0161	29529	632	2	Pass

0.0165	27517	511	1	Pass
0.0170	25656	386	1	Pass
0.0175	23883	298	1	Pass
0.0180	22299	247	1	Pass
0.0184	20886	203	0	Pass
0.0189	19573	143	0	Pass
0.0194	18299	105	0	Pass
0.0199	17102	80	0	Pass
0.0204	15961	61	0	Pass
0.0208	14903	43	0	Pass
0.0213	13972	21	0	Pass
0.0218	13075	9	0	Pass
0.0223	12277	6	0	Pass
0.0227	11512	4	0	Pass
0.0232	10787	4	0	Pass
0.0237	10088	3	0	Pass
0.0242	9418	3	0	Pass
0.0247	8792	3	0	Pass
0.0251	8233	3	0	Pass
0.0256	7728	3	0	Pass
0.0261	7235	2	0	Pass
0.0266	6787	2	0	Pass
0.0270	6399	2	0	Pass
0.0275	6094	2	0	Pass
0.0280	5812	2	0	Pass
0.0285	5515	2	0	Pass
0.0290	5232	2	0	Pass
0.0294	4965	2	0	Pass
0.0299	4734	2	0	Pass
0.0304	4483	1	0	Pass
0.0309	4297	0	0	Pass
0.0313	4099	0	0	Pass
0.0318	3871	0	0	Pass
0.0323	3648	0	0	Pass
0.0328	3474	0	0	Pass
0.0333	3312	0	0	Pass
0.0337	3166	0	0	Pass
0.0342	3019	0	0	Pass
0.0347	2915	0	0	Pass
0.0352	2789	0	0	Pass
0.0356	2680	0	0	Pass
0.0361	2527	0	0	Pass
0.0366	2410	0	0	Pass
0.0371	2302	0	0	Pass
0.0376	2200	0	0	Pass
0.0380	2097	0	0	Pass
0.0385	1978	0	0	Pass
0.0390	1875	0	0	Pass
0.0395	1767	0	0	Pass
0.0400	1682	0	0	Pass
0.0404	1594	0	0	Pass
0.0409	1525	0	0	Pass
0.0414	1458	0	0	Pass
0.0419	1378	0	0	Pass
0.0423	1305	0	0	Pass
0.0428	1249	0	0	Pass
0.0433	1191	0	0	Pass

0.0438	1135	0	0	Pass
0.0443	1083	0	0	Pass
0.0447	1032	0	0	Pass
0.0452	982	0	0	Pass
0.0457	929	0	0	Pass
0.0462	869	0	0	Pass
0.0466	819	0	0	Pass
0.0471	771	0	0	Pass
0.0476	710	0	0	Pass
0.0481	663	0	0	Pass
0.0486	626	0	0	Pass
0.0490	583	0	0	Pass
0.0495	541	0	0	Pass
0.0500	500	0	0	Pass
0.0505	456	0	0	Pass
0.0509	417	0	0	Pass
0.0514	380	0	0	Pass
0.0519	352	0	0	Pass
0.0524	318	0	0	Pass
0.0529	297	0	0	Pass
0.0533	276	0	0	Pass
0.0538	263	0	0	Pass
0.0543	246	0	0	Pass
0.0548	231	0	0	Pass
0.0552	216	0	0	Pass
0.0557	203	0	0	Pass
0.0562	180	0	0	Pass
0.0567	154	0	0	Pass
0.0572	142	0	0	Pass
0.0576	126	0	0	Pass
0.0581	112	0	0	Pass
0.0586	104	0	0	Pass
0.0591	99	0	0	Pass
0.0595	89	0	0	Pass

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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

NORTHWEST BASIN

WWHM2012
PROJECT REPORT

Project Name: Flow Analysis - NW
Site Name: Sunset
Site Address: 2301 23rd
City : Puyallup
Report Date: 5/22/2023
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Pre-Northwest
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	.366
Pervious Total	**0.366**

Impervious Land Use	acre
Impervious Total	**0**
Basin Total	**0.366**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Post Northwest
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	.115

Pervious Total 0.115

Impervious Land Use	acre

Impervious Total 0

Basin Total 0.115

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.366
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.115
Total Impervious Area:0

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.00835
5 year	0.012927
10 year	0.015585
25 year	0.018471
50 year	0.02033
100 year	0.021946

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.002623
5 year	0.004062
10 year	0.004897
25 year	0.005804
50 year	0.006388
100 year	0.006896

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

Year	Predeveloped	Mitigated
1902	0.007	0.002
1903	0.005	0.002
1904	0.010	0.003
1905	0.004	0.001
1906	0.002	0.001
1907	0.013	0.004
1908	0.009	0.003
1909	0.009	0.003
1910	0.013	0.004
1911	0.008	0.003
1912	0.032	0.010
1913	0.013	0.004
1914	0.003	0.001
1915	0.005	0.002
1916	0.008	0.003
1917	0.003	0.001
1918	0.009	0.003
1919	0.007	0.002
1920	0.008	0.003
1921	0.009	0.003
1922	0.009	0.003
1923	0.007	0.002
1924	0.004	0.001
1925	0.005	0.001
1926	0.008	0.003
1927	0.006	0.002
1928	0.006	0.002
1929	0.013	0.004
1930	0.008	0.003
1931	0.008	0.002
1932	0.006	0.002
1933	0.007	0.002
1934	0.017	0.005
1935	0.008	0.002
1936	0.007	0.002
1937	0.012	0.004
1938	0.007	0.002
1939	0.001	0.000
1940	0.008	0.002
1941	0.005	0.001
1942	0.011	0.004
1943	0.006	0.002
1944	0.013	0.004
1945	0.009	0.003
1946	0.006	0.002
1947	0.004	0.001
1948	0.018	0.006
1949	0.015	0.005
1950	0.004	0.001
1951	0.006	0.002
1952	0.023	0.007
1953	0.021	0.007
1954	0.007	0.002
1955	0.006	0.002

1956	0.003	0.001
1957	0.011	0.003
1958	0.022	0.007
1959	0.014	0.004
1960	0.004	0.001
1961	0.014	0.004
1962	0.007	0.002
1963	0.004	0.001
1964	0.004	0.001
1965	0.015	0.005
1966	0.005	0.001
1967	0.007	0.002
1968	0.007	0.002
1969	0.007	0.002
1970	0.011	0.003
1971	0.016	0.005
1972	0.011	0.003
1973	0.014	0.004
1974	0.008	0.003
1975	0.017	0.005
1976	0.009	0.003
1977	0.004	0.001
1978	0.015	0.005
1979	0.004	0.001
1980	0.009	0.003
1981	0.008	0.003
1982	0.004	0.001
1983	0.014	0.004
1984	0.006	0.002
1985	0.010	0.003
1986	0.008	0.003
1987	0.016	0.005
1988	0.010	0.003
1989	0.009	0.003
1990	0.010	0.003
1991	0.008	0.003
1992	0.011	0.003
1993	0.011	0.003
1994	0.016	0.005
1995	0.004	0.001
1996	0.018	0.006
1997	0.007	0.002
1998	0.009	0.003
1999	0.001	0.000
2000	0.007	0.002
2001	0.004	0.001
2002	0.013	0.004
2003	0.010	0.003
2004	0.009	0.003
2005	0.019	0.006
2006	0.005	0.002
2007	0.006	0.002
2008	0.009	0.003
2009	0.006	0.002
2010	0.005	0.002
2011	0.005	0.001
2012	0.007	0.002

2013	0.005	0.002
2014	0.004	0.001
2015	0.007	0.002
2016	0.003	0.001
2017	0.013	0.004
2018	0.023	0.007
2019	0.023	0.007
2020	0.007	0.002
2021	0.011	0.004
2022	0.005	0.001
2023	0.010	0.003
2024	0.024	0.008
2025	0.009	0.003
2026	0.014	0.004
2027	0.005	0.002
2028	0.004	0.001
2029	0.009	0.003
2030	0.017	0.005
2031	0.006	0.002
2032	0.003	0.001
2033	0.005	0.002
2034	0.005	0.002
2035	0.019	0.006
2036	0.010	0.003
2037	0.003	0.001
2038	0.009	0.003
2039	0.001	0.000
2040	0.005	0.002
2041	0.006	0.002
2042	0.020	0.006
2043	0.009	0.003
2044	0.012	0.004
2045	0.008	0.003
2046	0.010	0.003
2047	0.007	0.002
2048	0.010	0.003
2049	0.009	0.003
2050	0.006	0.002
2051	0.009	0.003
2052	0.005	0.002
2053	0.009	0.003
2054	0.011	0.004
2055	0.005	0.001
2056	0.004	0.001
2057	0.006	0.002
2058	0.008	0.002
2059	0.013	0.004

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

Rank	Predeveloped	Mitigated
1	0.0318	0.0100
2	0.0241	0.0076
3	0.0232	0.0073
4	0.0231	0.0072
5	0.0227	0.0071

6	0.0220	0.0069
7	0.0207	0.0065
8	0.0198	0.0062
9	0.0193	0.0061
10	0.0191	0.0060
11	0.0182	0.0057
12	0.0176	0.0055
13	0.0172	0.0054
14	0.0170	0.0053
15	0.0169	0.0053
16	0.0163	0.0051
17	0.0163	0.0051
18	0.0162	0.0051
19	0.0155	0.0049
20	0.0153	0.0048
21	0.0152	0.0048
22	0.0139	0.0044
23	0.0139	0.0044
24	0.0138	0.0043
25	0.0138	0.0043
26	0.0136	0.0043
27	0.0134	0.0042
28	0.0133	0.0042
29	0.0131	0.0041
30	0.0129	0.0041
31	0.0128	0.0040
32	0.0128	0.0040
33	0.0127	0.0040
34	0.0125	0.0039
35	0.0124	0.0039
36	0.0118	0.0037
37	0.0114	0.0036
38	0.0114	0.0036
39	0.0114	0.0036
40	0.0111	0.0035
41	0.0109	0.0034
42	0.0108	0.0034
43	0.0107	0.0034
44	0.0106	0.0033
45	0.0103	0.0032
46	0.0103	0.0032
47	0.0103	0.0032
48	0.0101	0.0032
49	0.0099	0.0031
50	0.0098	0.0031
51	0.0097	0.0031
52	0.0096	0.0030
53	0.0096	0.0030
54	0.0093	0.0029
55	0.0093	0.0029
56	0.0092	0.0029
57	0.0092	0.0029
58	0.0092	0.0029
59	0.0092	0.0029
60	0.0092	0.0029
61	0.0091	0.0029
62	0.0091	0.0029

63	0.0091	0.0029
64	0.0090	0.0028
65	0.0090	0.0028
66	0.0089	0.0028
67	0.0088	0.0028
68	0.0088	0.0028
69	0.0088	0.0028
70	0.0087	0.0027
71	0.0086	0.0027
72	0.0085	0.0027
73	0.0084	0.0026
74	0.0084	0.0026
75	0.0083	0.0026
76	0.0083	0.0026
77	0.0083	0.0026
78	0.0082	0.0026
79	0.0082	0.0026
80	0.0082	0.0026
81	0.0082	0.0026
82	0.0081	0.0025
83	0.0078	0.0024
84	0.0078	0.0024
85	0.0076	0.0024
86	0.0076	0.0024
87	0.0075	0.0023
88	0.0073	0.0023
89	0.0073	0.0023
90	0.0073	0.0023
91	0.0073	0.0023
92	0.0072	0.0023
93	0.0071	0.0022
94	0.0070	0.0022
95	0.0070	0.0022
96	0.0070	0.0022
97	0.0069	0.0022
98	0.0069	0.0022
99	0.0069	0.0022
100	0.0069	0.0022
101	0.0067	0.0021
102	0.0066	0.0021
103	0.0066	0.0021
104	0.0065	0.0020
105	0.0064	0.0020
106	0.0064	0.0020
107	0.0063	0.0020
108	0.0062	0.0020
109	0.0061	0.0019
110	0.0059	0.0019
111	0.0059	0.0018
112	0.0058	0.0018
113	0.0058	0.0018
114	0.0058	0.0018
115	0.0058	0.0018
116	0.0056	0.0018
117	0.0055	0.0017
118	0.0054	0.0017
119	0.0052	0.0016

120	0.0052	0.0016
121	0.0052	0.0016
122	0.0052	0.0016
123	0.0051	0.0016
124	0.0051	0.0016
125	0.0051	0.0016
126	0.0050	0.0016
127	0.0048	0.0015
128	0.0047	0.0015
129	0.0047	0.0015
130	0.0046	0.0015
131	0.0046	0.0014
132	0.0045	0.0014
133	0.0045	0.0014
134	0.0045	0.0014
135	0.0045	0.0014
136	0.0044	0.0014
137	0.0042	0.0013
138	0.0041	0.0013
139	0.0041	0.0013
140	0.0040	0.0013
141	0.0039	0.0012
142	0.0038	0.0012
143	0.0038	0.0012
144	0.0037	0.0012
145	0.0036	0.0011
146	0.0036	0.0011
147	0.0036	0.0011
148	0.0036	0.0011
149	0.0034	0.0011
150	0.0034	0.0011
151	0.0033	0.0010
152	0.0029	0.0009
153	0.0028	0.0009
154	0.0027	0.0009
155	0.0022	0.0007
156	0.0011	0.0004
157	0.0009	0.0003
158	0.0006	0.0002

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	**Predev**	**Mit**	**Percentage**	**Pass/Fail**
0.0042	55678	1888	3	Pass
0.0043	51223	1594	3	Pass
0.0045	47163	1359	2	Pass
0.0047	43451	1173	2	Pass
0.0048	40110	1003	2	Pass
0.0050	37174	831	2	Pass
0.0052	34415	666	1	Pass
0.0053	31883	535	1	Pass
0.0055	29523	405	1	Pass

0.0056	27484	305	1	Pass
0.0058	25634	251	0	Pass
0.0060	23867	203	0	Pass
0.0061	22288	141	0	Pass
0.0063	20886	104	0	Pass
0.0065	19551	78	0	Pass
0.0066	18282	60	0	Pass
0.0068	17097	38	0	Pass
0.0069	15955	15	0	Pass
0.0071	14903	8	0	Pass
0.0073	13944	5	0	Pass
0.0074	13063	4	0	Pass
0.0076	12271	3	0	Pass
0.0078	11512	3	0	Pass
0.0079	10787	3	0	Pass
0.0081	10083	3	0	Pass
0.0083	9413	3	0	Pass
0.0084	8792	3	0	Pass
0.0086	8233	2	0	Pass
0.0087	7728	2	0	Pass
0.0089	7230	2	0	Pass
0.0091	6781	2	0	Pass
0.0092	6399	2	0	Pass
0.0094	6094	2	0	Pass
0.0096	5812	2	0	Pass
0.0097	5511	2	0	Pass
0.0099	5230	1	0	Pass
0.0100	4974	0	0	Pass
0.0102	4739	0	0	Pass
0.0104	4490	0	0	Pass
0.0105	4309	0	0	Pass
0.0107	4099	0	0	Pass
0.0109	3874	0	0	Pass
0.0110	3657	0	0	Pass
0.0112	3475	0	0	Pass
0.0114	3315	0	0	Pass
0.0115	3175	0	0	Pass
0.0117	3019	0	0	Pass
0.0118	2917	0	0	Pass
0.0120	2800	0	0	Pass
0.0122	2677	0	0	Pass
0.0123	2528	0	0	Pass
0.0125	2416	0	0	Pass
0.0127	2302	0	0	Pass
0.0128	2201	0	0	Pass
0.0130	2099	0	0	Pass
0.0132	1978	0	0	Pass
0.0133	1876	0	0	Pass
0.0135	1769	0	0	Pass
0.0136	1688	0	0	Pass
0.0138	1594	0	0	Pass
0.0140	1528	0	0	Pass
0.0141	1461	0	0	Pass
0.0143	1379	0	0	Pass
0.0145	1306	0	0	Pass
0.0146	1250	0	0	Pass
0.0148	1191	0	0	Pass

0.0149	1137	0	0	Pass
0.0151	1085	0	0	Pass
0.0153	1032	0	0	Pass
0.0154	983	0	0	Pass
0.0156	930	0	0	Pass
0.0158	869	0	0	Pass
0.0159	819	0	0	Pass
0.0161	774	0	0	Pass
0.0163	708	0	0	Pass
0.0164	663	0	0	Pass
0.0166	627	0	0	Pass
0.0167	583	0	0	Pass
0.0169	541	0	0	Pass
0.0171	501	0	0	Pass
0.0172	458	0	0	Pass
0.0174	417	0	0	Pass
0.0176	380	0	0	Pass
0.0177	354	0	0	Pass
0.0179	318	0	0	Pass
0.0180	297	0	0	Pass
0.0182	277	0	0	Pass
0.0184	263	0	0	Pass
0.0185	246	0	0	Pass
0.0187	231	0	0	Pass
0.0189	216	0	0	Pass
0.0190	203	0	0	Pass
0.0192	180	0	0	Pass
0.0194	154	0	0	Pass
0.0195	142	0	0	Pass
0.0197	127	0	0	Pass
0.0198	112	0	0	Pass
0.0200	104	0	0	Pass
0.0202	99	0	0	Pass
0.0203	89	0	0	Pass

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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

APPENDIX D

Reports

GEOTECHNICAL ENGINEER’S REPORT

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
SUNSET POINTE
2301 - 23RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-5559

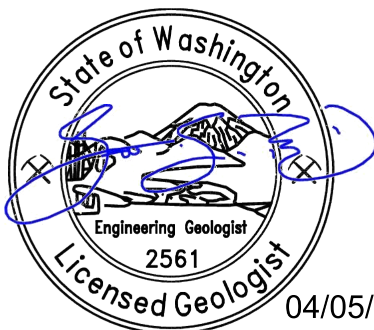
1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

MR. PETER CHEN

January 11, 2018
Updated April 5, 2023

Chase G. Halsen, L.G.
Senior Project Geologist



04/05/2023

Scott S. Riegel

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

GEOTECHNICAL ENGINEERING STUDY
SUNSET POINTE
2301 – 23RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-5559

Earth Solutions NW, LLC
15365 Northeast 90th Street, Suite 100
Redmond, Washington 98052
Phone: 425-449-4704 | Fax: 425-449-4711
www.earthsolutionsnw.com

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

January 11, 2018
Updated April 5, 2023
ES-5559

Mr. Peter Chen
4709 Memory Lane West
University Place, Washington 98488

Dear Mr. Chen:

Earth Solutions NW, LLC (ESNW) is pleased to present this report in support of the proposed project. Based on the results of our investigation, the proposed residential plat is feasible from a geotechnical standpoint. Our study indicates the site is underlain by areas of existing fill that overly Vashon drift glacial deposits Light to heavy perched groundwater seepage was encountered at three test pit locations at an approximate exposure depth of about one-and-one-half to six feet below the existing ground surface. As such, it is our opinion that the contractor should be prepared to manage zones of perched groundwater seepage during construction.

In our opinion, the proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, recompacted existing fill, or suitable structural fill placed directly on competent native soils. In general, native soils suitable for foundation support are anticipated to be encountered at depths of approximately two to five feet below the existing ground surface. Areas underlain by existing fill may require additional preparation efforts to establish suitable and uniform bearing conditions. Additional preparation activities will likely involve overexcavating unsuitable existing fill and restoring grades with suitable structural fill. Re-working and re-compacting the in-place fill may be feasible in areas where the fill is devoid of organic and deleterious material but must be evaluated by ESNW during grading. Areas of deeper fill (if encountered) may require additional or complete over excavation and restoration or alternative foundation support designs. In general, where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Stormwater management is currently proposed via a pond facility located within Tract B. Based on the soil and groundwater conditions and the results of representative in-situ infiltration testing it is our opinion that infiltration is considered infeasible in the areas tested. Further discussion of infiltration feasibility is provided in this report.

Originally completed in January 2018, this report has been updated to reflect the current proposed site layout and to provide responses to comments prepared by the City of Puyallup (see attached DRT letter). The current project proposal no longer includes the development of the northernmost site parcel (currently referred to as Parcel A). As such, soil and groundwater exposed at test pits TP-14 through TP-18 were not utilized as a basis for the recommendations and evaluations provided in this report.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Chase G. Halsen, L.G.
Senior Project Geologist

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ES-5559

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Cont'd

ES-5559

GRAPHICS

APPENDICES

GEOTECHNICAL ENGINEERING STUDY
SUNSET POINTE
2301 – 23RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-5559

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential plat to be completed at 2301 – 23rd Street Southeast in Puyallup, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this study included the following:

- Completion of test pits for purposes of characterizing site soils.
- Completion of laboratory testing of soil samples collected at the test pit locations.
- Conduction of engineering analyses and preparation of this report.

The following documents and maps were reviewed as part of our study preparation:

- Sunset Pointe Preliminary Plat Set, prepared by CES NW, Inc., dated October 22, 2020;
- Puyallup Municipal Code Chapter 21.06;
- Development Review Team Letter, prepared by the City of Puyallup, dated May 16, 2022;
- Online Web Soil Survey (WSS) resource, maintained by the Natural Resources Conservation Service under the United States Department of Agriculture;
- Liquefaction Susceptibility for Pierce County incorporating data from the Washington State Department of Natural Resources, dated September 2004, and;
- Geologic Map of the South Half of the Tacoma Quadrangle, Washington, by Timothy J. Walsh, 1987.

Project Description

We understand the site will be developed into a residential plat consisting of 18 residential lots and general site improvements. Stormwater management will be provided via a pond located within Tract B. At the time of report submission, building load plans were not available for review; however, based on our experience with similar developments, the proposed residential structures will likely be two to three stories in height and constructed using relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads of about 1 to 2 kips per lineal foot (klf) are expected. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf). We understand that grade fills of up to 20 feet will be necessary to achieve design elevations across the building pads and grading will occur in a stepped configuration where practical do reduce the site modifications required. Deeper excavations will likely be required to construct the stormwater pond.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review the final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located east of the intersection between 19th Avenue Southeast and 21st Street Southeast in Puyallup, Washington. The approximate location of the subject site is depicted on Plate 1 (Vicinity Map). The irregular-shaped property is comprised of two adjoining tax parcels (Pierce County Parcel Nos. 042035-3027) totaling approximately 9.09 acres.

The site is bordered on all sides primarily by existing residential development. A sewer and water easement is present on site, trending roughly east to west along the entire northern edge of the development area. A relay station is present within the east-central site area. Multiple barn and storage structures appear to have been present within the southern site area but had been demolished before our fieldwork. Based on our field observations, it appears that the land has been previously modified through the placement of fill material. It appears that the fill had been placed to establish an access pathway to the southern site area, to level sloping areas, and fill an existing natural trough feature. Based on our observations, it is our opinion the site modification was likely not associated with recent development. Current topography varies across the site; however, maintains an overall northerly/northeasterly declivity. Approximately 30 to 35 feet of total elevation change occurs within the proposed development area. Three existing wetlands (designated A-C on the referenced plans) are present within the central site area.

Subsurface

The subsurface explorations and in-situ filed testing consisted of the following:

- October 24, 2017: Completing 19 test pits were conducted across the entire site area (including Parcel A).

- May 15, 2019: Completing four test pits were conducted and targeted to the proposed stormwater management pond (Tract B). Three shallow groundwater monitoring piezometers were installed during this exploration.

- January 22, 2020: Completing two test pits were performed to conduct small-scale pilot infiltration testing at representative site areas. A shallow, groundwater monitoring piezometer was installed at both test pit locations.

Each exploration and in-situ testing program was observed, logged, and sampled by an ESNW representative and completed using machinery and an operator retained by our firm and completed to assess and classify subsurface soil and groundwater conditions across the site. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in accordance with the Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was encountered generally within the upper 2 to 18 inches of existing grades at the test pit locations. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions.

Fill was observed at the majority of the test pit locations, ranging in approximate depths from 1 to 13 feet below the existing ground surface (bgs). The fill was observed to be variable in nature, typically consisting of silty sand to sandy silt, and encountered in a loose to medium dense and moist condition. In general, the majority of the fill was observed to be free of debris, except isolated areas of brick and wire debris and trace organics. Due to the high variability in texture of the fill soils, ESNW should be retained to evaluate the suitability of fill encountered during construction.

Native Soil

Underlying topsoil and fill, native soils were encountered consisting of soils associated with and representative of glacial drift deposits. In general, the predominant native soil type should be considered silty sand with or without gravel (USCS: SM). However, localized areas and depositional lenses of poorly graded sand and silt (USCS: SP and ML, respectively) were encountered. The native soils were typically encountered in a medium dense and moist conditions.

Geologic Setting

The referenced geologic map resource identifies Vashon undifferentiated drift (Qdv) across the site and surrounding areas. Although not specifically characterized within the geologic map resource, Vashon drift typically consists of glacial till, glaciofluvial, and glaciolacustrine sediments. The reference WSS resource indicates soils of the Everett very gravelly sandy loam, Indianola loamy sand, and Kitsap silt loam (Map Unit Symbols: 13B, 18C, 20B, and 20C, respectively). These soil groups are typically associated with moraines, eskers, kames, and terrace landforms, derived from glacial outwash and glaciolacustrine material. The variability in the makeup of the native soils is generally consistent with that of Vashon drift.

Groundwater

Perched groundwater seepage was encountered at TP-4, TP-201, and TP-202 during the subsurface explorations. In general, the seepage was exposed at depths of about one-and-one-half to six feet bgs and characterized as light to heavy.

In our opinion, the contractor should anticipate, and be prepared to manage, zones of perched groundwater seepage during construction, especially within deeper excavations depending on the time of year grading occurs. Groundwater seepage is common within glacial sediments, particularly within relatively permeable lenses and/or atop dense to very dense, unweathered deposits. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

ESNW is currently performing a groundwater monitoring program for the site at three of the previously installed shallow wells. The results of the program and applicable design recommendations will be provided in a summary letter separate from this report.

Geologically Hazardous Areas

In preparation of this report, we reviewed the applicable city of Puyallup mapping and geologically hazardous area code section 21.06.

Landslide Hazard

As defined in Puyallup Municipal Code (PMC) 21.06.1210, landslide and erosion hazard areas include those identified by the U.S. Department of Agriculture Natural Resources Conservation Service as having a moderate to severe, severe, or very severe erosion hazard because of natural characteristics, including vegetative cover, soil texture, slope, gradient, and rainfall patterns, or human-induced changes to natural characteristics. Landslide and erosion hazard areas include areas with the following characteristics:

- Areas that have shown mass movement during the Holocene epoch (from 10,000 years ago to the present) or that are underlain or covered by mass wastage debris of that epoch;

- Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;

- Slopes having gradients steeper than 80 percent subject to rock fall during seismic shaking;

- Areas potentially unstable because of stream incision or stream bank erosion;

- Areas located in a canyon, ravine, or on an active alluvial fan, presently or potentially subject to inundation by debris flows or flooding;

- Any area with a slope of 40 percent or steeper and a vertical relief of 10 or more feet, except areas composed of consolidated rock and properly engineered manmade slopes/retained fill. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief;

- Areas with a severe limitation for building development because of slope conditions, according to the Natural Resource Conservations Service, and;

- Areas meeting all three of the following criteria: (A) slopes steeper than 15 percent, except that slopes of less than 15 percent may be considered erosion hazard areas if they have certain unstable soil and drainage characteristics; (B) hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and (C) wet season springs or groundwater seepage.

Based on the conditions encountered during our subsurface explorations, review of available topographic information, and review of the referenced slope schematic (which includes delineations of slopes greater than 40 percent), it appears that the majority of the site does not contain a landslide hazard, as defined by the PMC, except as noted below.

Slopes of 40 percent or greater have been delineated within the central site area and are associated with the sidewalls of Wetland A and Wetland C. However, these slopes are isolated and relatively minor in extent. Based on a review of the referenced preliminary plat plan set, a 25-foot buffer has been applied to each respective steep slope feature. Although the buffer appears to intersect the northwest corner of Lot 15, it is outside of the proposed building pad area; therefore, is outside future structural improvements.

In general, the development areas of the site do not contain a landslide hazard. Although some areas on site may meet the PMC criteria for landslide hazard, they are isolated and limited in occurrence. In our opinion, the site does not contain a hazard that would preclude successful development. However, remediation of unsuitable existing soils and groundwater drainage improvements will likely be necessary to assist in maintaining or improving post-construction soil stability. As such, ESNW should be present during grading activities to help identify areas of unsuitable soil and groundwater seepage and provide such mitigation recommendations. From a geotechnical standpoint, provided the recommendations of the referenced report and those contained within this letter are incorporated into the project designs, it is our opinion, based on our understanding of the current scope, the project can be developed as is currently proposed.

Erosion Hazard

As delineated in Puyallup Municipal Code (PMC) 21.06.1210, erosion hazard areas include those identified by the U.S. Department of Agriculture Natural Resources Conservation Service as having a moderate to severe, severe, or very severe erosion hazard because of natural characteristics, including vegetative cover, soil texture, slope, gradient, and rainfall patterns, or human-induced changes to natural characteristics.

Site soils are considered to have moderate to severe erosion potential when exposed to precipitation. In our opinion, provided appropriate temporary and permanent erosion and sediment control (ESC) measures are incorporated into final designs, the potential for erosion will remain low both during and after construction. Site BMPs and other means of sediment and surface flow control measures should be actively maintained during construction to ensure proper performance and functions. While seasonal grading restrictions may not be required for this project, we recommend the developer be prepared to employ enhanced ESC measures during the rainy season and be prepared to suspend grading activities if adequate BMPs cannot perform as intended during intense precipitation.

Provided the above recommendations and considerations are included with the construction plan and sequence, it is our opinion that the proposed development will not adversely affect soil stability on adjacent properties. Please note that our evaluation and corresponding lot recommendations are based on plans and site layouts made available to ESNW during report preparation. If site layout plans change, ESNW should be notified to provide updated recommendations.

DRT Comments and Response

For ease of review and clarity, this section of the report will be focused on responding to geotechnically related jurisdictional comments provided in the referenced DRT letter. Some elements of this response may be a duplicated from the discussion, evaluations, and/or recommendations provided in this report.

***Planning and Review Comment 4**: A 25' native growth protection area (NGPA) shall be provided on the rear of lot 13 due to slopes and protective buffer areas of 40% (or more) slopes and wetlands, per the Geotech report. These areas shall be landscaped and landscape plan shall be provided for these lots during final landscape plan and approval. February 2022, staff follow up comment: Please revise the lot layout with this protection area shown on the plat sheet(s) as 40% (or more) area (using the same call out as on Tract A) and show buffer setback.*

ESNW Response: As indicated on the referenced plan set, a NGPA of 35' feet has been incorporated along the east property line and encompasses all or a part of Lots 8 through 13. Furthermore, a 25-foot buffer has been incorporated in sloping areas that meet or exceed 40 percent, both of which are located around Wetland A or C. The slope buffer in proximity to Wetland A encompasses a part of the proposed stormwater pond and a minor portion of Lot 15. With respect to Wetland C, the slope buffer does not encroach on any adjacent lot areas.

***Engineering Review Comment 2**: First and foremost, there will be no further review of the civil portion of the Major Plat due to the non-response to repeated requests for detailed long term groundwater monitoring. In addition, 2 test pits are not adequate for a site this size. Infiltration must be shown as infeasible in order for the project to claim that it is infeasible and not use it. Provide detailed account of testing and tabulated results.*

ESNW Response: Site subsurface conditions were explored in October 2017, May 2019, and January 2020 and indicated variability concerning soil types present and grain size distribution across the site. Per USDA testing methods and procedures, native soils are also classified as slightly gravelly sand, gravelly loamy coarse sand, very gravelly loamy sand, and loam. Fines contents were about 6 percent within the sands, 26 to 40 percent within the sandy loam, and 58 to 98 percent within the gravelly loam and loam, as indicated by the sieve results of representative samples. To further evaluate site infiltration potential, two small-scale pilot infiltration tests (PITs) were performed in January 2020. The following table depicts each infiltration test location, encountered soil type, test depth, measured rate, appropriate safety factors, and recommended design rate.

Location	**Soil Type**	**Test Depth (ft bgs)**	**Measured Rate (in/hr)**	**Correction Factors**			**Recommended Design Rate (in/hr)**
				CF_v	**CF_t**	**CF_m**	
TP-201	ML	4.0	0	0.33	0.5	0.9	0
TP-202	ML	4.0	0	0.33	0.5	0.9	0

In accordance with our previous evaluations and recommendations, it is our opinion that infiltration be considered infeasible for the proposed project. Based on the soil and groundwater conditions exposed during each subsurface exploration, and the observed field infiltration rate of zero in/hr. at both PIT locations, it is our opinion that infiltration infeasibility has been sufficiently demonstrated.

Engineering Review Comment 6b: *The stormwater pond is located within a steep slope buffer. Per the DOE stormwater manual, the facility shall not be located above a slope that exceeds 15 percent.*

Engineering Review Comment 6d: The stormwater pond will be a City-owned infrastructure. The city does not accept its current location above a steep slope that leads to a wetland. This configuration will likely cause additional maintenance and has a potential for failure over time. The pond shall be relocated.

ESNW Response: From a geotechnical standpoint, construction of the stormwater pond at the proposed location may be considered feasible provided that lateral water migration can be sufficiently prevented. In our opinion, this can be achieved by including a low-permeable liner in the pond construction. Liners can consist of a geo-membrane or compacted soil that meets the requirements of the governing stormwater manual.

Engineering Review Comment 7: *Does the soils within the wetland tract have any capabilities of infiltrating?*

ESNW Response: From a geotechnical standpoint, infiltration should not be considered within the wetland areas. The presence of perennial, ponded water indicates that the wetland area is underlying by a confining or restrictive layer. Vertical transmission of water may occur; however, based on the soil conditions encountered at the test pit locations and or field observations, it would likely be a nearly negligible amount in concurrence with lateral water migration, however, it is not expected to the degree which would allow for successful, targeted infiltration designs to the area.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, the construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, the suitability of using on-site soils as structural fill, and construction of the stormwater facility(s).

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, and performing clearing and site stripping. Subsequent earthwork activities will involve mass site grading and related infrastructure improvements.

Temporary Erosion Control

The following temporary erosion control measures are offered:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide a stable access entrance surface. The placement of a geotextile fabric beneath the quarry spalls will provide greater stability if needed. Existing asphalt/gravel drive lanes can be considered for use as a temporary construction entrance and should be observed by ESNW before construction.

- Silt fencing should be placed around the site perimeter.

- When not in use, soil stockpiles should be covered or otherwise protected.

- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed before beginning earthwork activities.

- Dry soils disturbed during construction should be wetted to minimize dust.

Additional BMPs, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. Temporary erosion control measures should be continually maintained and improved to provide proper function over the course of construction.

Stripping

Topsoil was encountered generally within the upper 2 to 18 inches of existing grades at the test pit locations. Based on the encountered conditions, an average topsoil thickness of about eight to nine inches may be assumed ESNW should be retained to observe site stripping activities at the time of construction so that the degree of required stripping may be assessed. The exposed subgrade may still possess root elements, other organic material, or be present in a loose condition. As such, ESNW should evaluate the exposed soil subgrade to determine if further stripping or in-situ compaction efforts prior to fill operations or finish grading is necessary. Over-stripping should be avoided, as it is unnecessary and may result in increased project development costs. Topsoil and organic-rich soil are neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas if desired.

In-situ and Imported Soils

On-site soils are highly moisture sensitive; therefore, successful use as structural fill largely being dictated by the moisture content at the time of placement and compaction. Remedial measures, such as soil aeration and/or cement treatment (where allowed by the local jurisdiction or utility district), may be necessary as part of site grading and earthwork activities. Existing fill soils to be used within structural applications must be free of deleterious debris, especially concerning construction-like debris and organic material. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, a contingency should be provided in the project budget for the export of soil that cannot be successfully compacted as structural fill if grading activities take place during periods of extended rainfall activity. Soils with fine contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Subgrade Preparation

Following site stripping, cuts and fills will be completed to establish proposed subgrade elevations across the site. To establish a suitable subgrade for structural elements, recompaction of existing fill soils will likely be necessary for some areas. Due to the variable thickness and extent of the existing fill, it is our opinion that structural elements within the deeper fill areas be underlain by at least four feet of structural fill. It may be possible to recompact and reuse existing fill provided that it is free of deleterious material and contain a moisture content that is near optimum and is approved by ESNW at the time of placement and compaction.

Subgrades founded in competent native soils can likely be compacted in situ with mechanical equipment until a uniformly firm and unyielding condition is achieved. ESNW should observe the subgrade(s) during initial site preparation activities to confirm soil conditions are as anticipated and to provide supplementary recommendations for subgrade preparation, as necessary.

Please note the above considerations are based on current site layout plans available to ESNW, as depicted on the Test Pit Location Plan attached to this report. Should site layout designs change, ESNW should be informed and allowed to reevaluate necessary preparation efforts in relation to corresponding Lot numbers.

Structural Fill

Structural fill is defined as compacted soil placed in the foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). Soils intended for use as structural fill should be generally free of organic and deleterious material. For soil placed in utility trenches underlying structural areas, compaction requirements are dictated by the local city, county, or utility district, and are typically specified to a relative compaction of at least 95 percent.

Slope Fill

Structural fill placed along sloping areas (where a “sloping area” is defined as an area inclined at 15 percent or steeper) should be placed on a level bench as depicted on Plate 3 (Slope Fill Detail). Benches must be “keyed” into the slope and subsequently filled and compacted with suitable structural fill before continuing to the next bench. Sloping finish grades should be “overbuilt” using a bench-style fill and cut to the design gradient to ensure a permanent compacted slope face is maintained. ESNW should observe structural fill placement to confirm subgrade conditions and provide additional drainage recommendations, as necessary.

Temporary Excavations and Slopes

Excavation activities will likely expose loose to medium dense fill and weathered native soils that transition to medium dense to dense native soils at depth. Based on the soil conditions observed at the test pit locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Loose to medium dense soil — 1.5H:1V (Type C)
- Areas containing groundwater seepage — 1.5H:1V (Type C)
- Dense to very dense native soil — 0.75H:1V (Type A)

Steeper temporary slope inclinations within undisturbed, very dense native deposits may be feasible based on the soil and groundwater conditions exposed within the excavations. Steeper inclinations may be considered and must be subsequently approved, by ESNW at the time of grading.

Permanent slopes should be planted with vegetation to enhance stability and minimize erosion and should maintain a maximum gradient of 2H:1V or inclination prescribed by the governing jurisdiction. The presence of perched groundwater may cause localized sloughing of temporary slopes due to excess seepage forces. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations, as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

Foundations

In our opinion, the proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, recompacted existing fill, or suitable structural fill placed directly on competent native soils. In general, native soils competent for foundation support are anticipated to be encountered at approximate depths of two to five feet below the existing ground surface elevation. Areas underlain by existing fill may require additional preparation techniques to establish suitable and uniform bearing conditions, such as overexcavating unsuitable existing fill and restoring grades with suitable structural fill. Re-working and re-compacting the in-place fill may be feasible in areas where the fill is devoid of organic and deleterious material but must be evaluated by ESNW during grading. Areas of deeper fill may require additional or complete over excavation and restoration or alternative foundation support implementations (see Subgrade Preparation section of the report). In general, where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Provided the foundations will be supported as described above, the following parameters may be used for the design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically concerning earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (g)	1.255
Mapped 1-second period spectral response acceleration, S_1 (g)	0.432
Short period site coefficient, F_a	1.0
Long period site coefficient, F_v	1.868†
Adjusted short period spectral response acceleration, S_{MS} (g)	1.255
Adjusted 1-second period spectral response acceleration, S_{M1} (g)	0.807†
Design short period spectral response acceleration, S_{DS} (g)	0.837
Design 1-second period spectral response acceleration, S_{D1} (g)	0.538†

* *Assumes medium dense native soil conditions, encountered to a maximum depth of 18 feet bgs during the October 207, May 2019, and January 2020 field exploration, remain medium dense (if not become denser) to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner, and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered low. The depth of the regional groundwater table and the encountered in-situ density of the native soil were the primary bases for this opinion.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed residential structures should be supported on a well-compacted, firm, and unyielding subgrade. Where feasible, competent native soil exposed at the slab-on-grade subgrade level can likely be compacted in situ to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, before construction of the slab.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, the installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for the design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 55 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)*
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 8H psf**

* *Where applicable.*
** *Where H equals the retained height (in feet).*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 4. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Based on our field observations, isolated zones of perched groundwater seepage should be anticipated within site excavations depending on the time of year grading occurs. Temporary measures to control surface water runoff and groundwater seepage during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for instability related to seepage effects.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 5.

Infiltration Feasibility Evaluation

Site subsurface conditions were initially explored in October 2017, May 2019, and January 2020 and indicated variability concerning soil types present and grain size distribution across the site. Per USDA testing methods and procedures, native soils are also classified as slightly gravelly sand, gravelly loamy coarse sand, very gravelly loamy sand, and loam. Fines contents were about 6 percent within the sands, 26 to 40 percent within the sandy loam, and 58 to 98 percent within the gravelly loam and loam, as indicated by the sieve results of representative samples. To further evaluate site infiltration potential, two small-scale pilot infiltration tests (PITs) were performed in January 2020. The following table depicts each infiltration test location, encountered soil type, test depth, measured rate, appropriate safety factors, and recommended design rate.

Location	**Soil Type**	**Test Depth (ft bgs)**	**Measured Rate (in/hr)**	**Correction Factors**			**Recommended Design Rate (in/hr)**
				CF_v	**CF_t**	**CF_m**	
TP-201	ML	4.0	0	0.33	0.5	0.9	0
TP-202	ML	4.0	0	0.33	0.5	0.9	0

In accordance with our previous evaluations and recommendations, it is our opinion that infiltration be considered infeasible for the proposed project. Based on the soil and groundwater conditions exposed during each subsurface exploration, and the observed field infiltration rate of zero in/hr. at both PIT locations, it is our opinion that infiltration infeasibility has been sufficiently demonstrated.

Preliminary Stormwater Pond Recommendations

We understand that a stormwater detention pond will be constructed in Tract B for stormwater management for the project. We anticipate cuts of 10 feet or more feet will be necessary to reach the design subgrade elevation of the pond. Based on our field observations, grade cuts for the pond are likely to expose glacial drift deposits. Where necessary, the pond liner should consist of a suitable low-permeability material and may include compacted till liner. Appropriate gradation, liner thickness, and liner installation requirements should be determined by reviewing the standards provided in the governing stormwater management manual.

The functional success of a pond is largely related to construction methods, particularly compacted berms. In our experience, inadequate or poor construction techniques may cause pond berms to leak and fail. Leaks are difficult to detect and remediate, and as such, are costly and time-consuming to address. ESNW should be contacted to review the final pond designs to confirm that appropriate geotechnical considerations have been incorporated. ESNW should observe construction activities for the pond on a full-time basis to confirm adequate soil compaction and installation methods are used and to provide supplementary recommendations, as necessary.

Utility Support and Trench Backfill

In our opinion, on-site soils will generally be suitable for the support of utilities. Remedial measures may be necessary for some areas to provide support for utilities, such as overexcavation and replacement with structural fill and/or placement of geotextile fabric. Groundwater seepage may be encountered within utility excavations, and caving of trench walls may occur where groundwater is encountered. Depending on the time of year and conditions encountered, dewatering, as well as temporary trench shoring, may be necessary during utility trench excavation and installation.

Successful use will depend on the soil's moisture content at the time of placement and compaction. The silt soils encountered at our test pit locations is not suitable for utility trench backfill. Moisture conditioning of the soils may be necessary at some locations before use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should consist of and be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the governing jurisdiction or agency.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as over-excavation and/or placement of thicker crushed rock or structural fill sections, before pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

For heavy-loaded pavement areas such as main interior access roads and areas subject to occasional large commercial vehicle traffic, the following preliminary pavement sections may be considered:

- Three inches of HMA placed over six inches of CRB, or;

- Three inches of HMA placed over three inches of ATB.

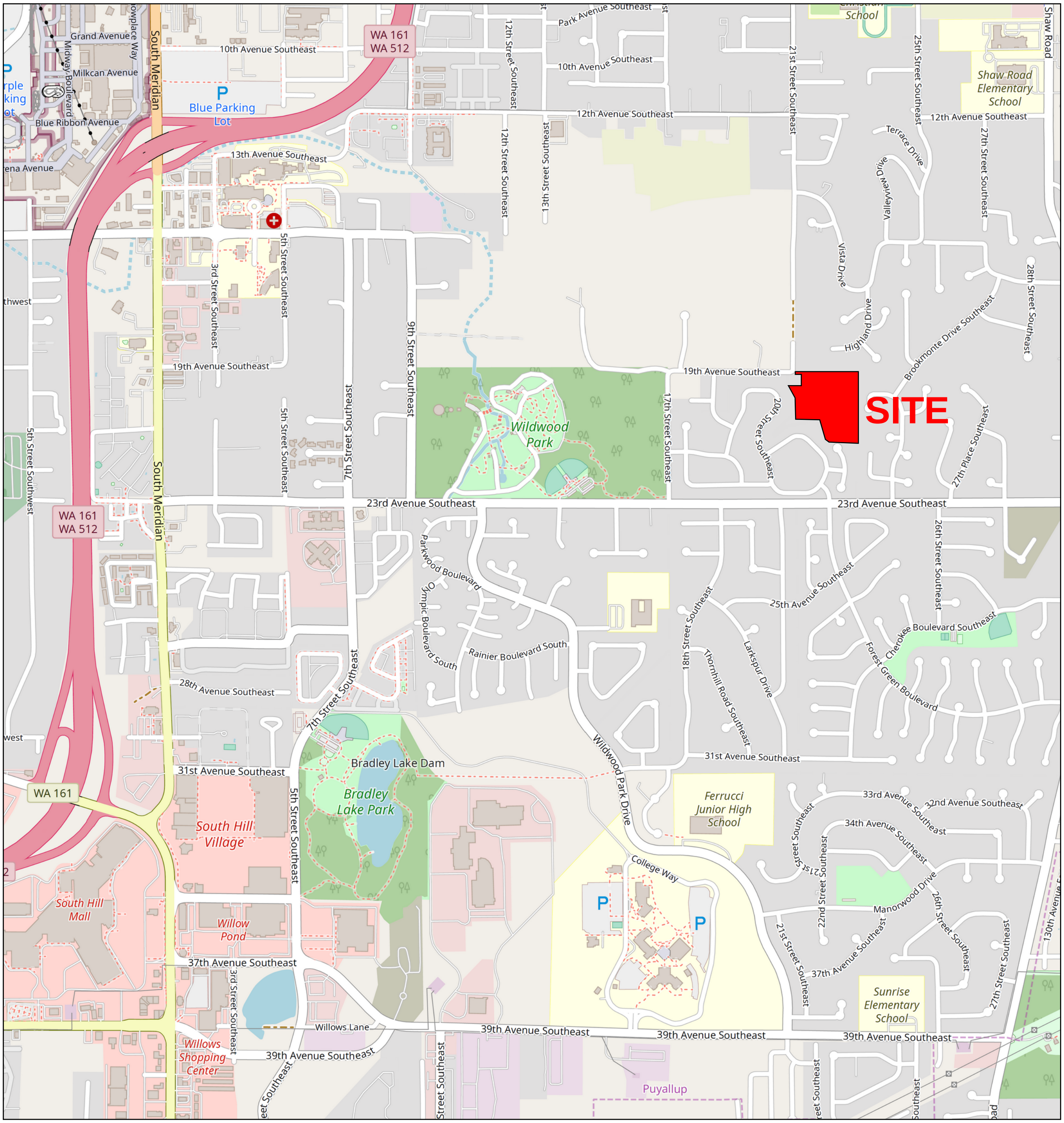
The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by a modified proctor test (ASTM D1557). Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the governing jurisdiction may supersede the recommendations provided in this report. If the roadway will be constructed with an inverted crown, additional drainage recommendations may be necessary, as evaluated and recommended by ESNW at the time of construction.

LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
Pierce County, Washington
OpenStreetMap.org

NORTH

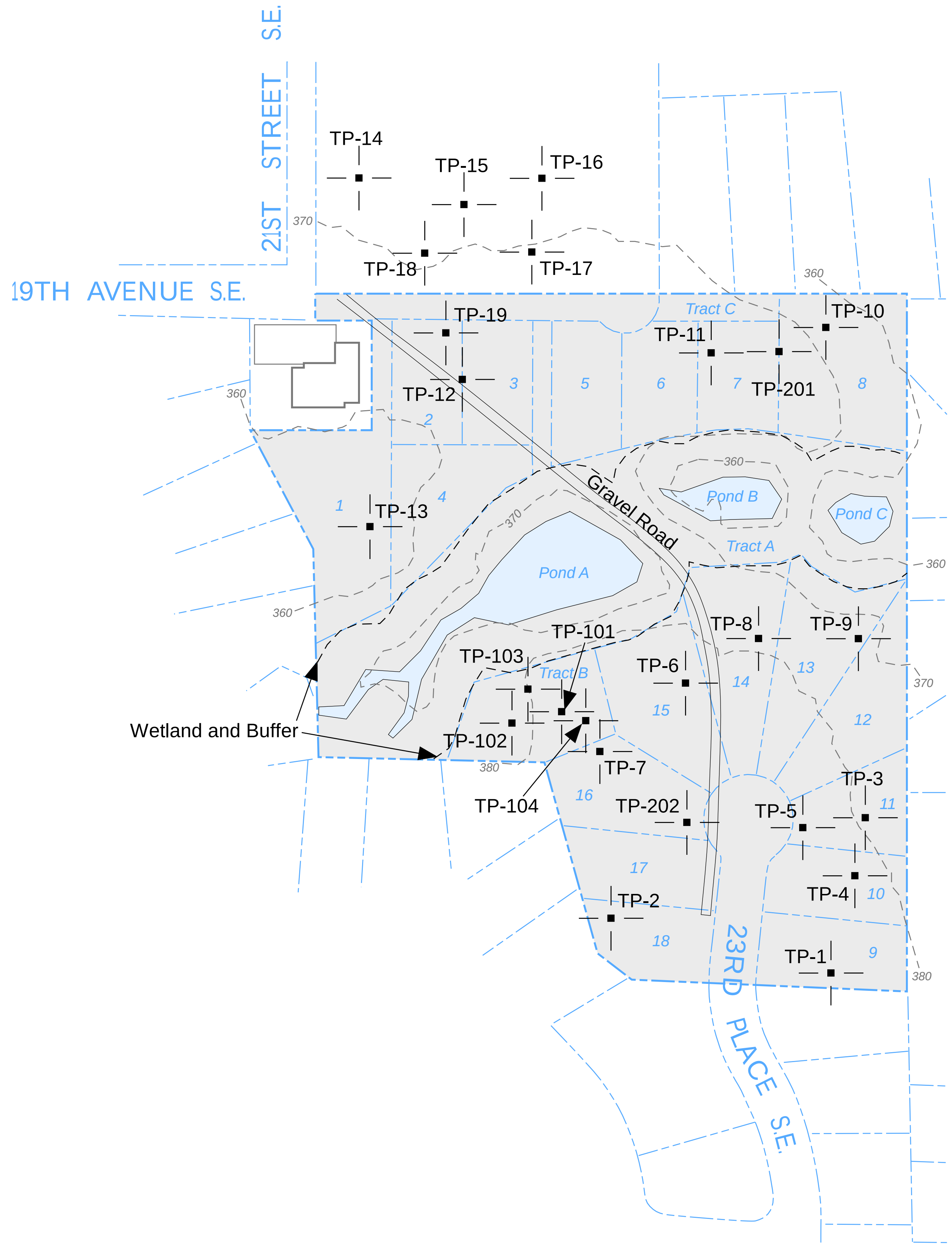
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

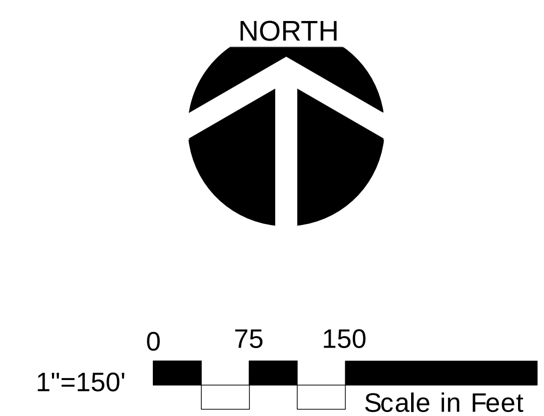
Vicinity Map
Sunset Pointe
Puyallup, Washington

Drwn. CAM	Date 04/05/2023	Proj. No. 5559
Checked CGH	Date April 2023	Plate 1



LEGEND

TP-201	Approximate Location of ESNW Test Pit, Proj. No. ES-5559.03, Jan. 2020
TP-101	Approximate Location of ESNW Test Pit, Proj. No. ES-5559, May 2019
TP-1	Approximate Location of ESNW Test Pit, Proj No. ES-5559, Oct. 2017
	Subject Site
	Existing Building
10	Proposed Lot Number



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

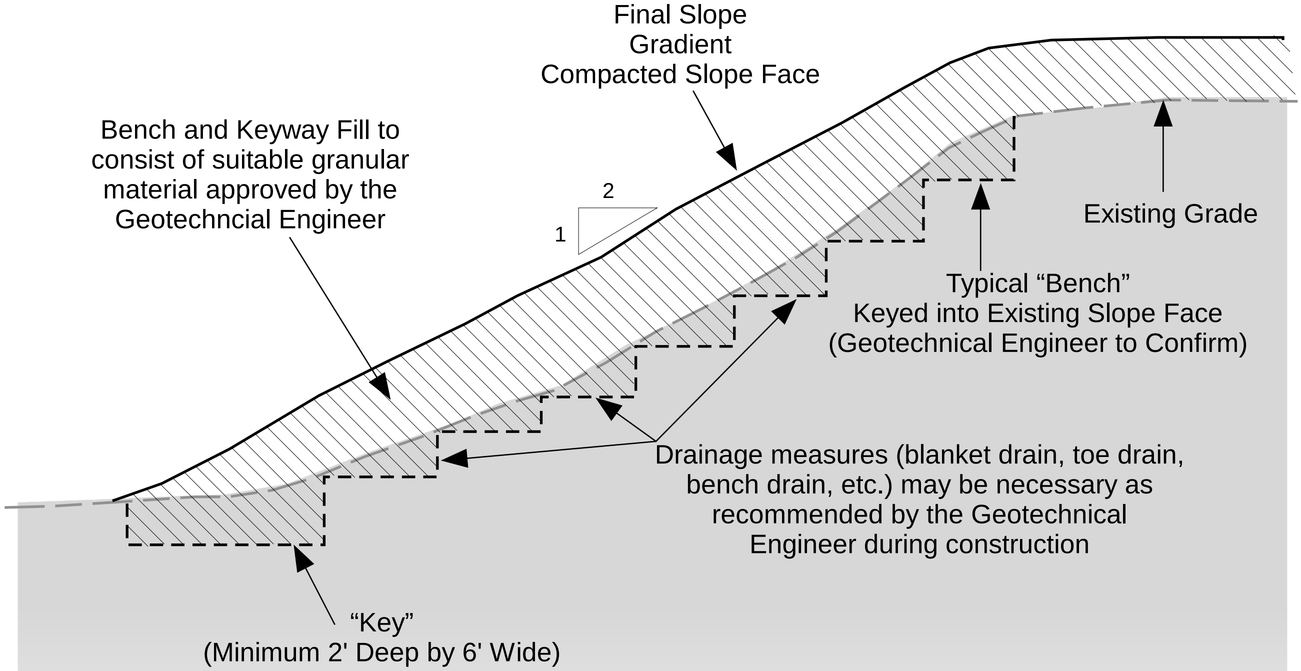
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Sunset Pointe
Puyallup, Washington

Earth Solutions NWLLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By CAM
Checked By CGH
Date 04/05/2023
Proj. No. 5559
Plate 2

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING



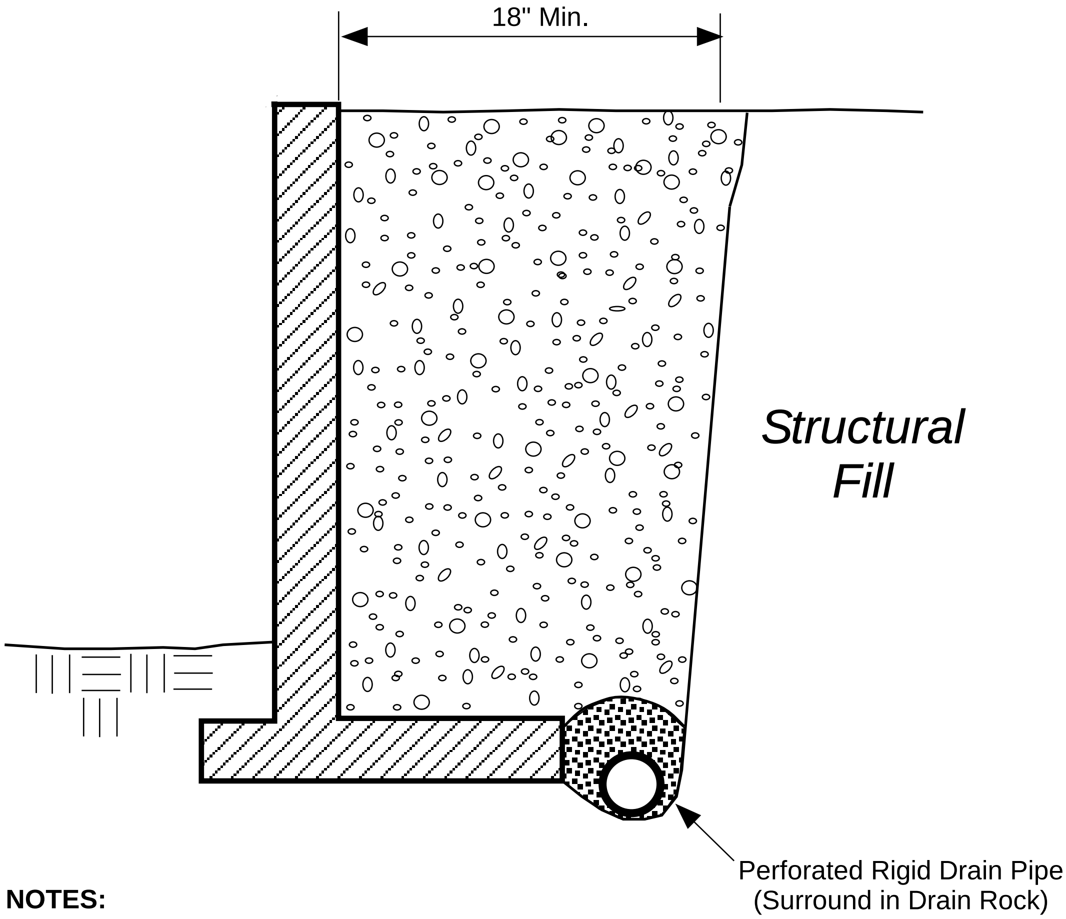
NOTES:

- Slope should be stripped of topsoil and unsuitable materials prior to excavating Keyway or benches.
- Benches will typically be equal to a bulldozer blade width of approximately 8 feet but shall be at least 4 feet.
- Final slope gradient should be 2H : 1V.
- Final slope face should be densified by over-building with compacted fill and trimming back to shape or by compaction with a bulldozer or vibratory drum roller.
- Planting or hydroseeding slope face with a rapid growth deep-rooted vegetative mat will reduce erosion potential of slope area.
- Use of pegged-in-place jute matting or geotechnical fabric will help maintain the seed and mulch in place until the root system has an opportunity to germinate.
- Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness. Each lift should be compacted to no less than the degree specified in the “Site Preparation and Earthwork” section of this report. No additional lift should be placed until compaction is achieved.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Slope Fill Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 3

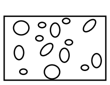


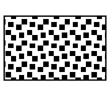
NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

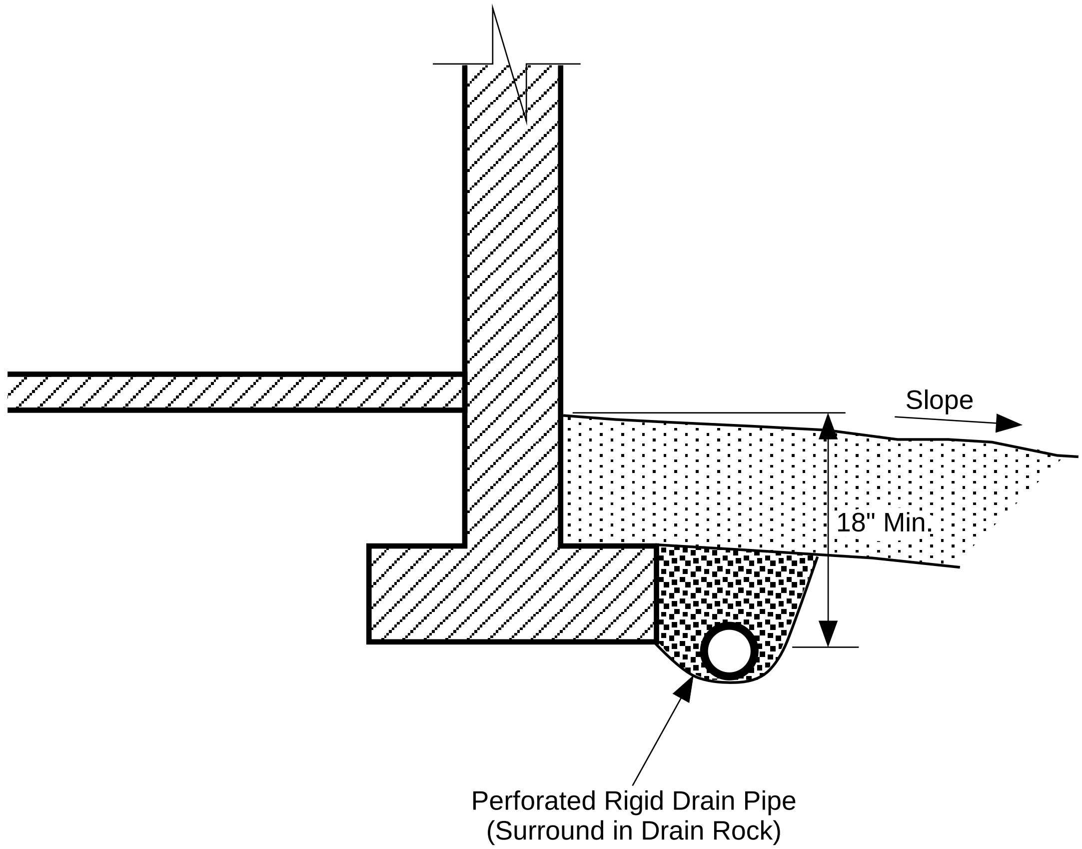
 Free-draining Structural Backfill

 1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 4



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

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Footing Drain Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 5

Appendix A

Subsurface Exploration
Test Pit Logs

ES-5559

Subsurface conditions at the subject site were explored by an ESNW representative on October 24, 2017, May 15, 2019, and January 22, 2020. A total of 25 test pits were excavated at accessible areas of the site using an operator and trackhoe retained by ESNW. The approximate locations of the test pits are illustrated on Plate 2 of this study. The test pits logs are provided in this Appendix. The test pits were excavated to a maximum depth of approximately 18 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Major Divisions		Fines	Group Symbol	Description
Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

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

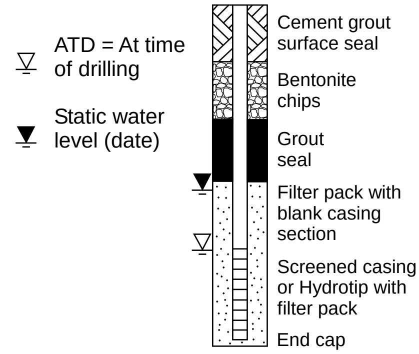
Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols



Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

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EXPLORATION LOG KEY

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TEST PIT NUMBER TP-201

PROJECT NUMBER ES-5559.03
PROJECT NAME Sunset Pointe
DATE STARTED 1/22/20 **COMPLETED** 1/22/20
GROUND ELEVATION 374 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	Layer depth	MATERIAL DESCRIPTION	Elevation
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 1'	373.5
		MC = 20.7 MC = 32.6 Fines = 88.9	ML		4.5	Tan SILT, medium dense, moist to wet -mottled texture [USDA Classification: LOAM]	369.5
5		MC = 15.1	SP		6.0	Gray poorly graded SAND, dense, moist to wet -heavy iron oxide staining at contact, light groundwater seepage at 6'	368.0
		MC = 30.7 MC = 30.5 Fines = 78.7	ML		8.0	Gray SILT with sand, dense, moist to wet -minor iron oxide staining throughout [USDA Classification: slightly gravelly LOAM]	366.0

Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 6.0 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-202

PROJECT NUMBER ES-5559.03
PROJECT NAME Sunset Pointe
DATE STARTED 1/22/20 **COMPLETED** 1/22/20
GROUND ELEVATION 388 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	Bottom depth (ft)	MATERIAL DESCRIPTION	Elevation (ft)
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 6"	387.5
			FILL		1.5	Crushed rock (Fill) -light perched groundwater seepage	386.5
		MC = 31.9	SM		2.7	Tan silty SAND, medium dense, moist ~<8" sand lens	385.3
		MC = 19.4 Fines = 58.7 MC = 31.8	ML		4.5	Tan sandy SILT, dense, moist -becomes gray [USDA Classification: slightly gravelly LOAM]	383.5
5		MC = 13.3 Fines = 39.9	SM		8.0	Gray silty SAND, dense, moist -light iron oxide staining -increased sand content [USDA Classification: slightly gravelly fine sandy LOAM]	380.0

Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 1.0 foot during excavation. No caving observed.

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TEST PIT NUMBER TP-101

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/19/19
GROUND ELEVATION 383 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": heavy bramble
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth	Elevation
0			TPSL		Dark brown TOPSOIL, root intrusions to 12"	1.0	382.0
		MC = 13.8	SM		Gray silty SAND with gravel, dense, moist (Fill) -sand lens ~12" thick	5.5	377.5
5		MC = 20.0 MC = 27.3 Fines = 90.0	ML		Gray SILT, medium dense, moist (Fill) -becomes brown, increased fines [USDA Classification: slightly gravelly LOAM]	13.0	370.0
10		MC = 31.9 Fines = 95.8	ML		Tan SILT, medium dense, wet [USDA Classification: LOAM]	15.0	368.0
15		MC = 35.3 MC = 28.5	SM		Tan silty SAND, medium dense, wet to saturated -minor iron oxide staining -sand lens 6"- 12" thick	18.0	365.0

Test pit terminated at 18.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-102

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/15/19
GROUND ELEVATION 376 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": heavy bramble
▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation
0			TPSL		Dark brown TOPSOIL, root intrusions to 2.25'	
1.0						375.0
			SM		Brown silty SAND, loose, moist	
2.5						373.5
		MC = 25.4 Fines = 98.3	ML		Gray SILT, dense, moist [USDA Classification: LOAM] -heavy iron oxide staining	
5		MC = 32.0 Fines = 92.5			-becomes brown, wet [USDA Classification: LOAM]	
					-becomes wet to saturated	
9.5		MC = 35.2				366.5

Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-103

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/15/19 **GROUND ELEVATION** 384 ft
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 8": heavy bush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
0			TPSL		0.6	Dark brown TOPSOIL, root intrusions to 6.25' (Fill)	383.4
			SM			Gray silty SAND with gravel, medium dense to dense, moist (Fill)	
						-asphalt debris	
		MC = 11.3					
5							
		MC = 10.4					
						-increased sand content	
						-erratic silt interbeds	
		MC = 11.7					
10							
		MC = 20.2			11.0		373.0

Test pit terminated at 11.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-104

PROJECT NUMBER	ES-5559	**PROJECT NAME**	Sunset Pointe
DATE STARTED	5/15/19	**COMPLETED**	5/15/19
GROUND ELEVATION	383 ft		
EXCAVATION CONTRACTOR	NW Excavating	**LATITUDE**	
LONGITUDE			
LOGGED BY	CGH	**CHECKED BY**	SSR
GROUND WATER LEVEL:			
NOTES	Depth of Topsoil & Sod 8": grass	**AT TIME OF EXCAVATION**	
SURFACE CONDITIONS		**AFTER EXCAVATION**	

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL	0.6	Dark brown TOPSOIL, root intrusions to 12"	382.4
		MC = 19.9	SM		Gray silty SAND with gravel, medium dense to dense, moist -becomes brown -becomes gray	
5		MC = 23.5		5.0	-heavy iron oxide staining	378.0
			ML		Gray SILT, loose, moist to wet -becomes brown, wet	
10		MC = 29.8 Fines = 93.5		11.0	[USDA Classification: LOAM]	372.0

Test pit terminated at 11.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-1

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil &Sod 1"- 3": grass ∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			Rock	0.5	Crushed Rock (Fill)
			ML	1.0	Brown SILT, loose, moist
			SP-SM		Brown poorly graded SAND with silt, medium dense, moist
		MC = 7.4 Fines = 6.2			[USDA Classification: slightly gravelly SAND]
					-increased gravel content
5					-becomes medium dense to dense
		MC = 4.4			
					-increased cobbles
		MC = 7.4		9.0	
					Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-2

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 4": brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.3	Dark brown TOPSOIL (Fill), root intrusions to 7'
			Fill	1.0	Clean washed ROCK (Fill)
		MC = 21.6	ML	5.0	Brown/tan sandy SILT, medium dense, moist -light iron oxide staining 2'- 4'
5			SP	6.5	Gray poorly graded SAND, medium dense to dense, moist
		MC = 9.5	ML	8.0	Tan sandy SILT, dense, moist
		MC = 4.8	SP	9.0	Gray poorly graded SAND with gravel, dense, moist -caving caused by excavation activities

Test pit terminated at 9.0 feet below existing grade. No groundwater seepage encountered during excavation. Caving observed from 6.0 to 6.5 feet and 8.0 feet to BOH.

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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 18": brush ∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL (Fill), intrusions to 7'
				1.5	
		MC = 8.9	SM		Gray silty SAND with gravel, medium dense, moist (Fill) -clean washed rock ~4" thick -becomes brown dense
5		MC = 8.1 Fines = 15.9			[USDA Classification: very gravelly loamy SAND]
				7.0	
			ML		Gray SILT with sand, medium dense, moist (Fill)
		MC = 19.2		9.0	

Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-4

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose to medium dense, moist (Fill) -root intrusions to 9' -heavy perched groundwater seepage
5		MC = 12.3		7.0	
			ML		Gray SILT with sand, loose to medium dense, wet (Fill) -trace organics -light iron oxide staining
10		MC = 19.3			
		MC = 22.1		12.0	
			ML		Brown sandy SILT, dense, moist -light iron oxide staining
15		MC = 27.4		15.0	

Test pit terminated at 15.0 feet below existing grade. Groundwater encountered seepage encountered at 4.0 feet during excavation. Caving observed from 0.0 to 9.0 feet.

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TEST PIT NUMBER TP-5

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	Dark brown TOPSOIL, root intrusions to 3'
		MC = 7.2	SM		Brown silty SAND, medium dense, moist -becomes tan, damp to moist
5		MC = 20.9	SM		-becomes dense -light iron oxide staining
		MC = 12.4	SM	9.5	-becomes gray, very dense -moderate cementation, light iron oxide staining

Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-6

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2"- 4": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM	2.0	Brown silty SAND, medium dense, moist (Fill) -root intrusions to 7'
				2.5	Relic TOPSOIL Horizon
5		MC = 20.5	ML	8.0	Brown sandy SILT, medium dense, moist (Fill) -minor brick debris -becomes gray
10		MC = 10.0 MC = 31.7	SP	12.0	Brown poorly graded SAND, dense, moist -light iron oxide staining -becomes wet to saturated

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-7

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6"- 8": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 7'
			SM		Brown silty SAND, loose to medium dense, moist
		MC = 9.5			-light to moderate iron staining
					-becomes gray, very dense
5					
		MC = 18.0		9.0	-becomes wet
					Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-8

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe

DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**

NOTES Depth of Topsoil & Sod 4": brush ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 5'
			SM		Brown silty SAND, medium dense, moist
		MC = 16.3			-becomes gray, dense
5					
		MC = 17.8		8.0	
			SP	9.0	Gray poorly graded SAND, dense, moist
		MC = 3.2			

Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-9

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 4": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 3'
		MC = 21.7 Fines = 81.2	ML			Brown SILT with sand, medium dense to dense, moist [USDA Classification: LOAM] -becomes gray -light iron oxide staining
5					6.0	
		MC = 3.9	SP		6.5	Gray poorly graded SAND, dense, moist

Test pit terminated at 6.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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Fax: 425-449-4711

TEST PIT NUMBER TP-10

PROJECT NUMBER ES-5559	PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 COMPLETED 10/24/17	GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating	LATITUDE LONGITUDE
LOGGED BY CGH CHECKED BY HTW	GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2": grass	AT TIME OF EXCAVATION
SURFACE CONDITIONS	AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Gray silty SAND, medium dense, moist (Fill) -root intrusions to 3.5'
				2.0	
		MC = 12.4	TPSL	2.5	Relic TOPSOIL Horizon
5		MC = 18.7 MC = 8.9	SM		Brown silty SAND, medium dense, moist -becomes gray, dense
				9.0	Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-11

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 4'
			SM		Tan silty SAND, medium dense, moist
					-moderate iron oxide staining to 4'
		MC = 21.1			
5		MC = 20.1			-intermittent light iron oxide staining
					-becomes dense
10		MC = 16.0		10.0	Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-12

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 2": grass ∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			ML		Brown sandy SILT, medium dense, moist -root intrusions to 3'
					-becomes gray
		MC = 15.2 Fines = 60.2			[USDA Classification: LOAM]
5					
		MC = 17.3		6.0	Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

GENERAL BH / TP / WELL - 5559.GPJ - GINT US.GDT - 4/5/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-13

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 4": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			ML		Brown sandy SILT, loose to medium dense, moist
		MC = 27.3			
5					-becomes gray
		MC = 23.9			
9.5					
10		MC = 16.0	SP		Gray poorly graded SAND with gravel, dense, wet
10.0					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-14

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6"- 8": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 3'
		MC = 15.2	SM	7.0	Brown silty SAND, loose to medium dense, moist -becomes gray, medium dense -light iron oxide staining
5		MC = 7.1	SP	10.0	Gray poorly graded SAND, dense, moist
10		MC = 12.5 MC = 9.0	SM	12.0	Brown silty SAND, dense, moist

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-15

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 COMPLETED 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE LONGITUDE
LOGGED BY CGH CHECKED BY HTW
GROUND WATER LEVEL:
NOTES Surface Conditions: brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist (Fill) -trace to moderate organics throughout -root intrusions to 12'
4		MC = 18.9			
10		MC = 91.3 Fines = 79.0			[USDA Classification: gravelly loamy coarse SAND] -becomes wet
15.5			ML		Gray sandy SILT, medium dense, moist
16.0		MC = 28.6			

Test pit terminated at 16.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-16

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Surface Conditions: brush
▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Dark brown silty SAND, loose, wet
					-root intrusions to 3'
		MC = 30.8	SM		
5		MC = 16.5			-becomes brown, medium dense, moist
		MC = 7.9		6.0	-becomes gray
					Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-17

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe

DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**

NOTES Depth of Topsoil & Sod 4": brush ∇ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 24.1	SM		Brown silty SAND, loose, wet (Fill) -root intrusions to 7'
5				7.0	
		MC = 6.3	SM	7.5	Tan silty SAND, medium dense, moist

Test pit terminated at 7.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-18

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 2"- 3": brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 14.9	SM		Brown silty SAND, loose, moist (Fill) -root intrusions to 3' -wire debris
5		MC = 6.3	SM	5.0	Tan silty SAND, medium dense, moist
				6.0	Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-19

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 10": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	Dark brown TOPSOIL, root intrusions to 2'
		MC = 13.0	SM		Gray silty SAND, medium dense, moist
5		MC = 15.4		5.0	-becomes dense
					Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Appendix B

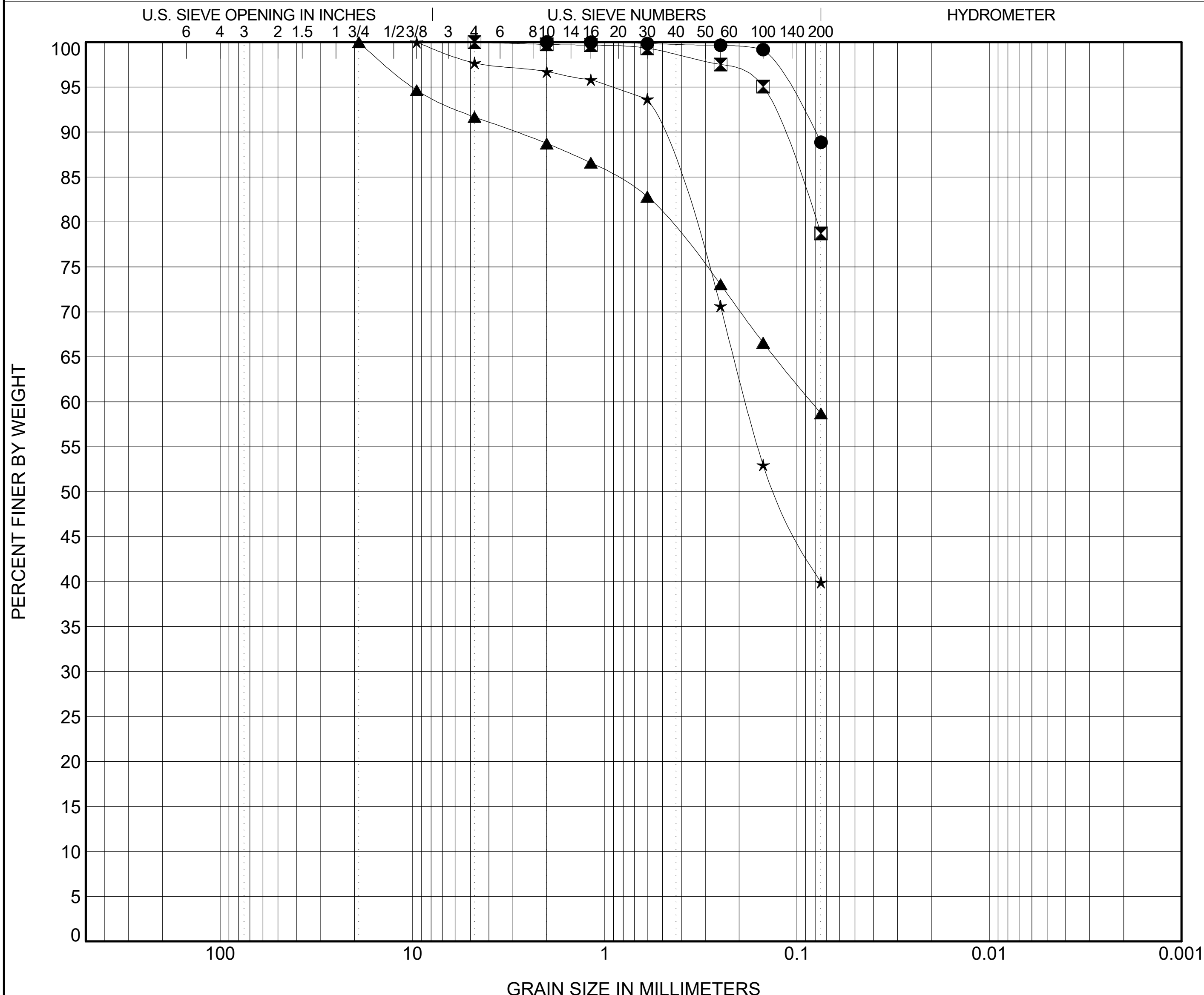
Laboratory Test Results

ES-5559

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-5559.03 **PROJECT NAME** Sunset Pointe



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

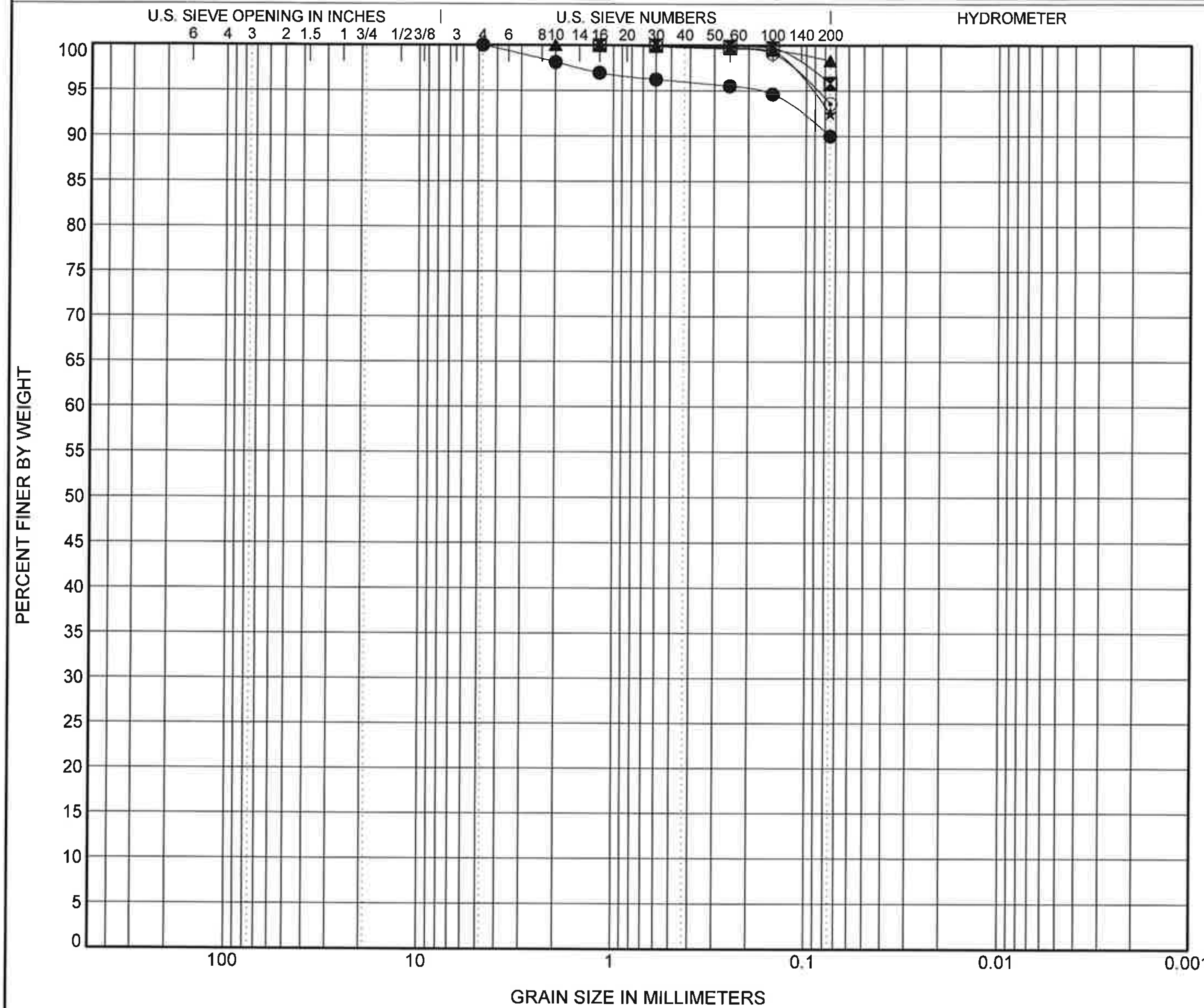
	Specimen Identification		Classification	Cc	Cu
●	**TP-201**	**4.00ft.**	**USDA: Tan Loam. USCS: ML.**		
⧗	**TP-201**	**8.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML with Sand.**		
▲	**TP-202**	**4.00ft.**	**USDA: Tan Slightly Gravelly Loam. USCS: Sandy ML.**		
★	**TP-202**	**8.00ft.**	**USDA: Gray Slightly Gravelly Fine Sandy Loam. USCS: SM.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-201**	**4.0ft.**	**2**							**88.9**	
⧗	**TP-201**	**8.0ft.**	**4.75**							**78.7**	
▲	**TP-202**	**4.0ft.**	**19**	**0.084**						**58.7**	
★	**TP-202**	**8.0ft.**	**9.5**	**0.184**						**39.9**	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**TP-101**	**10.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML.**		
⊠	**TP-101**	**14.00ft.**	**USDA: Tan Loam. USCS: ML.**		
▲	**TP-102**	**3.00ft.**	**USDA: Gray Loam. USCS: ML.**		
★	**TP-102**	**6.00ft.**	**USDA Brown Loam. USCS: ML.**		
⊙	**TP-104**	**11.00ft.**	**USDA: Brown Loam. USCS: ML.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-101**	**10.0ft.**	**4.75**							**90.0**	
⊠	**TP-101**	**14.0ft.**	**1.18**							**95.8**	
▲	**TP-102**	**3.0ft.**	**2**							**98.3**	
★	**TP-102**	**6.0ft.**	**1.18**							**92.5**	
⊙	**TP-104**	**11.0ft.**	**1.18**							**93.5**	

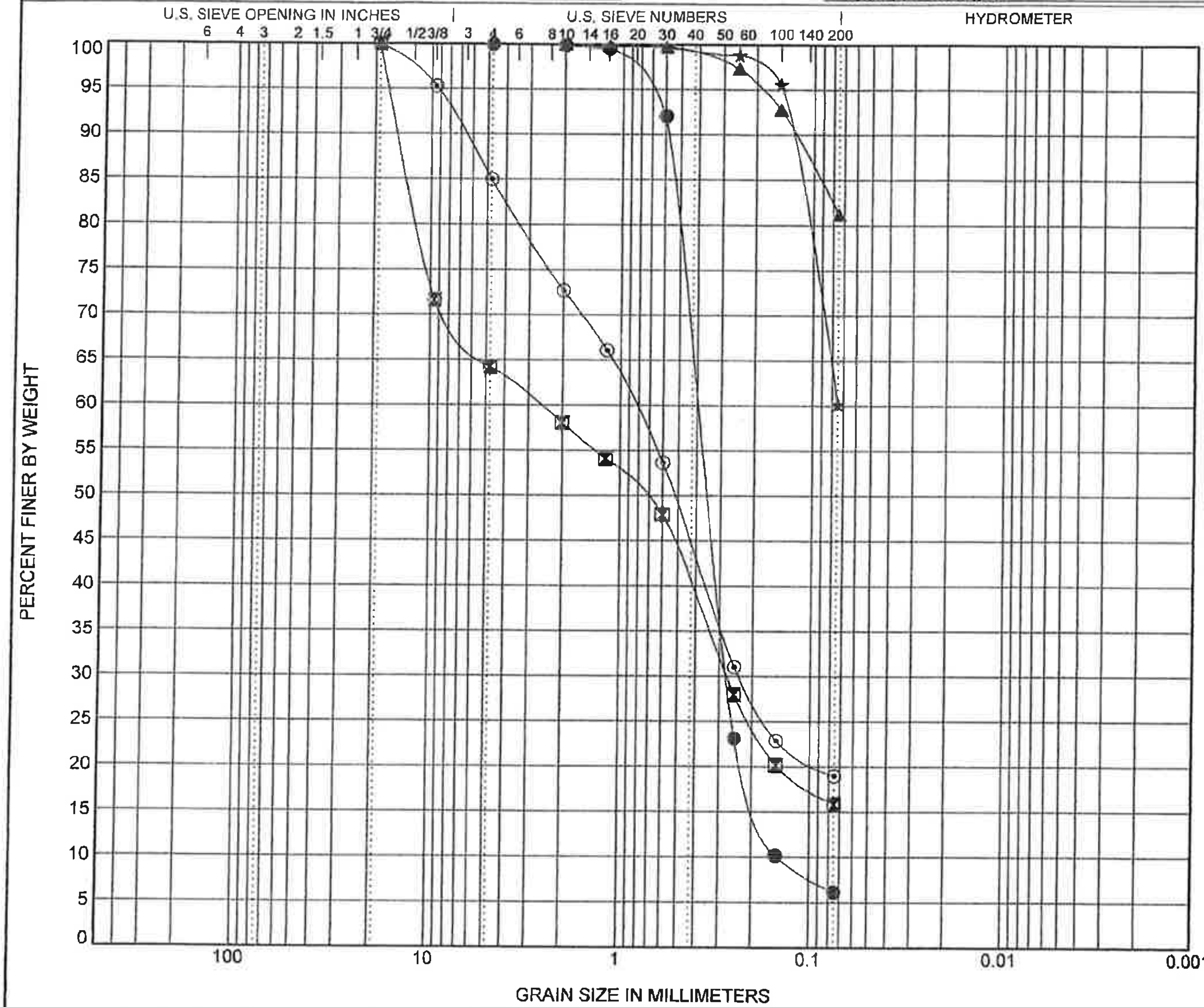
GRAIN SIZE USDA ES-5559 SUNSET POINTE.GPJ GINT US LAB.GDT 6/24/19

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

CLIENT Peter Chen **PROJECT NAME** Sunset Pointe

PROJECT NUMBER ES-5559 **PROJECT LOCATION** Puyallup, Washington



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-01	3.00ft.	USDA: Brown Slightly Gravelly Sand. USCS: SP-SM.	1.28	2.74
⊠	TP-03	5.00ft.	USDA: Brown Very Gravelly Loamy Sand. USCS: SM with Gravel.		
▲	TP-09	2.50ft.	USDA: Gray Loam. USCS: ML with Sand.		
★	TP-12	4.00ft.	USDA: Brown Loam. USCS: Sandy ML.		
⊙	TP-15	10.50ft.	USDA: Brown Gravelly Loamy Coarse Sand. USCS: SM with Gravel.		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	3.0ft.	4.75	0.399	0.273	0.146				6.2	
⊠	TP-03	5.0ft.	19	2.638	0.273					15.9	
▲	TP-09	2.5ft.	2							81.2	
★	TP-12	4.0ft.	2							60.2	
⊙	TP-15	10.5ft.	19	0.847	0.234					19.0	

Report Distribution

ES-5559

<u>EMAIL ONLY</u>	**Mr. Peter Chen** **4709 Memory Lane West** **University Place, Washington 98488**
<u>EMAIL ONLY</u>	**CES NW, Inc.** **429 – 29th Street Northeast, Suite D** **Puyallup, Washington 98372** **Attention: Mr. Fred Brown, P.E.**

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

May 9, 2023
Updated May 25, 2023
ES-5559.05

Peter Chen
4709 Memory Lane West
University Place, Washington 98488

Subject: Groundwater Monitoring Program Summary
Sunset Pointe
2301 – 23rd Street Southeast
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Engineering Study, ES-5559, updated April 5, 2023

Dear Peter:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter summarizing the recently completed groundwater monitoring program for the proposed development.

Groundwater Monitoring

Seasonal groundwater monitoring was conducted at three monitoring locations across the subject development area, which ESNW installed during earlier phases of work for the site. Please refence the attached Plate 1 (Test Pit Location Plan) for the approximate monitoring areas. The monitoring period was conducted from December 16, 2022, through the end of April 2023. Groundwater depths and fluctuations were recorded via hand measurements in combination with daily recordings obtained by dataloggers. The following table depicts the approximate surface elevation of each well, the approximate peak groundwater condition (GWC), the corresponding approximate groundwater elevation, and the occurrence date. Please note that if more precise peak GWC values are necessary, the surface elevations of each well location should be surveyed and recorded by a professional land surveyor.

Monitoring Well Location	Peak GWC Depth (ft bgs)	Approximate Surface Elevation (ft)	Approximate GWC Elevation (ft)	Peak Date
TP-104	10.6’	384	373.4	12/16/2022*
TP-201	N/A	376	N/A	N/A
TP-202	N/A	388	N/A	N/A

* *Peak GWC elevation occurred on multiple dates.*

Based on our observations and the recorded conditions, the site does not have a shallow, uniform groundwater table. There were no indications or records of significant subsurface water exposures at TP-201 or TP-202. Date are attached for levels recorded during our monitoring program. A relatively consistent water level was recorded at TP-104; however, in our opinion, represents a minor accumulation of water that could not infiltrate given the soil conditions in the area and not related to groundwater. This correlates with the subsurface conditions encountered at the test pit locations, which consist predominately of dense glacially consolidated deposits with isolated and discontinuous sandy layers.

The opinions and evaluations provided in this letter do not cover unforeseen or changed conditions. ESNW should observe the infiltration surface during construction to confirm soil conditions are as anticipated and to provide supplemental recommendations, if deemed necessary.

We trust this letter meets your current needs. Should you have any questions regarding the content herein, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

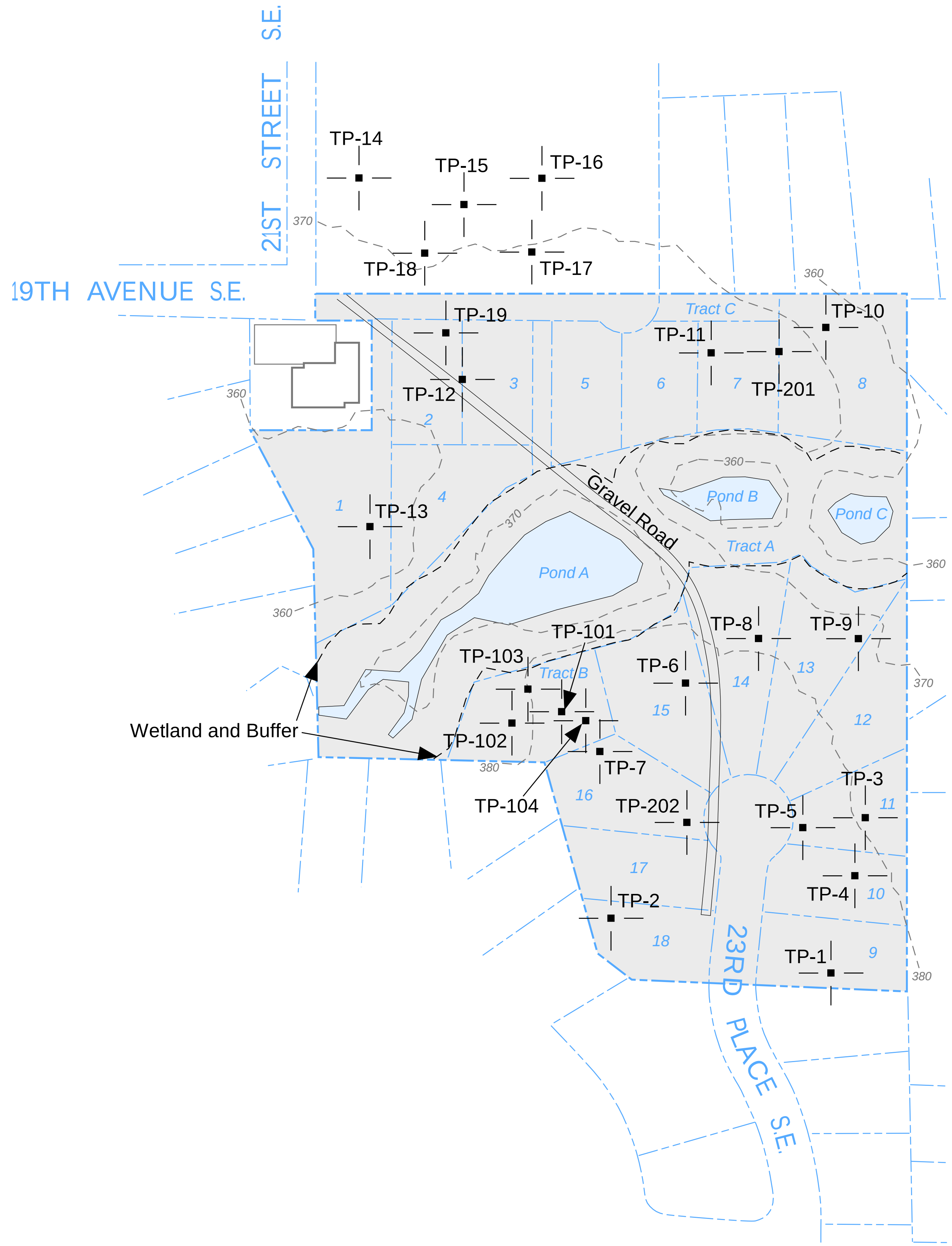
State of Washington
Engineering Geologist
2561
Licensed Geologist
05/25/2023
Scott S. Riegel

Chase G. Halsen, L.G., L.E.G.
Senior Project Geologist

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

Attachments: Plate 1 – Test Pit Location Plan
Groundwater Level Data

cc: CES NW, Inc.
Attention: Fred Brown, P.E. (Email only)
Dawn Markakis (Email only)



LEGEND

TP-201	Approximate Location of ESNW Test Pit, Proj. No. ES-5559.03, Jan. 2020
TP-101	Approximate Location of ESNW Test Pit, Proj. No. ES-5559, May 2019
TP-1	Approximate Location of ESNW Test Pit, Proj No. ES-5559, Oct. 2017
	Subject Site
	Existing Building
10	Proposed Lot Number

NORTH

1"=150'
0 75 150
Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Sunset Pointe
Puyallup, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By CAM
Checked By CGH
Date 05/08/2023
Proj. No. 5559.05
Plate 1

Serial_number:
2151506
Project ID:
ES-5559.05 Sunset Pointe
Location: TP-104
Tract Area
LEVEL
UNIT: m
Offset: 0.000000 m
TEMPERATURE
UNIT: °C

Date	Time	ms	LEVEL	TEMPERATURE	M. to Ft.	Approximate Depth from Ground Surface	Highest Recorded Elevation (ft. bgs)	Total Well Depth
12/17/2022	12:00:00 AM	0	0.09	10.95	0.30	10.32	10.19	10.62'
12/18/2022	12:00:00 AM	0	0.093	10.91	0.31	10.31		
12/19/2022	12:00:00 AM	0	0.094	10.876	0.31	10.31		
12/20/2022	12:00:00 AM	0	0.0829	10.868	0.27	10.35		
12/21/2022	12:00:00 AM	0	0.0879	10.824	0.29	10.33		
12/22/2022	12:00:00 AM	0	0.096	10.785	0.31	10.31		
12/23/2022	12:00:00 AM	0	0.0892	10.737	0.29	10.33		
12/24/2022	12:00:00 AM	0	0.0915	10.692	0.30	10.32		
12/25/2022	12:00:00 AM	0	0.0835	10.633	0.27	10.35		
12/26/2022	12:00:00 AM	0	0.0947	10.576	0.31	10.31		
12/27/2022	12:00:00 AM	0	0.0973	10.523	0.32	10.30		
12/28/2022	12:00:00 AM	0	0.1071	10.461	0.35	10.27		
12/29/2022	12:00:00 AM	0	0.0955	10.405	0.31	10.31		
12/30/2022	12:00:00 AM	0	0.1017	10.353	0.33	10.29		
12/31/2022	12:00:00 AM	0	0.1034	10.3	0.34	10.28		
1/1/2023	12:00:00 AM	0	0.1008	10.238	0.33	10.29		
1/2/2023	12:00:00 AM	0	0.1074	10.179	0.35	10.27		
1/3/2023	12:00:00 AM	0	0.1139	10.116	0.37	10.25		
1/4/2023	12:00:00 AM	0	0.1042	10.077	0.34	10.28		
1/5/2023	12:00:00 AM	0	0.1016	10.042	0.33	10.29		
1/6/2023	12:00:00 AM	0	0.1019	10.011	0.33	10.29		
1/7/2023	12:00:00 AM	0	0.0926	9.994	0.30	10.32		
1/8/2023	12:00:00 AM	0	0.1057	9.968	0.35	10.27		
1/9/2023	12:00:00 AM	0	0.0939	9.932	0.31	10.31		
1/10/2023	12:00:00 AM	0	0.0998	9.898	0.33	10.29		
1/11/2023	12:00:00 AM	0	0.1017	9.867	0.33	10.29		
1/12/2023	12:00:00 AM	0	0.0994	9.839	0.33	10.29		
1/13/2023	12:00:00 AM	0	0.1002	9.798	0.33	10.29		
1/14/2023	12:00:00 AM	0	0.1058	9.743	0.35	10.27		
1/15/2023	12:00:00 AM	0	0.11	9.701	0.36	10.26		
1/16/2023	12:00:00 AM	0	0.1114	9.675	0.37	10.25		
1/17/2023	12:00:00 AM	0	0.1018	9.646	0.33	10.29		
1/18/2023	12:00:00 AM	0	0.1005	9.618	0.33	10.29		
1/19/2023	12:00:00 AM	0	0.1085	9.598	0.36	10.26		
1/20/2023	12:00:00 AM	0	0.0949	9.58	0.31	10.31		
1/21/2023	12:00:00 AM	0	0.1039	9.562	0.34	10.28		
1/22/2023	12:00:00 AM	0	0.1085	9.54	0.36	10.26		
1/23/2023	12:00:00 AM	0	0.0967	9.53	0.32	10.30		
1/24/2023	12:00:00 AM	0	0.0972	9.504	0.32	10.30		
1/25/2023	12:00:00 AM	0	0.0949	9.485	0.31	10.31		
1/26/2023	12:00:00 AM	0	0.0933	9.47	0.31	10.31		
1/27/2023	12:00:00 AM	0	0.0965	9.453	0.32	10.30		
1/28/2023	12:00:00 AM	0	0.1028	9.447	0.34	10.28		
1/29/2023	12:00:00 AM	0	0.1187	9.434	0.39	10.23		
1/30/2023	12:00:00 AM	0	0.1099	9.433	0.36	10.26		
1/31/2023	12:00:00 AM	0	0.1093	9.428	0.36	10.26		
2/1/2023	12:00:00 AM	0	0.1135	9.409	0.37	10.25		
2/2/2023	12:00:00 AM	0	0.1138	9.4	0.37	10.25		
2/3/2023	12:00:00 AM	0	0.0977	9.39	0.32	10.30		
2/4/2023	12:00:00 AM	0	0.1072	9.381	0.35	10.27		
2/5/2023	12:00:00 AM	0	0.0929	9.371	0.30	10.32		
2/6/2023	12:00:00 AM	0	0.1056	9.359	0.35	10.27		
2/7/2023	12:00:00 AM	0	0.1161	9.359	0.38	10.24		
2/8/2023	12:00:00 AM	0	0.1181	9.35	0.39	10.23		
2/9/2023	12:00:00 AM	0	0.1137	9.339	0.37	10.25		
2/10/2023	12:00:00 AM	0	0.1242	9.318	0.41	10.21		
2/11/2023	12:00:00 AM	0	0.1226	9.294	0.40	10.22		
2/12/2023	12:00:00 AM	0	0.1254	9.274	0.41	10.21		
2/13/2023	12:00:00 AM	0	0.1182	9.25	0.39	10.23		
2/14/2023	12:00:00 AM	0	0.1175	9.226	0.39	10.23		
2/15/2023	12:00:00 AM	0	0.1124	9.213	0.37	10.25		
2/16/2023	12:00:00 AM	0	0.1208	9.197	0.40	10.22		
2/17/2023	12:00:00 AM	0	0.1257	9.172	0.41	10.21		
2/18/2023	12:00:00 AM	0	0.1102	9.152	0.36	10.26		
2/19/2023	12:00:00 AM	0	0.1139	9.138	0.37	10.25		
2/20/2023	12:00:00 AM	0	0.1087	9.117	0.36	10.26		
2/21/2023	12:00:00 AM	0	0.1106	9.096	0.36	10.26		
2/22/2023	12:00:00 AM	0	0.1276	9.078	0.42	10.20		

2/23/2023	12:00:00 AM	0	0.125	9.059	0.41	10.21
2/24/2023	12:00:00 AM	0	0.1295	9.05	0.42	10.20
2/25/2023	12:00:00 AM	0	0.1189	9.039	0.39	10.23
2/26/2023	12:00:00 AM	0	0.1165	9.024	0.38	10.24
2/27/2023	12:00:00 AM	0	0.1037	9.003	0.34	10.28
2/28/2023	12:00:00 AM	0	0.1229	8.996	0.40	10.22
3/1/2023	12:00:00 AM	0	0.1173	8.981	0.38	10.24
3/2/2023	12:00:00 AM	0	0.1095	8.976	0.36	10.26
3/3/2023	12:00:00 AM	0	0.1059	8.966	0.35	10.27
3/4/2023	12:00:00 AM	0	0.1166	8.955	0.38	10.24
3/5/2023	12:00:00 AM	0	0.1243	8.928	0.41	10.21
3/6/2023	12:00:00 AM	0	0.1125	8.921	0.37	10.25
3/7/2023	12:00:00 AM	0	0.1078	8.909	0.35	10.27
3/8/2023	12:00:00 AM	0	0.1024	8.889	0.34	10.28
3/9/2023	12:00:00 AM	0	0.1064	8.867	0.35	10.27
3/10/2023	12:00:00 AM	0	0.1136	8.85	0.37	10.25
3/11/2023	12:00:00 AM	0	0.1105	8.827	0.36	10.26
3/12/2023	12:00:00 AM	0	0.1058	8.812	0.35	10.27
3/13/2023	12:00:00 AM	0	0.1161	8.789	0.38	10.24
3/14/2023	12:00:00 AM	0	0.1158	8.77	0.38	10.24
3/15/2023	12:00:00 AM	0	0.1249	8.746	0.41	10.21
3/16/2023	12:00:00 AM	0	0.1059	8.725	0.35	10.27
3/17/2023	12:00:00 AM	0	0.1182	8.707	0.39	10.23
3/18/2023	12:00:00 AM	0	0.1069	8.68	0.35	10.27
3/19/2023	12:00:00 AM	0	0.1144	8.663	0.38	10.24
3/20/2023	12:00:00 AM	0	0.1199	8.647	0.39	10.23
3/21/2023	12:00:00 AM	0	0.1093	8.635	0.36	10.26
3/22/2023	12:00:00 AM	0	0.111	8.625	0.36	10.26
3/23/2023	12:00:00 AM	0	0.1072	8.612	0.35	10.27
3/24/2023	12:00:00 AM	0	0.1057	8.603	0.35	10.27
3/25/2023	12:00:00 AM	0	0.1069	8.595	0.35	10.27
3/26/2023	12:00:00 AM	0	0.1041	8.583	0.34	10.28
3/27/2023	12:00:00 AM	0	0.101	8.577	0.33	10.29
3/28/2023	12:00:00 AM	0	0.1103	8.562	0.36	10.26
3/29/2023	12:00:00 AM	0	0.1152	8.554	0.38	10.24
3/30/2023	12:00:00 AM	0	0.1085	8.543	0.36	10.26
3/31/2023	12:00:00 AM	0	0.1	8.538	0.33	10.29
4/1/2023	12:00:00 AM	0	0.1229	8.531	0.40	10.22
4/2/2023	12:00:00 AM	0	0.115	8.526	0.38	10.24
4/3/2023	12:00:00 AM	0	0.117	8.519	0.38	10.24
4/4/2023	12:00:00 AM	0	0.1097	8.505	0.36	10.26
4/5/2023	12:00:00 AM	0	0.103	8.505	0.34	10.28
4/6/2023	12:00:00 AM	0	0.1093	8.495	0.36	10.26
4/7/2023	12:00:00 AM	0	0.1175	8.486	0.39	10.23
4/8/2023	12:00:00 AM	0	0.0978	8.479	0.32	10.30
4/9/2023	12:00:00 AM	0	0.1014	8.468	0.33	10.29
4/10/2023	12:00:00 AM	0	0.105	8.461	0.34	10.28
4/11/2023	12:00:00 AM	0	0.111	8.451	0.36	10.26
4/12/2023	12:00:00 AM	0	0.1063	8.44	0.35	10.27
4/13/2023	12:00:00 AM	0	0.1055	8.434	0.35	10.27
4/14/2023	12:00:00 AM	0	0.1075	8.43	0.35	10.27
4/15/2023	12:00:00 AM	0	0.1092	8.428	0.36	10.26
4/16/2023	12:00:00 AM	0	0.1044	8.433	0.34	10.28
4/17/2023	12:00:00 AM	0	0.1076	8.435	0.35	10.27
4/18/2023	12:00:00 AM	0	0.1252	8.436	0.41	10.21
4/19/2023	12:00:00 AM	0	0.1105	8.437	0.36	10.26
4/20/2023	12:00:00 AM	0	0.1105	8.437	0.36	10.26
4/21/2023	12:00:00 AM	0	0.1177	8.442	0.39	10.23
4/22/2023	12:00:00 AM	0	0.1061	8.449	0.35	10.27
4/23/2023	12:00:00 AM	0	0.1193	8.455	0.39	10.23
4/24/2023	12:00:00 AM	0	0.1164	8.46	0.38	10.24
4/25/2023	12:00:00 AM	0	0.1126	8.46	0.37	10.25
4/26/2023	12:00:00 AM	0	0.108	8.461	0.35	10.27
4/27/2023	12:00:00 AM	0	0.109	8.465	0.36	10.26
4/28/2023	12:00:00 AM	0	0.1171	8.471	0.38	10.24
4/29/2023	12:00:00 AM	0	0.1321	8.48	0.43	10.19
4/30/2023	12:00:00 AM	0	0.1172	8.486	0.38	10.24
5/1/2023	12:00:00 AM	0	0.1046	8.496	0.34	10.28

Serial_number:
2151508
Project ID:
TP-201
Location: TP-201
ES-5559.05
LEVEL
UNIT: m
Offset: 0.000000 m
TEMPERATURE
UNIT: °C

Date	Time	ms	LEVEL	TEMPERATURE	M. to Ft.	Approximate Depth from Ground Surface	Highest Recorded Elevation (ft. bgs)	Total Well Depth
12/17/2022	12:00:00 AM	0	-0.0351	10.223	-0.12	7.92	6.79	7.8'
12/18/2022	12:00:00 AM	0	-0.0309	10.164	-0.10	7.90		
12/19/2022	12:00:00 AM	0	-0.0237	10.111	-0.08	7.88		
12/20/2022	12:00:00 AM	0	-0.0398	10.06	-0.13	7.93		
12/21/2022	12:00:00 AM	0	-0.0254	10.012	-0.08	7.88		
12/22/2022	12:00:00 AM	0	-0.0344	9.941	-0.11	7.91		
12/23/2022	12:00:00 AM	0	-0.0432	9.883	-0.14	7.94		
12/24/2022	12:00:00 AM	0	-0.0342	9.824	-0.11	7.91		
12/25/2022	12:00:00 AM	0	-0.0424	9.801	-0.14	7.94		
12/26/2022	12:00:00 AM	0	-0.0282	9.714	-0.09	7.89		
12/27/2022	12:00:00 AM	0	-0.0159	9.582	-0.05	7.85		
12/28/2022	12:00:00 AM	0	0.3065	8.343	1.01	6.79	Outliers	
12/29/2022	12:00:00 AM	0	0.1625	8.321	0.53	7.27		
12/30/2022	12:00:00 AM	0	-0.0064	8.868	-0.02	7.82		
12/31/2022	12:00:00 AM	0	-0.01	8.86	-0.03	7.83		
1/1/2023	12:00:00 AM	0	-0.0272	8.817	-0.09	7.89		
1/2/2023	12:00:00 AM	0	-0.0366	8.8	-0.12	7.92		
1/3/2023	12:00:00 AM	0	-0.0266	8.8	-0.09	7.89		
1/4/2023	12:00:00 AM	0	-0.0229	8.804	-0.08	7.88		
1/5/2023	12:00:00 AM	0	-0.0429	8.811	-0.14	7.94		
1/6/2023	12:00:00 AM	0	-0.0249	8.817	-0.08	7.88		
1/7/2023	12:00:00 AM	0	-0.0342	8.822	-0.11	7.91		
1/8/2023	12:00:00 AM	0	-0.0391	8.826	-0.13	7.93		
1/9/2023	12:00:00 AM	0	-0.038	8.824	-0.12	7.92		
1/10/2023	12:00:00 AM	0	-0.0284	8.818	-0.09	7.89		
1/11/2023	12:00:00 AM	0	-0.0268	8.806	-0.09	7.89		
1/12/2023	12:00:00 AM	0	-0.0283	8.795	-0.09	7.89		
1/13/2023	12:00:00 AM	0	-0.0425	8.782	-0.14	7.94		
1/14/2023	12:00:00 AM	0	-0.0352	8.764	-0.12	7.92		
1/15/2023	12:00:00 AM	0	-0.0322	8.758	-0.11	7.91		
1/16/2023	12:00:00 AM	0	-0.0278	8.732	-0.09	7.89		
1/17/2023	12:00:00 AM	0	-0.0262	8.705	-0.09	7.89		
1/18/2023	12:00:00 AM	0	-0.0354	8.678	-0.12	7.92		
1/19/2023	12:00:00 AM	0	-0.0217	8.659	-0.07	7.87		
1/20/2023	12:00:00 AM	0	-0.0348	8.648	-0.11	7.91		
1/21/2023	12:00:00 AM	0	-0.0317	8.639	-0.10	7.90		
1/22/2023	12:00:00 AM	0	-0.0237	8.633	-0.08	7.88		
1/23/2023	12:00:00 AM	0	-0.0312	8.629	-0.10	7.90		
1/24/2023	12:00:00 AM	0	-0.0296	8.623	-0.10	7.90		
1/25/2023	12:00:00 AM	0	-0.0295	8.616	-0.10	7.90		
1/26/2023	12:00:00 AM	0	-0.0345	8.605	-0.11	7.91		
1/27/2023	12:00:00 AM	0	-0.0479	8.594	-0.16	7.96		
1/28/2023	12:00:00 AM	0	-0.0402	8.584	-0.13	7.93		
1/29/2023	12:00:00 AM	0	-0.0198	8.58	-0.06	7.86		
1/30/2023	12:00:00 AM	0	-0.0281	8.568	-0.09	7.89		
1/31/2023	12:00:00 AM	0	-0.0331	8.553	-0.11	7.91		
2/1/2023	12:00:00 AM	0	-0.0278	8.543	-0.09	7.89		
2/2/2023	12:00:00 AM	0	-0.0268	8.531	-0.09	7.89		
2/3/2023	12:00:00 AM	0	-0.0424	8.519	-0.14	7.94		
2/4/2023	12:00:00 AM	0	-0.0289	8.508	-0.09	7.89		
2/5/2023	12:00:00 AM	0	-0.0467	8.493	-0.15	7.95		
2/6/2023	12:00:00 AM	0	-0.0216	8.474	-0.07	7.87		
2/7/2023	12:00:00 AM	0	-0.0358	8.454	-0.12	7.92		
2/8/2023	12:00:00 AM	0	-0.0235	8.432	-0.08	7.88		
2/9/2023	12:00:00 AM	0	-0.0378	8.409	-0.12	7.92		
2/10/2023	12:00:00 AM	0	-0.0288	8.391	-0.09	7.89		
2/11/2023	12:00:00 AM	0	-0.0289	8.364	-0.09	7.89		
2/12/2023	12:00:00 AM	0	-0.031	8.34	-0.10	7.90		
2/13/2023	12:00:00 AM	0	-0.0379	8.321	-0.12	7.92		
2/14/2023	12:00:00 AM	0	-0.0354	8.302	-0.12	7.92		
2/15/2023	12:00:00 AM	0	-0.0427	8.286	-0.14	7.94		
2/16/2023	12:00:00 AM	0	-0.0346	8.27	-0.11	7.91		
2/17/2023	12:00:00 AM	0	-0.0268	8.255	-0.09	7.89		
2/18/2023	12:00:00 AM	0	-0.0293	8.239	-0.10	7.90		
2/19/2023	12:00:00 AM	0	-0.0265	8.224	-0.09	7.89		
2/20/2023	12:00:00 AM	0	-0.0343	8.21	-0.11	7.91		
2/21/2023	12:00:00 AM	0	-0.045	8.192	-0.15	7.95		
2/22/2023	12:00:00 AM	0	-0.0289	8.174	-0.09	7.89		
2/23/2023	12:00:00 AM	0	-0.0298	8.157	-0.10	7.90		
2/24/2023	12:00:00 AM	0	-0.0225	8.132	-0.07	7.87		
2/25/2023	12:00:00 AM	0	-0.0349	8.115	-0.11	7.91		

2/26/2023	12:00:00 AM	0	-0.039	8.098	-0.13	7.93
2/27/2023	12:00:00 AM	0	-0.0298	8.084	-0.10	7.90
2/28/2023	12:00:00 AM	0	-0.0317	8.068	-0.10	7.90
3/1/2023	12:00:00 AM	0	-0.0204	8.057	-0.07	7.87
3/2/2023	12:00:00 AM	0	-0.0329	8.039	-0.11	7.91
3/3/2023	12:00:00 AM	0	-0.0313	8.022	-0.10	7.90
3/4/2023	12:00:00 AM	0	-0.0375	8	-0.12	7.92
3/5/2023	12:00:00 AM	0	-0.0246	7.976	-0.08	7.88
3/6/2023	12:00:00 AM	0	-0.0249	7.953	-0.08	7.88
3/7/2023	12:00:00 AM	0	-0.0298	7.932	-0.10	7.90
3/8/2023	12:00:00 AM	0	-0.0377	7.907	-0.12	7.92
3/9/2023	12:00:00 AM	0	-0.0319	7.881	-0.10	7.90
3/10/2023	12:00:00 AM	0	-0.0388	7.86	-0.13	7.93
3/11/2023	12:00:00 AM	0	-0.0241	7.833	-0.08	7.88
3/12/2023	12:00:00 AM	0	-0.035	7.811	-0.11	7.91
3/13/2023	12:00:00 AM	0	-0.0355	7.79	-0.12	7.92
3/14/2023	12:00:00 AM	0	-0.0252	7.767	-0.08	7.88
3/15/2023	12:00:00 AM	0	-0.022	7.74	-0.07	7.87
3/16/2023	12:00:00 AM	0	-0.03	7.705	-0.10	7.90
3/17/2023	12:00:00 AM	0	-0.028	7.673	-0.09	7.89
3/18/2023	12:00:00 AM	0	-0.0322	7.646	-0.11	7.91
3/19/2023	12:00:00 AM	0	-0.0362	7.628	-0.12	7.92
3/20/2023	12:00:00 AM	0	-0.0305	7.616	-0.10	7.90
3/21/2023	12:00:00 AM	0	-0.0318	7.604	-0.10	7.90
3/22/2023	12:00:00 AM	0	-0.0302	7.598	-0.10	7.90
3/23/2023	12:00:00 AM	0	-0.0267	7.593	-0.09	7.89
3/24/2023	12:00:00 AM	0	-0.0281	7.587	-0.09	7.89
3/25/2023	12:00:00 AM	0	-0.0263	7.585	-0.09	7.89
3/26/2023	12:00:00 AM	0	-0.0319	0.941	-0.10	7.90
3/27/2023	12:00:00 AM	0	-0.0319	7.231	-0.10	7.90
3/28/2023	12:00:00 AM	0	-0.039	7.251	-0.13	7.93
3/29/2023	12:00:00 AM	0	-0.0314	7.375	-0.10	7.90
3/30/2023	12:00:00 AM	0	-0.0326	7.394	-0.11	7.91
3/31/2023	12:00:00 AM	0	-0.0313	7.411	-0.10	7.90
4/1/2023	12:00:00 AM	0	-0.0231	7.431	-0.08	7.88
4/2/2023	12:00:00 AM	0	-0.0328	7.444	-0.11	7.91
4/3/2023	12:00:00 AM	0	-0.0273	7.455	-0.09	7.89
4/4/2023	12:00:00 AM	0	-0.03	7.47	-0.10	7.90
4/5/2023	12:00:00 AM	0	-0.0284	7.486	-0.09	7.89
4/6/2023	12:00:00 AM	0	-0.0372	7.5	-0.12	7.92
4/7/2023	12:00:00 AM	0	-0.0286	7.517	-0.09	7.89
4/8/2023	12:00:00 AM	0	-0.0321	7.531	-0.11	7.91
4/9/2023	12:00:00 AM	0	-0.0294	7.545	-0.10	7.90
4/10/2023	12:00:00 AM	0	-0.0279	7.557	-0.09	7.89
4/11/2023	12:00:00 AM	0	0.027	7.566	0.09	7.71
4/12/2023	12:00:00 AM	0	-0.029	7.616	-0.10	7.90
4/13/2023	12:00:00 AM	0	-0.0382	7.633	-0.13	7.93
4/14/2023	12:00:00 AM	0	-0.0302	7.655	-0.10	7.90
4/15/2023	12:00:00 AM	0	-0.0277	7.681	-0.09	7.89
4/16/2023	12:00:00 AM	0	-0.0377	7.706	-0.12	7.92
4/17/2023	12:00:00 AM	0	-0.0315	7.735	-0.10	7.90
4/18/2023	12:00:00 AM	0	-0.0287	7.764	-0.09	7.89
4/19/2023	12:00:00 AM	0	-0.0276	7.793	-0.09	7.89
4/20/2023	12:00:00 AM	0	-0.027	7.819	-0.09	7.89
4/21/2023	12:00:00 AM	0	-0.0201	7.851	-0.07	7.87
4/22/2023	12:00:00 AM	0	-0.0355	7.876	-0.12	7.92
4/23/2023	12:00:00 AM	0	-0.0367	7.898	-0.12	7.92
4/24/2023	12:00:00 AM	0	-0.0247	7.931	-0.08	7.88
4/25/2023	12:00:00 AM	0	-0.027	7.945	-0.09	7.89
4/26/2023	12:00:00 AM	0	-0.0319	7.964	-0.10	7.90
4/27/2023	12:00:00 AM	0	-0.0306	7.985	-0.10	7.90
4/28/2023	12:00:00 AM	0	-0.0302	8.009	-0.10	7.90
4/29/2023	12:00:00 AM	0	-0.0221	8.035	-0.07	7.87
4/30/2023	12:00:00 AM	0	-0.029	8.066	-0.10	7.90
5/1/2023	12:00:00 AM	0	-0.0309	8.101	-0.10	7.90

Serial_number:
2151491
Project ID:
ES-5559.05 Sunset Pointe
Location: TP-202
TP-202
LEVEL W
UNIT: m
Offset: 0.000000 m
TEMPERATURE
UNIT: °C

Date	Time	ms	LEVEL	TEMPERATURE	M to Ft.	Approximate Depth from Ground Surface	Highest Recorded Elevation (ft. bgs)	Total Well Depth
12/17/2022	12:00:00 AM	0	-0.0393	10.92	-0.13	7.88	6.94	7.75'
12/18/2022	12:00:00 AM	0	-0.0344	10.858	-0.11	7.86		
12/19/2022	12:00:00 AM	0	-0.0277	10.785	-0.09	7.84		
12/20/2022	12:00:00 AM	0	-0.0436	10.741	-0.14	7.89		
12/21/2022	12:00:00 AM	0	-0.0299	10.676	-0.10	7.85		
12/22/2022	12:00:00 AM	0	-0.0393	10.613	-0.13	7.88		
12/23/2022	12:00:00 AM	0	-0.0469	10.561	-0.15	7.90		
12/24/2022	12:00:00 AM	0	-0.0381	10.495	-0.12	7.87		
12/25/2022	12:00:00 AM	0	-0.037	9.883	-0.12	7.87		
12/26/2022	12:00:00 AM	0	-0.0459	9.897	-0.15	7.90		
12/27/2022	12:00:00 AM	0	0.2456	7.589	0.81	6.94	Outliers	
12/28/2022	12:00:00 AM	0	0.1281	7.625	0.42	7.33		
12/29/2022	12:00:00 AM	0	-0.0426	8.327	-0.14	7.89		
12/30/2022	12:00:00 AM	0	-0.0419	8.677	-0.14	7.89		
12/31/2022	12:00:00 AM	0	-0.0254	8.737	-0.08	7.83		
1/1/2023	12:00:00 AM	0	-0.0298	8.847	-0.10	7.85		
1/2/2023	12:00:00 AM	0	-0.0388	8.979	-0.13	7.88		
1/3/2023	12:00:00 AM	0	-0.0286	9.074	-0.09	7.84		
1/4/2023	12:00:00 AM	0	-0.0248	9.142	-0.08	7.83		
1/5/2023	12:00:00 AM	0	-0.0436	9.202	-0.14	7.89		
1/6/2023	12:00:00 AM	0	-0.0268	9.229	-0.09	7.84		
1/7/2023	12:00:00 AM	0	-0.0365	9.258	-0.12	7.87		
1/8/2023	12:00:00 AM	0	-0.0404	9.277	-0.13	7.88		
1/9/2023	12:00:00 AM	0	-0.0398	9.284	-0.13	7.88		
1/10/2023	12:00:00 AM	0	-0.0302	9.283	-0.10	7.85		
1/11/2023	12:00:00 AM	0	-0.0282	9.279	-0.09	7.84		
1/12/2023	12:00:00 AM	0	-0.0303	9.275	-0.10	7.85		
1/13/2023	12:00:00 AM	0	-0.0454	9.279	-0.15	7.90		
1/14/2023	12:00:00 AM	0	-0.0382	9.26	-0.13	7.88		
1/15/2023	12:00:00 AM	0	-0.0349	9.234	-0.11	7.86		
1/16/2023	12:00:00 AM	0	-0.0308	9.214	-0.10	7.85		
1/17/2023	12:00:00 AM	0	-0.0302	9.188	-0.10	7.85		
1/18/2023	12:00:00 AM	0	-0.0392	9.184	-0.13	7.88		
1/19/2023	12:00:00 AM	0	-0.0256	9.176	-0.08	7.83		
1/20/2023	12:00:00 AM	0	-0.0395	9.174	-0.13	7.88		
1/21/2023	12:00:00 AM	0	-0.036	9.176	-0.12	7.87		

1/22/2023	12:00:00 AM	0	-0.0278	9.17	-0.09	7.84
1/23/2023	12:00:00 AM	0	-0.0356	9.169	-0.12	7.87
1/24/2023	12:00:00 AM	0	-0.0379	9.158	-0.12	7.87
1/25/2023	12:00:00 AM	0	-0.056	9.151	-0.18	7.93
1/26/2023	12:00:00 AM	0	-0.0332	9.144	-0.11	7.86
1/27/2023	12:00:00 AM	0	-0.0297	9.137	-0.10	7.85
1/28/2023	12:00:00 AM	0	-0.0443	9.13	-0.15	7.90
1/29/2023	12:00:00 AM	0	-0.0244	9.106	-0.08	7.83
1/30/2023	12:00:00 AM	0	-0.033	9.089	-0.11	7.86
1/31/2023	12:00:00 AM	0	-0.0373	9.074	-0.12	7.87
2/1/2023	12:00:00 AM	0	-0.0324	9.059	-0.11	7.86
2/2/2023	12:00:00 AM	0	-0.0313	9.041	-0.10	7.85
2/3/2023	12:00:00 AM	0	-0.0466	9.028	-0.15	7.90
2/4/2023	12:00:00 AM	0	-0.0332	9.003	-0.11	7.86
2/5/2023	12:00:00 AM	0	-0.0504	8.989	-0.17	7.92
2/6/2023	12:00:00 AM	0	-0.0264	8.957	-0.09	7.84
2/7/2023	12:00:00 AM	0	-0.0399	8.934	-0.13	7.88
2/8/2023	12:00:00 AM	0	-0.0287	8.902	-0.09	7.84
2/9/2023	12:00:00 AM	0	-0.0423	8.876	-0.14	7.89
2/10/2023	12:00:00 AM	0	-0.0269	8.851	-0.09	7.84
2/11/2023	12:00:00 AM	0	-0.036	8.819	-0.12	7.87
2/12/2023	12:00:00 AM	0	-0.0318	8.793	-0.10	7.85
2/13/2023	12:00:00 AM	0	-0.0241	8.77	-0.08	7.83
2/14/2023	12:00:00 AM	0	-0.039	8.745	-0.13	7.88
2/15/2023	12:00:00 AM	0	-0.032	8.725	-0.10	7.85
2/16/2023	12:00:00 AM	0	-0.0386	8.708	-0.13	7.88
2/17/2023	12:00:00 AM	0	-0.0313	8.689	-0.10	7.85
2/18/2023	12:00:00 AM	0	-0.0336	8.676	-0.11	7.86
2/19/2023	12:00:00 AM	0	-0.0309	8.657	-0.10	7.85
2/20/2023	12:00:00 AM	0	-0.0383	8.641	-0.13	7.88
2/21/2023	12:00:00 AM	0	-0.0472	8.622	-0.15	7.90
2/22/2023	12:00:00 AM	0	-0.0323	8.601	-0.11	7.86
2/23/2023	12:00:00 AM	0	-0.0338	8.585	-0.11	7.86
2/24/2023	12:00:00 AM	0	-0.0272	8.546	-0.09	7.84
2/25/2023	12:00:00 AM	0	-0.0393	8.535	-0.13	7.88
2/26/2023	12:00:00 AM	0	-0.042	8.521	-0.14	7.89
2/27/2023	12:00:00 AM	0	-0.0338	8.505	-0.11	7.86
2/28/2023	12:00:00 AM	0	-0.0346	8.491	-0.11	7.86
3/1/2023	12:00:00 AM	0	-0.025	8.468	-0.08	7.83
3/2/2023	12:00:00 AM	0	-0.0371	8.453	-0.12	7.87
3/3/2023	12:00:00 AM	0	-0.0356	8.431	-0.12	7.87
3/4/2023	12:00:00 AM	0	-0.0408	8.405	-0.13	7.88
3/5/2023	12:00:00 AM	0	-0.0274	8.378	-0.09	7.84
3/6/2023	12:00:00 AM	0	-0.0281	8.35	-0.09	7.84
3/7/2023	12:00:00 AM	0	-0.0334	8.323	-0.11	7.86
3/8/2023	12:00:00 AM	0	-0.0411	8.298	-0.13	7.88
3/9/2023	12:00:00 AM	0	-0.0355	8.271	-0.12	7.87
3/10/2023	12:00:00 AM	0	-0.0415	8.254	-0.14	7.89

3/11/2023	12:00:00 AM	0	-0.0285	8.219	-0.09	7.84
3/12/2023	12:00:00 AM	0	-0.0391	8.194	-0.13	7.88
3/13/2023	12:00:00 AM	0	-0.0384	8.172	-0.13	7.88
3/14/2023	12:00:00 AM	0	-0.0296	8.119	-0.10	7.85
3/15/2023	12:00:00 AM	0	-0.0264	8.068	-0.09	7.84
3/16/2023	12:00:00 AM	0	-0.0348	8.048	-0.11	7.86
3/17/2023	12:00:00 AM	0	-0.032	8.037	-0.10	7.85
3/18/2023	12:00:00 AM	0	-0.0361	8.025	-0.12	7.87
3/19/2023	12:00:00 AM	0	-0.0399	8.015	-0.13	7.88
3/20/2023	12:00:00 AM	0	-0.034	8.004	-0.11	7.86
3/21/2023	12:00:00 AM	0	-0.0358	7.988	-0.12	7.87
3/22/2023	12:00:00 AM	0	-0.0338	7.981	-0.11	7.86
3/23/2023	12:00:00 AM	0	-0.0307	7.971	-0.10	7.85
3/24/2023	12:00:00 AM	0	-0.0318	7.965	-0.10	7.85
3/25/2023	12:00:00 AM	0	-0.0306	7.963	-0.10	7.85
3/26/2023	12:00:00 AM	0	-0.0335	7.963	-0.11	7.86
3/27/2023	12:00:00 AM	0	-0.0361	7.968	-0.12	7.87
3/28/2023	12:00:00 AM	0	-0.0422	7.975	-0.14	7.89
3/29/2023	12:00:00 AM	0	-0.0347	7.982	-0.11	7.86
3/30/2023	12:00:00 AM	0	-0.0359	7.99	-0.12	7.87
3/31/2023	12:00:00 AM	0	-0.0348	8	-0.11	7.86
4/1/2023	12:00:00 AM	0	-0.0263	8.014	-0.09	7.84
4/2/2023	12:00:00 AM	0	-0.0364	8.022	-0.12	7.87
4/3/2023	12:00:00 AM	0	-0.0318	8.028	-0.10	7.85
4/4/2023	12:00:00 AM	0	-0.0336	8.04	-0.11	7.86
4/5/2023	12:00:00 AM	0	-0.0326	8.046	-0.11	7.86
4/6/2023	12:00:00 AM	0	-0.041	8.06	-0.13	7.88
4/7/2023	12:00:00 AM	0	-0.0322	8.07	-0.11	7.86
4/8/2023	12:00:00 AM	0	-0.036	8.08	-0.12	7.87
4/9/2023	12:00:00 AM	0	-0.0333	8.084	-0.11	7.86
4/10/2023	12:00:00 AM	0	-0.0321	8.063	-0.11	7.86
4/11/2023	12:00:00 AM	0	0.0604	7.788	0.20	7.55
4/12/2023	12:00:00 AM	0	-0.0326	7.876	-0.11	7.86
4/13/2023	12:00:00 AM	0	-0.0368	7.945	-0.12	7.87
4/14/2023	12:00:00 AM	0	-0.034	8.003	-0.11	7.86
4/15/2023	12:00:00 AM	0	-0.0315	8.05	-0.10	7.85
4/16/2023	12:00:00 AM	0	-0.041	8.094	-0.13	7.88
4/17/2023	12:00:00 AM	0	-0.035	8.126	-0.11	7.86
4/18/2023	12:00:00 AM	0	-0.0312	8.158	-0.10	7.85
4/19/2023	12:00:00 AM	0	-0.0311	8.188	-0.10	7.85
4/20/2023	12:00:00 AM	0	-0.031	8.216	-0.10	7.85
4/21/2023	12:00:00 AM	0	-0.0241	8.246	-0.08	7.83
4/22/2023	12:00:00 AM	0	-0.039	8.275	-0.13	7.88
4/23/2023	12:00:00 AM	0	-0.0393	8.299	-0.13	7.88
4/24/2023	12:00:00 AM	0	-0.0276	8.32	-0.09	7.84
4/25/2023	12:00:00 AM	0	-0.031	8.338	-0.10	7.85
4/26/2023	12:00:00 AM	0	-0.0352	8.359	-0.12	7.87
4/27/2023	12:00:00 AM	0	-0.0342	8.377	-0.11	7.86

4/28/2023	12:00:00 AM	0	-0.0333	8.398	-0.11	7.86
4/29/2023	12:00:00 AM	0	-0.0251	8.415	-0.08	7.83
4/30/2023	12:00:00 AM	0	-0.032	8.443	-0.10	7.85
5/1/2023	12:00:00 AM	0	-0.034	8.466	-0.11	7.86

Earth Solutions NW LLC

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Construction Observation/Testing
Environmental Services

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January 11, 2018
Updated May 26, 2023

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will <u>not</u> likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will <u>not</u> be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do <u>not</u> rely on an executive summary. Do <u>not</u> read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

January 11, 2018
Updated May 26, 2023
ES-5559

Peter Chen
4709 Memory Lane West
University Place, Washington 98488

Greetings:

Earth Solutions NW, LLC (ESNW) is pleased to present this report in support of the proposed project. Based on the results of our investigation, the proposed residential plat is feasible from a geotechnical standpoint. Our study indicates the site is underlain by areas of existing fill that overly Vashon drift glacial deposits Light to heavy perched groundwater seepage was encountered at three test pit locations at an approximate exposure depth of about one-and-one-half to six feet below the existing ground surface. As such, it is our opinion that the contractor should be prepared to manage zones of perched groundwater seepage during construction.

In our opinion, the proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, recompacted existing fill, or suitable structural fill placed directly on competent native soils. In general, native soils suitable for foundation support are anticipated to be encountered at depths of approximately two to five feet below the existing ground surface. Areas underlain by existing fill may require additional preparation efforts to establish suitable and uniform bearing conditions. Additional preparation activities will likely involve overexcavating unsuitable existing fill and restoring grades with suitable structural fill. Re-working and re-compacting the in-place fill may be feasible in areas where the fill is devoid of organic and deleterious material but must be evaluated by ESNW during grading. Areas of deeper fill (if encountered) may require additional or complete over excavation and restoration or alternative foundation support designs. In general, where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Stormwater management is currently proposed using dispersion/level spreader BMPs for roadways and on targeted lots. Based on the soil and groundwater conditions and the results of representative in-situ infiltration testing it is our opinion that infiltration is considered infeasible in the areas tested. Further discussion of infiltration feasibility is provided in this report.

Originally completed in January 2018, this report has been updated to reflect the current proposed site layout and to provide responses to comments prepared by the City of Puyallup (see attached DRT letter). The current project proposal no longer includes the development of the northernmost site parcel (currently referred to as Parcel A). As such, soil and groundwater exposed at test pits TP-14 through TP-18 were not utilized as a basis for the recommendations and evaluations provided in this report.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Chase G. Halsen, L.G., L.E.G
Senior Project Geologist

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Cont'd

ES-5559

GEOTECHNICAL ENGINEERING STUDY
SUNSET POINTE
2301 – 23RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-5559

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential plat to be completed at 2301 – 23rd Street Southeast in Puyallup, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this study included the following:

- Completion of test pits for purposes of characterizing site soils.
- Completion of laboratory testing of soil samples collected at the test pit locations.
- Conduction of engineering analyses and preparation of this report.

The following documents and maps were reviewed as part of our study preparation:

- Sunset Pointe Preliminary Plat Set, prepared by CES NW, Inc., dated May 22, 2023;
- Puyallup Municipal Code Chapter 21.06;
- Development Review Team Letter, prepared by the City of Puyallup, dated May 16, 2022;
- Online Web Soil Survey (WSS) resource, maintained by the Natural Resources Conservation Service under the United States Department of Agriculture;
- Liquefaction Susceptibility for Pierce County incorporating data from the Washington State Department of Natural Resources, dated September 2004, and;
- Geologic Map of the South Half of the Tacoma Quadrangle, Washington, by Timothy J. Walsh, 1987.

Project Description

We understand the site will be developed into a residential plat consisting of 18 residential lots and general site improvements. Stormwater management will be provided using dispersion/level spreader BMPs at some locations. At the time of report submission, building load plans were not available for review; however, based on our experience with similar developments, the proposed residential structures will likely be two to three stories in height and constructed using relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads of about 1 to 2 kips per lineal foot (klf) are expected. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf). We understand that grade fills of up to 20 feet will be necessary to achieve design elevations across the building pads and grading will occur in a stepped configuration where practical do reduce the site modifications required. Deeper excavations will likely be required to construct the stormwater pond.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review the final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located east of the intersection between 19th Avenue Southeast and 21st Street Southeast in Puyallup, Washington. The approximate location of the subject site is depicted on Plate 1 (Vicinity Map). The irregular-shaped property is comprised of two adjoining tax parcels (Pierce County Parcel Nos. 042035-3027) totaling approximately 9.09 acres.

The site is bordered on all sides primarily by existing residential development. A sewer and water easement is present on site, trending roughly east to west along the entire northern edge of the development area. A relay station is present within the east-central site area. Multiple barn and storage structures appear to have been present within the southern site area but had been demolished before our fieldwork. Based on our field observations, it appears that the land has been previously modified through the placement of fill material. It appears that the fill had been placed to establish an access pathway to the southern site area, to level sloping areas, and fill an existing natural trough feature. Based on our observations, it is our opinion the site modification was likely not associated with recent development. Current topography varies across the site; however, maintains an overall northerly/northeasterly declivity. Approximately 30 to 35 feet of total elevation change occurs within the proposed development area. Three existing wetlands (designated A-C on the referenced plans) are present within the central site area.

Subsurface

The subsurface explorations and in-situ filed testing consisted of the following:

- October 24, 2017: Completing 19 test pits were conducted across the entire site area (including Parcel A).

- May 15, 2019: Completing four test pits were conducted and targeted to the proposed stormwater management pond (Tract B). Three shallow groundwater monitoring piezometers were installed during this exploration.

- January 22, 2020: Completing two test pits were performed to conduct small-scale pilot infiltration testing at representative site areas. A shallow, groundwater monitoring piezometer was installed at both test pit locations.

Each exploration and in-situ testing program was observed, logged, and sampled by an ESNW representative and completed using machinery and an operator retained by our firm and completed to assess and classify subsurface soil and groundwater conditions across the site. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in accordance with the Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was encountered generally within the upper 2 to 18 inches of existing grades at the test pit locations. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions.

Fill was observed at the majority of the test pit locations, ranging in approximate depths from 1 to 13 feet below the existing ground surface (bgs). The fill was observed to be variable in nature, typically consisting of silty sand to sandy silt, and encountered in a loose to medium dense and moist condition. In general, the majority of the fill was observed to be free of debris, except isolated areas of brick and wire debris and trace organics. Due to the high variability in texture of the fill soils, ESNW should be retained to evaluate the suitability of fill encountered during construction.

Native Soil

Underlying topsoil and fill, native soils were encountered consisting of soils associated with and representative of glacial drift deposits. In general, the predominant native soil type should be considered silty sand with or without gravel (USCS: SM). However, localized areas and depositional lenses of poorly graded sand and silt (USCS: SP and ML, respectively) were encountered. The native soils were typically encountered in a medium dense and moist conditions.

Geologic Setting

The referenced geologic map resource identifies Vashon undifferentiated drift (Qdv) across the site and surrounding areas. Although not specifically characterized within the geologic map resource, Vashon drift typically consists of glacial till, glaciofluvial, and glaciolacustrine sediments. The reference WSS resource indicates soils of the Everett very gravelly sandy loam, Indianola loamy sand, and Kitsap silt loam (Map Unit Symbols: 13B, 18C, 20B, and 20C, respectively). These soil groups are typically associated with moraines, eskers, kames, and terrace landforms, derived from glacial outwash and glaciolacustrine material. The variability in the makeup of the native soils is generally consistent with that of Vashon drift.

Groundwater

Perched groundwater seepage was encountered at TP-4, TP-201, and TP-202 during the subsurface explorations. In general, the seepage was exposed at depths of about one-and-one-half to six feet bgs and characterized as light to heavy.

In our opinion, the contractor should anticipate, and be prepared to manage, zones of perched groundwater seepage during construction, especially within deeper excavations depending on the time of year grading occurs. Groundwater seepage is common within glacial sediments, particularly within relatively permeable lenses and/or atop dense to very dense, unweathered deposits. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

ESNW is currently performing a groundwater monitoring program for the site at three of the previously installed shallow wells. The results of the program and applicable design recommendations will be provided in a summary letter separate from this report.

Geologically Hazardous Areas

In preparation of this report, we reviewed the applicable city of Puyallup mapping and geologically hazardous area code section 21.06.

Landslide Hazard

As defined in Puyallup Municipal Code (PMC) 21.06.1210, landslide and erosion hazard areas include those identified by the U.S. Department of Agriculture Natural Resources Conservation Service as having a moderate to severe, severe, or very severe erosion hazard because of natural characteristics, including vegetative cover, soil texture, slope, gradient, and rainfall patterns, or human-induced changes to natural characteristics. Landslide and erosion hazard areas include areas with the following characteristics:

- Areas that have shown mass movement during the Holocene epoch (from 10,000 years ago to the present) or that are underlain or covered by mass wastage debris of that epoch;
- Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;
- Slopes having gradients steeper than 80 percent subject to rock fall during seismic shaking;
- Areas potentially unstable because of stream incision or stream bank erosion;
- Areas located in a canyon, ravine, or on an active alluvial fan, presently or potentially subject to inundation by debris flows or flooding;
- Any area with a slope of 40 percent or steeper and a vertical relief of 10 or more feet, except areas composed of consolidated rock and properly engineered manmade slopes/retained fill. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief;
- Areas with a severe limitation for building development because of slope conditions, according to the Natural Resource Conservations Service, and;
- Areas meeting all three of the following criteria: (A) slopes steeper than 15 percent, except that slopes of less than 15 percent may be considered erosion hazard areas if they have certain unstable soil and drainage characteristics; (B) hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and (C) wet season springs or groundwater seepage.

Based on the conditions encountered during our subsurface explorations, review of available topographic information, and review of the referenced slope schematic (which includes delineations of slopes greater than 40 percent), it appears that the majority of the site does not contain a landslide hazard, as defined by the PMC, except as noted below.

Slopes of 40 percent or greater have been delineated within the central site area and are associated with the sidewalls of Wetland A and Wetland C. However, these slopes are isolated and relatively minor in extent. Based on a review of the referenced preliminary plat plan set, a 25-foot buffer has been applied to each respective steep slope feature. Although the buffer appears to intersect the northwest corner of Lot 14, it is outside of the proposed building pad area; therefore, is outside future structural improvements.

In general, the development areas of the site do not contain a landslide hazard. Although some areas on site may meet the PMC criteria for landslide hazard, they are isolated and limited in occurrence. In our opinion, the site does not contain a hazard that would preclude successful development. However, remediation of unsuitable existing soils and groundwater drainage improvements will likely be necessary to assist in maintaining or improving post-construction soil stability. As such, ESNW should be present during grading activities to help identify areas of unsuitable soil and groundwater seepage and provide such mitigation recommendations. From a geotechnical standpoint, provided the recommendations of the referenced report and those contained within this letter are incorporated into the project designs, it is our opinion, based on our understanding of the current scope, the project can be developed as is currently proposed.

Erosion Hazard

As delineated in Puyallup Municipal Code (PMC) 21.06.1210, erosion hazard areas include those identified by the U.S. Department of Agriculture Natural Resources Conservation Service as having a moderate to severe, severe, or very severe erosion hazard because of natural characteristics, including vegetative cover, soil texture, slope, gradient, and rainfall patterns, or human-induced changes to natural characteristics.

Site soils are considered to have moderate to severe erosion potential when exposed to precipitation. In our opinion, provided appropriate temporary and permanent erosion and sediment control (ESC) measures are incorporated into final designs, the potential for erosion will remain low both during and after construction. Site BMPs and other means of sediment and surface flow control measures should be actively maintained during construction to ensure proper performance and functions. While seasonal grading restrictions may not be required for this project, we recommend the developer be prepared to employ enhanced ESC measures during the rainy season and be prepared to suspend grading activities if adequate BMPs cannot perform as intended during intense precipitation.

Provided the above recommendations and considerations are included with the construction plan and sequence, it is our opinion that the proposed development will not adversely affect soil stability on adjacent properties. Please note that our evaluation and corresponding lot recommendations are based on plans and site layouts made available to ESNW during report preparation. If site layout plans change, ESNW should be notified to provide updated recommendations.

DRT Comments and Response

For ease of review and clarity, this section of the report will be focused on responding to geotechnically related jurisdictional comments provided in the referenced DRT letter. Some elements of this response may be a duplicated from the discussion, evaluations, and/or recommendations provided in this report.

***Planning and Review Comment 4**: A 25’ native growth protection area (NGPA) shall be provided on the rear of lot 13 due to slopes and protective buffer areas of 40% (or more) slopes and wetlands, per the Geotech report. These areas shall be landscaped and landscape plan shall be provided for these lots during final landscape plan and approval. February 2022, staff follow up comment: Please revise the lot layout with this protection area shown on the plat sheet(s) as 40% (or more) area (using the same call out as on Tract A) and show buffer setback.*

ESNW Response: As indicated on the referenced plan set, a NGPA easement of 35’ feet has been incorporated along the east property line and encompasses all or a part of Lots 8 through 13. Furthermore, a 25-foot buffer has been incorporated in sloping areas that meet or exceed 40 percent, both of which are located around Wetland A or C. The slope buffer in proximity to Wetland A encompasses a part of Lot 14; however does not encroach into the building envelope for that lot. With respect to Wetland C, the slope buffer does not encroach on any adjacent lot areas.

***Engineering Review Comment 2**: First and foremost, there will be no further review of the civil portion of the Major Plat due to the non-response to repeated requests for detailed long term groundwater monitoring. In addition, 2 test pits are not adequate for a site this size. Infiltration must be shown as infeasible in order for the project to claim that it is infeasible and not use it. Provide detailed account of testing and tabulated results.*

ESNW Response: Site subsurface conditions were explored in October 2017, May 2019, and January 2020 and indicated variability concerning soil types present and grain size distribution across the site. Per USDA testing methods and procedures, native soils are also classified as slightly gravelly sand, gravelly loamy coarse sand, very gravelly loamy sand, and loam. Fines contents were about 6 percent within the sands, 26 to 40 percent within the sandy loam, and 58 to 98 percent within the gravelly loam and loam, as indicated by the sieve results of representative samples. To further evaluate site infiltration potential, two small-scale pilot infiltration tests (PITs) were performed in January 2020. The following table depicts each infiltration test location, encountered soil type, test depth, measured rate, appropriate safety factors, and recommended design rate.

Location	Soil Type	Test Depth (ft bgs)	Measured Rate (in/hr)	Correction Factors			Recommended Design Rate (in/hr)
				CF_v	CF_t	CF_m	
TP-201	ML	4.0	0	0.33	0.5	0.9	0
TP-202	ML	4.0	0	0.33	0.5	0.9	0

In accordance with our previous evaluations and recommendations, it is our opinion that infiltration be considered infeasible for the proposed project. Based on the soil and groundwater conditions exposed during each subsurface exploration, and the observed field infiltration rate of zero in/hr. at both PIT locations, it is our opinion that infiltration infeasibility has been sufficiently demonstrated.

Engineering Review Comment 6b: *The stormwater pond is located within a steep slope buffer. Per the DOE stormwater manual, the facility shall not be located above a slope that exceeds 15 percent.*

Engineering Review Comment 6d: The stormwater pond will be a City-owned infrastructure. The city does not accept its current location above a steep slope that leads to a wetland. This configuration will likely cause additional maintenance and has a potential for failure over time. The pond shall be relocated.

ESNW Response: From a geotechnical standpoint, construction of the stormwater pond at the proposed location may be considered feasible provided that lateral water migration can be sufficiently prevented. In our opinion, this can be achieved by including a low-permeable liner in the pond construction. Liners can consist of a geo-membrane or compacted soil that meets the requirements of the governing stormwater manual.

Engineering Review Comment 7: *Does the soils within the wetland tract have any capabilities of infiltrating?*

ESNW Response: From a geotechnical standpoint, infiltration should not be considered within the wetland areas. The presence of perennial, ponded water indicates that the wetland area is underlying by a confining or restrictive layer. Vertical transmission of water may occur; however, based on the soil conditions encountered at the test pit locations and or field observations, it would likely be a nearly negligible amount in concurrence with lateral water migration, however, it is not expected to the degree which would allow for successful, targeted infiltration designs to the area.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, the construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, the suitability of using on-site soils as structural fill, and construction of the stormwater facility(s).

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, and performing clearing and site stripping. Subsequent earthwork activities will involve mass site grading and related infrastructure improvements.

Temporary Erosion Control

The following temporary erosion control measures are offered:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide a stable access entrance surface. The placement of a geotextile fabric beneath the quarry spalls will provide greater stability if needed. Existing asphalt/gravel drive lanes can be considered for use as a temporary construction entrance and should be observed by ESNW before construction.
- Silt fencing should be placed around the site perimeter.
- When not in use, soil stockpiles should be covered or otherwise protected.
- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed before beginning earthwork activities.
- Dry soils disturbed during construction should be wetted to minimize dust.

Additional BMPs, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. Temporary erosion control measures should be continually maintained and improved to provide proper function over the course of construction.

Stripping

Topsoil was encountered generally within the upper 2 to 18 inches of existing grades at the test pit locations. Based on the encountered conditions, an average topsoil thickness of about eight to nine inches may be assumed ESNW should be retained to observe site stripping activities at the time of construction so that the degree of required stripping may be assessed. The exposed subgrade may still possess root elements, other organic material, or be present in a loose condition. As such, ESNW should evaluate the exposed soil subgrade to determine if further stripping or in-situ compaction efforts prior to fill operations or finish grading is necessary. Over-stripping should be avoided, as it is unnecessary and may result in increased project development costs. Topsoil and organic-rich soil are neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas if desired.

In-situ and Imported Soils

On-site soils are highly moisture sensitive; therefore, successful use as structural fill largely being dictated by the moisture content at the time of placement and compaction. Remedial measures, such as soil aeration and/or cement treatment (where allowed by the local jurisdiction or utility district), may be necessary as part of site grading and earthwork activities. Existing fill soils to be used within structural applications must be free of deleterious debris, especially concerning construction-like debris and organic material. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, a contingency should be provided in the project budget for the export of soil that cannot be successfully compacted as structural fill if grading activities take place during periods of extended rainfall activity. Soils with fine contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Subgrade Preparation

Following site stripping, cuts and fills will be completed to establish proposed subgrade elevations across the site. To establish a suitable subgrade for structural elements, recompaction of existing fill soils will likely be necessary for some areas. Due to the variable thickness and extent of the existing fill, it is our opinion that structural elements within the deeper fill areas be underlain by at least four feet of structural fill. It may be possible to recompact and reuse existing fill provided that it is free of deleterious material and contain a moisture content that is near optimum and is approved by ESNW at the time of placement and compaction.

Subgrades founded in competent native soils can likely be compacted in situ with mechanical equipment until a uniformly firm and unyielding condition is achieved. ESNW should observe the subgrade(s) during initial site preparation activities to confirm soil conditions are as anticipated and to provide supplementary recommendations for subgrade preparation, as necessary.

Please note the above considerations are based on current site layout plans available to ESNW, as depicted on the Test Pit Location Plan attached to this report. Should site layout designs change, ESNW should be informed and allowed to reevaluate necessary preparation efforts in relation to corresponding Lot numbers.

Structural Fill

Structural fill is defined as compacted soil placed in the foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). Soils intended for use as structural fill should be generally free of organic and deleterious material. For soil placed in utility trenches underlying structural areas, compaction requirements are dictated by the local city, county, or utility district, and are typically specified to a relative compaction of at least 95 percent.

Slope Fill

Structural fill placed along sloping areas (where a “sloping area” is defined as an area inclined at 15 percent or steeper) should be placed on a level bench as depicted on Plate 3 (Slope Fill Detail). Benches must be “keyed” into the slope and subsequently filled and compacted with suitable structural fill before continuing to the next bench. Sloping finish grades should be “overbuilt” using a bench-style fill and cut to the design gradient to ensure a permanent compacted slope face is maintained. ESNW should observe structural fill placement to confirm subgrade conditions and provide additional drainage recommendations, as necessary.

Temporary Excavations and Slopes

Excavation activities will likely expose loose to medium dense fill and weathered native soils that transition to medium dense to dense native soils at depth. Based on the soil conditions observed at the test pit locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Loose to medium dense soil 1.5H:1V (Type C)
- Areas containing groundwater seepage 1.5H:1V (Type C)
- Dense to very dense native soil 0.75H:1V (Type A)

Steeper temporary slope inclinations within undisturbed, very dense native deposits may be feasible based on the soil and groundwater conditions exposed within the excavations. Steeper inclinations may be considered and must be subsequently approved, by ESNW at the time of grading.

Permanent slopes should be planted with vegetation to enhance stability and minimize erosion and should maintain a maximum gradient of 2H:1V or inclination prescribed by the governing jurisdiction. The presence of perched groundwater may cause localized sloughing of temporary slopes due to excess seepage forces. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations, as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

Foundations

In our opinion, the proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, recompacted existing fill, or suitable structural fill placed directly on competent native soils. In general, native soils competent for foundation support are anticipated to be encountered at approximate depths of two to five feet below the existing ground surface elevation. Areas underlain by existing fill may require additional preparation techniques to establish suitable and uniform bearing conditions, such as overexcavating unsuitable existing fill and restoring grades with suitable structural fill. Re-working and re-compacting the in-place fill may be feasible in areas where the fill is devoid of organic and deleterious material but must be evaluated by ESNW during grading. Areas of deeper fill may require additional or complete over excavation and restoration or alternative foundation support implementations (see Subgrade Preparation section of the report). In general, where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Provided the foundations will be supported as described above, the following parameters may be used for the design:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf (equivalent fluid)
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically concerning earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (g)	1.255
Mapped 1-second period spectral response acceleration, S_1 (g)	0.432
Short period site coefficient, F_a	1.0
Long period site coefficient, F_v	1.868†
Adjusted short period spectral response acceleration, S_{MS} (g)	1.255
Adjusted 1-second period spectral response acceleration, S_{M1} (g)	0.807†
Design short period spectral response acceleration, S_{DS} (g)	0.837
Design 1-second period spectral response acceleration, S_{D1} (g)	0.538†

* *Assumes medium dense native soil conditions, encountered to a maximum depth of 18 feet bgs during the October 207, May 2019, and January 2020 field exploration, remain medium dense (if not become denser) to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner, and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered low. The depth of the regional groundwater table and the encountered in-situ density of the native soil were the primary bases for this opinion.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed residential structures should be supported on a well-compacted, firm, and unyielding subgrade. Where feasible, competent native soil exposed at the slab-on-grade subgrade level can likely be compacted in situ to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, before construction of the slab.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, the installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for the design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 55 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)*
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 8H psf**

* *Where applicable.*
** *Where H equals the retained height (in feet).*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 4. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Based on our field observations, isolated zones of perched groundwater seepage should be anticipated within site excavations depending on the time of year grading occurs. Temporary measures to control surface water runoff and groundwater seepage during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for instability related to seepage effects.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 5.

Infiltration Feasibility Evaluation

Site subsurface conditions were initially explored in October 2017, May 2019, and January 2020 and indicated variability concerning soil types present and grain size distribution across the site. Per USDA testing methods and procedures, native soils are also classified as slightly gravelly sand, gravelly loamy coarse sand, very gravelly loamy sand, and loam. Fines contents were about 6 percent within the sands, 26 to 40 percent within the sandy loam, and 58 to 98 percent within the gravelly loam and loam, as indicated by the sieve results of representative samples. To further evaluate site infiltration potential, two small-scale pilot infiltration tests (PITs) were performed in January 2020. The following table depicts each infiltration test location, encountered soil type, test depth, measured rate, appropriate safety factors, and recommended design rate.

Location	Soil Type	Test Depth (ft bgs)	Measured Rate (in/hr)	Correction Factors			Recommended Design Rate (in/hr)
				CF_v	CF_t	CF_m	
TP-201	ML	4.0	0	0.33	0.5	0.9	0
TP-202	ML	4.0	0	0.33	0.5	0.9	0

In accordance with our previous evaluations and recommendations, it is our opinion that infiltration be considered infeasible for the proposed project. Based on the soil and groundwater conditions exposed during each subsurface exploration, and the observed field infiltration rate of zero in/hr. at both PIT locations, it is our opinion that infiltration infeasibility has been sufficiently demonstrated.

Stormwater System

We understand that roof runoff will be collected and conveyed to individual lot dispersion/level spreader BMPs. The intent of this configuration is to reduce the potential for concentrated discharge and recharge the site wetland/pond areas to preserve functions and values of those features. In our opinion, this approach is acceptable from a geotechnical standpoint.

Utility Support and Trench Backfill

In our opinion, on-site soils will generally be suitable for the support of utilities. Remedial measures may be necessary for some areas to provide support for utilities, such as overexcavation and replacement with structural fill and/or placement of geotextile fabric. Groundwater seepage may be encountered within utility excavations, and caving of trench walls may occur where groundwater is encountered. Depending on the time of year and conditions encountered, dewatering, as well as temporary trench shoring, may be necessary during utility trench excavation and installation.

Successful use will depend on the soil's moisture content at the time of placement and compaction. The silt soils encountered at our test pit locations is not suitable for utility trench backfill. Moisture conditioning of the soils may be necessary at some locations before use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should consist of and be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the governing jurisdiction or agency.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as over-excavation and/or placement of thicker crushed rock or structural fill sections, before pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

For heavy-loaded pavement areas such as main interior access roads and areas subject to occasional large commercial vehicle traffic, the following preliminary pavement sections may be considered:

- Three inches of HMA placed over six inches of CRB, or;

- Three inches of HMA placed over three inches of ATB.

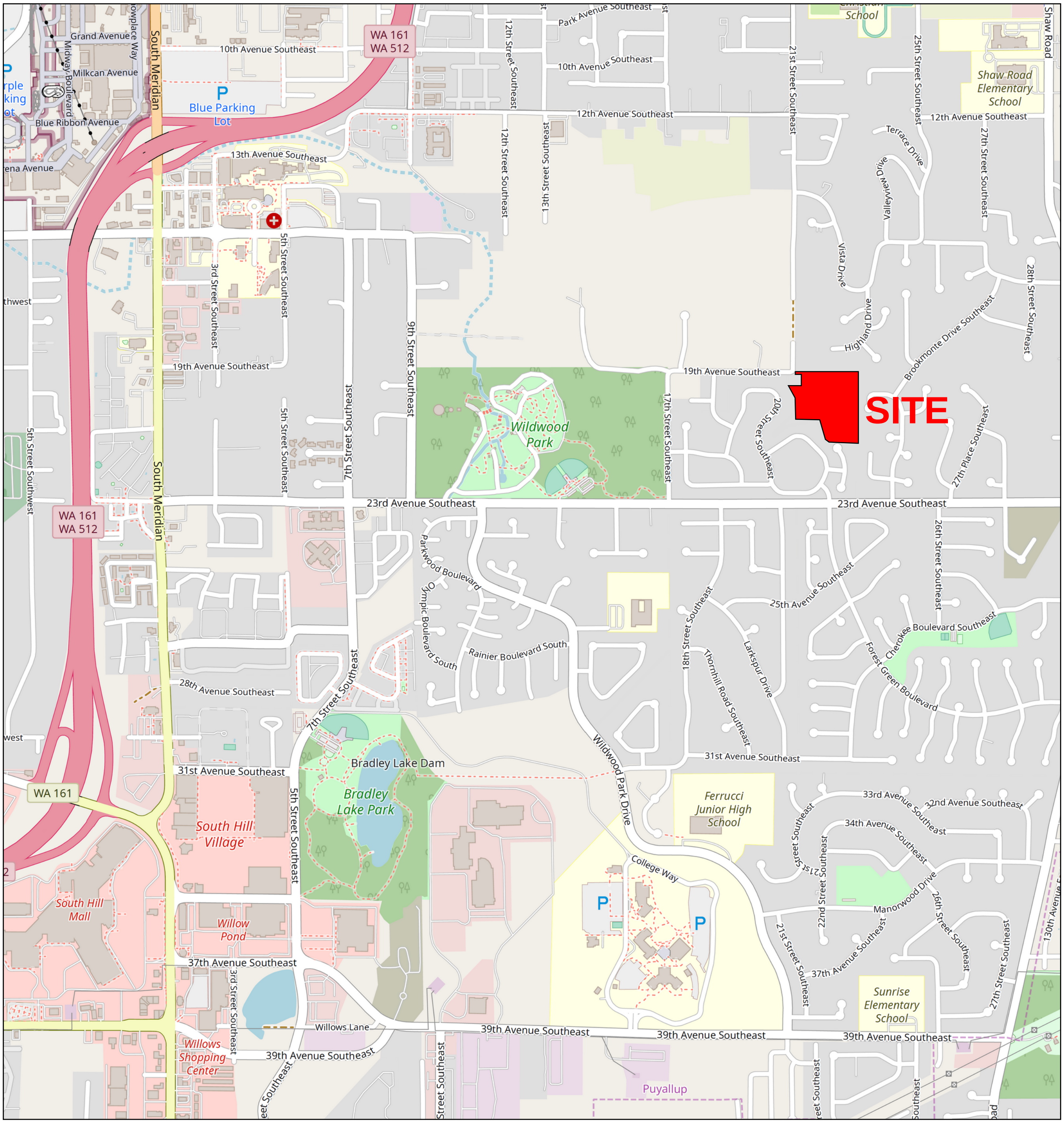
The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by a modified proctor test (ASTM D1557). Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the governing jurisdiction may supersede the recommendations provided in this report. If the roadway will be constructed with an inverted crown, additional drainage recommendations may be necessary, as evaluated and recommended by ESNW at the time of construction.

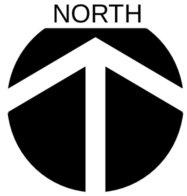
LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.





Reference:
Pierce County, Washington
OpenStreetMap.org

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

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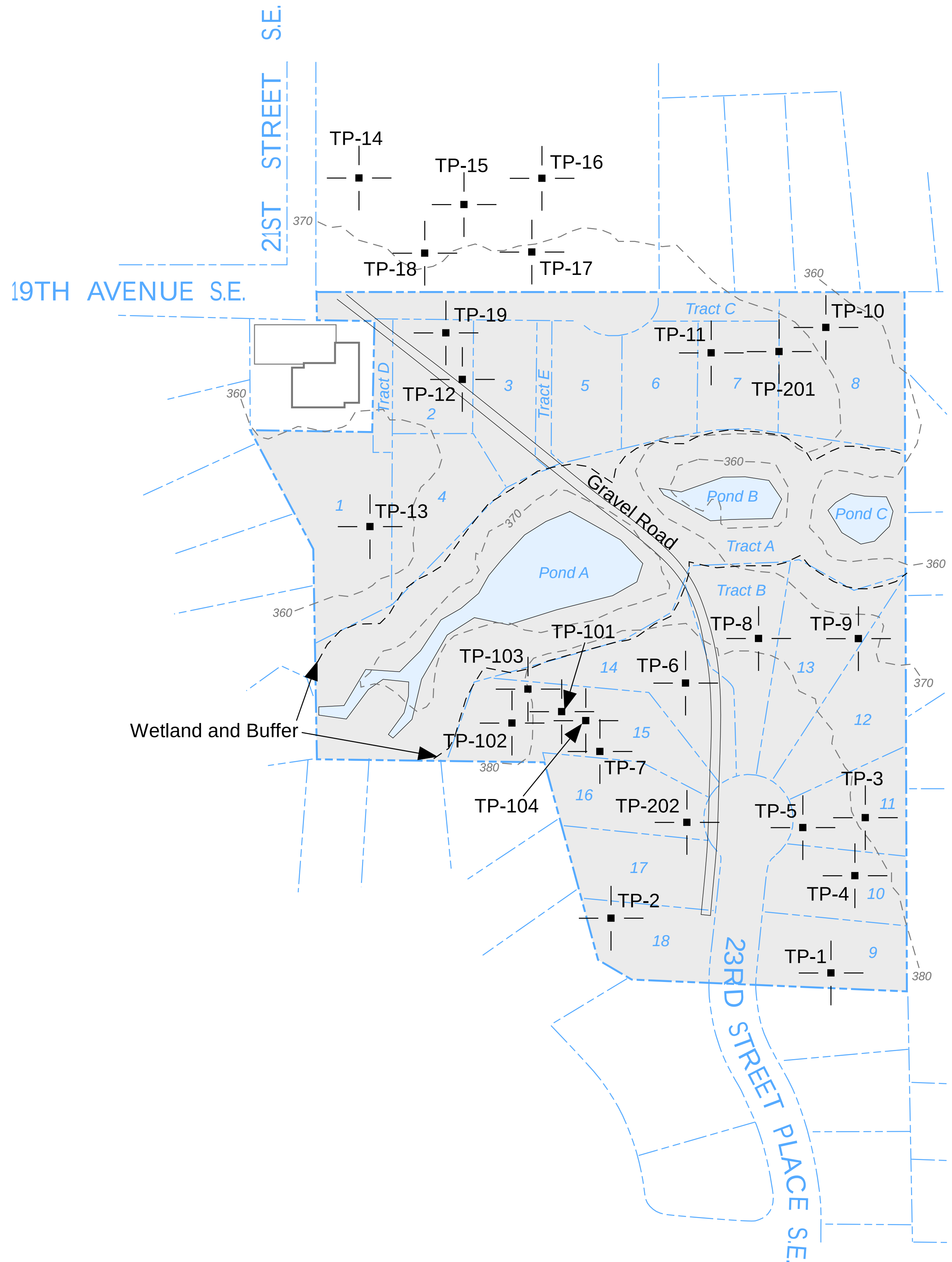
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Sunset Pointe
Puyallup, Washington

Drwn. CAM	Date 04/05/2023	Proj. No. 5559
Checked CGH	Date April 2023	Plate 1



LEGEND

TP-201 — Approximate Location of ESNW Test Pit, Proj. No. ES-5559.03, Jan. 2020

TP-101 — Approximate Location of ESNW Test Pit, Proj. No. ES-5559, May 2019

TP-1 — Approximate Location of ESNW Test Pit, Proj No. ES-5559, Oct. 2017

Subject Site

Existing Building

10 — Proposed Lot Number

NORTH

1"=150'

0 75 150

Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

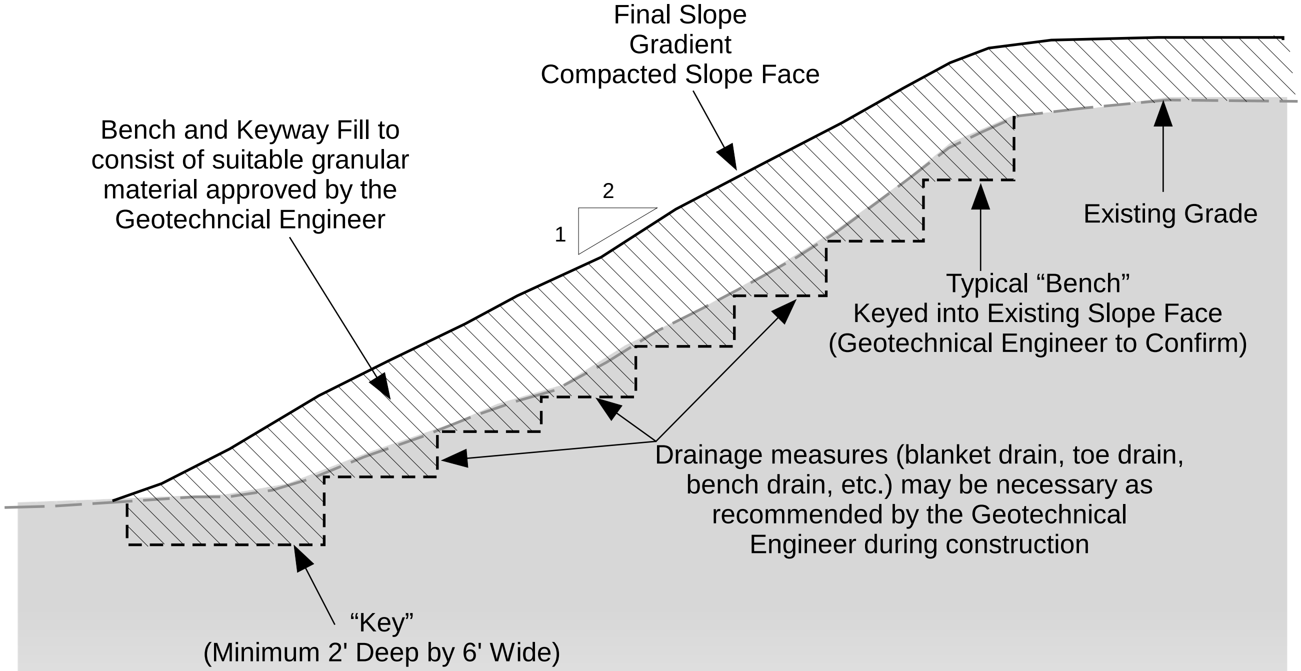
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
Sunset Pointe
Puyallup, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By	CAM
Checked By	CGH
Date	05/26/2023
Proj. No.	5559
Plate	2

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING



NOTES:

- Slope should be stripped of topsoil and unsuitable materials prior to excavating Keyway or benches.
- Benches will typically be equal to a bulldozer blade width of approximately 8 feet but shall be at least 4 feet.
- Final slope gradient should be 2H : 1V.
- Final slope face should be densified by over-building with compacted fill and trimming back to shape or by compaction with a bulldozer or vibratory drum roller.
- Planting or hydroseeding slope face with a rapid growth deep-rooted vegetative mat will reduce erosion potential of slope area.
- Use of pegged-in-place jute matting or geotechnical fabric will help maintain the seed and mulch in place until the root system has an opportunity to germinate.
- Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness. Each lift should be compacted to no less than the degree specified in the "Site Preparation and Earthwork" section of this report. No additional lift should be placed until compaction is achieved.

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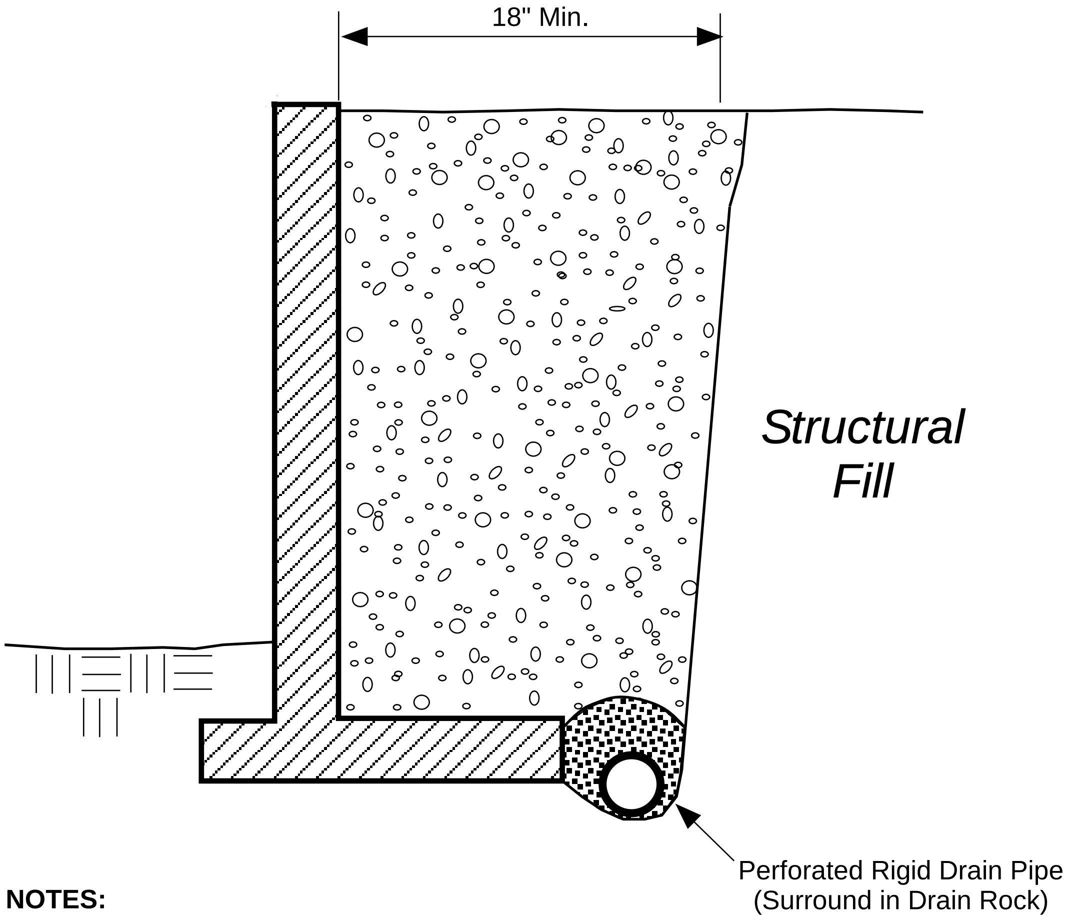
Slope Fill Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 3



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Free-draining Structural Backfill

1-inch Drain Rock

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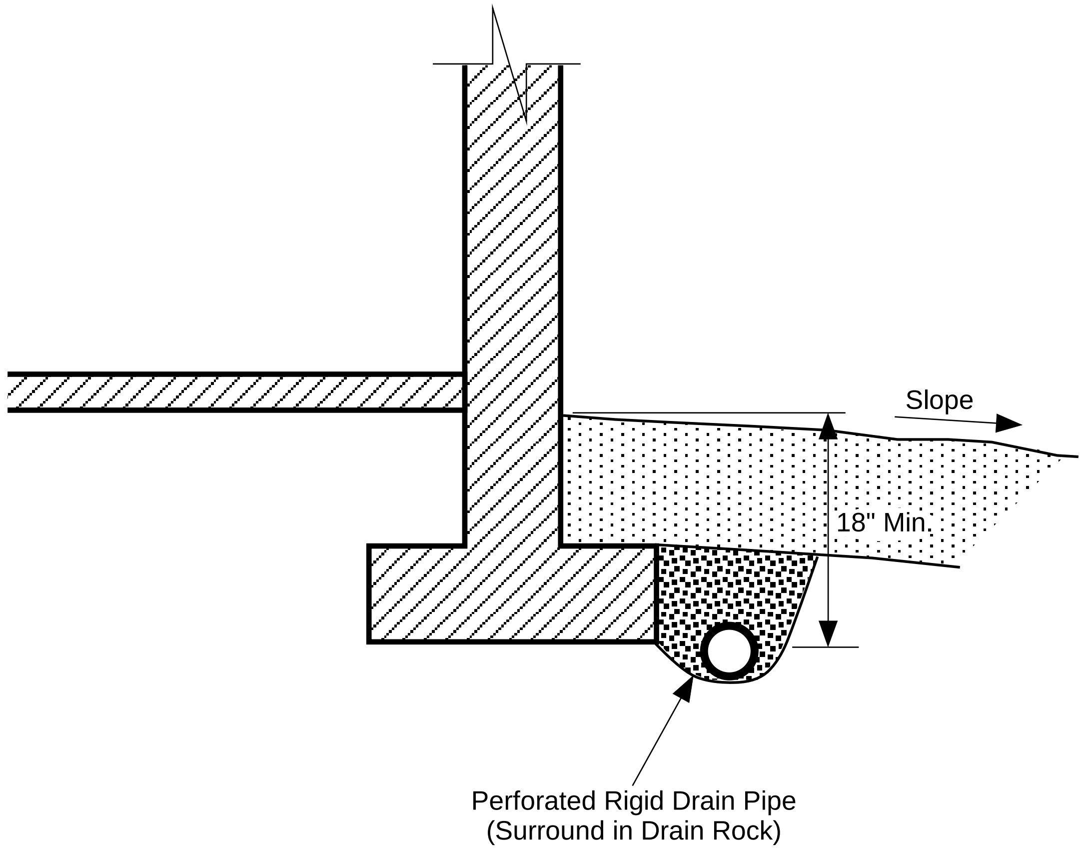
Retaining Wall Drainage Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 4



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

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Footing Drain Detail
Sunset Pointe
Puyallup, Washington

Drwn. MRS	Date 10/09/2018	Proj. No. 5559
Checked CGH	Date Oct. 2018	Plate 5

Appendix A

Subsurface Exploration
Test Pit Logs

ES-5559

Subsurface conditions at the subject site were explored by an ESNW representative on October 24, 2017, May 15, 2019, and January 22, 2020. A total of 25 test pits were excavated at accessible areas of the site using an operator and trackhoe retained by ESNW. The approximate locations of the test pits are illustrated on Plate 2 of this study. The test pits logs are provided in this Appendix. The test pits were excavated to a maximum depth of approximately 18 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Major Divisions			Group Symbol	Description
Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

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

Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

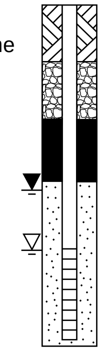
Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols

ATD = At time of drilling

Static water level (date)



Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

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EXPLORATION LOG KEY

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-201

PROJECT NUMBER ES-5559.03
PROJECT NAME Sunset Pointe
DATE STARTED 1/22/20 **COMPLETED** 1/22/20
GROUND ELEVATION 374 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	DEPTH	MATERIAL DESCRIPTION	ELEV.
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 1'	373.5
		MC = 20.7 MC = 32.6 Fines = 88.9	ML		4.5	Tan SILT, medium dense, moist to wet -mottled texture [USDA Classification: LOAM]	369.5
5		MC = 15.1	SP		6.0	Gray poorly graded SAND, dense, moist to wet -heavy iron oxide staining at contact, light groundwater seepage at 6'	368.0
		MC = 30.7 MC = 30.5 Fines = 78.7	ML		8.0	Gray SILT with sand, dense, moist to wet -minor iron oxide staining throughout [USDA Classification: slightly gravelly LOAM]	366.0

Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 6.0 feet during excavation. No caving observed.

GENERAL BH / TP / WELL - 5559-3.GPJ - GINT US.GDT - 4/5/23

Earth Solutions NW, LLC
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Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-202

PROJECT NUMBER ES-5559.03
PROJECT NAME Sunset Pointe
DATE STARTED 1/22/20 **COMPLETED** 1/22/20
GROUND ELEVATION 388 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	Depth	MATERIAL DESCRIPTION	Elevation
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 6"	387.5
			FILL		1.5	Crushed rock (Fill) -light perched groundwater seepage	386.5
		MC = 31.9	SM		2.7	Tan silty SAND, medium dense, moist ~<8" sand lens	385.3
		MC = 19.4 Fines = 58.7 MC = 31.8	ML		4.5	Tan sandy SILT, dense, moist -becomes gray [USDA Classification: slightly gravelly LOAM]	383.5
5		MC = 13.3 Fines = 39.9	SM		8.0	Gray silty SAND, dense, moist -light iron oxide staining -increased sand content [USDA Classification: slightly gravelly fine sandy LOAM]	380.0

Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 1.0 foot during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-101

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/19/19
GROUND ELEVATION 383 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": heavy bramble
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation
0 – 1.0			TPSL		Dark brown TOPSOIL, root intrusions to 12"	382.0
1.0 – 5.5		MC = 13.8	SM		Gray silty SAND with gravel, dense, moist (Fill) -sand lens ~12" thick	377.5
5.5 – 13.0		MC = 20.0 MC = 27.3 Fines = 90.0	ML		Gray SILT, medium dense, moist (Fill) -becomes brown, increased fines [USDA Classification: slightly gravelly LOAM]	370.0
13.0 – 15.0		MC = 31.9 Fines = 95.8	ML		Tan SILT, medium dense, wet [USDA Classification: LOAM]	368.0
15.0 – 18.0		MC = 35.3 MC = 28.5	SM		Tan silty SAND, medium dense, wet to saturated -minor iron oxide staining -sand lens 6"- 12" thick	365.0

Test pit terminated at 18.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-102

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/15/19
GROUND ELEVATION 376 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": heavy bramble
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
0			TPSL		1.0	Dark brown TOPSOIL, root intrusions to 2.25'	375.0
			SM		2.5	Brown silty SAND, loose, moist	373.5
		MC = 25.4 Fines = 98.3	ML			Gray SILT, dense, moist [USDA Classification: LOAM] -heavy iron oxide staining	
5		MC = 32.0 Fines = 92.5				-becomes brown, wet [USDA Classification: LOAM]	
		MC = 35.2			9.5	-becomes wet to saturated	366.5

Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
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Telephone: 425-449-4704
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TEST PIT NUMBER TP-103

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 5/15/19 **COMPLETED** 5/15/19
GROUND ELEVATION 384 ft
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 8": heavy bush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL	0.6	Dark brown TOPSOIL, root intrusions to 6.25' (Fill)	383.4
			SM		Gray silty SAND with gravel, medium dense to dense, moist (Fill)	
					-asphalt debris	
		MC = 11.3				
5						
		MC = 10.4				
					-increased sand content	
					-erratic silt interbeds	
		MC = 11.7				
10						
		MC = 20.2		11.0		373.0

Test pit terminated at 11.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-104

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe

DATE STARTED 5/15/19 **COMPLETED** 5/15/19 **GROUND ELEVATION** 383 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

LOGGED BY CGH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES Depth of Topsoil & Sod 8": grass ∇ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0 – 0.6			TPSL		Dark brown TOPSOIL, root intrusions to 12"	382.4
0.6 – 5.0		MC = 19.9 MC = 23.5	SM		Gray silty SAND with gravel, medium dense to dense, moist -becomes brown -becomes gray -heavy iron oxide staining	378.0
5.0 – 11.0		MC = 29.8 Fines = 93.5	ML		Gray SILT, loose, moist to wet -becomes brown, wet [USDA Classification: LOAM]	372.0

Test pit terminated at 11.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-1

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil &Sod 1"- 3": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			Rock	0.5	Crushed Rock (Fill)
			ML	1.0	Brown SILT, loose, moist
			SP-SM		Brown poorly graded SAND with silt, medium dense, moist
		MC = 7.4 Fines = 6.2			[USDA Classification: slightly gravelly SAND]
					-increased gravel content
5					-becomes medium dense to dense
		MC = 4.4			
					-increased cobbles
		MC = 7.4		9.0	
					Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-2

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 4": brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.3	Dark brown TOPSOIL (Fill), root intrusions to 7'
			Fill	1.0	Clean washed ROCK (Fill)
		MC = 21.6	ML	5.0	Brown/tan sandy SILT, medium dense, moist -light iron oxide staining 2'- 4'
5			SP	6.5	Gray poorly graded SAND, medium dense to dense, moist
		MC = 9.5	ML	8.0	Tan sandy SILT, dense, moist
		MC = 4.8	SP	9.0	Gray poorly graded SAND with gravel, dense, moist -caving caused by excavation activities

Test pit terminated at 9.0 feet below existing grade. No groundwater seepage encountered during excavation. Caving observed from 6.0 to 6.5 feet and 8.0 feet to BOH.

GENERAL BH / TP / WELL - 5559.GPJ - GINT US.GDT - 4/5/23

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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 18": brush
▽ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.5	Dark brown TOPSOIL (Fill), intrusions to 7'
		MC = 8.9	SM		Gray silty SAND with gravel, medium dense, moist (Fill) -clean washed rock ~4" thick -becomes brown dense
5		MC = 8.1 Fines = 15.9		7.0	[USDA Classification: very gravelly loamy SAND]
		MC = 19.2	ML	9.0	Gray SILT with sand, medium dense, moist (Fill)

Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-4

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose to medium dense, moist (Fill) -root intrusions to 9' -heavy perched groundwater seepage
5		MC = 12.3		7.0	
			ML		Gray SILT with sand, loose to medium dense, wet (Fill) -trace organics -light iron oxide staining
10		MC = 19.3			
		MC = 22.1		12.0	
			ML		Brown sandy SILT, dense, moist -light iron oxide staining
15		MC = 27.4		15.0	Test pit terminated at 15.0 feet below existing grade. Groundwater encountered seepage encountered at 4.0 feet during excavation. Caving observed from 0.0 to 9.0 feet.

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TEST PIT NUMBER TP-5

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 12": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	Dark brown TOPSOIL, root intrusions to 3'
			SM		Brown silty SAND, medium dense, moist
		MC = 7.2			-becomes tan, damp to moist
5					
					-becomes dense
		MC = 20.9			-light iron oxide staining
					-becomes gray, very dense
					-moderate cementation, light iron oxide staining
		MC = 12.4		9.5	Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-6

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2"- 4": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM	2.0	Brown silty SAND, medium dense, moist (Fill) -root intrusions to 7'
				2.5	Relic TOPSOIL Horizon
5		MC = 20.5	ML	8.0	Brown sandy SILT, medium dense, moist (Fill) -minor brick debris -becomes gray
10		MC = 10.0 MC = 31.7	SP	12.0	Brown poorly graded SAND, dense, moist -light iron oxide staining -becomes wet to saturated

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-7

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6"- 8": brush
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 7'
			SM		Brown silty SAND, loose to medium dense, moist
		MC = 9.5			-light to moderate iron staining
					-becomes gray, very dense
5					
		MC = 18.0		9.0	-becomes wet

Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-8

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 4": brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 5'
			SM		Brown silty SAND, medium dense, moist
		MC = 16.3	SM		-becomes gray, dense
5					
		MC = 17.8		8.0	
		MC = 3.2	SP	9.0	Gray poorly graded SAND, dense, moist

Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-9

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 4": grass
∇ **AT TIME OF EXCAVATION**
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 3'
		MC = 21.7 Fines = 81.2	ML		Brown SILT with sand, medium dense to dense, moist [USDA Classification: LOAM] -becomes gray -light iron oxide staining
5				6.0	
		MC = 3.9	SP	6.5	Gray poorly graded SAND, dense, moist

Test pit terminated at 6.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-10

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Gray silty SAND, medium dense, moist (Fill) -root intrusions to 3.5'
		MC = 12.4	TPSL	2.0	Relic TOPSOIL Horizon
5		MC = 18.7	SM	2.5	Brown silty SAND, medium dense, moist -becomes gray, dense
		MC = 8.9		9.0	Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-11

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Depth of Topsoil & Sod 6": grass **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0			TPSL		0.5	Dark brown TOPSOIL, root intrusions to 4'
			SM			Tan silty SAND, medium dense, moist
						-moderate iron oxide staining to 4'
		MC = 21.1				
5		MC = 20.1				-intermittent light iron oxide staining
						-becomes dense
10		MC = 16.0			10.0	
						Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-12

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			ML		Brown sandy SILT, medium dense, moist -root intrusions to 3' -becomes gray [USDA Classification: LOAM]
5		MC = 15.2 Fines = 60.2			
		MC = 17.3		6.0	Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-13

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 4": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			ML		Brown sandy SILT, loose to medium dense, moist
		MC = 27.3			
5					-becomes gray
		MC = 23.9			
9.5					
10		MC = 16.0	SP		Gray poorly graded SAND with gravel, dense, wet
10.0					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-14

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 6"- 8": grass
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, root intrusions to 3'
		MC = 15.2	SM	7.0	Brown silty SAND, loose to medium dense, moist -becomes gray, medium dense -light iron oxide staining
5		MC = 7.1	SP	10.0	Gray poorly graded SAND, dense, moist
10		MC = 12.5 MC = 9.0	SM	12.0	Brown silty SAND, dense, moist

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-15

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Surface Conditions: brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist (Fill) -trace to moderate organics throughout -root intrusions to 12'
5		MC = 18.9			
10		MC = 91.3 Fines = 79.0			[USDA Classification: gravelly loamy coarse SAND] -becomes wet
15				15.5	
		MC = 28.6	ML	16.0	Gray sandy SILT, medium dense, moist
					Test pit terminated at 16.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-16

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17 **GROUND ELEVATION**
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW **GROUND WATER LEVEL:**
NOTES Surface Conditions: brush **AT TIME OF EXCAVATION**
SURFACE CONDITIONS **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Dark brown silty SAND, loose, wet -root intrusions to 3'
		MC = 30.8	SM		
5		MC = 16.5			-becomes brown, medium dense, moist
		MC = 7.9		6.0	-becomes gray
					Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-17

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 COMPLETED 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE LONGITUDE
LOGGED BY CGH CHECKED BY HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 4": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0		MC = 24.1	SM			Brown silty SAND, loose, wet (Fill) -root intrusions to 7'
5					7.0	
		MC = 6.3	SM		7.5	Tan silty SAND, medium dense, moist

Test pit terminated at 7.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-18

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 2"- 3": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist (Fill) -root intrusions to 3'
		MC = 14.9			-wire debris
5				5.0	
		MC = 6.3	SM	6.0	Tan silty SAND, medium dense, moist

Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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TEST PIT NUMBER TP-19

PROJECT NUMBER ES-5559
PROJECT NAME Sunset Pointe
DATE STARTED 10/24/17 **COMPLETED** 10/24/17
GROUND ELEVATION
EXCAVATION CONTRACTOR NW Excavating
LATITUDE **LONGITUDE**
LOGGED BY CGH **CHECKED BY** HTW
GROUND WATER LEVEL:
NOTES Depth of Topsoil & Sod 10": brush
AT TIME OF EXCAVATION
SURFACE CONDITIONS
AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	Dark brown TOPSOIL, root intrusions to 2'
		MC = 13.0	SM		Gray silty SAND, medium dense, moist
					-becomes dense
5		MC = 15.4		5.0	
					Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Appendix B

Laboratory Test Results

ES-5559

Earth Solutions NW, LLC
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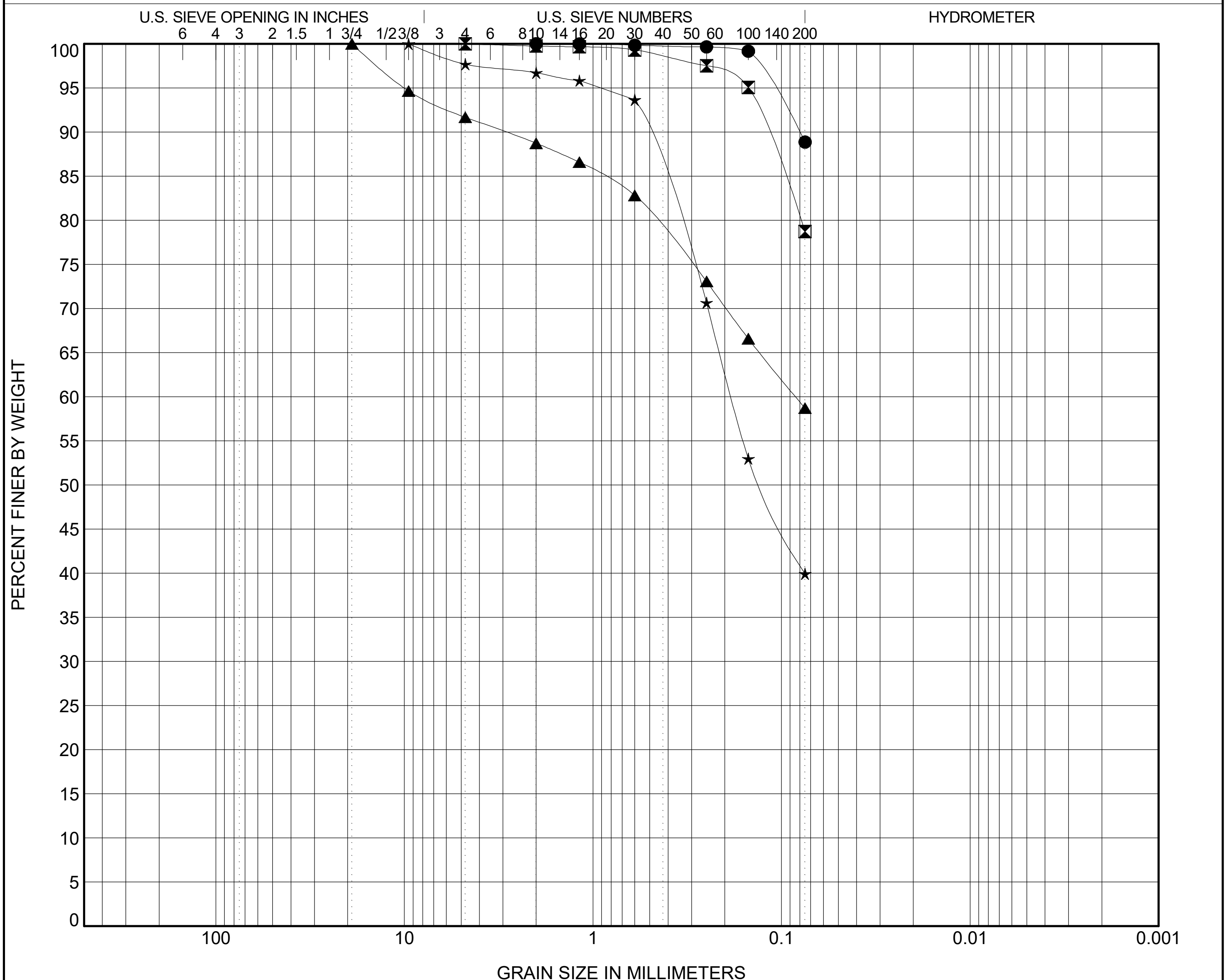
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-5559.03 **PROJECT NAME** Sunset Pointe



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**TP-201**	**4.00ft.**	**USDA: Tan Loam. USCS: ML.**		
⧗	**TP-201**	**8.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML with Sand.**		
▲	**TP-202**	**4.00ft.**	**USDA: Tan Slightly Gravelly Loam. USCS: Sandy ML.**		
★	**TP-202**	**8.00ft.**	**USDA: Gray Slightly Gravelly Fine Sandy Loam. USCS: SM.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-201**	**4.0ft.**	**2**							**88.9**	
⧗	**TP-201**	**8.0ft.**	**4.75**							**78.7**	
▲	**TP-202**	**4.0ft.**	**19**	**0.084**						**58.7**	
★	**TP-202**	**8.0ft.**	**9.5**	**0.184**						**39.9**	

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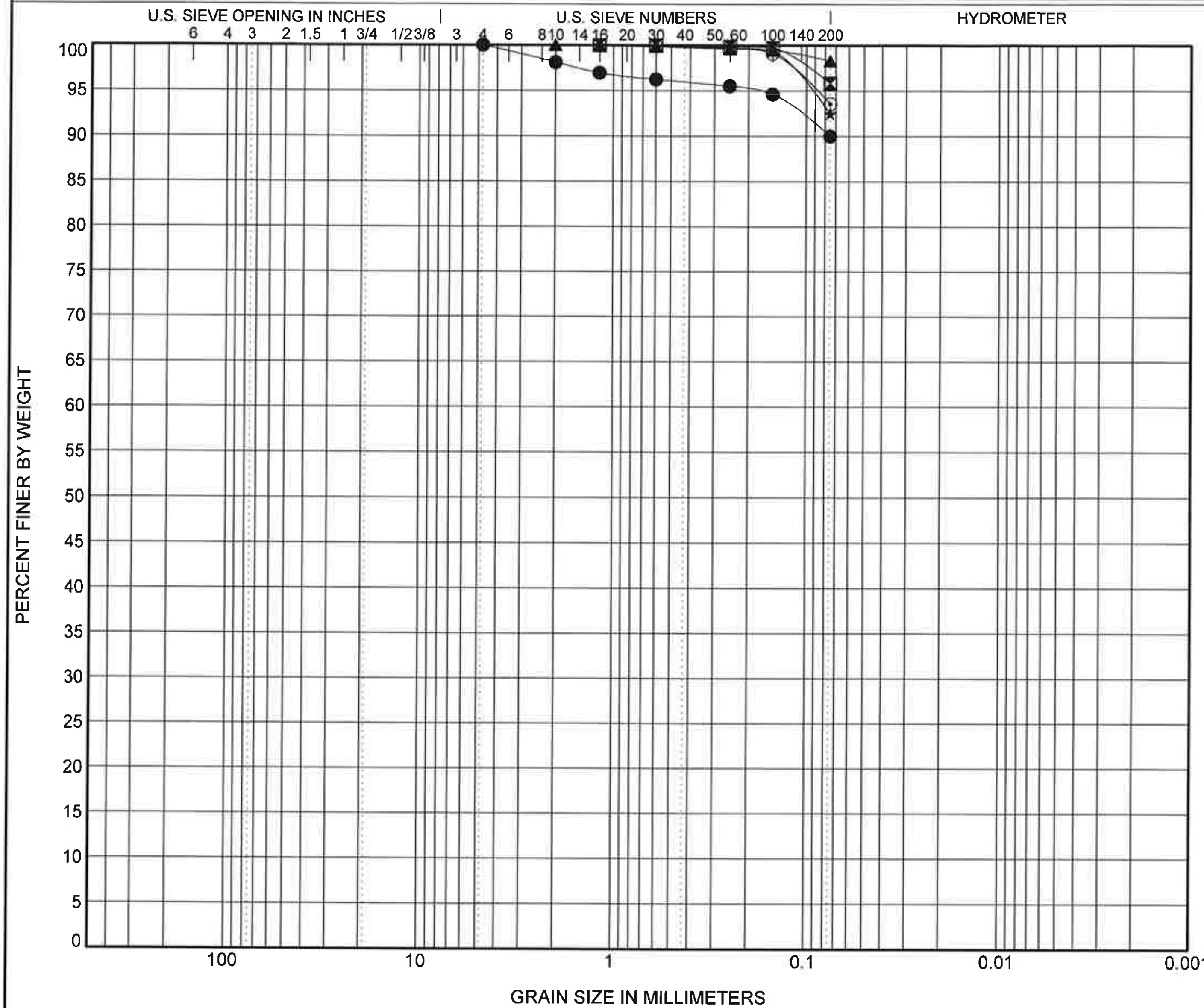
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-5559 **PROJECT NAME** Sunset Pointe



	Specimen Identification		Classification	Cc	Cu
●	**TP-101**	**10.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML.**		
⊠	**TP-101**	**14.00ft.**	**USDA: Tan Loam. USCS: ML.**		
▲	**TP-102**	**3.00ft.**	**USDA: Gray Loam. USCS: ML.**		
★	**TP-102**	**6.00ft.**	**USDA Brown Loam. USCS: ML.**		
⊙	**TP-104**	**11.00ft.**	**USDA: Brown Loam. USCS: ML.**		

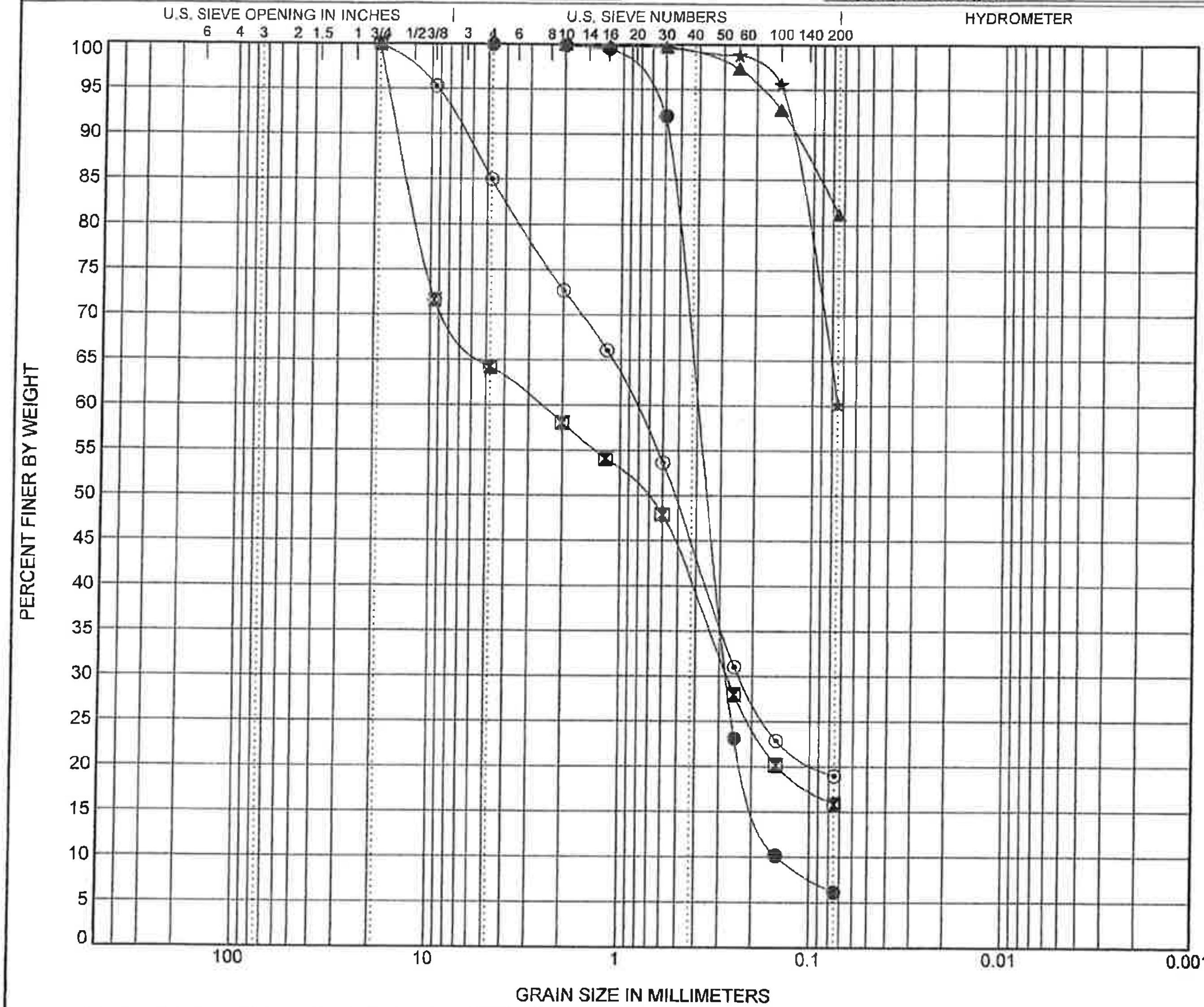
	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-101**	**10.0ft.**	**4.75**							**90.0**	
⊠	**TP-101**	**14.0ft.**	**1.18**							**95.8**	
▲	**TP-102**	**3.0ft.**	**2**							**98.3**	
★	**TP-102**	**6.0ft.**	**1.18**							**92.5**	
⊙	**TP-104**	**11.0ft.**	**1.18**							**93.5**	

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

CLIENT Peter Chen **PROJECT NAME** Sunset Pointe

PROJECT NUMBER ES-5559 **PROJECT LOCATION** Puyallup, Washington



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-01	3.00ft.	USDA: Brown Slightly Gravelly Sand. USCS: SP-SM.	1.28	2.74
⊠	TP-03	5.00ft.	USDA: Brown Very Gravelly Loamy Sand. USCS: SM with Gravel.		
▲	TP-09	2.50ft.	USDA: Gray Loam. USCS: ML with Sand.		
★	TP-12	4.00ft.	USDA: Brown Loam. USCS: Sandy ML.		
⊙	TP-15	10.50ft.	USDA: Brown Gravelly Loamy Coarse Sand. USCS: SM with Gravel.		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	3.0ft.	4.75	0.399	0.273	0.146				6.2	
⊠	TP-03	5.0ft.	19	2.638	0.273					15.9	
▲	TP-09	2.5ft.	2							81.2	
★	TP-12	4.0ft.	2							60.2	
⊙	TP-15	10.5ft.	19	0.847	0.234					19.0	

GRAIN SIZE USDA ES-5559 SUNSET POINTE.GPJ GINT US LAB.GDT 11/10/17

Report Distribution

ES-5559

<u>EMAIL ONLY</u>	**Peter Chen** **4709 Memory Lane West** **University Place, Washington 98488**
<u>EMAIL ONLY</u>	**CES NW, Inc.** **429 – 29th Street Northeast, Suite D** **Puyallup, Washington 98372** **Attention: Fred Brown, P.E.**

CRITICAL AREA ASSESSMENT

CRITICAL AREAS ASSESSMENT

SUNSET POINTE RESIDENTIAL COMMUNITY
PARCELS 0420353026 and 0420353027
2100 - 19th Avenue SE, City of Puyallup, Washington

This report has been revised to incorporate review comments provided by the City of Puyallup Environmental Review Team

prepared for

Ms. Jennifer Caldwell, Senior Planner
@ CES NW Inc.
310 - 29th Street NE, Suite 101
Puyallup, Washington 98372

prepared by

HABITAT TECHNOLOGIES
P.O. Box 1088
Puyallup, Washington 98371-1088
253-845-5119

January 19, 2018

REVISED
SEPTEMBER 21, 2018

Table of Contents

INTRODUCTION

This document details the culmination of activities and onsite evaluations undertaken to complete a critical areas (i.e. wetlands, streams, fish and wildlife habitats) assessment for the proposed **Sunset Pointe Residential Community** - **Parcels 0420353026 and 0420353027 (project site).** Initial planning for this residential community also included two independent parcel to the north of 19th Avenue SE (Parcels 0420353009 and 0420157011). However, these two northern parcels have been removed for this residential community following a series of discussions with the City of Puyallup Environmental Review Team.

The project site was located at 2100 - 19th Avenue SE within the eastern portion of the City of Puyallup, Pierce County, Washington (part of Section 35, Township 20 North, Range 04 East, W.M.) (Figure 1). The evaluation and characterization of onsite and adjacent critical areas is a vital element in land use planning. The goal of this approach is to ensure that present and future proposed planned site development, to include the establishment of protective buffers, does not result in adverse environmental impacts to identified critical areas, their associated buffer, or adversely impact local water quality.

The assessment and delineation of specific critical areas within and immediately adjacent to the project site followed the methods and procedures defined in the *Corps of Engineers Wetland Delineation Manual* (United States Army Corps of Engineers, 1987) with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (United States Army Corps of Engineers, 2010); the Washington State *Wetland Rating System for Western Washington* (Hruby, 2014), the State of Washington Department of Natural Resources (WDNR) Forest Practice Rules (WAC 222-16-030), and the City of Puyallup Chapter 21. This document was designed to accommodate site planning and potential regulatory actions and is suitable for submittal to federal, state, and local authorities for potential critical areas verification and permitting actions.

PROJECT SITE DESCRIPTION

The project site was irregular in shape and approximately 9.45-acres in size. The project site was accessed along the northwestern boundary via 19th Avenue SE. The project site was surrounded by existing development to the west, east, and south. A vacant parcel was located to the north. The project site had undergone a number of land use manipulations over the past several decades. These manipulations have included forest harvest; clearing and grading; excavation, creation, and maintenance of a series of ornamental ponds; the development and management of pastures; perimeter and internal fencing; the development of internal roadways; the development and demolition of prior homesites and associated outbuildings, the development of a new single-family home; the manipulation of seasonal surface water runoff within the watershed; and the development of adjacent parcels and public roadways.

Legal Description - Parcel 0420353026: Section 35 Township 20 Range 04 Quarter 33 : PARCEL `C` 0F DBLR 95-07-17-0491 DESC AS FOLL COM AT SW COR OF SW TH N ALG W LI SD SW 1387.82 FT TO NW COR OF SW OF SW TH E ALG N LI SD SUBD 1260.60 FT TO POB TH CONT E 81.25 FT TH S 51 DEG 21 MIN 11 SEC E

Legal Description - Parcel 0420353027: Section 35 Township 20 Range 04 Quarter 34 : PARCEL `D` OF DBLR 95-05-17-0491 DESC AS FOLL COM AT SW COR OF SW TH E ALG S LI SD SW 1974.60 FT TH N 01 DEG 06 MIN 54 SEC W 615.92 FT TO POB TH N 87 DEG 01 MIN 41 SEC W 292.30 FT TH N 61 DEG 33 MIN 32 SEC W 4

Directions to Project Site: From Meridian Avenue South through the center of the City of Puyallup turn east onto 23rd Avenue SE. Continue easterly on 23rd Avenue SE to 19th Street SE. Turn north onto 19rd Street SE and continue to 21st Avenue SE. Turn east onto 21st Avenue SE and continue to 2100 - 21st Avenue SE (project site).

BACKGROUND INFORMATION

NATIONAL WETLAND INVENTORY

The *National Wetland Inventory (NWI) Mapping* completed by the U.S. Fish and Wildlife Service was reviewed as a part of this assessment. This mapping resource identified an excavated pond within the central portion of the project site. This excavated pond was identified as palustrine, unconsolidated bottom, permanently flooded, excavated (PUBHx) (Figure 2). This mapping resource also identified an excavated pond directly to the south of the southwestern corner of the project site. The adjacent excavated pond to the south was identified as palustrine, unconsolidated bottom, permanently flooded, excavated (PUBHx).

STATE OF WASHINGTON PRIORITY HABITATS AND SPECIES

The State of Washington *Priority Habitats and Species (PHS) Mapping* was reviewed as a part of this assessment (Figure 3). This mapping resource did not identify any priority habitats or species within or immediately adjacent to the project site. This mapping resource did identify an offsite wetland to the southwest of the project site separated by existing residential development.

STATE OF WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

The State of Washington Department of Fish and Wildlife (WDFW) *SalmonScape Mapping* was reviewed as a part of this assessment (Figure 4). This mapping resource did not identify any drainage corridors within or immediately adjacent to the project site.

STATE OF WASHINGTON DEPARTMENT OF NATURAL RESOURCES

The State of Washington Department of Natural Resources (WDNR) *Water Type Mapping* was reviewed as a part of this assessment (Figure 5). This mapping resource did not identify any wetlands or drainage corridors within or immediately adjacent to the project site.

CITY OF PUYALLUP MAPPING

The City of Puyallup *Inventory Mapping* was reviewed as a part of this assessment (Figure 6). This mapping resource identified a stream entering the southwestern portion of the project site. This stream then crossed through the project site to the east/northeast existing along the eastern boundary of the project site. This mapping resource also noted an offsite wetland to the west of 21st Avenue SE to the west of the project site.

SOILS MAPPING

The soil mapping prepared by the *Natural Resource Conservation Service* was reviewed as a part of this assessment (Figure 5). This mapping resource identified the northern portion of the project site was dominated by Kitsap silt loam (#20B and #20C). The Kitsap soil series consists of moderately well drained soil that formed in glacial lake sediments on remnant terraces along Puget Sound. This mapping resource also identified the southern portion of the project site to contain Everett gravelly sandy loam (#13C). The Everett soil series is noted as somewhat excessively drained and formed in gravelly glacial outwash. The Everett soil series is not listed as a “hydric” soil.

ONSITE ANALYSIS

CRITERIA FOR CRITICAL AREAS IDENTIFICATION

The City of Puyallup defines “critical areas” to include wetlands, fish and wildlife habitat areas, critical aquifer recharge areas, geologically hazardous areas, and frequently flooded areas. The critical areas assessment reported in this document has been limited to address wetlands and fish and wildlife habitat areas.

Wetlands: The City of Puyallup has defined “wetlands” as areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, retention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway.

Wetlands exhibit three essential characteristics, all of which must be present for an area to meet the established criteria (United States Army Corps of Engineers, 1987 and United States Army Corps of Engineers, 2010). These essential characteristics are:

1. **Hydrophytic Vegetation:** The assemblage of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to influence plan occurrence. Hydrophytic vegetation is present when the plant community is dominated by species that require or can tolerate prolonged inundation or soil saturation during the growing season.

2. **Hydric Soil:** A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper parts. Most hydric soils exhibit characteristic morphologies that result from repented periods of saturation or inundation. These processes result in distinctive characteristics that persist in the soil during both wet and dry periods.

3. **Wetland Hydrology:** Permanent or periodic inundation, or surface soil saturation, at least seasonally. Wetland hydrology indicators are used in combination with indicators of hydric soil and hydrophytic vegetation to define the area. Wetland hydrology indications provide evidence that the site has a continuing wetland hydrology regime. Where hydrology has not been altered vegetation and soils provide strong evidence that wetland hydrology is present.

Fish and Wildlife Habitat Areas: The City of Puyallup has defined “fish and wildlife habitat areas” to include those areas necessary for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created as designated by WAC 365-190-080. These areas include:

(a) Areas with which state or federally designated endangered, threatened, and sensitive species have a primary association;
(b) Habitats of local importance, including but not limited to areas designated as priority habitat by the Department of Fish and Wildlife;
(c) Streams and surface waters within the jurisdiction of the state of Washington; and

(d) Land essential for preserving connections between habitats and open spaces.

STUDY METHODS

Habitat Technologies completed a series of onsite assessments from September through early December 2017. In addition, Habitat Technologies has completed similar assessments for parcels located within the general area of the project site over the past several decades. The objective of this evaluation was to define and delineate potential critical areas (wetlands; drainage corridors; and fish and wildlife habitats) that may be present within or immediately adjacent to the project area. Onsite activities were completed in accordance with criteria and procedures established in the *Corps of Engineers Wetland Delineation Manual* (United States Army Corps of Engineers, 1987) with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (United States Army Corps of Engineers, 2010); the Washington State *Wetland Rating System for Western Washington* (Hruby, 2014), the State of Washington Department of Natural Resources (WDNR) Forest Practice Rules (WAC 222-16-030), and the City of Puyallup Chapter 21.

FIELD OBSERVATION

The project site was accessed via 19th Street SE along the northwestern boundary of the project site. The project site had historically been managed as a single-family home associated with the production of livestock and for the production of hay crops. These activities appeared to have stopped around 2008. The phased demolition of the historic single-family home and associated outbuildings appeared to have begun in 2011. A new single-family home appeared to have been constructed in 2014 and was located at 2100 - 19th Avenue SE (along the western boundary of the project site).

The project site had undergone a number of land use manipulations over the past several decades. These manipulations have included forest harvest; clearing and grading; excavation, creation, and maintenance of a series of ornamental ponds; the development and management of pastures; perimeter and internal fencing; the development of internal roadways; the development and demolition of prior homesites and associated outbuildings, the development of a new single-family home; the manipulation of seasonal surface water runoff within the watershed; and the development of adjacent parcels and public roadways.

The project site was generally slightly sloped to the north/northeast. A ravine crossed through the site from the western boundary to the eastern boundary. This ravine was identified to contain a seasonal stream that originated offsite to the south. Onsite this ravine had undergone prior development actions to include the excavation and creation of three (3) ornamental ponds. These ponds appeared to have been created through the excavation of material within the ravine and through the placement of material to establish two (2) internal roadways corridors crossing the ravine generally north to south. Hydrology control structures and culverts had been installed to intentionally control surface water ponding within these ornamental features.

- **Onsite Plant Communities**

The plant communities throughout the entire project site had been altered by prior and ongoing land use actions. The plant community within the very southwestern portion of the project site adjacent with the drainage corridor was dominated by a mixed forest that included a number of mature trees. Observed tree species included Douglas fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), big leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), Western hemlock (*Tsuga heterophylla*), Hawthorne (*Crataegus monogyna*), and black cottonwood (*Populus trichocarpa*). The understory within this forested area included hazelnut (*Corylus cornuta*), vine maple (*Acer circinatum*), Scot's broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus procera*), evergreen blackberry (*Rubus laciniatus*), trailing blackberry (*Rubus ursinus*), Oregon grape (*Berberis nervosa* and *Berberis aquifolium*), snowberry (*Symphoricarpus albus*), salmonberry (*Rubus spectabilis*), wild rose (*Rosa gymnocarpa*), Indian plum (*Oemleria cerasiformis*), sword fern (*Polystichum munitum*), bracken fern (*Pteridium aquilium*), salal (*Gaultheria shallon*), holly (*Ilex* spp.), Pacific red elderberry (*Sambucus racemosa*), geranium (*Geranium* spp.), smooth cats ear (*Hypochaeris glabra*), nettle (*Urtica dioica*), and buttercup (*Ranunculus repens*). This plant community was identified as non-hydrophytic in character (i.e. typical of non-wetlands).

The plant community associated with the drainage corridor and intentionally excavated ornamental ponds within the southern portion of the project site included a mixture of mature trees, dense shrubs, grasses, herbs, and aquatic plants. Observed species included red alder, Western red cedar, black cottonwood, salmonberry, Douglas spiraea (*Spiraea douglasii*), red osier dogwood (*Cornus stolonifera*), twinberry (*Lonicera involucrata*), nettle, buttercup, skunk cabbage (*Lysichitum americanum),* softrush (*Juncus effusus*), slough sedge (*Carex obnupta*), reed canarygrass (*Phalaris arundinacea*), reed managrass (*Glyceria grandis*), common cattail (*Typha latifolia*), water parsley (*Oenanthe sarmentosa*), speedwell (*Veronica* spp.), lady fern (*Athyrium filix-femina*), small fruited bulrush (*Scirpus microcarpus*), and horsetail (Equisetum spp.). This plant community appeared to have formed following the creation of the three (3) excavated ponds within the drainage corridor. This plant community was identified as hydrophytic in character (i.e. typical of wetlands).

- **Hydrology Patterns**

Onsite hydrology appeared to be the result of seasonal stormwater runoff from onsite and offsite areas, concentration of surface flows within identified drainage corridor, and the series of onsite hillside seeps. The majority of the project site appeared to drain moderately well and did not exhibit field indicators associated with the movement of seasonal surface water runoff.

A surface water drainage corridor was identified entering near the southwestern corner of the project site. This drainage corridor extended through the project site generally to the east/northeast within a well-defined ravine. This ravine had undergone prior development actions to include the intentional creation of three (3) excavated ornamental ponds. These ornamental ponds appeared to have been created through the excavation of material within the ravine and through the placement of material to establish two (2) internal roadways corridors crossing the ravine generally north to south. Hydrology control structures and culverts had been installed to intentionally control surface water ponding within these ornamental features. At the property boundary the surface water within this drainage corridor was captured within a buried drainage system installed as a part of the development of the adjacent residential community. This drainage appeared to be an eventual tributary to the Deer Creek System located well offsite to the northeast. The lower reaches of Deer Creek well offsite have been identified to meet the criteria for designation as a City of Puyallup Category II Stream with salmonids.

- **Soils**

As documented at several sample plots the project site was dominated by soil that exhibited a silty loam texture and coloration typical of the Kitsap soil series. The majority of the onsite soil appeared to drain moderately well and did not exhibit prominent redoximorphic features. In addition, prior land use actions appeared to have dramatically altered the surface soil profile. Within many areas the surface soil appeared to have been removed by prior grading. Throughout the project site the surface soil had been compacted by the historic livestock usage.

A drainage corridor was identified entering the project site near the southwestern boundary and continued through the project site through a series of intentionally excavated ornamental ponds to the eastern boundary. The surface soil within these intentionally excavated ponds was black to very dark gray (10YR 2/1 to 10YR 3/1) to a depth of 8 to 20 inches. The subsoil to a depth of 20 to 24 inches was very dark gray to gray (10YR 3/1 to 10YR 4/2) and exhibited prominent redoximorphic features and oxidized root channels. The soil within these intentionally excavated ponds exhibited a surface layer of generally soft captured alluvial sandy silty loam to silty loam with a high organic content as a result of intentionally ponded seasonal surface water.

- **Wildlife**

Wildlife species observed onsite, observed within the general area during prior assessments, and that would be reasonably expected to utilize the habitats provided within or adjacent to the project site would include red tailed hawk (*Buteo jamaicensis*), great blue heron (*Ardea herodias*), American crow (*Corvus brachynchos*), American robin (*Turdus migratorius*), black capped chickadee (*Parus atricapillus*), dark eyed junco (*Junco hyemalis*), rufous hummingbird (*Selasphorus rufus*), merlin (*Falco columbarius*), pileated woodpecker (*Dryocopus pileatus*), rock dove (*Columbia livia*), evening grosbeak (*Hesperiphona vespertina*), black-headed grosbeak (*Pheucticus melanocephalus*), mourning dove (*Zenaida macroura*), red winged blackbird (*Agelaius phoenisues*), brewers blackbird (*Euphagus cyanocephalus*), golden crowned sparrow (*Zonotrichia atricapilla*), song sparrow (*Melospiza melodia*), white crowned sparrow (*Zonotrichia leucophrys*), house sparrow, house finch (*Carpodacus mexicanus*), starling (*Sturnus vulgaris*), American goldfinch (*Carduelis tristis*), purple finch (*Carpodacus purpureus*), violet green swallow (*Tachycineta thallassina*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), song sparrow (*Melospiza melodia*), Steller's jay (*Cyanocitta stelleri*), starling (*Sturnus vulgaris*), black capped chickadee (*Parus atricapillus*), Northern flicker (*Colaptes auratus*), house sparrow (*Passer domesticus*), rufous-sided towhee (*Pipilo erythrophthalmus*), American goldfinch (*Carduelis tristis*), marsh wren (*Cistothorus palustirs*), killdeer (*Charadrius vociferus*), common mallard (*Anas platyrhynchos*), Canadian goose (*Branta canadensis*), black tailed deer (*Odocoileus hemionus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginianus*), eastern gray squirrel (*Sciurus carolinensis*), deer mouse (*Peromyscus maniculatus*), shrew (*Sorex* spp.), Townsend mole (*Scapanus townsendii*), voles (*Microtus* spp.), Norway rat (*Rattus norvegicus*), bats (*Myotis spp.*), common garter snake (*Thamnophis sirtalis*).

The project site provided suitable spawning and rearing habitats for Pacific treefrog (*Hyla regilla*), red-legged frog (*Rana aurora*), and salamander (*Ambystoma* spp). Common garter snake (*Thamnophis sirtalis*) was also present across the project site.

The project site did **not** provide direct habitats for fish species.

Wildlife Movement Corridors: The project site was within a well urbanized area. As identified by onsite wildlife trials, small and medium sized mammals appeared to be moving throughout the project site. The project site is also within the general area of the migratory movement of passerine birds.

State Priority Species: Several species identified by the State of Washington as "Priority Species" were observed onsite or potentially may utilize the project site. Priority species require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance.

> **Game Species:** "Game species" are regulated by the State of Washington through recreational hunting bag limits, harvest seasons, and harvest area restrictions. Observed or documented "game species" within and adjacent to the project site included black tailed deer, common mallard, Canada goose, and mourning dove.
>
> **State Monitored:** State Monitored species are native to Washington but require habitat that has limited availability, are indicators of environmental quality, require further assessment, have unresolved taxonomy, may be competing with other species of concern, or have significant popular appeal. One State Monitored

species – great blue heron - was observed within the excavated pond in the southern portion of the project site.

State Candidate: State Candidate species are presently under review by the State of Washington Department of Fish and Wildlife (WDFW) for possible listing as endangered, threatened, or sensitive. One State Candidate species - pileated woodpecker – was not observed to use the habitats associated with the project site but has been identified during prior assessments to use the habitats associated with Wildwood Park located offsite to the west.

State Sensitive: State Sensitive species are native to Washington and is vulnerable to declining and is likely to become endangered or threatened throughout a significant portion of its range without cooperative management or removal of threats. No State Sensitive species were observed or have been documented to use the habitats associated with the project site.

State Threatened: State Threatened species means any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats. The project site did not appear and has not been documented to provide direct critical habitats for State Listed Threatened species.

State Endangered: State endangered species means any species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state. The project site did not appear and has not been documented to provide direct critical habitats for State Listed Endangered species.

Federally Listed Species: The project site has not been documented to provide critical habitats for federally listed Endangered, Threatened, or Sensitive species. A single, federally listed species of concern – bald eagle – has been documented to use the offsite habitats associated with the Puyallup River Corridor and the Clarks Creek Corridor.

CRITICAL AREAS DETERMINATION

WETLANDS

Wetland determination was based on observations of hydrophytic vegetation, hydric soils, and wetland hydrology in accordance with the *Corps of Engineers Wetland Delineation Manual* (United States Army Corps of Engineers, 1987) with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (United States Army Corps of Engineers, 2010). Based on these methods no area within the project site was identified within the project site to exhibit all three of the established wetland criteria. Two (2) areas within the vicinity of the project site were identified to exhibit all three of the established wetland criteria.

WETLAND	CLASSIFICATION (USFWS)	CITY OF PUYALLUP CATEGORY	WDOE RATING SCORE	WDOE HABITAT SCORE	BUFFER WIDTH (High Intensity)
D	**PFOEx/PSSEx**	**III**	**17**	**6**	**150 feet**
E	**PSSE/PEME**	**III**	**16**	**5**	**150 feet**

Wetland D: Wetland D was identified offsite to the north of the eastern portion of the of the project site. This wetland was within a ravine associated with hillside seeps and a seasonal surface water drainage corridor. Hydrology for this wetland appeared to be provided primarily by the hillside seeps and seasonal surface water runoff from the local area. Wetland D had undergone prior land use manipulations to include clearing, grading, the intentional excavation of small livestock ponds, the installation of culverts, and the creation of internal roadways. Wetland D was dominated by a mixed forest plant community. The understory was limited as a result of the prior livestock grazing. The movement of surface water through this wetland was intermittent and controlled in part by prior ditch excavation. However, this movement did not form a continuous defined channel or swale. Surface flow within Wetland D was captured along the eastern parcel boundary and conveyed offsite via a buried storm drainage system.

Wetland D met the U.S. Fish and Wildlife Service (USFWS) criteria for classification as palustrine, forested, seasonally flooded/saturated, excavated (PFOEx); and palustrine, scrub-shrub, seasonally flooded/saturated, excavated (PEMEx). Following a series of discussions with City of Puyallup Environmental Review Team Wetland D was best defined to meet the criteria for designation as a City of Puyallup Category III Wetland. Wetland D achieved a total functions score of 17 points utilizing the Washington State Department of Ecology (WDOE) *Wetland Rating Form for Western Washington* (Hruby 2014) (Appendix B).

Wetland E: Wetland E was identified offsite to the north of the western portion of the project site within a swale adjacent to 21st Street SE. Hydrology appeared provided primarily from hillside seeps and seasonal sheetflow from adjacent upland areas. Wetland E was dominated by blackberries and included areas of buttercup, slough sedge, soft rush, and reed canary grass. Wetland E had undergone prior land use manipulations associated with livestock usage. The development of 21st Street SE also appeared to have been completed without the placement of a culvert to allow for the movement of seasonal surface water runoff to the northwest as existing topography would suggest.

This wetland met the USFWS criteria for classification as palustrine, emergent, seasonally flooded/saturated (PEME). Following a series of discussions with City of Puyallup Environmental Review Team Wetland E appeared best defined to meet the criteria for designation as a City of Puyallup Category III Wetland. Wetland E achieved a total functions score of 16 points utilizing the WDOE *Wetland Rating Form for Western Washington* (Hruby 2014) (Appendix B).

FISH AND WILDLIFE HABITAT AREAS

This onsite assessment and discussions with the City of Puyallup Environmental Review Team identified two (2) City of Puyallup designated “fish and wildlife habitat areas.” These areas were identified within and immediately adjacent to the project site and were defined as “streams” within the jurisdiction of the State of Washington. No state or federally designated endangered, threatened, and sensitive species have been documented to have a primary association within the habitats onsite; no portion of the project site has been defined as a “habitat of local importance;” and no lands essential for preserving connections between habitats and open spaces have been identified or documented within the project site.

Stream A: Stream A was identified entering near the southwestern corner of the project site. This drainage corridor extended through the project site generally to the east/northeast within a well-defined ravine. This ravine had undergone prior development actions to include the intentional creation of three (3) excavated ornamental ponds. These ornamental ponds appeared to have been created through the excavation of material within the ravine and through the placement of material to establish two (2) internal roadways corridors crossing the ravine generally north to south. Hydrology control structures and culverts had been installed to intentionally control surface water ponding within these ornamental features. At the property boundary the surface water within this drainage corridor was captured within a buried drainage system installed as a part of the development of the adjacent residential community. This drainage appeared to be an eventual tributary to the Deer Creek System located well offsite to the northeast.

As discussed with the City of Puyallup Environmental Review Team Stream A meet the criteria for designation as a City of Puyallup Type III Stream within the project site. A Type III Stream is defined to exhibit perennial or intermittent flow and as not used by anadromous fish. The standard buffer for a Type III Stream is 50 feet in width as measured perpendicular from the ordinary high water mark (OHWM).

Stream B: Stream B was identified offsite to the north of the eastern portion of project site and as associated with offsite Wetland D. This stream commenced from a series of hillside seeps then flowed generally to the north/northeast. Hydrology was collected in a drainage system along the western boundary of the adjacent housing development. Further to the north, hydrology appeared to infiltrate within the historic pasture area. Stream B had undergone prior development activities to include to creation of excavated livestock ponds, ditching, internal road crossing, and culvert installation within the project site.

Stream B appeared to meet the criteria for designation as a City of Puyallup Type III Stream. A Type III Stream is defined to exhibit perennial or intermittent flow and as not used by anadromous fish. The standard buffer for a Type III Stream is 50 feet in width as measured perpendicular from the OHWM.

INTENTIONALLY CREATED MAN-MADE FEATURES

EXCAVATED PONDS

Three intentionally excavated ponds were identified associated with Stream A in the southern portion of the project site. These excavated ponds had been created in a topographic ravine that contained Stream A which entered the site near the southwestern boundary and continued through the site generally to the east/northeast. These ponds appeared best defined as intentionally created through the excavation of material within the Stream A ravine and through the placement of material to establish two (2) internal roadways corridors crossing the ravine generally north to south. Hydrology control structures and culverts had also been installed and maintained to provide hydrology within the ponds and to control seasonal high storage levels. These excavated ponds had been historically created as a part of the site development activities associated with the use by livestock and irrigation of the project site.

These intentionally excavated ponds appeared to meet the criteria within the City of Puyallup Title 21.06.210 Definitions section:

> (21.06.210.75) "Intentionally created wetland or surface water systems" means wetlands or surface water systems created through purposeful human action, such as irrigation and drainage ditches, grass-lined swales, canals, farm ponds, detention/retention facilities, and landscape/ornamental amenities. Purposeful creation must be demonstrated through documentation, photographs, statements and/or other evidence. Intentionally created wetlands or surface water systems do not include areas or systems created as mitigation.

SELECTED DEVELOPMENT ACTION

The *Selected Development Action* for the project site for the project site focuses on the creation of a number of new parcels suitable for single-family homesite development. The final creation of new homesite parcels would be consistent with the City of Puyallup Comprehensive Plan, local zoning, and the City's Critical Areas Ordinance. As presently identified within the initial site plan and as discussed with the City of Puyallup Environmental Review Team, the final site plan would establish a protective stream buffer as measured from the top edge of the excavated ponds associated with Stream A within the project site. Protective buffers associated with Wetlands D and E located offsite to the north would not be expected to encroach into the project site. The proposed development of this residential community would avoid potential adverse impacts to identified streams and wetlands within the project site and adjacent area.

STANDARD OF CARE

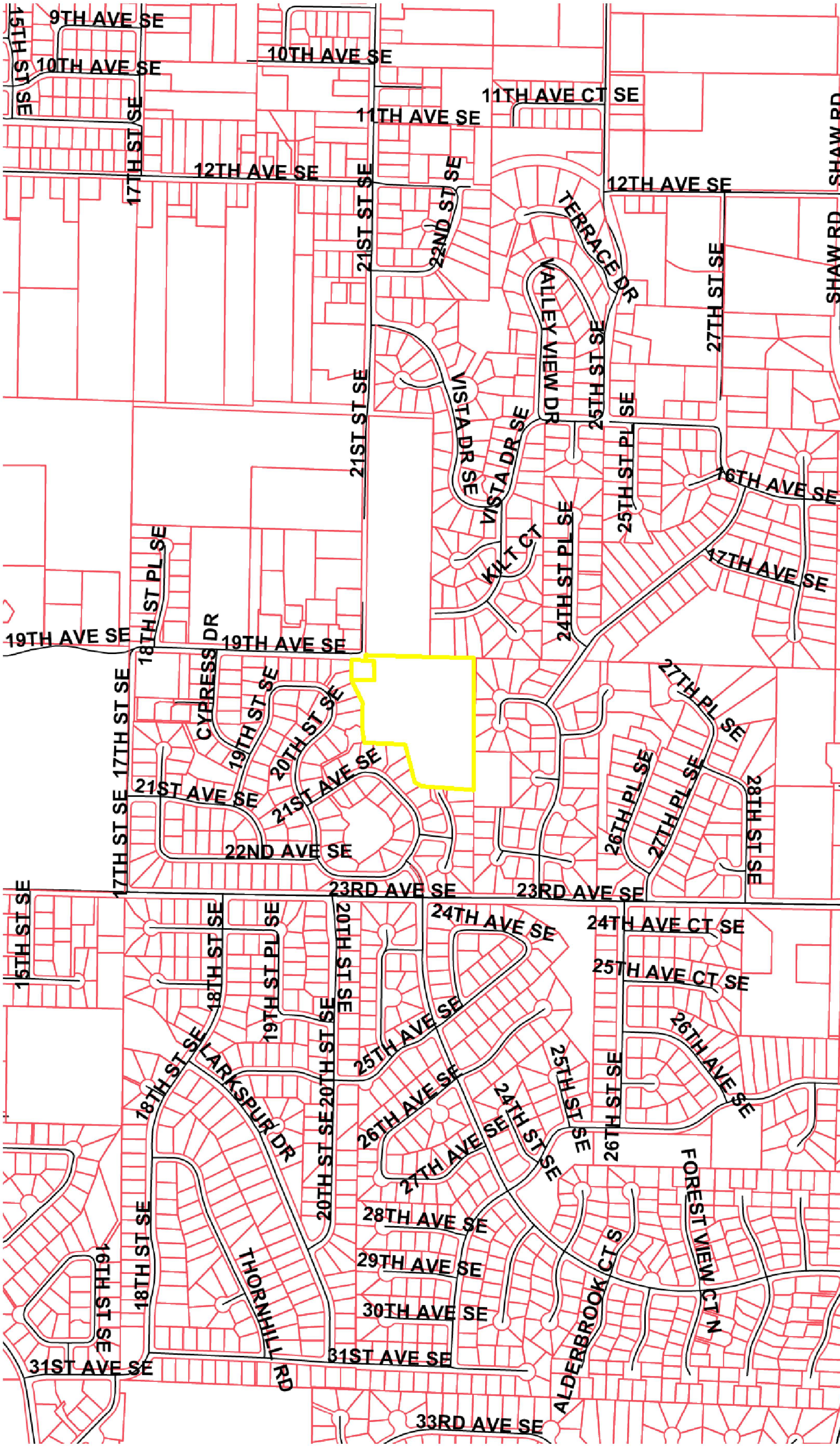
This document has been completed by Habitat Technologies for use by **CES NW Inc**. Prior to extensive site planning the findings documented in this document should be reviewed and verified by the City of Puyallup. Habitat Technologies has provided professional services that are in accordance with the degree of care and skill generally accepted in the nature of the work accomplished. No other warranties are expressed or implied. Habitat Technologies is not responsible for design costs incurred before this document is approved by the appropriate resource and permitting agencies.

Bryan W. Peck　　　　　　Thomas D. Deming

Bryan W. Peck
Wetland Biologist

Thomas D. Deming, PWS
Habitat Technologies

FIGURES



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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.

Map Legend

- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads

0 450 900 ft.

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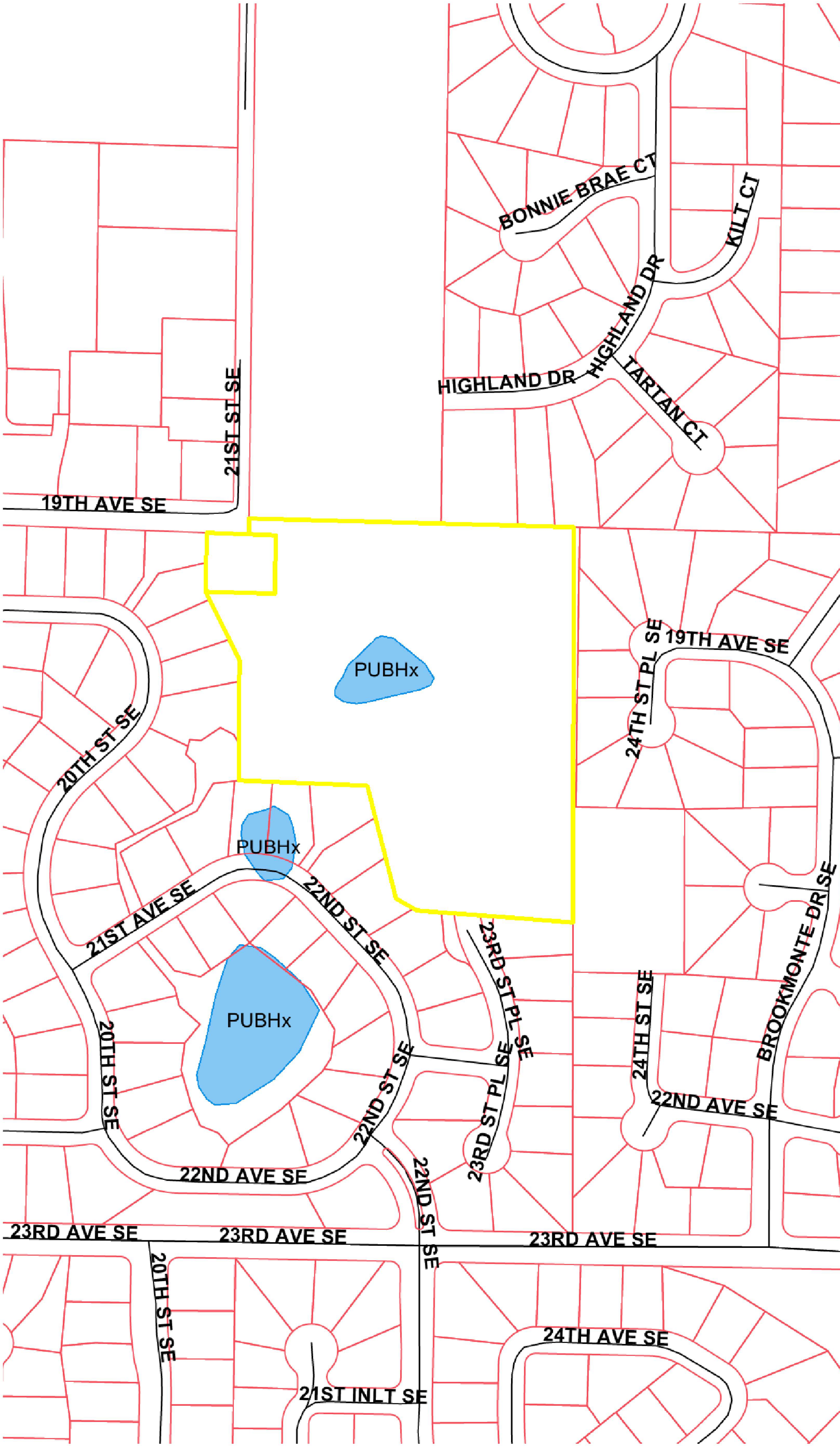
Figure 1 Site Vicinity

Habitat Technologies

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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.



Map Legend

- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads
- National Wetlands Inventory

Figure 2 NWI Mapping

Habitat Technologies

0 150 300 ft.

N

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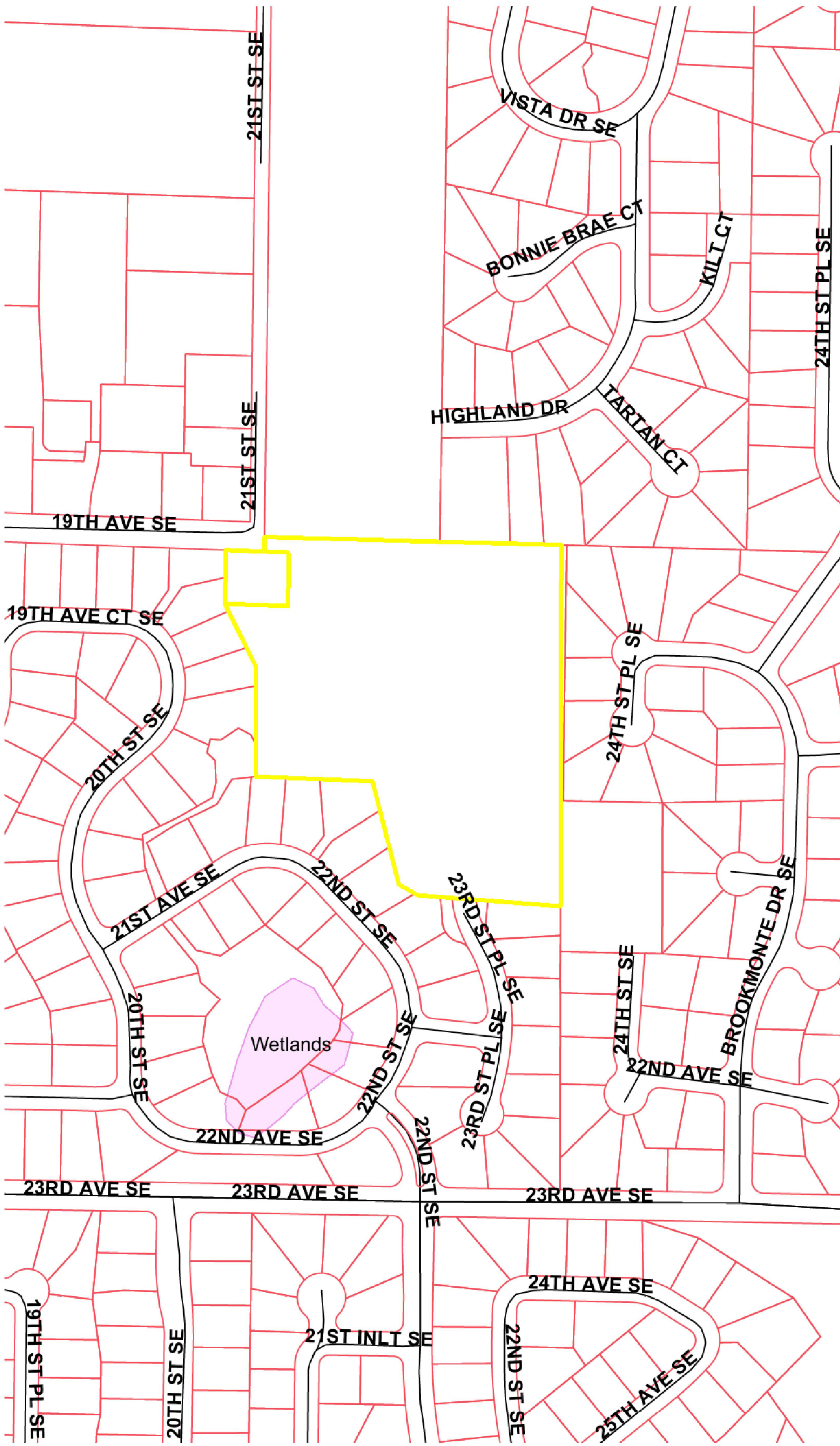
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.



Map Legend

- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads
- Priority Habitat/Species

Figure 3 PHS Mapping

Habitat Technologies

0 160 320 ft.

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Figure 4 WDFW Mapping

September 27, 2018

1:9,028

0	0.075	0.15		0.3	mi
0	0.1	0.2		0.4	km

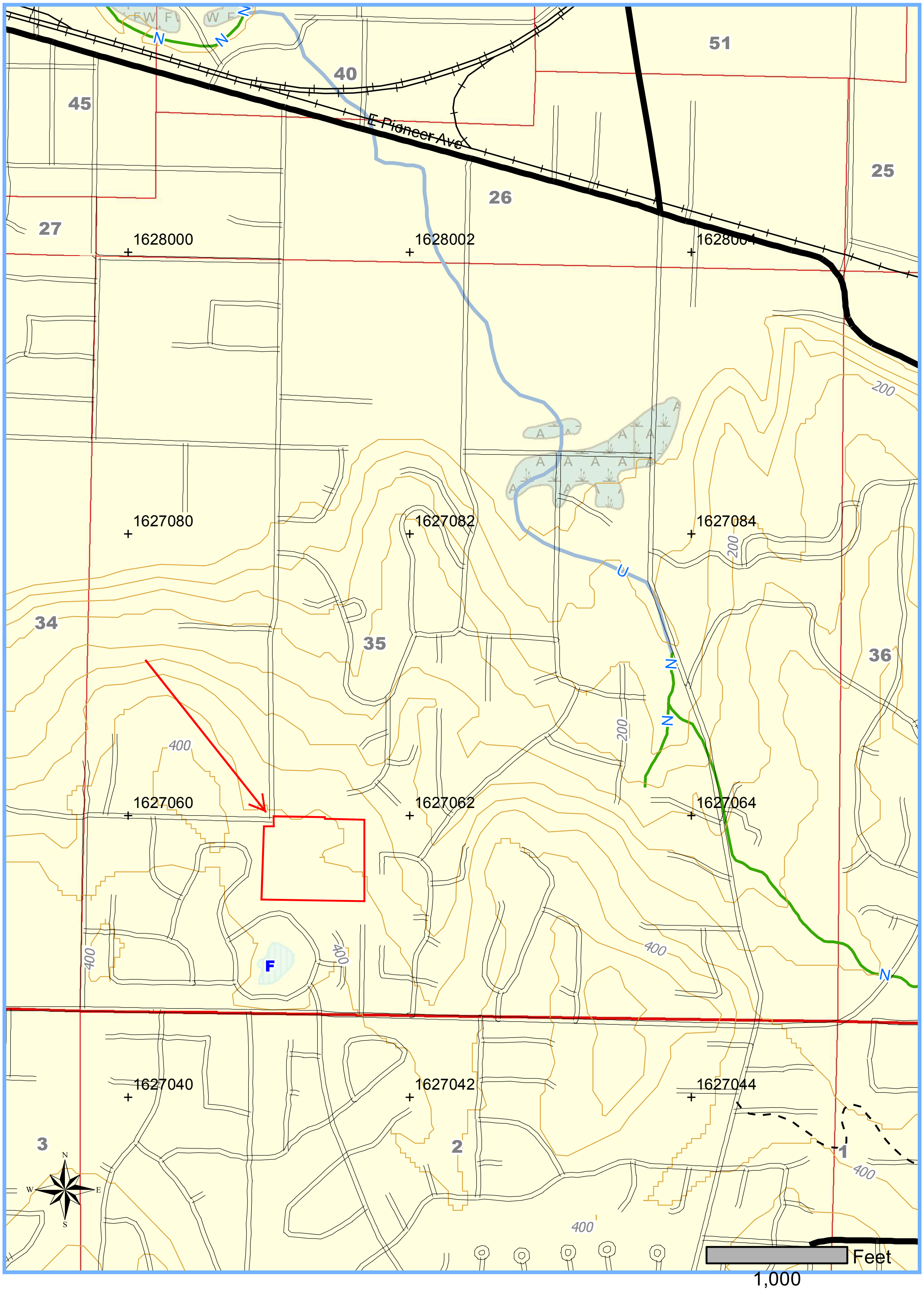
— All SalmonScape Species

USGS/NHD
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

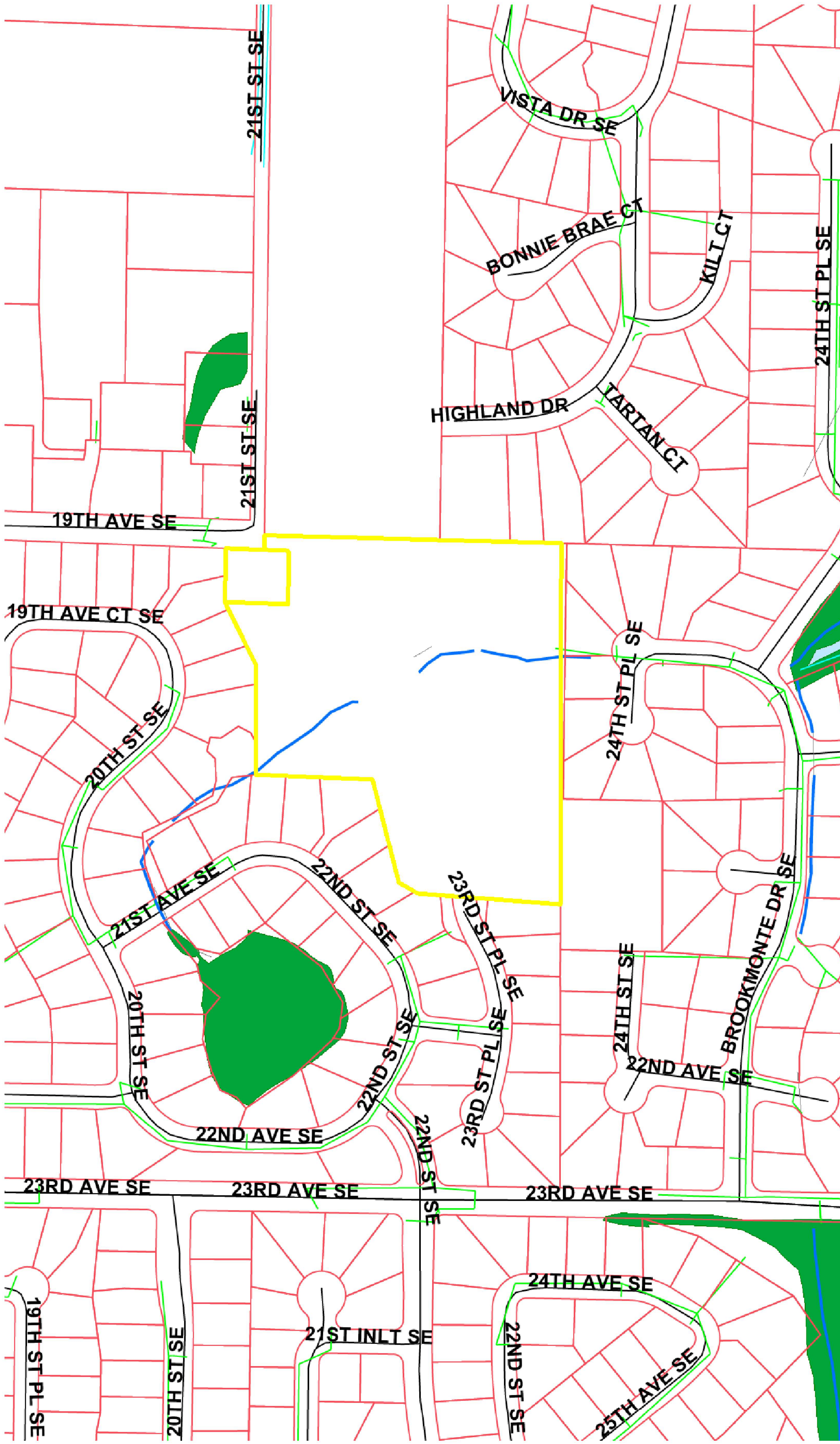
Figure 5 FOREST PRACTICE WATER TYPE MAP

TOWNSHIP 20 NORTH HALF 0, RANGE 04 EAST (W.M.) HALF 0, SECTION 35

Application #: ________________________



Date: 10/31/2017 Time: 10:43:11 AM
NAD 83
Contour Interval: 40 Feet



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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.

Map Legend

- Drainage - Control Structures - Puyallup
- Highlighted Tax Parcels
- Tax Parcels
- Streams - Puyallup
- Drainage - Culverts - Puyallup
- Drainage - Channels - Puyallup
- Drainage - Pipes - Puyallup
- Roads
- Major Roads
- General Habitat Areas Wetlands - Puyallup
  - Field-verified Delineated
  - Field-verified
  - Unverified
  - Buffer
  - Mitigation Site
- Drainage - Stormwater Facilities

Figure 6 City of Puyallup Mapping

Habitat Technologies

0 160 320 ft.

N

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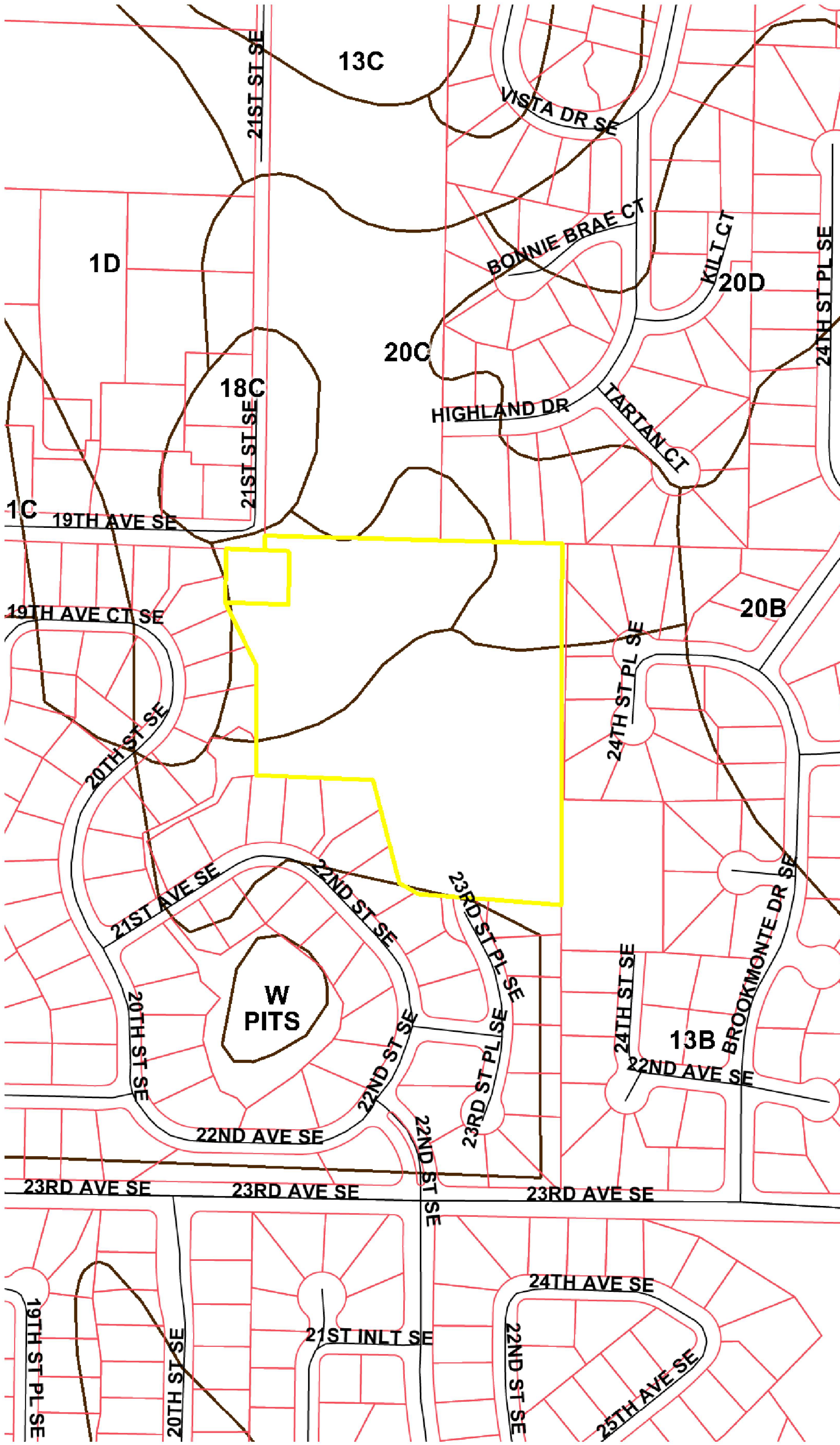
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.



Map Legend

- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads
- Soils

Figure 7 Soils Mapping

0 160 320 ft.

N

Habitat Technologies

9/27/18 2:27 PM

REFERENCE AND BACKGROUND LIST

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Washington State Department of Fish and Wildlife SalmonScape Mapping System, 2016 (for fish presence): http://apps.wdfw.wa.gov/salmonscape/map.html

Washington State Department of Natural Resources FPARS Mapping System, 2016 (for stream typing): http://fortess.wa.gov/dnr/app1/fpars/viewer.htm

APPENDIX A – Field Data Forms

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-1

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Wetland D.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	50	yes	FAC
2.			
3.			
4.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1. Cornus stolonifera	20	yes	FACW
2.			
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Lysichitum americanum	30	yes	OBL
2. Equisetum arvense	20	yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	40	yes	FAC
2.			
	40	= Total Cover	
% Bare Ground in Herb Stratum 40			

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 ______	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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-1

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
0-4	10YR 2/1	100					L	
4-20	10YR 4/2	80	10YR 4/6	20	C	M	Gcl	

[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): 2

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 0

Wetland Hydrology Present? Yes ☒ **No** ☐

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-2

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pseudotsuga menziesii	45	yes	FACU
2. Crataegus monogyna	20	yes	FACU
3.			
4.			
	65	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1. Oemleria cerasiformis	10	yes	FACU
2. Sambucus racemosa	10	yes	FACU
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Polystichum munitum	30	yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	40	yes	FAC
2. Rubus ursinus	50	yes	FACU
	90	= Total Cover	

% Bare Ground in Herb Stratum 40

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	14	(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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-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 Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100					L	
4-20	10YR 3/3	100					Sgl	

[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): ____

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-3

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pseudotsuga menziesii	50	yes	FACU
2.			
3.			
4.			
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1. Sambucus racemosa	30	yes	FACU
2.			
3.			
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Polystichum munitum	20	yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	100	yes	FAC
2. Rubus ursinus	30	yes	FACU
	100	= Total Cover	

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 20 (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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-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
0-4	10YR 3/2	100					L	
4-18	10YR 3/3	100					Sgl	

[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):

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-10

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: 15ft radius)			
1. Ranunculus repens	100	yes	FAC
2. Juncus effusus	20	yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	60	yes	FAC
2.			
	60 = Total Cover		
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-10

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
0-8	10YR 4/2	100					Sl	
8-18	10YR 4/1	80	10YR 4/6	20	C	M	Sl	

[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): 3
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-11

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Wetland

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	100	yes	FAC
2.			
	100	= Total Cover	
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-11

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
0-6	10YR 4/2	100					Sl	
6-18	10YR 4/1	70	10YR 4/6	30	C	M	Sl	

[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): 3
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? Yes ☒ **No** ☐

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: State: Washington Sampling Point: SPB-12

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	100	yes	FAC
2.			
	100	= Total Cover	
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-12

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	10YR 3/3	100					Sl	
12-18	10YR 4/2	95	10YR 4/6	5	C	M	Sl	

[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): ________

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-16

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Upland

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15ft radius)			
1. Alnus rubra	20	yes	FAC
2.			
3.			
4.			
	20	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Equisetum arvense	30	yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	100	yes	FAC
2.			
	100	= Total Cover	
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-16

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
0-18	10YR 3/3	100					Sl	

[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): ____________

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-18

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	40	yes	FAC
2.			
3.			
4.			
	40	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Juncus effusus	20	yes	FACW
2. Equisetum arvense	30	yes	FAC
3. Athyrium filix-femina	30	yes	FAC
4. Ranunculus repens	20	yes	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1. Rubus procera	30	yes	FAC
2.			
	30	= Total Cover	
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

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

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-18

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
0-4	10YR 4/2	100					Sl	
4-20	10YR 4/1	80	10YR 4/6	20	C	M	Sl	

[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): 4
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? Yes ☒ **No** ☐

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

Remarks:

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

Project/Site: Sunset Pointe City/County: Puyallup / Pierce Sampling Date: 03 OCT 2017

Applicant/Owner: ______ State: Washington Sampling Point: SPB-24

Investigator(s): Habitat Technologies Section, Township, Range: S35, T20, R4E

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

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

Soil Map Unit Name: Kitsap silt loam 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: Wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 15ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	30	yes	FAC
2.			
3.			
4.			
	30	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15ft radius)			
1. Rubus spectabilis	20	yes	FAC
2.			
3.			
4.			
5.			
	20	= Total Cover	
Herb Stratum (Plot size: 15ft radius)			
1. Lysichitum americanum	80	yes	FACW
2. Equisetum arvense	20	yes	FAC
3. Athyrium filix-femina	20	yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	
Woody Vine Stratum (Plot size: 15ft radius)			
1.			
2.			
	0	= Total Cover	
% Bare Ground in Herb Stratum 0			

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		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:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 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:

SOIL

Sampling Point: SPB-24

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
0-18	10YR 3/1	100					Sil	

[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): 3

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 0

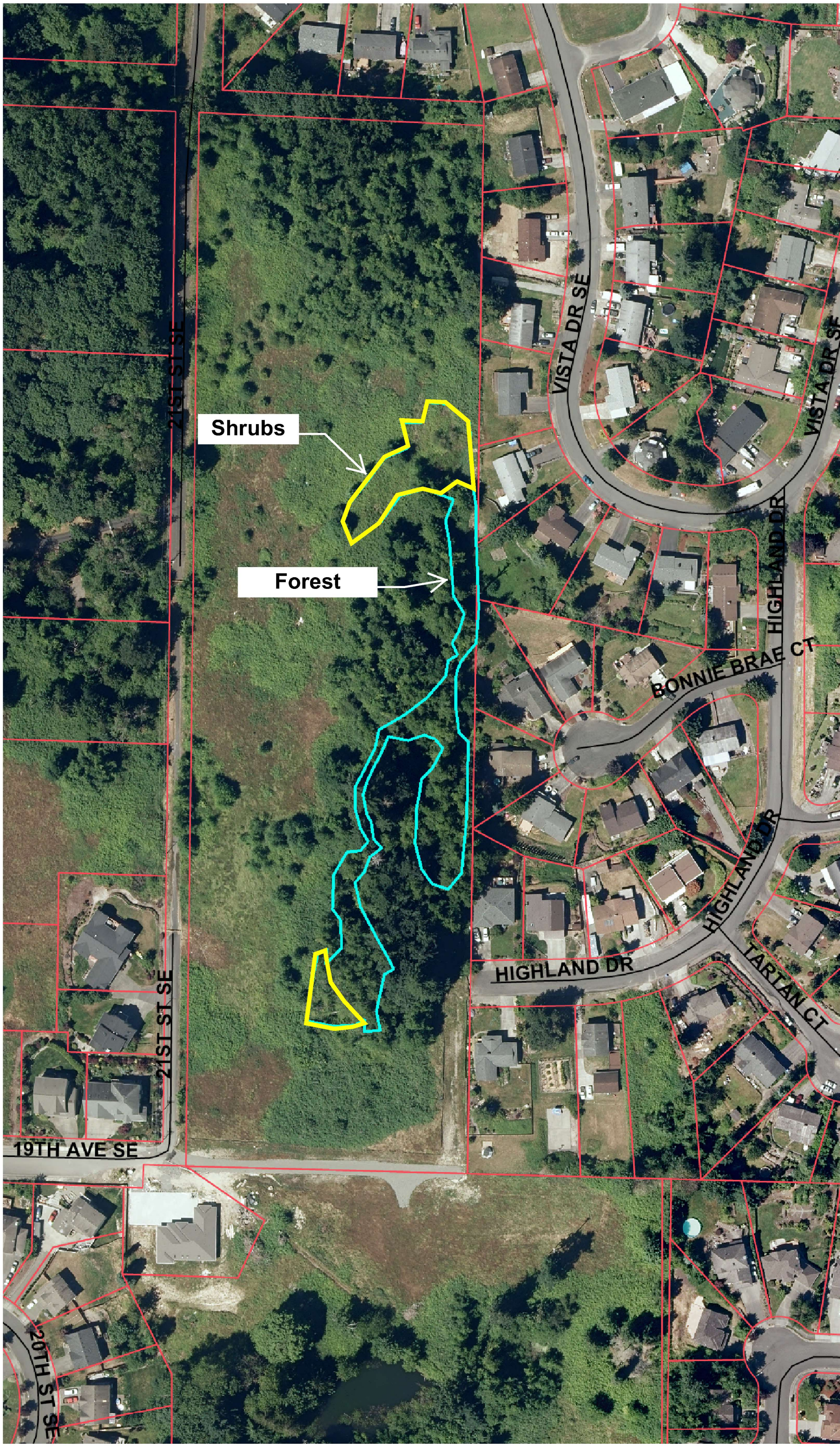
Wetland Hydrology Present? Yes ☒ No ☐

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

Remarks:

APPENDIX B – Wetland Rating Worksheets

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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.



Map Legend

- Wetland D
- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads
- County - 2014 - Ortho

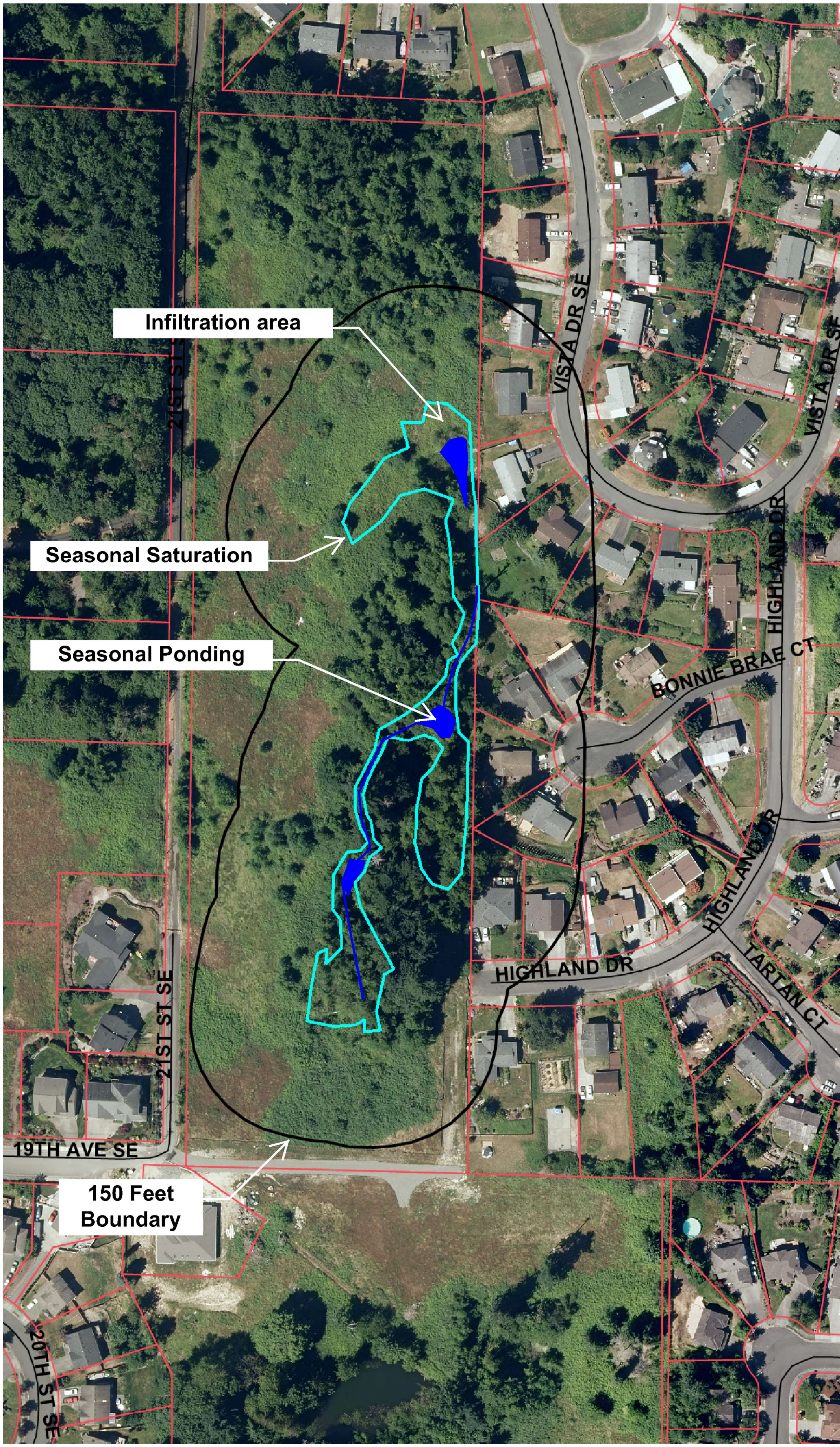
0 100 200 ft.

Figure D1

Habitat Technologies

10/11/17 11:58 AM

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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.



Map Legend

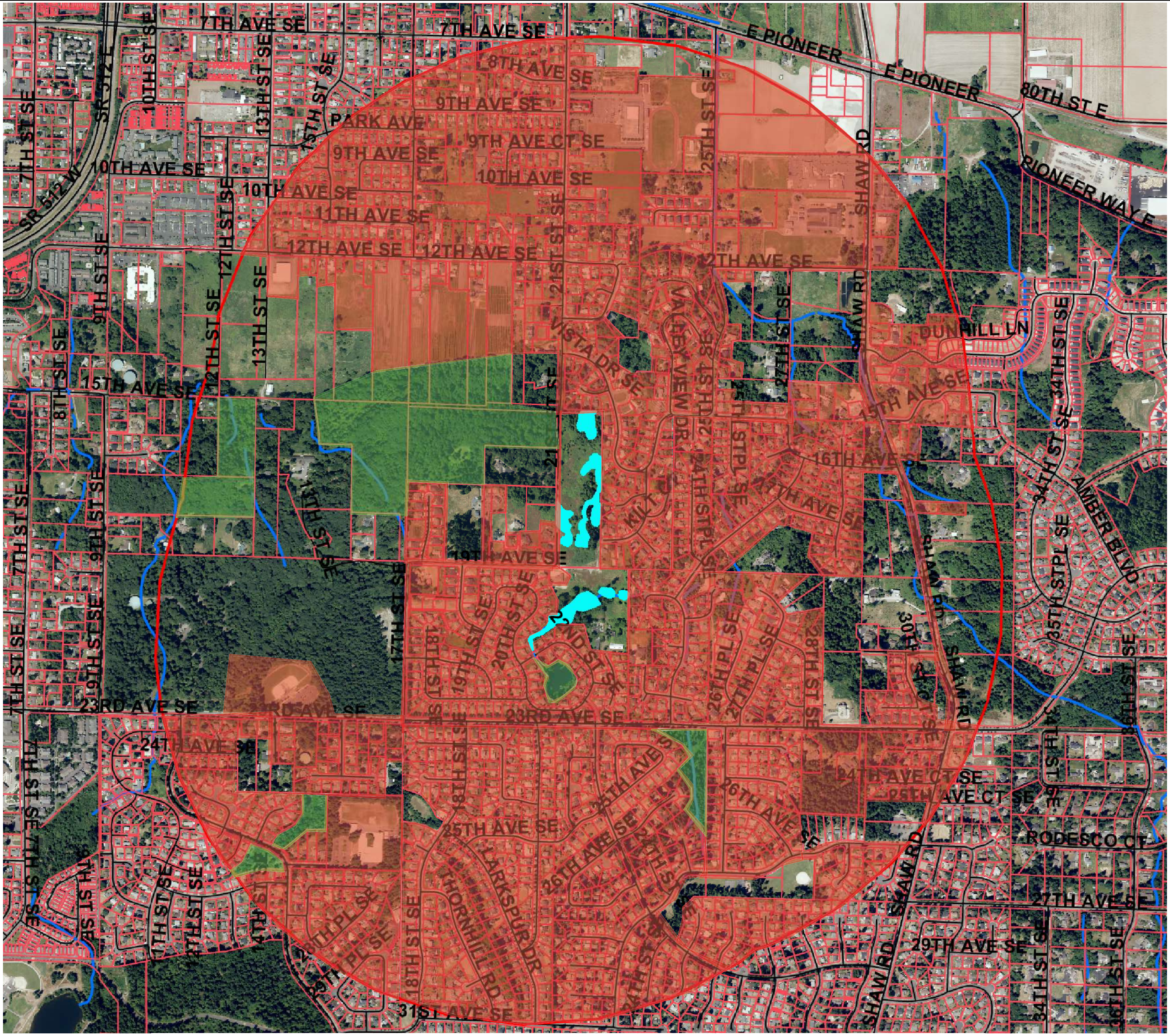
- Wetland D
- Highlighted Tax Parcels
- Tax Parcels
- Roads
- Major Roads
- County - 2014 - Ortho

Figure D2

Habitat Technologies

0 100 200 ft.

10/11/17 12:01 PM



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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.

Map Legend

- Wetlands
- Highlighted Wetland F
- Tax Parcels
- Streams - Puyallup
- Roads
- Major Roads
- County - 2014 - Ortho
- High Intensity Land Use
- Low/Moderate Intensity Land Use
- Habitat Area

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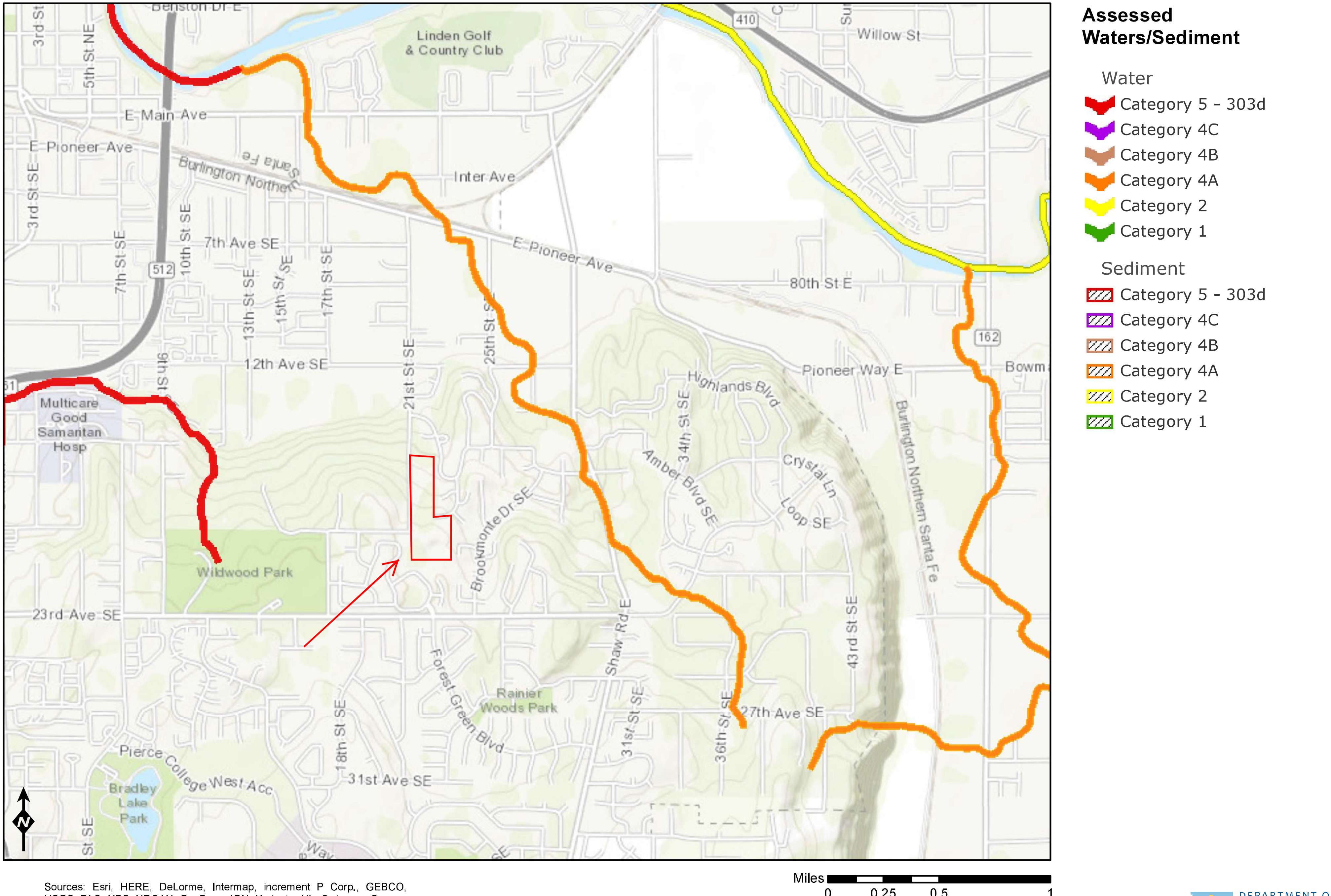
0 650 1300 ft.

N

Habitat Technologies | **Figure W4**

October 11, 2017

Figure W5



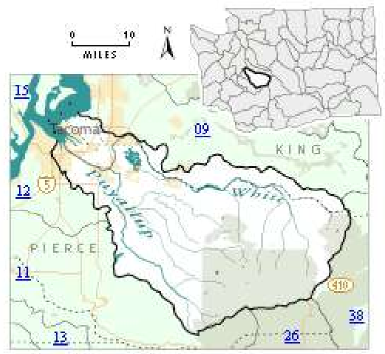
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, ©

DEPARTMENT OF ECOLOGY State of Washington

Figure W6

Water Quality Improvement Projects (TMDLs)

WRIA 10: Puyallup-White



The following table lists overview information for water quality improvement projects (also known as total maximum daily loads, or TMDLs) for this water resource inventory area (WRIA). Please use links (where available) for more information on a project.

Counties

- King County
- Pierce County

Waterbody Name	Pollutant	Status**	TMDL Leads
Clarks Creek Meeker Creek	Dissolved Oxygen Sediment	Approved by EPA Has an implementation plan	Donovan Gray 360-407-6407
	Fecal Coliform	Approved by EPA Has an implementation plan	
Commencement Bay	Dioxin	Approved by EPA	Donovan Gray 360-407-6407
Puyallup River Watershed	Fecal Coliform	Approved by EPA	Donovan Gray 360-407-6407
	Multi-parameter Ammonia-N BOD (5-day)	Approved by EPA	
	White River Watershed Upper White: • Sediment • Temperature Lower White • pH	Approved by EPA Under Development	
South Prairie Creek Tributary: Wilkeson/Gale Creek	Fecal Coliform Temperature	Approved by EPA Has an implementation plan	Donovan Gray 360-407-6407

**** Status*** *will be listed as one of the following: Approved by EPA, Under Development or Implementation*

For more information about WRIA 10:

- Waterbodies in WRIA 10 - using the Water Quality Assessment Query Tool
- Watershed Information for WRIA 10

* The Department of Ecology and other state resource agencies frequently use a system of 62 "Water Resource Inventory Areas" or "WRIAs" to refer to the state's major watershed basins.

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Last updated October 2016

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Sunset Pointe Date of site visit: 11 OCT 2017

Rated by Habitat Technologies Trained by Ecology? x Yes ___No Date of training 2014

HGM Class used for rating Slope Wetland has multiple HGM classes? ___Y x N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map Pierce County GIS

OVERALL WETLAND CATEGORY 4 (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
x **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M $\boxed{L}$	H $\boxed{M}$ L	H $\boxed{M}$ L	
Landscape Potential	H $\boxed{M}$ L	H M $\boxed{L}$	H M $\boxed{L}$	
Value	H $\boxed{M}$ L	H $\boxed{M}$ L	H M $\boxed{L}$	**TOTAL**
Score Based on Ratings	5	5	4	14

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	x

Wetland name or number D

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	N/A
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	N/A
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	N/A
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	D1
Hydroperiods	H 1.2	D2
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	D1
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	D1
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	D2
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	W4
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	W5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	W6

Wetland name or number D

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?
   x The wetland is on a slope (*slope can be very gradual*),
   x 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,
   x 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.

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 D

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)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	0
S 1.2. <u>The soil 2 in below the surface (or duff layer)</u> 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: 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.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	3
Total for S 1 Add the points in the boxes above	3

Rating of Site Potential If score is:___**12 = H** ___**6-11 = M** _X_**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? 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:_X_**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	0
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	1
Total for S 3 Add the points in the boxes above	1

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

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.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	1

Rating of Site Potential If score is: x 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	0

Rating of Landscape Potential If score is:___1 = M x 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: 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 Surface flooding problems are in a sub-basin farther down-gradient points = 1 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 x 0 = L *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number D

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
X Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
X Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

X 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: 2

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
X 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	
X Seasonally flowing stream in, or adjacent to, the wetland	
____**Lake Fringe wetland**	**2 points**
____**Freshwater tidal wetland**	**2 points**

Score: 2

H 1.3. Richness of plant species

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

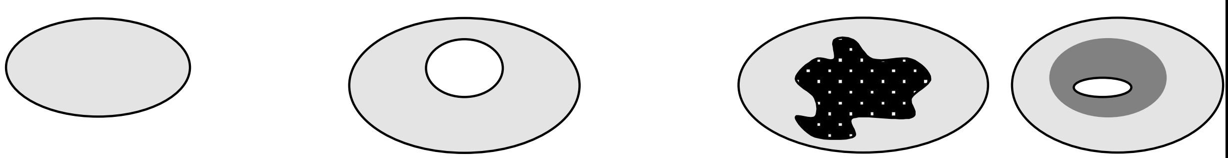
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

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

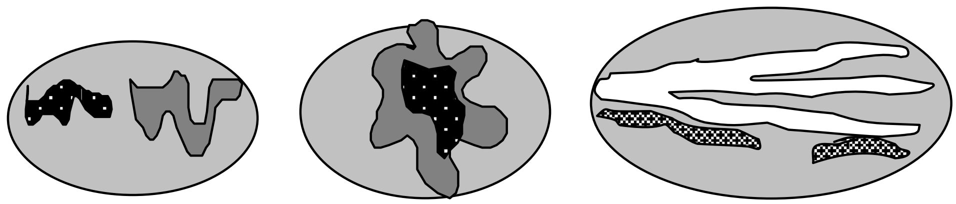
Score: 1

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: 1

Wetland name or number __D__

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* _X_Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). _X_Standing snags (dbh > 4 in) within the wetland _X_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) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	3
Total for H 1 Add the points in the boxes above	9

Rating of Site Potential If score is:___**15-18 = H** _X_**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*). *Calculate:* % undisturbed habitat_5_ **+** [(% moderate and low intensity land uses)/2]_3_ **=** _8_% If total accessible habitat is: > $^{1}/_{3}$ (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat_12_**+** [(% moderate and low intensity land uses)/2]_20_**=** _32_% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	(-2)
Total for H 2 Add the points in the boxes above	0

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

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

Rating of Value If score is:___**2 = H** ___**1 = M** _X_**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).*

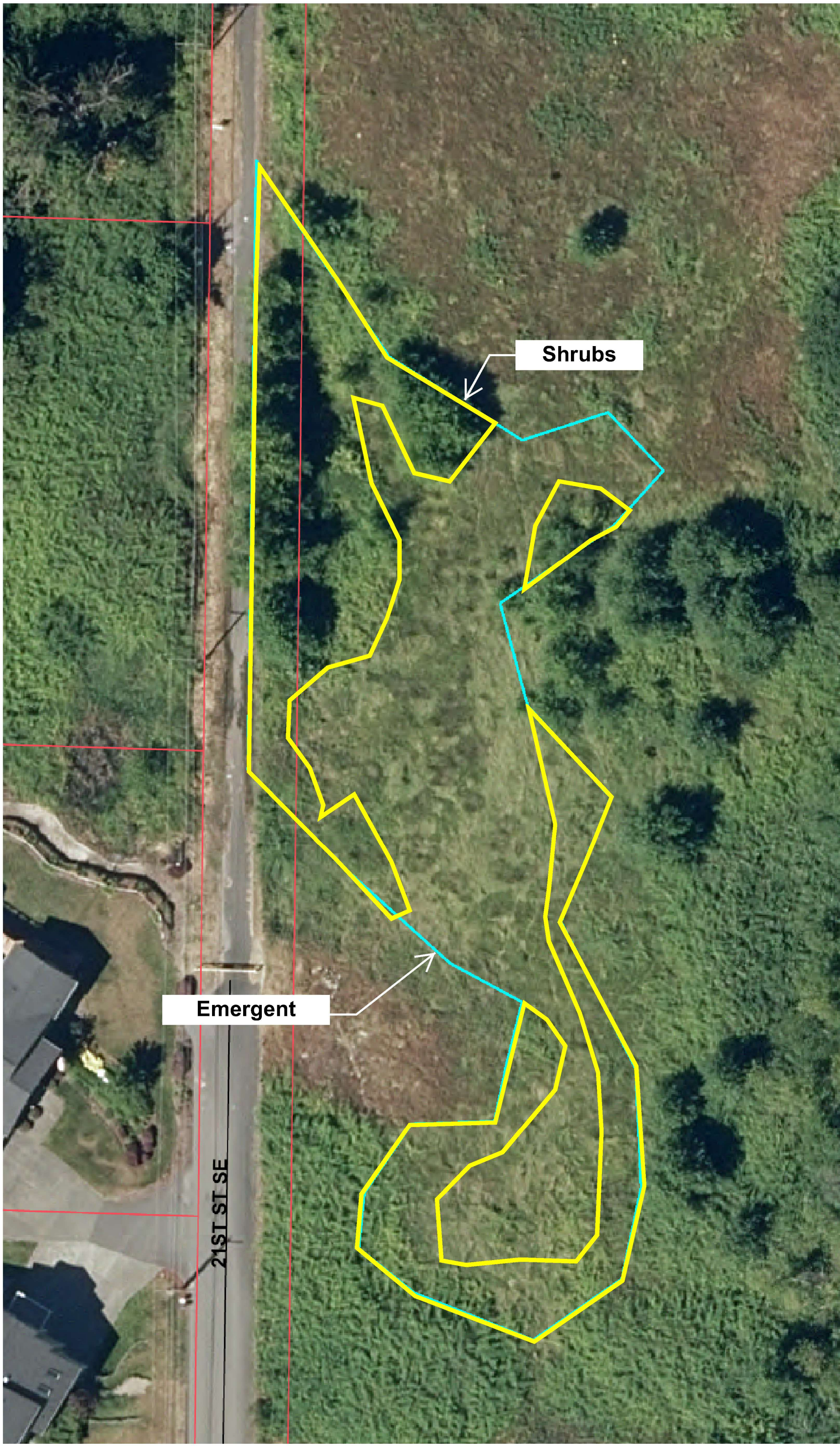
— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **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.



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Map Legend

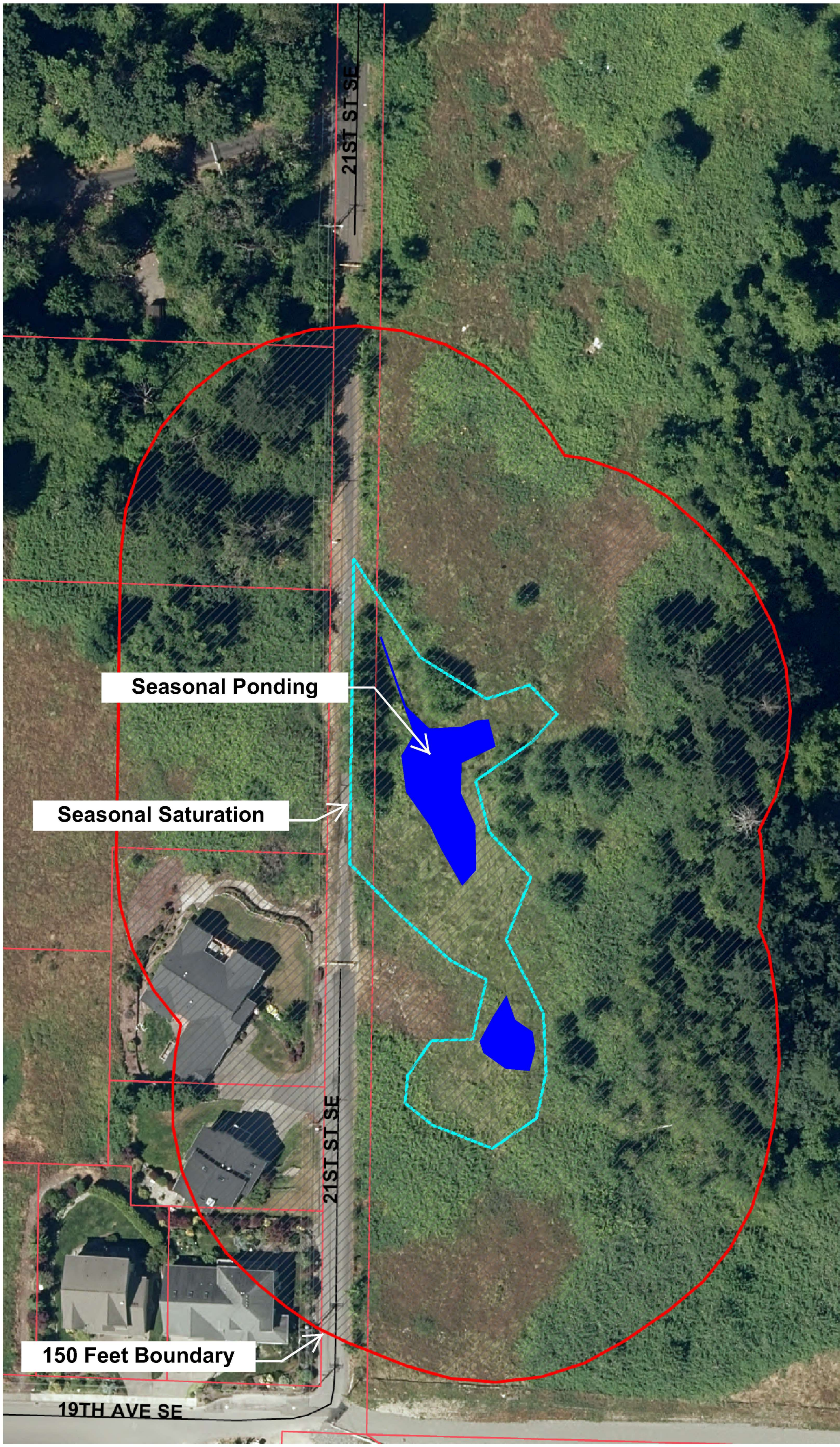
- Wetland E
- Tax Parcels
- Streams - Puyallup
- Drainage - Main Lines
- Roads
- Major Roads
- County - 2014 - Ortho

Figure E1

Habitat Technologies

0 25 50 ft.

10/19/17 1:29 PM



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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.

Map Legend

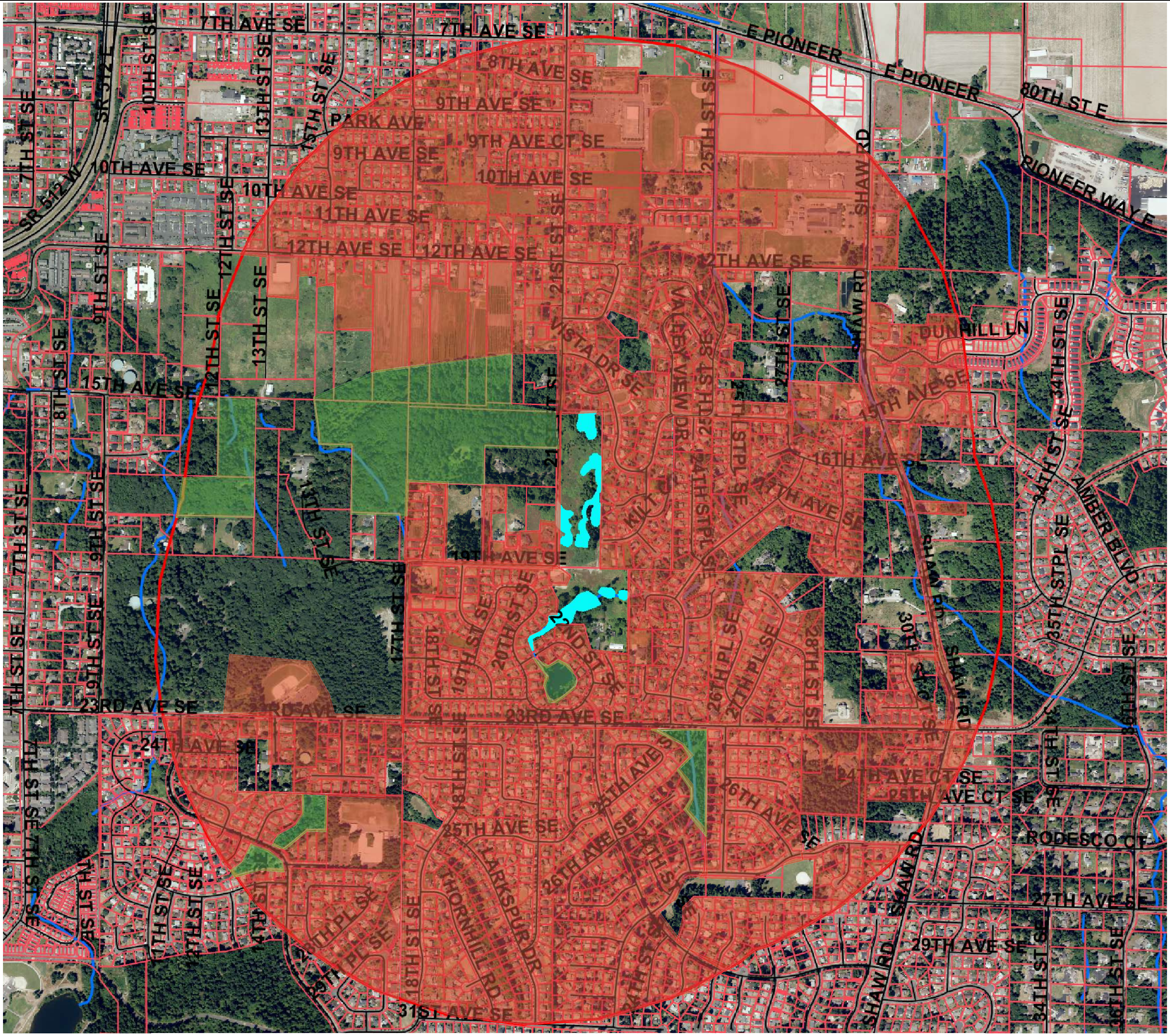
- Wetland E
- Tax Parcels
- Streams - Puyallup
- Drainage - Main Lines
- Roads
- Major Roads
- County - 2014 - Ortho

0 50 100 ft.

Figure E2

Habitat Technologies

10/19/17 2:05 PM



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. The orthophotos and other data may not align. Pierce County and Habitat Technologies assume no liability for variations ascertained by actual survey. All data is expressly provided AS IS and WITH ALL FAULTS. Pierce County and Habitat Technologies make no warranty of fitness for a particular purpose.

Map Legend

- Wetlands
- Highlighted Wetland F
- Tax Parcels
- Streams - Puyallup
- Roads
- Major Roads
- County - 2014 - Ortho
- High Intensity Land Use
- Low/Moderate Intensity Land Use
- Habitat Area

Printed: 10/19/17 3:56 PM

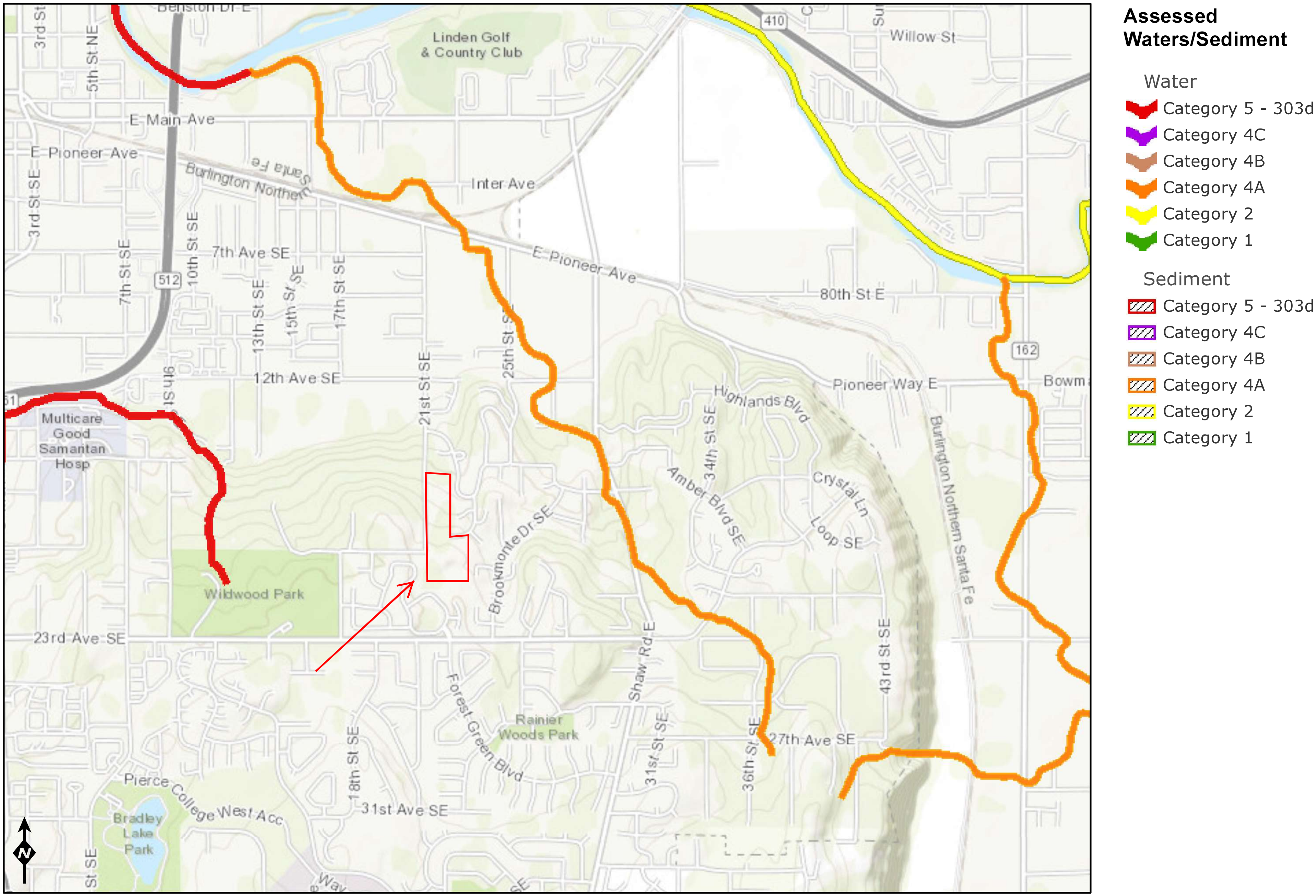
0 650 1300 ft.

Habitat Technologies

Figure W4

October 11, 2017

Figure W5



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, ©

DEPARTMENT OF ECOLOGY State of Washington

Figure W6

DEPARTMENT OF ECOLOGY State of Washington

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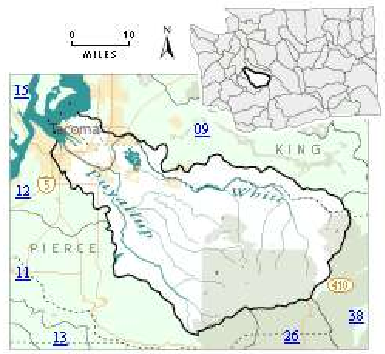
Home Water Quality & Supply Waste & Toxics Air & Climate Cleanup & Spills

Water Quality Improvement Projects (TMDLs)

Water Quality Improvement > Water Quality Improvement Projects by WRIA > WRIA 10: Puyallup-White

WRIA 10: Puyallup-White



The following table lists overview information for water quality improvement projects (also known as total maximum daily loads, or TMDLs) for this water resource inventory area (WRIA). Please use links (where available) for more information on a project.

Counties

- King County
- Pierce County

Waterbody Name	Pollutant	Status**	TMDL Leads
Clarks Creek Meeker Creek	Dissolved Oxygen Sediment	Approved by EPA Has an implementation plan	Donovan Gray 360-407-6407
	Fecal Coliform	Approved by EPA Has an implementation plan	
Commencement Bay	Dioxin	Approved by EPA	Donovan Gray 360-407-6407
Puyallup River Watershed	Fecal Coliform	Approved by EPA	Donovan Gray 360-407-6407
	Multi-parameter Ammonia-N BOD (5-day)	Approved by EPA	
	White River Watershed Upper White: • Sediment • Temperature Lower White • pH	Approved by EPA Under Development	
South Prairie Creek Tributary: Wilkeson/Gale Creek	Fecal Coliform Temperature	Approved by EPA Has an implementation plan	Donovan Gray 360-407-6407

*** **Status** will be listed as one of the following: Approved by EPA, Under Development or Implementation*

For more information about WRIA 10:

- Waterbodies in WRIA 10 - using the Water Quality Assessment Query Tool
- Watershed Information for WRIA 10

* The Department of Ecology and other state resource agencies frequently use a system of 62 "Water Resource Inventory Areas" or "WRIAs" to refer to the state's major watershed basins.

Back to top of page

Last updated October 2016

Feedback?

Wetland name or number E

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Sunset Pointe Date of site visit: 11 OCT 2017

Rated by Habitat Technologies Trained by Ecology? x Yes ___No Date of training 2014

HGM Class used for rating Slope Wetland has multiple HGM classes?___Y x N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map Pierce County GIS

OVERALL WETLAND CATEGORY 4 (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

x **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M $\boxed{L}$	H $\boxed{M}$ L	H M $\boxed{L}$	
Landscape Potential	H $\boxed{M}$ L	H M $\boxed{L}$	H M $\boxed{L}$	
Value	H $\boxed{M}$ L	H $\boxed{M}$ L	H M $\boxed{L}$	**TOTAL**
Score Based on Ratings	5	5	3	13

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	x

Wetland name or number E

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	N/A
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	N/A
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	N/A
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	E1
Hydroperiods	H 1.2	E2
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	E1
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	E1
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	E2
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	W4
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	W5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	W6

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?
x The wetland is on a slope (*slope can be very gradual*),
x 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,
x 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.

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 E

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)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	0
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: 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.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	3
Total for S 1 Add the points in the boxes above	3

Rating of Site Potential If score is:___**12 = H** ___**6-11 = M** X **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? 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: X **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	0
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	1
Total for S 3 Add the points in the boxes above	1

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

Wetland name or number E

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.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	1

Rating of Site Potential If score is:**_x_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	0

Rating of Landscape Potential If score is:**___1 = M _x_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: 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 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	1
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	1

Rating of Value If score is:**___2-4 = H _x_1 = M ___0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number E

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	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

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	
x Seasonally flooded or inundated	3 types present: points = 2	
____Occasionally flooded or inundated	2 types present: points = 1	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**	

H 1.3. Richness of plant species

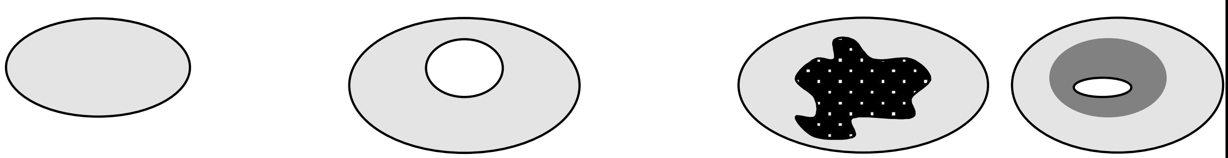
Count the number of plant species in the wetland that cover at least 10 ft^2.

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	1
< 5 species	points = 0	

H 1.4. Interspersion of habitats

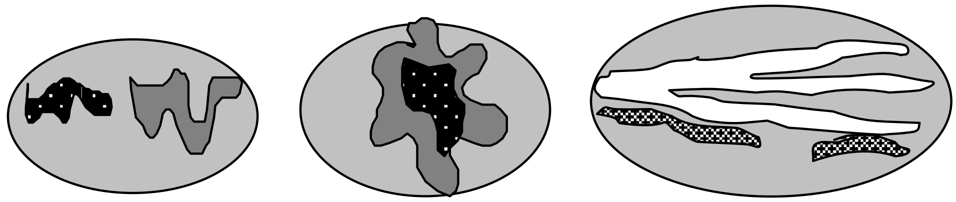
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always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



None = 0 points **Low** = 1 point **Moderate** = 2 points

1

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



Wetland name or number E

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* _X__Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants 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) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
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** _X_**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*). *Calculate:* % undisturbed habitat _2_ **+** [(% moderate and low intensity land uses)/2] _3_ = _5_% If total accessible habitat is: > $^{1}/_{3}$ (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat _12_ **+** [(% moderate and low intensity land uses)/2] _20_ = _32_% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	(-2)
Total for H 2 Add the points in the boxes above	0

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

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

Rating of Value If score is:___**2 = H** ___**1 = M** _X_**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.

HABITAT TECHNOLOGIES

May 17, 2023

CES NW Inc.
Mr. Craig Deaver
429 29th Street NE, Suite D
Puyallup, Washington 98372
e-mail cdeaver@cesnwinc.com

RE: Sunset Pointe Residential Community (P-18-0040)
City of Puyallup, Pierce County, Washington

Dear Mr. Deaver,

As outlined in the revised report by Habitat Technologies dated September 21, 2018, the excavated ponds within the southern portion of the project site were defined as intentionally created features. As viewed in the 1970 historical aerial photo, no ponds or drainage corridor were evident in the southern portion of the project site (See Photos). The easternmost pond (Pond C) only become evident in and after the 1985 aerial photo. In the 1995 aerial photo along with subsequent photos, two (2) additional excavated ponds are present (Ponds A and B) southwesterly of Pond C. The 1998 aerial color photo has the best resolution and clearly shows all three ponds.

As such, it is the opinion of Habitat Technologies that all three ponds in the southern portion of the project site were created within an area that did <u>not</u> exhibit wetland or drainage corridor characteristics prior to excavation and that these areas meet the City of Puyallup definition of an "intentionally created wetland or surface water systems."

> *(21.06.210.75) "Intentionally created wetland or surface water systems" means wetlands or surface water systems created through purposeful human action, such as irrigation and drainage ditches, grass-lined swales, canals, farm ponds, detention/retention facilities, and landscape/ornamental amenities. Purposeful creation must be demonstrated through documentation, photographs, statements and/or other evidence. Intentionally created wetlands or surface water systems do not include areas or systems created as mitigation.*

Sincerely,

Bryan W Peck
Bryan W. Peck
Senior Wetland Biologist

Thomas D Deming
Thomas D. Deming, SPWS
Habitat Technologies

PHOTOS

Photo 1: 1970 Aerial photo with no excavated ponds present.

Photo 2: 1985 Aerial photo with eastern most pond no excavated ponds present.

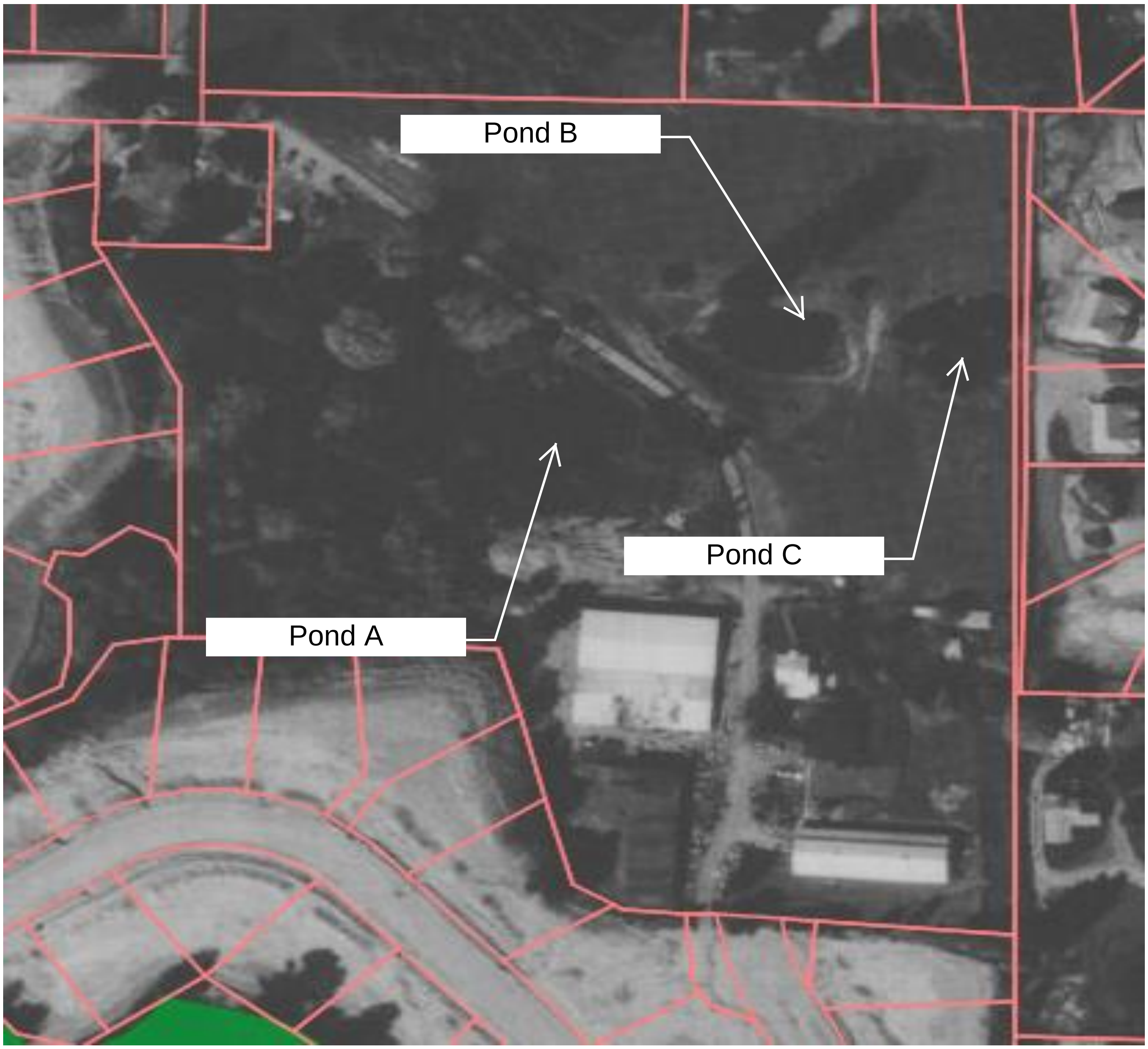


Photo 3: 1995 Aerial photo with three (3) excavated ponds present.

Photo 4: 1998 Aerial photo (color) with three (3) excavated ponds present.

APPENDIX E

Maintenance Schedules

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).

Debris Barriers (e.g. Trash Racks) Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
M,S	General					Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
A	General					Damaged/Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
A	General					Damaged/Missing Bars.	Bars are missing or entire barrier missing.	Bars in place according to design.
A	General					Damaged/Missing Bars.	Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
A	General					Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe.	Barrier firmly attached to pipe.

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).

Energy Dissipaters Checklist

Frequency	Drainage System Feature	Date ✓	✓	✓	✓	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).

Stormfilter® Cast-In-Place, Precast, Linear Stormfilter Units and Catch Basin Units Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
M	Media filter vault					Sediment accumulation on top of filter cartridges	Sediment accumulation exceeds 0.25 inches on top of cartridges.	No sediment deposits on top of cartridges. Sediment on cartridges likely indicates that cartridges are plugged and require maintenance.
M	Media filter vault					Sediment accumulation in vault	Sediment accumulation in vault exceeds 2 inches. Look for other indicators of clogged cartridges or overflow.	Sediment in vault should be removed. Cartridges should be checked and replaced or serviced as needed.
M	Media filter vault					Trash and floatable debris accumulation	Trash and floatable debris accumulation in vault.	No trash or other floatable debris in filter vault.
S	Media filter vault					Filter cartridges submerged	Filter vault does not drain within 24 hours following storm. Look for evidence of submergence due to backwater or excessive hydrocarbon loading.	Filter media checked and replaced if needed. If cartridges are plugged with oil additional treatment or source control BMP may be needed.
M	Forebay					Sediment accumulation	Sediment accumulation exceeds 6 inches or 1/3 of available sump.	Sediment accumulation less than 6 inches.
M	Forebay					Trash and floatable debris accumulation	Trash and/or floatable debris accumulation.	Trash and/or floatable debris should be removed during monthly inspections. Significant oil accumulation may indicate the need for additional treatment or source control.
A	Below ground vault					Access cover Damaged/ Not working	One maintenance person cannot remove lid after applying 80 pounds of lift, corrosion of deformation of cover.	Cover repaired to proper working specifications or replaced.
A	Below ground vault					Damaged Pipes	Any part of the pipes are crushed or damaged due to corrosion and/or settlement.	Pipe repaired or replaced.
A	Below ground vault					Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.	Cracks wider than ½ inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault repaired or replaced so that vaults meets design specifications and is structurally sound.
A	Below ground vault					Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.	Cracks wider than 0.5 inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks	Vault repaired so that no cracks exist wider than 0.25 inch at the joint of inlet/outlet pipe.

Stormfilter® Cast-In-Place, Precast, Linear Stormfilter Units and Catch Basin Units Checklist (Continued)

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
A	Below ground vault					Baffles	Baffles corroding, cracking, warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to design specifications.
A	Below ground vault					Ladder rungs unsafe	Maintenance person judges that ladder is unsafe due to missing rungs, misalignment, rust, or cracks. Ladder must be fixed or secured immediately.	Ladder meets design standards and allows maintenance persons 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).

3.19 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).

3.21 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

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	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:

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).

Field Inlet Checklist

		Date						
Frequency	Drainage System Feature	✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
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,S	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,S	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,S	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.
M	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.
M	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 regrouted and secure at basin wall.
M	General					Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.

Field Inlet Checklist (Continued)

Frequency	Drainage System Feature	Date ✓	✓	✓	✓	Problem	Conditions to Check For	Conditions That Should Exist
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					Contaminants 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.
M	Field Inlet Cover					Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed.
M	Field Inlet 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.
M	Field Inlet 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.
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.
M	Metal Grates (If Applicable)					Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
M,S	Metal Grates (If Applicable)					Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
M	Metal Grates (If Applicable)					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:
(A) Annual (March or April preferred)
(M) Monthly (see schedule)
(S) After major storms (use 1-inch in 24 hours as a guideline).