



# Monroe 30

## *Preliminary Drainage Report*

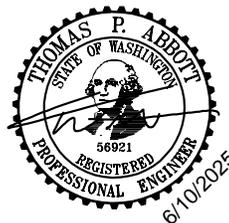
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## **SECTION 1: PROJECT OVERVIEW**

The proposed Monroe 30 project is an approximately 28.72 acre site. The proposed project is a single-family residential development on nine parcels located on parcels #28062600400100, #28062600400900, #28062600401100, #28062600400500, #28062600401200, #2806200401700, #28062600401300, #01038000099900, and #28062600400700. The project site is addressed at 12611 175<sup>th</sup> Ave SE in Snohomish, WA and will be annexed into the City of Monroe. The project proposes to construct 179 single-family homes and an additional 34 townhomes on the site. Standard access drives along with associated private and public utilities are proposed to serve project development. Frontage improvements along 175<sup>th</sup> Ave SE consisting of sidewalk improvements and drainage update to City standards are proposed. See the Vicinity Map in Appendix 1 for visual representation of the subject property.

### **Existing Site**

Parcels #28062600400100, #28062600401100, #28062600400500, #28062600401200, #2806200401700, #28062600401300, #01038000099900, and #28062600400700 are currently occupied by 5 residences and associated structures. Parcels #28062600400900, #28062600401100 are currently unoccupied and consist of moderately steep forest. The project parcels are currently zoned R-7. The existing ground cover is a combination of trees, undergrowth, grass, and gravel.

The proposed development will exist within the bounds of a single stormwater threshold discharge basin as all site runoff from developed surfaces meets within ¼ mile from the project site downstream. Wetland Resources, Inc has prepared a Wetlands Critical Areas Report on the site. The findings indicate that in the northwest portion of the site, there is a category III wetland with a 150' high intensity buffer that will be reduced to 110' through impact minimization. There is also a Type Ns stream with a 50' buffer on site that sits within the wetland area. No development is planned within these buffer areas and no stormwater is proposed to be discharged to or diverted from the wetland and stream area on the parcel.

A Geotechnical Report has been prepared by Terra Associates, Inc. dated October, 2024 on the site. Please reference the geotechnical report for detailed soils information. Slopes on site descend generally to the West. Terra Associates indicate that there is no evidence of deep seated landslide activity or slope instability. The Geotechnical Engineer's onsite soil borings and findings of till soils underlying the site indicate the impermeability of the soil.

### **Proposed Development**

The proposed project will construct 179 single-family homes and 34 townhomes with standard access drives along with associated private and public utilities are proposed to serve project development. Frontage improvements along 175<sup>th</sup> Ave SE are proposed.

Tiered walls are proposed throughout the site in order to facilitate the grades necessary to construct access, utility lines and proposed homes.

### **Proposed Drainage System**

This project is designed to comply with the 2024 Department of Ecology Stormwater Manual for Western Washington (2024 DOE SWMWW) as well as the 2019 Snohomish County Drainage Manual (SCDM). Stormwater will be mitigated via a detention vault that is proposed to be located within Tract 999. The vault will discharge to existing storm infrastructure within the 175<sup>th</sup> Ave SE ROW.

Prior to discharge, a Stormfilter water quality treatment unit will be used to treat stormwater runoff to water quality treatment requirements. Onsite development and frontage improvements will disturb approximately 29.48 AC. Of this area, 27.05 AC will be within the Onsite Basin and direct flows to the detention vault for stormwater modeling. The remaining 2.43 AC will be considered in the Bypass Basin and drain directly into existing and new stormwater infrastructure within the site and frontage areas. This includes frontage improvements consisting of new sidewalk and planter along 175<sup>th</sup> Ave SE. Additionally, 1.08 AC has been modeled as a future development tract that will be permitted and constructed at a later date.

Proposed new pollution generating impervious surfaces (PGIS) will exceed the 5,000 SF threshold and thus basic water quality treatment will be provided via a water quality treatment structure that treats stormwater runoff after discharge from the stormwater detention vault. There will also be additional water quality units used to treat the bypass basins that will not be treated by the water quality unit at the detention vault. A Stormfilter water quality treatment unit is proposed for this purpose. See Section 4.0 for additional discussion regarding proposed stormwater management and water quality treatment measures.

The proposed detention vault and water quality treatment system will discharge into an existing public drainage system located west of the site, which is a part of the Roosevelt Ridge development. The existing drainage system briefly flows north before turning west and then south to an existing pond. The pond then discharges south into an unnamed creek, a tributary of French Creek. All flow eventually reaches the Skykomish River and then Puget Sound to the west.

### **Erosion/Sedimentation Control**

Erosion control measures that will be utilized during construction will include a combination of silt fence, storm drain inlet protection, interceptor swales, and sediment ponds. See Section 2.0 for discussion of how SWPP Elements are addressed.

### **Minimum Requirements**

Per the 2024 DOE Manual, Minimum Requirements 1-9 apply to the proposed development.

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

This report along with the preliminary plans satisfies the minimum requirement.

#### Minimum Requirement #2: Construction Stormwater Pollution Prevention

See Section 2 of this Report for the SWPPP BMP Elements, and the SWPPP (submitted as a separate document) for a complete discussion of erosion control BMP's and their use specific to the site.

#### Minimum Requirement #3: Source of Pollution

Permanent source control BMPs are not applicable for the subject site since the associated activities for the new residence do not fall within the types of facilities listed within Volume IV of the DOE Manual (Residential developments are not required to implement source control BMP's). BMPs for erosion and sedimentation control will be specified in the Construction Plans and the CSWPP.

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

Flow from the site will preserve its natural drainage pattern from the east toward the west. Runoff flows towards an unnamed creek to the west, a tributary to French Creek, which then eventually discharges into the Skykomish River.

#### Minimum Requirement #5: On-Site Stormwater Management

The project proposes BMP T5.13 soils to be underlain within all pervious areas that are disturbed by development. Generally, all other infiltration-related BMPs are infeasible due to the site being underlain with impermeable soils confirmed by the Geotech Report. Generally, other dispersion-related BMPs are considered infeasible due to the proximity of slopes to the developed impervious coverage of the site and the lack of available dispersion length. Please see Section 4.5 for additional discussion of Onsite Stormwater Management and Low Impact Development BMP feasibility.

#### Minimum Requirement #6: Runoff Treatment

As the project will exceed the 5,000 SF threshold of new/replaced PGIS, the project is required to provide basic water quality treatment per the 2024 DOE Manual. A Stormfilter water quality treatment unit will be installed downstream of the detention vault to meet this requirement.

#### Minimum Requirement #7: Flow Control

The project will exceed the 10,000 SF new/replaced impervious threshold and is required to provide flow control. A concrete detention vault will be installed within Tract 999. This vault will gravity discharge at historic, mitigated rates into an existing drainage system in the frontage of 175<sup>th</sup> Ave SE to the west. Please see Section 4.0 for additional flow control modeling and parameters for detention sizing.

#### Minimum Requirement #8: Wetlands Protection

Wetland Resources, Inc has prepared a Wetlands Critical Areas Report on the site. The findings indicate that in the northeast portion of the site, there is a Category III wetland with a 150' high intensity buffer that will be reduced to 110' through impact minimization. There is also a Type Ns stream with a 50' buffer on site. No development is planned within these buffer areas and no stormwater is proposed to be discharged to or diverted from the wetland and stream area on the parcel. Wetland areas will not be disturbed during site construction and will be protected with silt fencing and other BMPs throughout construction.

Minimum Requirement #9: Operation and Maintenance  
See Operations and Maintenance in Section 6 of this report.

## **SECTION 2: TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN**

### **SWPPP Design Elements**

A Construction Stormwater Pollution Prevention Plan (SWPPP) will be provided prior to construction. Construction SWPPP Elements #1 through #13 are addressed below.

#### Element #1 – Mark Clearing Limits

All clearing limits will be delineated with high visibility plastic fence and/or silt fence. See sheets ER-01 of the preliminary plans for locations and details.

#### Element #2 – Establish Construction Access

Stabilized construction accesses will be installed as shown on the preliminary plans. See sheets ER-01 and ER-02 of the construction plans for locations and details.

#### Element #3 – Control Flow Rates

Detention of construction period runoff will be provided by means of sediment ponds on the site. See sheets ER-01 of the preliminary plans for location and details for flow and sediment control BMP's.

#### Element #4 – Install Sediment Controls

Silt fence, catch basin protection, and the temporary sediment pond will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

#### Element #5 – Stabilize Soils

Exposed soils will be stabilized as specified in the Grading and Erosion Control Notes with temporary and permanent seeding, mulching, and plastic covering. See sheet ER-02 of the preliminary plans for notes.

#### Element #6 – Protect Slopes

Slopes are moderate on the subject site. Slopes shall be protected as specified under Element #5.

#### Element #7 – Protect Drain Inlets

Storm drain inlet protection will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

#### Element #8 – Stabilize Channels and Outlets

Temporary channels shall be stabilized with check dams. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

#### Element #9 – Control Pollutants

Pollutants shall be controlled as specified in Volume IV of the 2024 DOE Manual—Source Control BMPs to address potential sources of pollution which may exacerbate possible soil/groundwater contamination identified onsite.

#### Element #10 – Control De-Watering

There will be no de-watering as a part of this project. See sheet ER-02 of the preliminary plans for notes.

#### Element #11 – Maintain BMPs

Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the preliminary plans for the Construction Sequence and notes.

#### Element #12: Manage the Project

The Grading and Erosion Control Notes specify seasonal work limitations. Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the preliminary plans for the Construction Sequence and notes.

#### Element #13: Protect on-site stormwater management BMPs

On-site stormwater management BMPs used for runoff from roofs and other hard surfaces are not feasible due to soil conditions and proposed project density.

## **SECTION 3: DOWNSTREAM ANALYSIS**

### **Task 1. Study Area Definition and Maps**

Snohomish County Bare Earth LiDAR, survey, and 2024 aerial photography were the best topographical references available for the area containing the site. The limits of the downstream analysis extend roughly 0.25 miles beyond the subject property's natural discharge location.

### **Task 2. Resource Review**

All of the resources below have been reviewed for existing and potential issues near the project site:

#### Adopted Basin Plans

No Adopted Basin Plans were located that include the project site.

#### Drainage Basin

This site is in the French Creek subbasin, within the Snohomish River watershed. Discharge from the proposed development will discharge into an unnamed creek tributary to French Creek.

#### Floodplain / Floodway (FEMA) maps

Per FEMA Floodplain map #53061C1100F the subject property is not within a floodplain.

#### Critical Areas Map

There's a Category II wetland in the West portion of the site. There is a Type Ns stream also in the western portion of the site. See section 7 for a complete list of reports prepared for the project including a Critical Areas Report and a geotechnical report.

#### Drainage Complaints

No relevant issues were identified near the proposed site.

#### Road Drainage Problems

No issues were identified near the proposed site.

#### Soil Survey

Site soils are classified as Tokul gravelly medial loam, (0 to 8 percent slopes) which is classified as Hydrologic Soil Group B, Tokul gravelly medial loam, (8 to 15 percent slopes) which is classified as Hydrologic Soil Group B, and Tokul gravelly medial loam (15 to 30 percent slopes) which is classified as Hydrologic Soil Group B.

#### Wetland Inventory Maps

Wetlands are identified to be on, or immediately adjacent to, the project site. Reference the critical areas report submitted with this report for additional information regarding the wetland areas onsite.

#### Migrating River Studies

Migrating River Studies are not considered applicable to the proposed development.

#### Section 303d List of Polluted Waters

Washington State Department of Ecology's Water Quality Assessment for Washington contains a listing for French Creek downstream of the project. Please refer to Appendix 3 for copies of applicable 303(d) listings.

#### Water Quality Problems

French Creek has a category 5 listing in the DOE Water Quality Assessment Review tools. The creek has a category 5 listing because the two most recent data points indicate that biological integrity is degraded or because two or more B-IBI/RIVPACS data points in the most recent five points indicate biological degradation and the scores do not qualify for Category 1 or Category 2.

#### Stormwater Compliance Plans

Not applicable to the proposed project.

### **Task 3. Field Inspection/Downstream Analysis**

On January 3<sup>rd</sup>, 2025, a Downstream Analysis was performed at the site. The weather consisted of 45°F, cloudy skies, and scattered showers. The following observations were verified during the visit.

The subject property area consists primarily of steep slopes covered in forested vegetation, existing homes, driveways, and grassy areas. On the west frontage of the property there is a wetland area along a portion of 175<sup>th</sup> Ave SE.

Two flow paths have been identified leaving the west side of the parcel and converging within one quarter mile of the site, to form one threshold discharge area. Flow path one is formed where runoff from the north portion of the site collects travels through new stormwater pipes south down 175<sup>th</sup> Ave SE (Image 2) and then crosses West into existing stormwater drainage ditch (Image 4) that continues west and then discharges south where it connects with Flow path 2 (Image 10). Flow path 2 originates from the detention vault in the southwest corner of the project. The vault discharges into existing stormwater system on 175<sup>th</sup> Ave SE and travels north until it reaches 125<sup>th</sup> St SE and turns west and then discharges south converging with Flow path 1 into a drainage trench stream that travels into an existing detention pond. It then outfalls south through wetland area until it gets picked up and crosses 129<sup>th</sup> St SE and outfalls into wetland area. The combined flow then continues south past the ¼-mile boundary of this analysis (Image 23). See Figure 3.0, "Downstream Analysis Map" in Appendix 3 for a visual representation of current discharge.

### **Task 4. Drainage System Description and Problem Descriptions**

Based on the information available and all the resources available including visual inspection of the downstream flow path to the ¼-mile boundary, there is no evidence of existing or anticipated downstream drainage problems. All flows are adequately carried through natural channels to the quarter mile buffer of analysis.

### **Task 5. Mitigation of Existing or Potential Drainage Problems**

No evidence of existing or potential problems with downstream drainage conveyance infrastructure was found. Mitigation is not required.

## SECTION 4: DETENTION AND WATER QUALITY TREATMENT DESIGN

### 4.1 Predeveloped Site Hydrology

The pre-developed and developed conditions were modeled in WWHM for the purpose of matching predeveloped durations. Based on the site location, the WWHM used the Everett Gage with a Precipitation Scale factor of 1.2. For visual representation of the listed basins, see Figure 4.0, "Predeveloped Hydrology Map".

#### Onsite Basin:

The predeveloped condition applied to the Onsite Basin results in a forested land cover condition. It does not include the wetland buffer area onsite that will not be disturbed for development, nor any other undisturbed areas onsite including the future development tract. The values as modeled in WWHM are as follows:

Table 1: Predeveloped Conditions: Onsite Basin

Onsite Basin	
<u>Ground Cover</u>	<u>Area (acre)</u>
Forest, steep	27.05
<b>Total</b>	<b>27.05</b>

#### Bypass Basin:

The predeveloped condition applied to the Frontage Bypass Basin results in a forested land cover condition. In the developed condition, this basin will not be collected to detention. This basin is separated into three separate bypass areas, basin A consists of 1.01 acres which drains into existing stormwater infrastructure in 175<sup>th</sup> St SE, Basin B consists of 0.49 acres which drains into existing stormwater infrastructure in 175<sup>th</sup> St, and Basin C consists of 0.41 Acres which drains into existing stormwater infrastructure in Robinhood Ln. The values as modeled in WWHM are as follows:

Table 2: Predeveloped Conditions: Bypass Basin

Bypass Basin	
<u>Ground Cover</u>	<u>Area (acre)</u>
Forest, steep	1.91
<b>Total</b>	<b>1.91</b>

#### Future Development Basin:

The predeveloped condition applied to the Future Development Basin results in a forested land cover condition. In the developed condition, this basin will be collected to detention. The values as modeled in WWHM are as follows:

Table 3: Predeveloped Conditions: Future Development Basin

Future Development Basin	
<u>Ground Cover</u>	<u>Area (acre)</u>
Forest, steep	1.08
<b>Total</b>	<b>1.08</b>

### 4.2 Developed Site Hydrology

In the developed condition, the proposed single-family project will construct 179 single family lots, 34 Townhomes, and site amenities. Standard access drives along with associated private and public utilities are proposed to serve project development. Frontage improvements along 175<sup>th</sup> Ave SE are proposed.

In compliance with the 2024 DOE Manual, all runoff from onsite developed/disturbed surfaces will be collected, treated, and discharged directly to existing/historic flow paths or will bypass detention and be mitigated within the proposed flow control system.

Onsite Basin:

The developed Onsite Basin is 27.05 acres and includes the majority of the developed site within its boundaries. In the developed condition, the Onsite Basin has been modeled using WWHM with the following areas and ground cover designations:

Table 4: Developed Conditions: Onsite Basin

Onsite Basin	
<u>Ground Cover</u>	<u>Area (acre)</u>
Roof, flat	10.37
Road, Steep	3.38
Sidewalks, steep	1.08
Pasture, steep	12.22
<b>Total</b>	<b>27.05</b>

Bypass Basin:

The developed Bypass Basin is 1.91 acres and is comprised of sloped landscape area that cannot be topographically collected into the detention system, but this basin is separated into three separate bypass areas, basin A consists of 1.01 acres which drains into existing stormwater infrastructure in 175<sup>th</sup> St SE, Basin B consists of 0.49 acres which drains into existing stormwater infrastructure in 175<sup>th</sup> St, and Basin C consists of 0.41 Acres which drains into existing stormwater infrastructure in Robinhood Ln. The Bypass Basin was modeled using WWHM with the following areas and ground cover designations:

Table 5: Developed Conditions: Bypass Basin

Bypass Basins	
<u>Ground Cover</u>	<u>Area (acre)</u>
Pasture, Steep	0.69
Roads, Steep	0.69
Roof Tops, Flat	0.22
Sidewalk, Steep	0.31
<b>Total</b>	<b>1.91</b>

Future Development Basin:

The developed Future Development Basin is comprised of a northern section of the development designated for future development of 14 townhomes and 3 single family homes. In the developed condition, this basin will be collected to detention. The values as modeled in WWHM are as follows:

Table 6: Developed Conditions: Future Development Basin

Future Development Basin	
<u>Ground Cover</u>	<u>Area (acre)</u>
Roof Tops, Flat	0.70
Pasture, Steep	0.38
<b>Total</b>	<b>1.08</b>

### 4.3 Detention Facility Design

The proposed detention vault facility used for mitigating developed condition flows was designed in compliance with the 2024 DOE requirements to model hydrologic conditions and detention in a continuous runoff model (WWHM2012) where the following evaluation parameters are employed:

*“Flow duration is computed by counting the number of flow values that exceed a specified flow level. The specified flow levels used by WWHM in the flow duration analysis are listed below.*

1. 50% of the 2-year predevelopment peak flow.
2. 100% of the 2-year predevelopment peak flow.
3. 100% of the 50-year predevelopment peak flow.

*There are three criteria by which flow duration values are compared:*

1. *If the postdevelopment flow duration values exceed any of the predevelopment flow levels between 50% and 100% of the 2-year predevelopment peak flow values (100 Percent Threshold) then the flow duration requirement has not been met.*
2. *If the postdevelopment flow duration values exceed any of the predevelopment flow levels between 100% of the 2-year and 100% of the 50-year predevelopment peak flow values more than 10 percent of the time (110 Percent Threshold) then the flow duration requirement has not been met.*
3. *If more than 50 percent of the flow duration levels exceed the 100 percent threshold then the flow duration requirement has not been met.”*

#### Detention Vault Facility

The proposed cast in place concrete detention facility detains, and releases collected storm water runoff from the Onsite Basin. The facility is located in a Tract in the Western portion of the site. Flows from the Onsite Basin are collected and conveyed to the detention vault via a proposed network of catch basins and storm water conveyance pipes. Detailed WWHM output is provided in Appendix 4. A summary of the detailed statistics and inputs used for modeling the system in WWHM2012 can be found below.

Table 7: Detention Vault Design Summary

Detention Vault	
Live Storage Bottom Area (modeled)	27,600 SF
Live Storage Bottom Area (provided)	27,900 SF
Number of Cells	6
Cell Dimensions	6 x 15.50' x 300'
Begin Live Storage Elevation	204
Riser Height	10.00'
Volume (modeled)	276,000 CF
Volume (provided)	279,000 CF
Top of Riser Elevation	214
Top Outside of Vault Elevation	216.50

See table below for the flow rates and water surface elevations by storm event for the detention vault.

Table 8: Flow Rates and Water Surface Elevations by Storm Event

Storm Event	Predeveloped Rate (cfs)	Mitigated Rates (cfs)	Water Surface Elevation (ft)
2-Year	1.7923	1.6836	209.70
10-Year	3.8207	2.7200	211.66
50-Year	6.5024	3.8812	213.58
100-Year	7.9565	4.4557	213.64

#### 4.4 Water Quality Treatment

##### Stormfilter

Water Quality Treatment for the Onsite Basin is accomplished through a Stormfilter structure located downstream of the detention vault. A summary of design criteria is provided below:

Table 9: Stormfilter Design Summary

<b>8'x20' Ø Peak Diversion Stormfilter</b>	
Tributary Area	27.08 AC
Water Quality Flow Rate (2 yr mitigated peak)	1.6836 cfs
Number of Cartridges	41
Cartridge Height	27"
Internal Drop	3.05'
Peak Flow Rate	6.0145 cfs
Peak Flow Storm Event	100-year

##### Stormfilter Bypass A

Water Quality Treatment for Bypass Basin A is accomplished through a Stormfilter structure located in a catch basin. A summary of design criteria is provided below:

Table 10: Stormfilter Design Summary

<b>4 Cartridge Catch basin Stormfilter</b>	
Tributary Area	1.01 AC
Water Quality Flow Rate (2 yr mitigated peak)	0.0694 cfs
Number of Cartridges	3
Cartridge Height	18"
Internal Drop	2.30'
Peak Flow Rate	0.9837 cfs
Peak Flow Storm Event	100-year

##### Stormfilter Bypass B

Water Quality Treatment for Bypass Basin B is accomplished through a Stormfilter structure located in a catch basin. A summary of design criteria is provided below:

Table 11: Stormfilter Design Summary

<b>2 Cartridge Catch basin Stormfilter</b>	
Tributary Area	0.49 AC
Water Quality Flow Rate (2 yr mitigated peak)	0.0445 cfs
Number of Cartridges	2
Cartridge Height	18"
Internal Drop	2.30'
Peak Flow Rate	0.6522 cfs
Peak Flow Storm Event	100-year

### Stormfilter Bypass C

Water Quality Treatment for Bypass Basin C is accomplished through a Stormfilter structure located in a catch basin. A summary of design criteria is provided below:

Table 12: Stormfilter Design Summary

1 Cartridge Catch basin Stormfilter	
Tributary Area	0.41 AC
Water Quality Flow Rate (2 yr mitigated peak)	0.0249 cfs
Number of Cartridges	1
Cartridge Height	18"
Internal Drop	2.30'
Peak Flow Rate	0.4179 cfs
Peak Flow Storm Event	100-year

## 4.5 Onsite Stormwater Management

The project does not meet the LID performance standard and minimum requirements 1-9 are required for the project but choose to implement List #2 to evaluate low impact design. The following BMP's below are assessed for implementation:

### Lawn and Landscaped Areas:

1. *Post-Construction Soil Quality and Depth*
  - BMP T5.13 soils will be applied to all permeable and landscaped areas in developed condition.
    - i. **Conclusion: Feasible**

### Roofs:

1. *Downspout Full Infiltration per BMP T5.10A or Downspout Full Dispersion per BMP T5.30*
  - Infiltration is not feasible on site, which has been confirmed by testing found in the geotechnical report and thus BMP T5.10A is infeasible. Due to site specific constraints including building as well as the proximity of slopes and walls to the developed site improvements, there is inadequate flow path to disperse on site per BMP T5.30.
    - i. **Conclusion: Infeasible**
2. *Bioretention*
  - Due to spatial constraints provided by the development footprint and infiltration infeasibility as confirmed by testing in the geotechnical report, a bioretention facility cannot be designed to provide the required horizontally projected surface area.
    - i. **Conclusion: Infeasible**
3. *Downspout Dispersion per BMP T5.10B.*
  - Due to site specific constraints including building as well as the proximity of slopes and walls to the developed site improvements, there is inadequate flow path to disperse on site.
    - i. **Conclusion: Infeasible**
4. *Perforated Stub-Out Connections per BMP T5.10C.*
  - No stub-out connections will be implemented in the design as soils are not suitable for infiltration as well as the site's proximity to steep slopes.
    - i. **Conclusion: Infeasible**

### Other Hard Surfaces:

1. *Full Dispersion per BMP T5.30*

- Due to site specific constraints including building location as well as the proximity of slopes and walls to the developed site improvements, there is inadequate flow path to disperse on site.
  - i. **Conclusion: Infeasible**
- 2. *BMP T5.15 Permeable Pavement*
  - Infiltration is not feasible on site, which has been confirmed by testing found in the geotechnical report.
    - i. **Conclusion: Infeasible**
- 3. *Bioretention*
  - Due to spatial constraints provided by the development footprint and infiltration infeasibility as confirmed by testing in the geotechnical report, a bioretention facility cannot be designed to provide the required horizontally projected surface area.
    - i. **Conclusion: Infeasible**
- 4. *Sheet Flow Dispersion or Concentrated Flow Dispersion in accordance with BMP T5.12 or BMP T5.11*
  - Due to site specific constraints including building location as well as the proximity of slopes and walls to the developed site improvements, there is inadequate flow path to disperse on site.
    - i. **Conclusion: Infeasible**

## **SECTION 5: CONVEYANCE DESIGN**

The stormwater conveyance system is comprised of a network of open/closed grate catch basins, buried pipe, a concrete detention vault and a Stormfilter water quality unit. Catch basins have been located such that each section of storm drainage pipe may adequately convey associated tributary area flows.

A fully prepared conveyance capacity analysis of the proposed pipes onsite will be prepared at a future submittal.

## **SECTION 6: OPERATIONS AND MAINTENANCE MANUAL**

The proposed storm drainage system consists of buried pipes, catch basins, a detention vault, and a Stormfilter water quality treatment structure and a modular wetland water quality treatment structure. These facilities will require periodic maintenance and inspection. Inspection and maintenance procedures are contained on the following pages.

## **SECTION 7: SPECIAL REPORTS AND STUDIES**

The following studies were conducted in preparation of this Report:

- Critical Area Report & Mitigation Plan for Monroe 30, Wetland Resources, Inc April 24, 2025
- Geotechnical Report, Monroe 30 13611-175<sup>th</sup> Ave SE Snohomish, WA, Terra Associates, Inc., April 3, 2025



**CRITICAL AREA REPORT  
&  
MITIGATION PLAN**

**FOR**

**MONROE 30**  
**MONROE, WA**

*Wetland Resources, Inc.* Project #24231

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April 24, 2025

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## 1.0 INTRODUCTION

Monroe 30 is proposed on a 29.8-acre, nine-parcel assemblage located between 175<sup>th</sup> Avenue SE and Robinhood Lane, in the city limits of Monroe, WA. The tax identification numbers for the parcels are 01038000099900, 28062600400700, 28062600400500, 28062600400100, 28062600401300, 28062600401700, 28062600400900, 28062600401100, 28062600401200. Wetland Resources, Inc. (WRI) performed site investigations on June 14, 2022, July 17, 2023, August 14, 2023, and August 8, 2024, to evaluate the site and surrounding area for the presence of wetlands and streams. The property is located within the French Creek sub-basin of the Snohomish River Watershed, Water Resource Inventory Area 7 and is mapped by the Public Land Survey System within Section 26, Township, 28N, Range 6E, W.M.



**Figure 1** – Aerial photo of the subject properties and surrounding area.

## 1.1 SITE DESCRIPTION

The assemblage includes six parcels that are developed and/or maintained and three undeveloped, forested parcels. The maintained portions of the site include pasture/lawn areas and areas with sporadic canopy coverage. Dominant species in these areas includes various grasses (*Poa* spp. and *Agrostis* spp.), hairy cat's ear (*Hypochaeris radicata*), common dandelion (*Taraxacum officinale*), and creeping buttercup (*Ranunculus repens*). The canopy across the forested portions of the site includes Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), red alder (*Alnus rubra*), and big leaf maple (*Acer macrophyllum*), with a dense understory of Himalayan blackberry (*Rubus armeniacus*), salmonberry (*Rubus spectabilis*), osoberry (*Oemleria cerasiformis*), vine maple (*Acer circinatum*), cut-leaf blackberry (*Rubus laciniatus*), trailing blackberry (*Rubus ursinus*), and swordfern (*Polystichum munitum*).

Topography slopes generally downward to a lower area in the western portion of the site. Most of the area surrounding the site is developed with high-intensity residential uses. A small, undeveloped forested area is present west of the assemblage on the west side of 175<sup>th</sup> Avenue SE.

One wetland (Wetland A) and an associated stream (Stream A) were identified in the western portion of the site. Wetland A is a Category III wetland with a habitat score of 6 and therefore requires a 110-foot buffer per Monroe Municipal Code (MMC) 22.80.090.D.4. This buffer is increased to 150 feet if the impact minimization measures of MMC Table 22.80.090(D)(2) are not implemented. Stream A is a Type Ns stream and requires a 50-foot buffer per MMC 22.80.100.D.6.

## **2.0 REVIEW OF EXISTING INFORMATION**

Prior to conducting the site investigation, public resource information was reviewed to gather background information on the subject property and the surrounding area regarding wetlands, streams, and other critical areas. These sources included the following:

- USDA/NRCS Web Soil Survey: The Web Soil Survey maps on-site soils as Tokul gravelly medial loam with slopes ranging between 8 and 30 percent.
- United States Fish and Wildlife Service National Wetlands Inventory (NWI): The NWI does not map any wetland or riparian areas on site. A pond is shown approximately 370 feet west of the site along the general flow path of Stream A.
- Snohomish County PDS Map Portal: The PDS Map Portal identifies a stream and an associated linear wetland that crosses the southwestern portion of the site, flowing in a northwesterly direction. The mapped wetland and stream cross through the areas where Wetland A and Stream A are located in the westernmost portion of the assemblage. A second wetland associated with the riparian corridor is mapped along the southern property boundary. Wetland conditions were not observed at or near the southern property boundary where the second wetland is identified. This resource maps a pond and associated wetlands off site to the west, in a similar location to the pond mapped by the NWI. Stream A is identified as a Type Ns water in areas upstream of the off-site pond. The off-site pond and downstream waters are mapped as Type F waters.
- WDFW SalmonScape Interactive Mapping System: SalmonScape maps a salmonid-bearing stream off site to the west, in a similar alignment to the stream shown by Snohomish County PDS. This off-site stream is listed as gradient-accessible habitat for steelhead trout, chum salmon, coho salmon, Chinook salmon, and pink salmon.

- WDFW Priority Habitat and Species (PHS) Interactive Map: The PHS Interactive Map depicts a linear area of Coho habitat that crosses the northern portion of the subject property from east to west, however, no stream is present in this area. This resource also identifies wetland areas in and around the pond located west of the site. The pond and upstream reaches of Stream A are not mapped as fish-habitat by this resource. An area of Coho habitat is depicted beginning 750 feet downstream of the pond and extending away from the pond and subject site.
- Washington Department of Natural Resources Forest Practices Application Mapping Tool (DNR-FPAMT): FPAMT maps Stream A in the southwestern portion of the site. The on-site portion of Stream A is depicted as a Type N water. The break between fish-bearing and non-fish-bearing portions of Stream A is shown 350 feet north of the off-site pond and 370 feet west of the subject property.

### **3.0 WETLAND AND ORDINARY HIGH WATER MARK DETERMINATION**

#### **3.1 WETLAND DETERMINATION AND DELINEATION METHODOLOGY**

Wetland conditions were identified using methodologies described in the *Corps of Engineers Wetlands Delineation Manual (Final Report; January 1987)*, except where superseded by the *2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0, referred to as 2010 Regional Supplement)*. Our findings are consistent with these manuals. The following criteria descriptions were used in the wetland boundary determination:

- 1.) Examination of the site for hydrophytic vegetation (species present and percent cover);
- 2.) Examination of the site for hydric soils;
- 3.) Determining the presence of wetland hydrology

The ordinary high water marks (OHWM) of streams and waterbodies, where present, were identified using the methodology described in *Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State* (Anderson et al. 2016).

##### **3.1.1 Hydrophytic Vegetation Criteria**

The 2010 Regional Supplement defines hydrophytic vegetation as “assemblage of macrophytes that occur in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to influence plant occurrence.” Field indicators were used to determine whether the vegetation meets the definition for hydrophytic vegetation. Commonly used indicators include the dominance test and the prevalence index, which are based on the wetland indicator status of plant species present.

### 3.1.2 Soils Criteria and Mapped Description

The 2010 Regional Supplement (per the National Technical Committee for Hydric Soils) defines hydric soils as soils “that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” Field indicators are used to determine whether a given soil meets the definition for hydric soils. Indicators are numerous and include, but are not limited to, presence of a histosol or histic epipedon, a sandy gleyed matrix, depleted matrix, and redoximorphic depressions.

### 3.1.3 Hydrology Criteria

The 2010 Regional Supplement defines wetland hydrology as “areas that are inundated (flooded or ponded) or the water table is less than or equal to 12 inches below the soil surface for 14 or more consecutive days during the growing season at a minimum frequency of 5 years in 10.” During the early growing season, wetland hydrology determinations are made based on physical observation of surface water, a high water table, or saturation in the upper 12 inches. Outside of the early growing season, wetland hydrology determinations are made based on physical evidence of recent inundation or saturation (i.e. water marks, surface soil cracks, water-stained leaves).

## 3.2 BOUNDARY DETERMINATION FINDINGS/RESULTS

### Wetland A

**HGM Class:** Depressional

**Wetland Rating Category and Score (Total/Habitat):** Category III (19/6)

**City of Monroe Standard Buffer:** 110 feet

**City of Monroe High-Intensity Buffer:** 150 feet

Wetland A is a small wetland associated with Stream A located in the western portion of the site, entirely within parcel 01038000099900. The outer edge of the wetland is forested with a dense, shrubby understory. The interior of the wetland is dominated by emergent plants. Species observed within Wetland A include western red cedar (*Thuja plicata*; FAC), Himalayan blackberry (*Rubus armeniacus*; FAC), salmonberry (*Rubus spectabilis*; FAC), vine maple (*Acer circinatum*; FAC), youth-on-age (*Tolmiea menziesii*; FAC), and creeping buttercup (*Ranunculus repens*; FAC). Dominant vegetation within Wetland A is rated as facultative (FAC) and therefore the plant community within the wetland is considered hydrophytic.

The top four inches of soil within Wetland A is typically very dark grayish brown (10YR 3/2) sandy loam. Between four and sixteen inches below the soil surface, soils are generally very dark brown (10YR 2/2) sandy loam with dark yellowish brown (10YR 3/6) redoximorphic concentrations present in the matrix. These soils meet the criteria for the hydric soil indicator Redox Dark Surface (F6). Soils within Wetland A were dry at the time of the August 2023 site investigation; however, conditions meeting the criteria for the secondary hydrologic indicators Drainage Patterns (B10) and Geomorphic Position (D2) were observed.



**Figure 2** - Looking east through Wetland A.

### **Stream A**

**Stream Classification:** Type Ns

**City of Monroe Buffer:** 50 feet

Stream A is a narrow stream that flows from east to west through Wetland A. The stream enters a culvert at the eastern edge of 175<sup>th</sup> Avenue SE and discharges to the west. On the west side of 175<sup>th</sup> Avenue SE, the stream turns to the south and drains away from the site. The on-site segment of Stream A was dry during all of our site visits. Several public resources show Stream A extending across the southwestern portion of the site, however, stream conditions are not present beyond the flagged boundary of Stream A. No bed, bank, or evidence of flow was observed southeast of the delineated terminus of Stream A. Due to the width of on-site portions of Stream A, seasonal flow of the stream, and the gradient between on-site portions of the stream and the mapped pond west of the site, Stream A is considered a Type Ns stream. This is supported by DNR and WDFW mapping.

### **Non-Wetland Areas**

Non-wetland portions of the site include areas of unmaintained forest, maintained pastures, and maintained lawns. Vegetation in the forested portions is dense and diverse. Observed species in these areas include red alder (*Alnus rubra*; FAC), western red cedar (*Thuja plicata*; FAC), Douglas-fir (*Pseudotsuga menziesii*; FACU), western hemlock (*Tsuga heterophylla*; FACU), Himalayan blackberry (*Rubus armeniacus*; FAC), English holly (*Ilex aquifolium*; FACU), salmonberry (*Rubus spectabilis*; FAC), red elderberry (*Sambucus racemosa*; FACU), cut-leaf blackberry (*Rubus laciniatus*; FACU), trailing blackberry (*Rubus ursinus*; FACU), and swordfern (*Polystichum munitum*; FACU). Maintained parts of the assemblage are dominated by emergent species such as pasture grasses (*Poa* and *Agrostis* spp.; varies), hairy cat's ear (*Hypochaeris radicata*; FACU), narrowleaf plantain (*Plantago lanceolata*; FACU), common dandelion (*Taraxacum officinale*; FACU), and creeping buttercup (*Ranunculus repens*; FAC).

The dominance of facultative-upland species in non-wetland areas indicates that the plant communities in these areas is not hydrophytic.

The top layer of soil in non-wetland parts of the site is generally very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) sandy loam that extends to depths between three and six inches. The sublayer is typically brighter, with commonly observed soil colors including varying shades of dark yellowish brown (10YR 3/4, 10YR 4/4, or 10YR 3/6). Subsoils generally have a sandy loam texture. Soils in non-wetland portions of the site were dry during the site investigations.



**Figure 3** – Non-wetland forested area in the northwestern portion of the site.

## **4.0 PROPOSED PROJECT, IMPACTS, AND MITIGATION**

### **4.1 PROJECT DESCRIPTION**

The applicant is proposing to construct a high-density residential development throughout the assemblage. The project includes 179 single-family houses, seven multi-family residential buildings, access roads, utilities, and associated appurtenances. The applicant is proposing to implement the impact minimization measures described in MMC Table 22.80.090(D)(2) to maintain the standard 110-foot buffer for Wetland A. Additionally, historically maintained portions of the on-site buffer will be planted with native species, as required by MMC 22.80.090.D.4.

**4.2 WETLAND BUFFER REDUCTION – IMPACT MINIMIZATION MEASURES**

MMC Table 22.80.090(D)(2) provides impact minimization standards required to utilize the standard buffer width for identified wetlands. The table below details the examples of disturbance outlined by the referenced table with a description of how those disturbances will be minimized on this project.

**Table 1 – Implementation of Optional Mitigation Measure 1**

<b>Example of disturbance</b>	<b>Proposed impact minimization measures</b>
Lights	Lights will be directed away from wetland, stream, and buffer areas. Residential structures have been sited as far from wetland areas as feasible.
Noise	Residential uses have been sited as far from wetland, stream, and buffer areas as feasible. Plants will be installed as part of the buffer enhancement mature and, as they mature, they will help to reduce noise within critical areas.
Toxic runoff	Runoff generated by the proposed development will be treated in accordance with the applicable drainage manual. Stormwater will be captured and routed away from Wetland A and Stream A which will prevent pollutants from reaching the critical areas and their associated buffers.
Stormwater runoff	Runoff generated by the proposed use will be treated in accordance with the applicable drainage manual. Stormwater will be captured and routed away from Wetland A and Stream A which will prevent pollutants from reaching the critical areas and their associated buffers.
Change in water regime	A drainage report has been prepared as part of this project. No hydrologic impacts to Wetland A or Stream A are expected to result from this project.
Pets and human disturbance	Dense planting within the buffer will reduce the potential for human intrusion within critical areas. Fencing and signage marking the critical area will be installed along the edge of the buffer, as required by MMC 22.80.080.D.2.
Dust	Best management practices will be applied to prevent dust from reaching the critical areas during construction. Roads and residential uses are being sited as far from the wetland, stream, and buffer areas as feasible to prevent dust from reaching critical areas.

**4.3 BUFFER ENHANCEMENT PLAN**

The 110-foot standard buffer width for Wetland A assumes that the buffer is vegetated with a native plant community appropriate for the site. The eastern portion of the on-site buffer has been historically maintained and used as a driveway for neighboring residences. Therefore, the existing buffer condition does not meet the vegetation standard. The applicant will enhance all degraded buffer areas by removing existing gravel and structural developments, removing all invasive shrubs, decompacting areas where gravel and development were present, and installing a diverse array of native trees and shrubs. In total, 14,710 square feet of buffer enhancement is proposed. The following plants will be installed across the buffer enhancement area:

**Table 1 - Buffer Enhancement Planting Plan (14,710 Sq. Ft.)**

<b><u>Common Name</u></b>	<b><u>Latin Name</u></b>	<b><u>Size</u></b>	<b><u>Spacing</u></b>	<b><u>Quantity</u></b>
Big leaf maple	<i>Acer macrophyllum</i>	1 gallon	10'	65
Douglas-fir	<i>Pseudotsuga menziesii</i>	1 gallon	10'	65
Western red-cedar	<i>Thuja plicata</i>	1 gallon	10'	40
Thimbleberry	<i>Rubus parviflorus</i>	1 gallon	5'	72
Salmonberry	<i>Rubus spectabilis</i>	1 gallon	5'	72
Vine maple	<i>Acer circinatum</i>	1 gallon	5'	72
Ocean spray	<i>Holodiscus discolor</i>	1 gallon	5'	72
Beaked hazelnut	<i>Corylus cornuta</i>	1 gallon	5'	72
Snowberry	<i>Symphoricarpos albus</i>	1 gallon	5'	72
Swordfern	<i>Polystichum munitum</i>	1 gallon	5'	72

**4.4 PLANTING NOTES**

Plant in the early spring or late fall and obtain all plants from a reputable nursery. Care and handling of all plant materials is extremely important to the overall success of the project. The origin of all plant materials specified in this plan shall be native plants, nursery grown in the Puget Sound region of Washington. Some species substitution may be allowed with the agreement of the consulting wetland professional and/or County staff.

*Pre-Planting Meeting*

Prior to control of invasive species or installation of mitigation plantings, a site meeting between the contracted landscaper and the consulting wetland professional shall occur to resolve any questions that may arise. During this meeting, a discussion regarding plant spacing and locations of plant species shall occur between the landscape contractor and the consulting wetland professional.

*Handling*

Plants shall be handled so as to avoid all damage, including: breaking, bruising, root damage, sunburn, drying, freezing or other injury. Plants must be covered during transport. Plants shall not be bound with wire or rope in a manner that could damage branches. Protect plant roots with shade and wet soil in the time period between delivery and installation. Do not lift container stock by trunks, stems, or tops. Do not remove from containers until ready to plant. Water all plants as necessary to keep moisture levels appropriate to the species horticultural requirements. Plants shall not be allowed to dry out. All plants shall be watered thoroughly immediately upon installation. Soak all containerized plants thoroughly prior to installation.

*Storage*

Plants stored by the Permittee for longer than one month prior to planting shall be planted in nursery rows and treated in a manner suitable to those species' horticultural requirements. Plants must be re-inspected by the wetland biologist and/or landscape designer prior to installation.

### *Damaged plants*

Damaged, dried out, or otherwise mishandled plants will be rejected at installation inspection. All rejected plants shall be immediately removed from the site, and properly replaced.

### *Plant Names*

Plant names shall comply with those generally accepted in the native plant nursery trade. Any question regarding plant species or variety shall be referred to the landscape designer, wetland professional, or County staff. All plant materials shall be true to species and variety and legibly tagged.

### *Quality and condition*

Plants shall be normal in pattern of growth, healthy, well-branched, vigorous, with well-developed root systems, and free of pests and diseases. Damaged, diseased, pest-infested, scraped, bruised, dried out, burned, broken, or defective plants will be rejected. Plants with pruning wounds over 1" in diameter will be rejected.

### *Roots*

All plants shall be balled and burlapped (B&B) or containerized, unless explicitly authorized by the landscape designer and/or wetland professional. Rootbound plants will be rejected. Immediately before installation, plants with minor root damage must be root-pruned. Matted or circling roots of containerized plantings must be pruned or straightened and the sides of the root ball must be roughened from top to bottom to a depth of approximately half an inch in two to four places.

### *Sizes*

Plant sizes shall be the size indicated in the plant schedule in approved plans. Larger stock may be acceptable provided that it has not been cut back to the size specified, and that the root ball is proportionate to the size of the plant. Smaller stock may be acceptable, and preferable under some circumstances, based on site-specific conditions. Measurements, caliper, branching, and balling and burlapping shall conform to the American Standard of Nursery Stock by the American Association of Nurserymen (latest edition).

### *Form*

Evergreen trees shall have single trunks and symmetrical, well-developed form. Deciduous trees shall be single trunked unless specified as multi-stem in the plant schedule. Shrubs shall have multiple stems and be well-branched.

### *Timing of Planting*

Unless otherwise approved by County staff, all planting shall occur between October 1 and March 1. Overall, the earlier the plants go into the ground during the dormant period, the more time they have to adapt to the site and extend their root systems before the water demands of spring and summer.

### *Weeding*

Existing and exotic vegetation in the enhancement areas will be hand-weeded from around all newly installed plants at the time of installation and on a routine basis throughout the monitoring period. No chemical control of vegetation on any portion of the site is recommended without prior approval from the County and wetland specialist.

### *Site conditions*

The contractor shall immediately notify the landscape designer and/or wetland professional of drainage or soil conditions likely to be detrimental to the growth or survival of plants. Planting operations shall not be conducted under the following conditions: freezing weather, when the ground is frozen, excessively wet weather, excessively windy weather, or in excessive heat.

### *Planting Pits*

Planting pits shall be circular or square with vertical sides, and shall be 6” deeper and 12” wider in diameter than the root ball of the plant. Break up the sides of the pit in compacted soils. Set plants upright in pits. Burlap shall be removed from the planting pit. Backfill shall be worked back into holes such that air pockets are removed without adversely compacting soils.

### *Fertilizer*

Slow release fertilizer may be used if pre-approved by County officials. Fertilizers shall be applied only at the base of plantings underneath the required covering of mulch (that does not make contact with stems of the plants). No soil amendment or fertilizers will be placed within planting holes.

### *Staking*

Most shrubs and many trees DO NOT require any staking. If the plant can stand alone without staking in a moderate wind, do not use a stake. If the plant needs support, then strapping or webbing should be used as low as possible on the trunk to loosely brace the tree with two stakes. Do not brace the tree tightly or too high on the trunk. If the tree is unable to sway, it will further lose the ability to support itself. Do not use wire in a rubber hose for strapping as it exerts too much pressure on the bark. As soon as supporting the plant becomes unnecessary, remove the stakes. All stakes must be removed within two (2) years of installation.

### *Plant Location*

Colored surveyors ribbon or other appropriate marking shall be attached to the installed plants to assist in locating the plants while removing the competing non-native vegetation and during monitoring activities. Flagging or ribbon shall not be tied to the plant’s leader, but to smaller branches.

### *Arrangement and Spacing*

The plants shall be arranged in a pattern with the appropriate numbers, sizes, species, and distribution that are required in accordance with the approved plans. The actual placement of individual plants shall mimic natural, asymmetric vegetation patterns found on similar undisturbed

sites in the area. Spacing of the plantings shall be adjusted to maintain existing native vegetation with the agreement of the landscape designer, wetland biologist, and/or County staff.

*Inspection(s)*

A wetland biologist shall be present on site to inspect the plants prior to planting. Minor adjustments to the original design may be required prior to and during construction.

*Mulch*

All landscaped areas denuded of vegetation and the soil surface surrounding all planting pit areas shall receive no less than 3 inches (depth) of wood chips after planting. Mulch shall be kept well away (at least 2 inches) from the trunks and stems of woody plants.

*Seeding*

Seeds must be sown at the recommended seeding rate. Seeds should generally be sown into a relatively clean and weed-free seedbed to a depth of 1/4 to 1/2 inch. Spread seed evenly across the area, and rake lightly to cover. Pack or roll area to ensure seed contact with soil. Seeding should be scheduled in early fall after the first rains have begun, or in early spring. Areas of seeding should be maintained throughout the monitoring period.

**4.4.2 Project Notes**

*Pre-Construction Meeting*

Buffer enhancement projects are typically more complex to install than described in plans. Careful monitoring by the wetland professional for applicable portions of this project are strongly recommended. Construction timing and sequencing is important to the success of this type of project. There will be a pre-construction meeting on this site between the Permittee, the wetland professional, engineer(s), equipment operator(s), and County representatives (as necessary). The objective will be to verify the location of erosion control facilities, verify the location of planting areas, and to discuss project sequencing.

*Inspections*

The wetland professional shall be contracted to periodically inspect the planting installation described in this plan. Minor adjustments to the original design may be necessary prior to and during construction due to unusual or hidden site conditions. A County representative and/or the wetland professional will make these decisions during construction.

## **4.5 PROJECT MONITORING PROGRAM**

Requirements for monitoring project:

1. Initial compliance/as-built report
2. Annual site inspection (once per year) for five years
3. Annual reports including final report (one report submitted in the fall of each monitored year)

### *Purpose for Monitoring*

The purpose for monitoring shall be to evaluate the project's success. Success will be determined if monitoring shows at the end of five years that the definitions of success stated below are being met. Access shall be granted to the planting area for inspection and maintenance to the contracted landscape and/or wetland professional and the County during the period of the bond or until the project is evaluated as successful.

### *Monitoring*

Monitoring shall be conducted annually in the fall for five years.

### *Vegetation Monitoring*

Survivorship shall be determined through a census of installed plants or through establishment and routine monitoring of sample plots or transects. The areal coverage of native and invasive species will be determined by a visual estimate at a site-wide level. Vegetation monitoring shall occur annually between May 15 and September 30 (prior to leaf drop), unless otherwise specified.

### *Photo points*

At least two permanent photo points shall be established within the planting area during as-built site visit. Photographs will be taken from these points annually, to visually record the condition of the enhancement area over time. Photos shall be taken annually between May 15 and September 30 (prior to leaf drop), unless otherwise specified.

## **4.5.1 Monitoring Reports**

### *Report Contents*

Monitoring reports shall be submitted by December 31 of each year during the monitoring period. As applicable, monitoring reports must include descriptions/data for:

- (1) Site plan and vicinity map;
- (2) Historic description of project, including date of installation, current year of monitoring, restatement of planting/restoration goals, and performance standards;
- (3) Plant survival and areal coverage estimates, and explanation of monitoring methodology in the context of assessing performance standards;
- (4) Assessment of nuisance/exotic biota and recommendations for management;
- (5) The location of color photographs taken from permanent photo-points shall be depicted on monitoring report maps.

#### **4.5.2 Project Success and Compliance**

##### *Criteria for Success*

Upon completion of the proposed planting plan, an inspection by a qualified biologist will be made to determine plan compliance. A compliance report will be supplied to Snohomish County within 30 days of the completion of planting. A wetland professional will perform condition monitoring of the plantings before September of each year for five years. A written report describing the monitoring results will be submitted to the County after each site inspection of each monitored year. Final inspection will occur five years after completion of this project. The contracted consultant will prepare a report on the success of the project.

##### *Performance Standards*

The planting areas shall meet the following performance standards:

Year 1: 100 percent survival of newly planted species;

Year 1: Less than 5 percent invasive tree/shrub cover\*\*;

Year 3: 90 percent survival of newly planted species;

Year 3: Less than 5 percent invasive tree/shrub cover\*\*;

Year 3: At least 40 percent native tree/shrub cover\*;

Year 5: Less than 5 percent invasive tree/shrub cover\*\*;

Year 5: At least 60 percent native tree/shrub cover\*.

\*Native volunteer species may be used in percent cover calculation for all years.

\*\*Maintenance shall occur immediately after any site visit that documents an increase in invasive species coverage, regardless of established thresholds.

#### **4.6 MAINTENANCE**

The planting areas will require periodic maintenance to remove undesirable species, cut back reed canarygrass, and replace vegetation mortality. Maintenance of trees and shrubs shall occur at least twice a year for the 5-year monitoring period in accordance with the approved plan. Reed canarygrass shall be cut at least four times a year for the 5-year monitoring period. Maintenance may include, but will not be limited to, removal of competing grasses, irrigation, replacement of plant mortality, and the replacement of mulch for each maintenance period. Mulch should be replenished during each maintenance visit. The contracted landscape professional or property owner is responsible for maintenance during all monitoring years.

##### *Duration and Extent*

In order to achieve aforementioned Performance Standards, the Permittee shall have the planting area maintained for the duration of the five-year monitoring period. Maintenance will include: watering, weeding around the base of installed plants, pruning, replacement, re-staking, removal of all classes of noxious weeds (see Washington State Noxious Weeds List), and any other measures needed to insure plant survival.

### *Survival*

The Permittee shall be responsible for the health of 100 percent of all newly installed plants for *one growing season* after installation has been accepted by the County. A growing season for these purposes is defined as occurring from spring to spring (March 15 to March 15 of the following year). For fall installation (often required), the growing season will begin the following spring. The Permittee shall replace any plants that are failing, weak, defective in manner of growth, or dead during this growing season, as directed by the landscape designer, wetland professional, and/or County staff.

### *Installation Timing for Replacement Plants*

Replacement plants shall be installed between October 1 and March 1, unless otherwise determined by the wetland professional and/or County staff.

### *Standards for Replacement Plants*

Replacement plants shall meet the same standards for size and type as those specified for the original installation unless otherwise directed by the landscape designer, wetland professional, and/or County staff.

### *Replanting*

Plants that have settled in their planting pits too deep, too shallow, loose, or crooked shall be replanted as directed by the wetland professional and/or County staff.

### *Mulch*

All plantings will have mulch reapplied at their bases every year of the monitoring period. Plants shall receive no less than 3 inches of wood chips every spring. Mulch shall be kept well away (at least 2 inches) from the trunks and stems of woody plants.

### *Herbicides/Pesticides*

Chemical controls shall not be used in the planting area, sensitive areas, or their buffers. However, limited use of herbicides may be approved depending on site-specific conditions, only if approved by County staff.

### *Watering*

Water should be provided during the dry season (July 1 through September 15) for at least the first year after installation to insure plant survival and establishment. Water should be applied at a rate of one inch of water once per week during Year 1.

**4.7 PERFORMANCE AND/OR MAINTENANCE ASSURANCE**

The City of Monroe may require performance and/or maintenance assurances if it is determined to be necessary. If required, the City will determine the type and amount of assurance device required. The performance or maintenance assurance device amount is typically based on the estimated cost of work. An estimate of the cost of project installation is provided below.

Cost of Plants and Labor (674 1-gal plants @ \$12/plant, installed)	\$8,088.00
Cost of Mulch (\$3.25/sq. yd.)	\$800.00
Cost of Maintenance (5 years @ \$1,000/year)	\$5,000.00
<b>TOTAL ESTIMATED COST</b>	<b>\$13,888.00</b>

**5.0 FUNCTIONS AND VALUES ASSESSMENT**

SCC 30.62A.140 requires a comparative analysis of ecological functions and values in pre- and post-development conditions. The following section demonstrates the expected benefit of the proposed mitigation plan relative to the existing condition of the site.

**5.1 ASSESSMENT METHODOLOGY**

The methodology for this functions and values assessment is based on professional opinion developed through past field analyses and interpretation. This assessment pertains specifically to on-site wetlands and buffers, but is typical for assessments of similar systems common to western Washington.

**5.2 EXISTING BUFFER CONDITIONS**

On-site buffer conditions include forested areas, historically maintained pasture areas, areas used as driveway for the existing on-site land uses. Natively forested areas are densely vegetated and perform buffer functions and values at a high level. Dense vegetation reduces hydrologic flow rates as water moves through the buffer. This, in turn, allows for pollutants within the water column to fall out of suspension or be filtered from the water as it is absorbed by plants. Additionally, dense and diverse plant life provides opportunities to wildlife for activities such as foraging, resting, nesting, shading, and hiding. By contrast, maintained and developed portions of the buffer provide little-to-no value to hydrologic, water quality, or wildlife functions. Water moves quickly through these areas and routine maintenance and usage releases toxins into the buffer. The absence of dense vegetation also restricts the opportunities for wildlife within maintained areas.

**5.3 POST-DEVELOPMENT FUNCTIONS AND VALUES**

The proposed buffer enhancement plan is expected to increase the functions and values provided by on-site buffer areas. Water quality functions will improve as development is removed from the buffer and restored with native vegetation. Hydrologic discharges from the proposed development will be treated and regulated, which will reduce the pollutants discharging to critical areas on and

near the site. The hydrologic functions provided by the buffer will be maintained or improved. Dense plantings will help regulate hydrologic flows during peak precipitation events and discharges from the development will be regulated through the stormwater control plan. Finally, the wildlife functions and values of the buffer will increase. Historically maintained and developed areas will be planted with a diverse array of native trees and shrubs. These plantings will increase species richness and structural diversity in the buffer which will in turn provide additional opportunities to wildlife that use the site.

## **6.0 WILDLIFE ASSESSMENT**

Wetlands, streams, and their associated buffers contain resources for wildlife such as food, water, thermal cover, and refuge in close proximity. Given the habitat available, the following mammalian species may use the area: Columbian black-tailed deer (*Odocoileus hemionus columbianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), shrews (*Sorex spp.*), moles (*Scapanus spp.*), skunks (*Mephitis spp.*), eastern gray squirrel (*Sciurus carolinensis*), deer mice (*Peromyscus maniculatus*), and Virginia opossum (*Didelphis virginiana*). The following avian species are expected to use the area: American Robin (*Turdus migratorius*), American Crow (*Corvus brachyrhynchos*), Stellar's Jay (*Cyanocitta stelleri*), Black-capped Chickadee (*Poecile atricapillus*), Dark-eyed Junco (*Junco hyemalis*), Spotted Towhee (*Pipilo maculatus*), Bushtit (*Psaltriparus minimus*), Northern Flicker (*Colaptes auratus*), Hairy Woodpecker (*Picoides villosus*), Downy Woodpecker (*Dendrocopus villosus*), Red-breasted Nuthatch (*Sitta canadensis*), Brown Creeper (*Certhia americana*), and Red-tailed Hawk (*Buteo jamaicensis*). Other wildlife expected to use this site include: pacific tree frog (*Hyla regilla*), northwestern salamander (*Ambystoma gracile*), and rough-skinned newt (*Taricha granulosa*). These lists are not meant to be all-inclusive and may omit species that currently utilize or could utilize the site.

## 7.0 USE OF THIS REPORT

This Critical Area Report and Mitigation Plan is supplied to South Lake Ridge, LLC, as a means of identifying on-site and nearby critical areas and demonstrating that the proposed mitigation plan is compliant with Snohomish County Code. This report is based largely on readily observable conditions and, to a lesser extent, on readily ascertainable conditions. No attempt has been made to determine hidden or concealed conditions.

The laws applicable to critical areas are subject to varying interpretations and may be changed at any time by the courts or legislative bodies. This report is intended to provide information deemed relevant in the applicant's attempt to comply with the laws now in effect.

This report conforms to the standard of care employed by wetland ecologists. No other representation or warranty is made concerning the work or this report and any implied representation or warranty is disclaimed.

*Wetland Resources, Inc.*

A handwritten signature in black ink, appearing to read 'Eamonn Collins', written over a light blue circular stamp.

Eamonn Collins, PWS  
*Senior Ecologist*

## 8.0 REFERENCES

- Brinson, M.M. 1993. *A Hydrogeomorphic Classification for Wetlands*. Technical Report WRPDE-4. US Army Engineers Waterways Experiment Station, Vicksburg, MS.
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**APPENDIX A:**  
**CORPS WETLAND DETERMINATION DATA FORMS**

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

Project/Site: 24231 - Monroe 30 City/County: Snohomish County Sampling Date: 8/14/23  
 Applicant/Owner: South Lake Ridge, LLC State: WA Sampling Point: S1  
 Investigator(s): EC Section, Township, Range: S26, T28N, R6E, W.M.  
 Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): <2%  
 Subregion (LRR): LRR-A Lat: 47.883651 Long: -121.996604 Datum: NAD83  
 Soil Map Unit Name: Tokul gravelly medial loam (8 to 15 percent slopes) NWI classification: R4SBC

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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Climate in preceding months was drier than normal per WETS table. Data taken in Wetland A near WRA3.	

## VEGETATION – Use scientific names of plants.

Stratum	Plot size	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: 5m radius)					
1. <u>Thuja plicata</u>		10	Y	FAC	
2. <u>Pseudotsuga menziesii*</u>		35	N	FACU	
3. _____					
4. _____					
		45	= Total Cover		
<b>Sapling/Shrub Stratum</b> (Plot size: 3m radius)					
1. <u>Rubus armeniacus</u>		40	Y	FAC	
2. <u>Rubus spectabilis</u>		5	Y	FAC	
3. _____					
4. _____					
5. _____					
		45	= Total Cover		
<b>Herb Stratum</b> (Plot size: 1m radius)					
1. <u>Ranunculus repens</u>		70	Y	FAC	
2. <u>Tolmiea menziesii</u>		35	Y	FAC	
3. <u>Athyrium filix-femina</u>		5	N	FAC	
4. _____					
5. _____					
6. _____					
7. _____					
8. _____					
9. _____					
10. _____					
11. _____					
		110	= Total Cover		
<b>Woody Vine Stratum</b> (Plot size: 3m <sup>2</sup> )					
1. _____					
2. _____					
		0	= Total Cover		
<b>% Bare Ground in Herb Stratum</b> <u>0</u>					

**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 = 0  
 FACW species \_\_\_\_\_ x 2 = 0  
 FAC species \_\_\_\_\_ x 3 = 0  
 FACU species \_\_\_\_\_ x 4 = 0  
 UPL species \_\_\_\_\_ x 5 = 0  
 Column Totals: 0 (A) 0 (B)  
 Prevalence Index = B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Rapid Test for Hydrophytic Vegetation  
 Dominance Test is >50%  
 Prevalence Index is ≤3.0<sup>1</sup>  
 Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)  
 Wetland Non-Vascular Plants<sup>1</sup>  
 Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)  
<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 \*Pseudotsuga menziesii rooted outside of wetland

**SOIL**

Sampling Point: S1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Loc <sup>2</sup>	Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			
0-4	10YR 3/2	100					Sandy Loam	
4-16	10YR 2/2	92	10YR 3/6	8	C	M	Sandy Loam	

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)	Indicators for Problematic Hydric Soils <sup>3</sup> :
<input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) <input type="checkbox"/> Loamy Mucky Mineral (F1) (except MLRA 1) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input checked="" type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)
	<input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Red Parent Material (TF2) <input type="checkbox"/> Very Shallow Dark Surface (TF12) <input type="checkbox"/> Other (Explain in Remarks)
	<sup>3</sup> Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if present):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:	

**HYDROLOGY**

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one required; check all that apply)	Secondary Indicators (2 or more required)
<input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B) <input type="checkbox"/> Salt Crust (B11) <input type="checkbox"/> Aquatic Invertebrates (B13) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Stunted or Stressed Plants (D1) (LRR A) <input type="checkbox"/> Other (Explain in Remarks)
	<input type="checkbox"/> Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) <input checked="" type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input checked="" type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> FAC-Neutral Test (D5) <input type="checkbox"/> Raised Ant Mounds (D6) (LRR A) <input type="checkbox"/> Frost-Heave Hummocks (D7)
<b>Field Observations:</b> Surface Water Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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: 24231 - Monroe 30 City/County: Snohomish County Sampling Date: 8/14/23  
 Applicant/Owner: South Lake Ridge, LLC State: WA Sampling Point: S2  
 Investigator(s): EC Section, Township, Range: S26, T28N, R6E, W.M.  
 Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): <2%  
 Subregion (LRR): LRR-A Lat: 47.883651 Long: -121.996604 Datum: NAD83  
 Soil Map Unit Name: Tokul gravelly medial loam (8 to 15 percent slopes) NWI classification: R4SBC

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 <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Climate in preceding months was drier than normal per WETS table. Data taken outside of Wetland A near WRA3.	

**VEGETATION – Use scientific names of plants.**

Stratum	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: 5m radius)				
1. <u>Pseudotsuga menziesii</u>	<u>25</u>	<u>Y</u>	<u>FACU</u>	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>6</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B)
2. <u>Thuja plicata</u>	<u>10</u>	<u>Y</u>	<u>FAC</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: OBL species _____ x 1 = <u>0</u> FACW species _____ x 2 = <u>0</u> FAC species _____ x 3 = <u>0</u> FACU species _____ x 4 = <u>0</u> UPL species _____ x 5 = <u>0</u> Column Totals: <u>0</u> (A) <u>0</u> (B)  Prevalence Index = B/A = _____
Sapling/Shrub Stratum (Plot size: 3m radius)				
1. <u>Rubus armeniacus</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Wetland Non-Vascular Plants <sup>1</sup> <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain) <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. <u>Oemleria cerasiformis</u>	<u>30</u>	<u>Y</u>	<u>FACU</u>	
3. <u>Rubus spectabilis</u>	<u>10</u>	<u>N</u>	<u>FAC</u>	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
Herb Stratum (Plot size: 1m radius)				
1. <u>Rubus ursinus</u>	<u>40</u>	<u>Y</u>	<u>FACU</u>	
2. <u>Ranunculus repens</u>	<u>15</u>	<u>Y</u>	<u>FAC</u>	
3. <u>Agrostis sp.*</u>	<u>5</u>	<u>N</u>	<u>FAC</u>	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
Woody Vine Stratum (Plot size: 3m <sup>2</sup> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
% Bare Ground in Herb Stratum <u>40</u>				
0 = Total Cover				

Remarks:  
 \*unidentified grass conservatively assumed to be FAC

**SOIL**

Sampling Point: S2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Loc <sup>2</sup>	Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			
0-2	10YR 2/2	100					Sandy Loam	
2-16	10YR 3/3	100					Sandy Loam	

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)	Indicators for Problematic Hydric Soils <sup>3</sup> :
<input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) <input type="checkbox"/> Loamy Mucky Mineral (F1) (except MLRA 1) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)
	<input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Red Parent Material (TF2) <input type="checkbox"/> Very Shallow Dark Surface (TF12) <input type="checkbox"/> Other (Explain in Remarks)
	<sup>3</sup> Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if present):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks:	

**HYDROLOGY**

Wetland Hydrology Indicators:	
Primary Indicators (minimum of one required; check all that apply)	Secondary Indicators (2 or more required)
<input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B) <input type="checkbox"/> Salt Crust (B11) <input type="checkbox"/> Aquatic Invertebrates (B13) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Stunted or Stressed Plants (D1) (LRR A) <input type="checkbox"/> Other (Explain in Remarks)
	<input type="checkbox"/> Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> FAC-Neutral Test (D5) <input type="checkbox"/> Raised Ant Mounds (D6) (LRR A) <input type="checkbox"/> Frost-Heave Hummocks (D7)
<b>Field Observations:</b> Surface Water Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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: 24231 - Monroe 30 City/County: Monroe/Snohomish Sampling Date: 7/13/2023  
 Applicant/Owner: South Lake Ridge, LLC State: WA Sampling Point: S3  
 Investigator(s): EC Section, Township, Range: S26 T28 R06E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 8 - 15  
 Subregion (LRR): A Lat: 47.882637 Long: -121.99426 Datum: WGS84  
 Soil Map Unit Name: Tokul gravelly medial loam, 8 to 15 percent slopes NWI classification: None

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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data taken in forested area near southern property boundary in the center of the site.	

## VEGETATION – Use scientific names of plants.

Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Notes
<b>Tree Stratum</b> (Plot size: 5 sm)				
1. <u>Thuja plicata</u>	65	Y	FAC	
2. <u>Tsuga heterophylla</u>	15	N	FACU	
3. <u>Frangula purshiana</u>	5	N	FAC	
4. _____				
85 = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: 3 sm)				
1. <u>Rubus spectabilis</u>	20	Y	FAC	
2. <u>Rubus armeniacus</u>	10	Y	FAC	
3. <u>Gaultheria shallon</u>	10	Y	FACU	
4. <u>Acer circinatum</u>	5	N	FAC	
5. _____				
45 = Total Cover				
<b>Herb Stratum</b> (Plot size: 1 sm)				
1. <u>Ranunculus repens</u>	40	Y	FAC	
2. <u>Dicentra formosa</u>	10	Y	FACU	
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
50 = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: _____)				
1. _____				
2. _____				
_____ = Total Cover				
<b>% Bare Ground in Herb Stratum</b> <u>50</u>				

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)  
 Total Number of Dominant Species Across All Strata: 6 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by:  
 OBL species \_\_\_\_\_ x 1 = 0  
 FACW species \_\_\_\_\_ x 2 = 0  
 FAC species \_\_\_\_\_ x 3 = 0  
 FACU species \_\_\_\_\_ x 4 = 0  
 UPL species \_\_\_\_\_ x 5 = 0  
 Column Totals: 0 (A) 0 (B)  
 Prevalence Index = B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Rapid Test for Hydrophytic Vegetation  
 Dominance Test is >50%  
 Prevalence Index is ≤3.0<sup>1</sup>  
 Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)  
 Wetland Non-Vascular Plants<sup>1</sup>  
 Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)  
<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes  No

Remarks:





**SOIL**

Sampling Point: S4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Loc <sup>2</sup>	Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			
0 - 8	10YR 3/3	100					SaLo	
8-18	10YR 3/6	100					SaLo	

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

<b>Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)</b> <input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> Sandy Gleyed Matrix (S4)	<b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b> <input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Red Parent Material (TF2) <input type="checkbox"/> Very Shallow Dark Surface (TF12) <input type="checkbox"/> Other (Explain in Remarks)
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<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if present):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Remarks:

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b>	
Primary Indicators (minimum of one required; check all that apply) <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	Secondary Indicators (2 or more required) <input type="checkbox"/> Water-Stained Leaves (B9) ( <b>except MLRA 1, 2, 4A, and 4B</b> ) <input type="checkbox"/> Salt Crust (B11) <input type="checkbox"/> Aquatic Invertebrates (B13) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Stunted or Stressed Plants (D1) ( <b>LRR A</b> ) <input type="checkbox"/> Other (Explain in Remarks)
<b>Field Observations:</b> Surface Water Present?    Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Water Table Present?    Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Saturation Present?    Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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: 24231 - Monroe 30 City/County: Monroe/Snohomish Sampling Date: 7/13/2023  
 Applicant/Owner: South Lake Ridge, LLC State: WA Sampling Point: S5  
 Investigator(s): EC Section, Township, Range: S26 T28 R06E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 8 - 15  
 Subregion (LRR): A Lat: 47.88262 Long: -121.99233 Datum: WGS84  
 Soil Map Unit Name: Tokul gravelly medial loam, 8 to 15 percent slopes NWI classification: None

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 <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data taken in southeast portion of the site.	

## VEGETATION – Use scientific names of plants.

Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
<u>Tree Stratum</u> (Plot size: <u>5 sm</u> )				Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A)
1. <u>Acer macrophyllum</u>	<u>15</u>	<u>Y</u>	<u>FACU</u>	Total Number of Dominant Species Across All Strata: <u>5</u> (B)
2. <u>Prunus emarinata</u>	<u>10</u>	<u>Y</u>	<u>FACU</u>	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>40</u> (A/B)
3. <u>Alnus rubra</u>	<u>Trace</u>	<u>N</u>	<u>FAC</u>	
4. <u>Betula papyrifera</u>	<u>Trace</u>	<u>N</u>	<u>FAC</u>	
	<u>25</u>	= Total Cover		
<u>Sapling/Shrub Stratum</u> (Plot size: <u>3 sm</u> )				<b>Prevalence Index worksheet:</b>
1. <u>Rubus armeniacus</u>	<u>65</u>	<u>Y</u>	<u>FAC</u>	Total % Cover of: _____ Multiply by:
2. <u>Rubus spectabilis</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	OBL species _____ x 1 = <u>0</u>
3. <u>Spiraea douglasii</u>	<u>20</u>	<u>N</u>	<u>FACW</u>	FACW species _____ x 2 = <u>0</u>
4. <u>Prunus emarginata</u>	<u>20</u>	<u>N</u>	<u>FACU</u>	FAC species _____ x 3 = <u>0</u>
5. <u>Rubus parviflorus</u>	<u>5</u>	<u>N</u>	<u>FACU</u>	FACU species _____ x 4 = <u>0</u>
	<u>140</u>	= Total Cover		UPL species _____ x 5 = <u>0</u>
<u>Herb Stratum</u> (Plot size: <u>1 sm</u> )				Column Totals: <u>0</u> (A) <u>0</u> (B)
1. <u>Vaccinium parvifolium</u>	<u>Trace</u>	<u>N</u>	<u>FACU</u>	Prevalence Index = B/A = _____
2. _____				<b>Hydrophytic Vegetation Indicators:</b>
3. <u>BEGIN HERB STRATUM</u>				<input type="checkbox"/> Rapid Test for Hydrophytic Vegetation
4. <u>Rubus ursinus</u>	<u>60</u>	<u>Y</u>	<u>FACU</u>	<input type="checkbox"/> Dominance Test is >50%
5. <u>Polystichum munitum</u>	<u>10</u>	<u>N</u>	<u>FACU</u>	<input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup>
6. _____				<input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)
7. _____				<input type="checkbox"/> Wetland Non-Vascular Plants <sup>1</sup>
8. _____				<input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
9. _____				<sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
10. _____				
11. _____				
	<u>70</u>	= Total Cover		<b>Hydrophytic Vegetation Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<u>Woody Vine Stratum</u> (Plot size: _____)				
1. _____				
2. _____				
		= Total Cover		
% Bare Ground in Herb Stratum <u>30</u>				
Remarks:				

**SOIL**

Sampling Point: S5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Loc <sup>2</sup>	Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			
0-4	10YR 3/4	100					SaLo	
4-14	7.5YR 4/6	100					SaLo	

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)	Indicators for Problematic Hydric Soils <sup>3</sup> :
<input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) <input type="checkbox"/> Loamy Mucky Mineral (F1) (except MLRA 1) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)
	<input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Red Parent Material (TF2) <input type="checkbox"/> Very Shallow Dark Surface (TF12) <input type="checkbox"/> Other (Explain in Remarks)
	<sup>3</sup> Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if present):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks:	

**HYDROLOGY**

Wetland Hydrology Indicators:		
Primary Indicators (minimum of one required; check all that apply)	Secondary Indicators (2 or more required)	
<input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B) <input type="checkbox"/> Salt Crust (B11) <input type="checkbox"/> Aquatic Invertebrates (B13) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Stunted or Stressed Plants (D1) (LRR A) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> FAC-Neutral Test (D5) <input type="checkbox"/> Raised Ant Mounds (D6) (LRR A) <input type="checkbox"/> Frost-Heave Hummocks (D7)
<b>Field Observations:</b> Surface Water Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present?    Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)		<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks:		



**SOIL**

Sampling Point: S6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Loc <sup>2</sup>	Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			
0-3	10YR 3/3	100					SaLo	
3-16	7.5YR 4/6	100					SaLo	

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

<p><b>Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)</b></p> <table style="width:100%;"> <tr> <td><input type="checkbox"/> Histosol (A1)</td> <td><input type="checkbox"/> Sandy Redox (S5)</td> </tr> <tr> <td><input type="checkbox"/> Histic Epipedon (A2)</td> <td><input type="checkbox"/> Stripped Matrix (S6)</td> </tr> <tr> <td><input type="checkbox"/> Black Histic (A3)</td> <td><input type="checkbox"/> Loamy Mucky Mineral (F1) (<b>except MLRA 1</b>)</td> </tr> <tr> <td><input type="checkbox"/> Hydrogen Sulfide (A4)</td> <td><input type="checkbox"/> Loamy Gleyed Matrix (F2)</td> </tr> <tr> <td><input type="checkbox"/> Depleted Below Dark Surface (A11)</td> <td><input type="checkbox"/> Depleted Matrix (F3)</td> </tr> <tr> <td><input type="checkbox"/> Thick Dark Surface (A12)</td> <td><input type="checkbox"/> Redox Dark Surface (F6)</td> </tr> <tr> <td><input type="checkbox"/> Sandy Mucky Mineral (S1)</td> <td><input type="checkbox"/> Depleted Dark Surface (F7)</td> </tr> <tr> <td><input type="checkbox"/> Sandy Gleyed Matrix (S4)</td> <td><input type="checkbox"/> Redox Depressions (F8)</td> </tr> </table>	<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Loamy Mucky Mineral (F1) ( <b>except MLRA 1</b> )	<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Depleted Dark Surface (F7)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Redox Depressions (F8)	<p><b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b></p> <table style="width:100%;"> <tr> <td><input type="checkbox"/> 2 cm Muck (A10)</td> </tr> <tr> <td><input type="checkbox"/> Red Parent Material (TF2)</td> </tr> <tr> <td><input type="checkbox"/> Very Shallow Dark Surface (TF12)</td> </tr> <tr> <td><input type="checkbox"/> Other (Explain in Remarks)</td> </tr> </table> <p><sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.</p>	<input type="checkbox"/> 2 cm Muck (A10)	<input type="checkbox"/> Red Parent Material (TF2)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Redox (S5)																				
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Stripped Matrix (S6)																				
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Loamy Mucky Mineral (F1) ( <b>except MLRA 1</b> )																				
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)																				
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<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Depleted Dark Surface (F7)																				
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Redox Depressions (F8)																				
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<input type="checkbox"/> Red Parent Material (TF2)																					
<input type="checkbox"/> Very Shallow Dark Surface (TF12)																					
<input type="checkbox"/> Other (Explain in Remarks)																					

<p><b>Restrictive Layer (if present):</b></p> <p>Type: _____</p> <p>Depth (inches): _____</p>	<p><b>Hydric Soil Present?</b>    Yes <input type="checkbox"/>    No <input checked="" type="checkbox"/></p>
<p>Remarks:</p>	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b>																																
<p>Primary Indicators (minimum of one required; check all that apply)</p> <table style="width:100%;"> <tr> <td><input type="checkbox"/> Surface Water (A1)</td> <td><input type="checkbox"/> Water-Stained Leaves (B9) (<b>except MLRA 1, 2, 4A, and 4B</b>)</td> </tr> <tr> <td><input type="checkbox"/> High Water Table (A2)</td> <td><input type="checkbox"/> Salt Crust (B11)</td> </tr> <tr> <td><input type="checkbox"/> Saturation (A3)</td> <td><input type="checkbox"/> Aquatic Invertebrates (B13)</td> </tr> <tr> <td><input type="checkbox"/> Water Marks (B1)</td> <td><input type="checkbox"/> Hydrogen Sulfide Odor (C1)</td> </tr> <tr> <td><input type="checkbox"/> Sediment Deposits (B2)</td> <td><input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)</td> </tr> <tr> <td><input type="checkbox"/> Drift Deposits (B3)</td> <td><input type="checkbox"/> Presence of Reduced Iron (C4)</td> </tr> <tr> <td><input type="checkbox"/> Algal Mat or Crust (B4)</td> <td><input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)</td> </tr> <tr> <td><input type="checkbox"/> Iron Deposits (B5)</td> <td><input type="checkbox"/> Stunted or Stressed Plants (D1) (<b>LRR A</b>)</td> </tr> <tr> <td><input type="checkbox"/> Surface Soil Cracks (B6)</td> <td><input type="checkbox"/> Other (Explain in Remarks)</td> </tr> <tr> <td><input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)</td> <td></td> </tr> <tr> <td><input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)</td> <td></td> </tr> </table>	<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Water-Stained Leaves (B9) ( <b>except MLRA 1, 2, 4A, and 4B</b> )	<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Salt Crust (B11)	<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)	<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Iron Deposits (B5)	<input type="checkbox"/> Stunted or Stressed Plants (D1) ( <b>LRR A</b> )	<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)		<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)		<p>Secondary Indicators (2 or more required)</p> <table style="width:100%;"> <tr> <td><input type="checkbox"/> Water-Stained Leaves (B9) (<b>MLRA 1, 2, 4A, and 4B</b>)</td> </tr> <tr> <td><input type="checkbox"/> Drainage Patterns (B10)</td> </tr> <tr> <td><input type="checkbox"/> Dry-Season Water Table (C2)</td> </tr> <tr> <td><input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)</td> </tr> <tr> <td><input type="checkbox"/> Geomorphic Position (D2)</td> </tr> <tr> <td><input type="checkbox"/> Shallow Aquitard (D3)</td> </tr> <tr> <td><input type="checkbox"/> FAC-Neutral Test (D5)</td> </tr> <tr> <td><input type="checkbox"/> Raised Ant Mounds (D6) (<b>LRR A</b>)</td> </tr> <tr> <td><input type="checkbox"/> Frost-Heave Hummocks (D7)</td> </tr> </table>	<input type="checkbox"/> Water-Stained Leaves (B9) ( <b>MLRA 1, 2, 4A, and 4B</b> )	<input type="checkbox"/> Drainage Patterns (B10)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)	<input type="checkbox"/> Geomorphic Position (D2)	<input type="checkbox"/> Shallow Aquitard (D3)	<input type="checkbox"/> FAC-Neutral Test (D5)	<input type="checkbox"/> Raised Ant Mounds (D6) ( <b>LRR A</b> )	<input type="checkbox"/> Frost-Heave Hummocks (D7)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Water-Stained Leaves (B9) ( <b>except MLRA 1, 2, 4A, and 4B</b> )																															
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Salt Crust (B11)																															
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Invertebrates (B13)																															
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)																															
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)																															
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Presence of Reduced Iron (C4)																															
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)																															
<input type="checkbox"/> Iron Deposits (B5)	<input type="checkbox"/> Stunted or Stressed Plants (D1) ( <b>LRR A</b> )																															
<input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Other (Explain in Remarks)																															
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)																																
<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)																																
<input type="checkbox"/> Water-Stained Leaves (B9) ( <b>MLRA 1, 2, 4A, and 4B</b> )																																
<input type="checkbox"/> Drainage Patterns (B10)																																
<input type="checkbox"/> Dry-Season Water Table (C2)																																
<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)																																
<input type="checkbox"/> Geomorphic Position (D2)																																
<input type="checkbox"/> Shallow Aquitard (D3)																																
<input type="checkbox"/> FAC-Neutral Test (D5)																																
<input type="checkbox"/> Raised Ant Mounds (D6) ( <b>LRR A</b> )																																
<input type="checkbox"/> Frost-Heave Hummocks (D7)																																
<p><b>Field Observations:</b></p> <p>Surface Water Present?    Yes <input type="checkbox"/>    No <input checked="" type="checkbox"/>    Depth (inches): _____</p> <p>Water Table Present?    Yes <input type="checkbox"/>    No <input checked="" type="checkbox"/>    Depth (inches): _____</p> <p>Saturation Present?    Yes <input type="checkbox"/>    No <input checked="" type="checkbox"/>    Depth (inches): _____  <small>(includes capillary fringe)</small></p>	<p><b>Wetland Hydrology Present?</b>    Yes <input type="checkbox"/>    No <input checked="" type="checkbox"/></p>																															
<p>Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:</p>																																
<p>Remarks:</p>																																

**APPENDIX B:**  
**DEPARTMENT OF ECOLOGY**  
**WETLAND RATING FORMS AND FIGURES**

Wetland name or number A

# RATING SUMMARY – Western Washington

Name of wetland (or ID #): 23163 - Wetland A Date of site visit: 8/14/2023

Rated by EC Trained by Ecology?  Yes  No Date of training 10/18

HGM Class used for rating DEPRESSIONAL Wetland has multiple HGM classes?  Y  N

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

Source of base aerial photo/map Snohomish County GIS

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

## 1. Category of wetland based on FUNCTIONS

         Category I – Total score = 23 - 27

         Category II – Total score = 20 - 22

Category III – Total score = 16 - 19

         Category IV – Total score = 9 - 15

FUNCTION	Improving Water Quality			Hydrologic			Habitat			
<i>Circle the appropriate ratings</i>										
Site Potential	H	M	<input type="checkbox"/> L	H	M	<input type="checkbox"/> L	H	M	<input type="checkbox"/> L	
Landscape Potential	<input type="checkbox"/> H	M	L	H	<input type="checkbox"/> M	L	H	<input type="checkbox"/> M	L	
Value	<input type="checkbox"/> H	M	L	H	<input type="checkbox"/> M	L	<input type="checkbox"/> H	M	L	
<b>Score Based on Ratings</b>	<b>7</b>			<b>5</b>			<b>6</b>			<b>18</b>

**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	<input checked="" type="checkbox"/>

Wetland name or number A

## Maps and figures required to answer questions correctly for Western Washington

### Depressional Wetlands

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

### Riverine Wetlands

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

### Lake Fringe Wetlands

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

### Slope Wetlands

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

## HGM Classification of Wetlands in Western Washington

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

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

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

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

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

**NO – Saltwater Tidal Fringe (Estuarine)**

**YES – Freshwater Tidal Fringe**

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

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

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

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

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

- \_ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size,
- \_ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

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

- \_ The wetland is on a slope (slope can be very gradual),
- \_ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheet flow, or in a swale without distinct banks,
- \_ The water leaves the wetland **without being impounded**.

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

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

Wetland name or number A

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

- The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
- The overbank flooding occurs at least once every 2 years.

**NO – go to 6**

**YES – The wetland class is Riverine**

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

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

NO – go to 7

**YES – The wetland class is Depressional**

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

NO – go to 8

**YES – The wetland class is Depressional**

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

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

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

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

Wetland name or number A

### DEPRESSIONAL AND FLATS WETLANDS

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

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

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

<b>D 2.0. Does the landscape have the potential to support the water quality function of the site?</b>		
<b>D 2.1. Does the wetland unit receive stormwater discharges?</b> <input checked="" type="checkbox"/> Yes = 1 No = 0 <input type="checkbox"/>	<b>1</b>	
<b>D 2.2. Is &gt; 10% of the area within 150 ft of the wetland in land uses that generate pollutants?</b> <input checked="" type="checkbox"/> Yes = 1 No = 0 <input type="checkbox"/>	<b>1</b>	
<b>D 2.3. Are there septic systems within 250 ft of the wetland?</b> <input checked="" type="checkbox"/> Yes = 1 No = 0 <input type="checkbox"/>	<b>1</b>	
<b>D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3?</b> Source _____ <input type="checkbox"/> Yes = 1 <input type="checkbox"/> No = 0 <input checked="" type="checkbox"/>		<b>0</b>
<b>Total for D 2</b> <span style="float: right;">Add the points in the boxes above</span>		<b>3</b>

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

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

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

Wetland name or number A

**DEPRESSIONAL AND FLATS WETLANDS**  
**Hydrologic Functions** - Indicators that the site functions to reduce flooding and stream degradation

<b>D 4.0. Does the site have the potential to reduce flooding and erosion?</b>		
<b>D 4.1. Characteristics of surface water outflows from the wetland:</b> <input type="checkbox"/> Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 <input checked="" type="checkbox"/> Wetland has an intermittently flowing stream/ditch, OR highly constricted permanently flowing outlet points = 2 <input type="checkbox"/> Wetland is a flat depression (question 7 on key), whose outlet is a permanently flowing ditch points = 1 <input type="checkbox"/> Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	<b>2</b>	
<b>D 4.2. Depth of storage during wet periods:</b> Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part. <input type="checkbox"/> Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 <input type="checkbox"/> Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 <input checked="" type="checkbox"/> Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 <input type="checkbox"/> The wetland is a "headwater" wetland points = 3 <input type="checkbox"/> Wetland is flat but has small depressions on the surface that trap water points = 1 <input type="checkbox"/> Marks of ponding less than 0.5 ft (6 in) points = 0	<b>3</b>	
<b>D 4.3. Contribution of the wetland to storage in the watershed:</b> Estimate the ratio of the area of upstream basin contributing surface water to the area of the wetland unit itself. <input type="checkbox"/> The area of the basin is less than 10 times the area of the unit points = 5 <input type="checkbox"/> The area of the basin is 10 to 100 times the area of the unit points = 3 <input checked="" type="checkbox"/> The area of the basin is more than 100 times the area of the unit points = 0 <input type="checkbox"/> Entire wetland is in the Flats class points = 5	<b>0</b>	
<b>Total for D 4</b>		<b>5</b> Add the points in the boxes above

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

<b>D 5.0. Does the landscape have the potential to support hydrologic functions of the site?</b>		
<b>D 5.1. Does the wetland receive stormwater discharges?</b>	<input checked="" type="checkbox"/> Yes = 1 No = 0 <input type="checkbox"/>	<b>1</b>
<b>D 5.2. Is &gt;10% of the area within 150 ft of the wetland in land uses that generate excess runoff?</b>	<input checked="" type="checkbox"/> Yes = 1 No = 0 <input type="checkbox"/>	<b>1</b>
<b>D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at &gt;1 residence/ac, urban, commercial, agriculture, etc.)?</b>	<input type="checkbox"/> Yes = 1 <input checked="" type="checkbox"/> No = 0 <input type="checkbox"/>	<b>0</b>
<b>Total for D 5</b>		<b>2</b> Add the points in the boxes above

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

<b>D 6.0. Are the hydrologic functions provided by the site valuable to society?</b>		
<b>D 6.1. Is the unit in a landscape that has flooding problems?</b> Choose the description that best matches conditions around the wetland unit being rated. Do not add points. <u>Choose the highest score if more than one condition is met.</u> The wetland captures surface water that would otherwise flow downgradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): <input type="checkbox"/> • Flooding occurs in a sub-basin that is immediately downgradient of unit. points = 2 <input checked="" type="checkbox"/> • Surface flooding problems are in a sub-basin farther downgradient. points = 1 <input type="checkbox"/> • Flooding from groundwater is an issue in the sub-basin. points = 1 <input type="checkbox"/> • The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. <i>Explain why</i> _____ points = 0 <input type="checkbox"/> • There are no problems with flooding downstream of the wetland. points = 0	<b>1</b>	
<b>D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?</b>	<input type="checkbox"/> Yes = 2 <input checked="" type="checkbox"/> No = 0 <input type="checkbox"/>	<b>0</b>
<b>Total for D 6</b>		<b>1</b> Add the points in the boxes above

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

Wetland name or number A

**These questions apply to wetlands of all HGM classes.**

**HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat

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

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

- Aquatic bed  4 structures or more: points = 4
  - Emergent  3 structures: points = 2
  - Scrub-shrub (areas where shrubs have > 30% cover)  2 structures: points = 1
  - Forested (areas where trees have > 30% cover)  1 structure: points = 0
- If the unit has a Forested class, check if:*
- The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/groundcover) that each cover 20% within the Forested polygon

**1**

H 1.2. Hydroperiods

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

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

**1**

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft<sup>2</sup>.

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

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

**1**

H 1.4. Interspersion of habitats

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



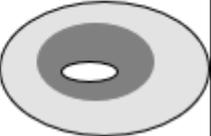
**None = 0 points**



**Low = 1 point**

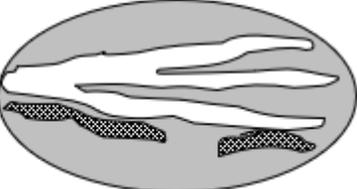


**Moderate = 2 points**



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





**1**

Wetland name or number A

<p>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.  <input type="checkbox"/> Large, downed, woody debris within the wetland (&gt; 4 in. diameter and 6 ft long).  <input type="checkbox"/> Standing snags (dbh &gt; 4 in.) within the wetland  <input type="checkbox"/> Undercut banks are present for at least 6.6 ft (2 m) <b>and/or</b> overhanging plants extend at least 3.3 ft (1 m) over open water or a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)  <input type="checkbox"/> Stable steep banks of fine material that might be used by beaver or muskrat for denning (&gt; 30 degree slope) OR signs of recent beaver activity are present (cut shrubs or trees that have not yet weathered where wood is exposed)  <input type="checkbox"/> 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)  <input type="checkbox"/> Invasive plants cover less than 25% of the wetland area in every stratum of plants (see H 1.1 above for the list of strata and H 1.5 in the manual for the list of aggressive plant species)</p>		<b>0</b>
Total for H 1	Add the points in the boxes above	<b>4</b>

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

H 2.0. Does the landscape have the potential to support the habitat functions of the site?		
<p>H 2.1. Accessible habitat (include only habitat polygons accessible from the wetland).  <i>Calculate:</i> % relatively undisturbed habitat <u>2</u> + [(% moderate and low intensity land uses)/2] <u>2</u> = <u>4</u> %            Total accessible habitat is:  <input type="checkbox"/> &gt; 1/3 (33.3%) of 1 km Polygon points = 3  <input type="checkbox"/> 20-33% of 1 km Polygon points = 2  <input type="checkbox"/> 10-19% of 1 km Polygon points = 1  <input checked="" type="checkbox"/> &lt; 10% of 1 km Polygon points = 0</p>		<b>0</b>
<p>H 2.2. Total habitat in 1 km Polygon around the wetland.  <i>Calculate:</i> % relatively undisturbed habitat <u>30</u> + [(% moderate and low intensity land uses)/2] <u>15</u> = <u>45</u> %  <input type="checkbox"/> Total habitat &gt; 50% of Polygon points = 3  <input type="checkbox"/> Total habitat 10-50% and in 1-3 patches points = 2  <input checked="" type="checkbox"/> Total habitat 10-50% and &gt; 3 patches points = 1  <input type="checkbox"/> Total habitat &lt; 10% of 1 km Polygon points = 0</p>		<b>1</b>
<p>H 2.3. Land use intensity in 1 km Polygon:  <input type="checkbox"/> &gt; 50% of 1 km Polygon is high intensity land use points = (- 2)  <input checked="" type="checkbox"/> ≤ 50% of 1 km Polygon is high intensity points = 0</p>		<b>0</b>
Total for H 2	Add the points in the boxes above	<b>1</b>

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

H 3.0. Is the habitat provided by the site valuable to society?		
<p>H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? <i>Choose only the highest score that applies to the wetland being rated.</i>            Site meets ANY of the following criteria: points = 2  <input checked="" type="checkbox"/> It has 3 or more Priority Habitats within 100 m (see next page)  <input type="checkbox"/> It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)  <input type="checkbox"/> It is mapped as a location for an individual WDFW Priority Species  <input type="checkbox"/> It is a Wetland of High Conservation Value as determined by the Department of Natural Resources data  <input type="checkbox"/> 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  <input type="checkbox"/> Site has 1 or 2 Priority Habitats (listed on next page) within 100 m points = 1  <input type="checkbox"/> Site does not meet any of the criteria above points = 0</p>		<b>2</b>

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

## WDFW Priority Habitats

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

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

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

- Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).
- Biodiversity Areas and Corridors:** Areas of habitat that are relatively important to various species of native fish and wildlife. This habitat automatically counts if mapped on the PHS online map within 100m of the wetland. If not mapped, a determination can be made in the field.
- Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.
- Fresh Deepwater:** Lands permanently flooded with freshwater, including environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live. Substrate does not support emergent vegetation. Do not select if Instream habitat is also present, or if the entire Deepwater feature is included in the wetland unit being rated (such as a pond with a vegetated fringe).
- Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.
- Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. Do not select if Fresh Deepwater habitat is also present.
- Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore.
- Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in. (81 cm) diameter at breast height (dbh) or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in. (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

Wetland name or number A

- Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important. For single oaks or oak stands <0.4 ha in urban areas, [WDFW's Management Recommendations for Oregon White Oak](#)<sup>134</sup> provides more detail for determining if they are Priority Habitats
- Riparian:** The area adjacent to freshwater aquatic systems with flowing or standing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in. (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in. (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.
- Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie.

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<sup>134</sup> <https://wdfw.wa.gov/publications/00030/wdfw00030.pdf>  
Wetland Rating System for Western WA: 2014 Update  
Rating Form – Version 2, July 2023

## CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

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

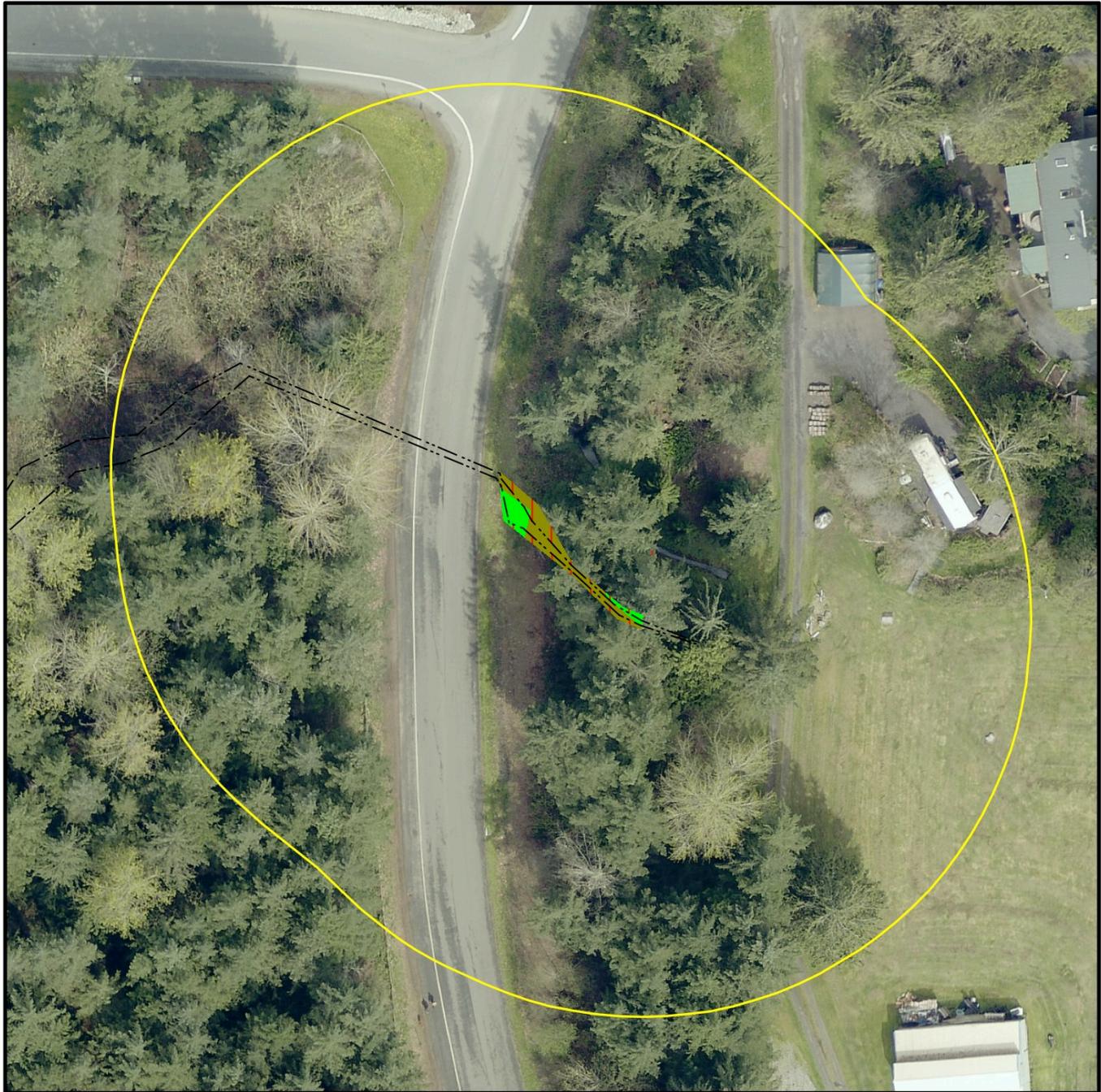
<sup>135</sup> <https://www.dnr.wa.gov/NHPdata>

<sup>136</sup> [https://www.dnr.wa.gov/Publications/amp\\_nh\\_sighting\\_form.pdf](https://www.dnr.wa.gov/Publications/amp_nh_sighting_form.pdf)

Wetland name or number   A  

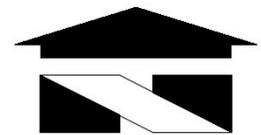
<p><b>SC 4.0. Forested Wetlands</b></p> <p>Does the wetland have at least <u>1 contiguous acre</u> of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as Priority Habitats? <i>If you answer YES, you will still need to rate the wetland based on its functions.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

SOUTH LAKE RIDGE - MONROE 30 - PKA NORTH 41  
WETLAND RATING FIGURE 1- WETLAND A

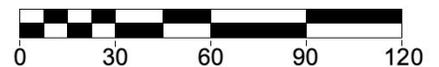


**LEGEND**

-  SCRUB-SHRUB
-  FORESTED VEGETATION
-  SATURATED ONLY
-  150' FROM WL BOUNDARY
-  INTERMITTENT STREAM



Scale 1" = 60'

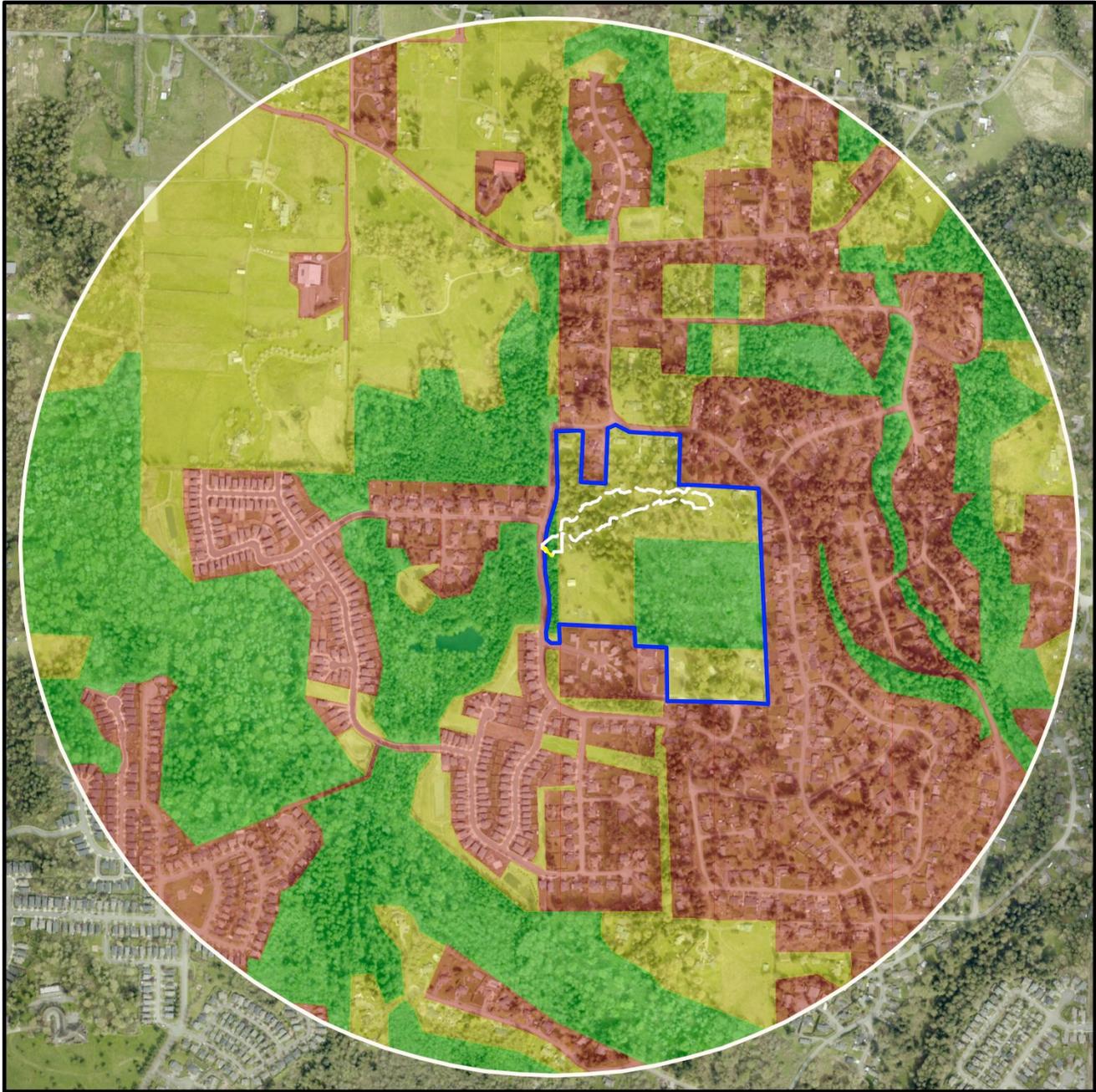


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Phone: (425) 337-3174  
Fax: (425) 337-3045  
Email: mailbox@wetlandresources.com

**WETLAND RATING**  
**Wetland A**

Figure A-1  
WRI Job # 24231  
Rated by: EC

SOUTH LAKE RIDGE - MONROE 30 - PKA NORTH 41  
 WETLAND RATING FIGURE 2- WETLAND A



**LEGEND**

- RELATIVELY UNDISTURBED
- LOW/MOD. INTENSITY
- HIGH INTENSITY
- ACCESSIBLE HABITAT
- WETLAND
- 1 KM FROM WETLAND
- CONTRIBUTING BASIN



Scale 1" = 1,000'



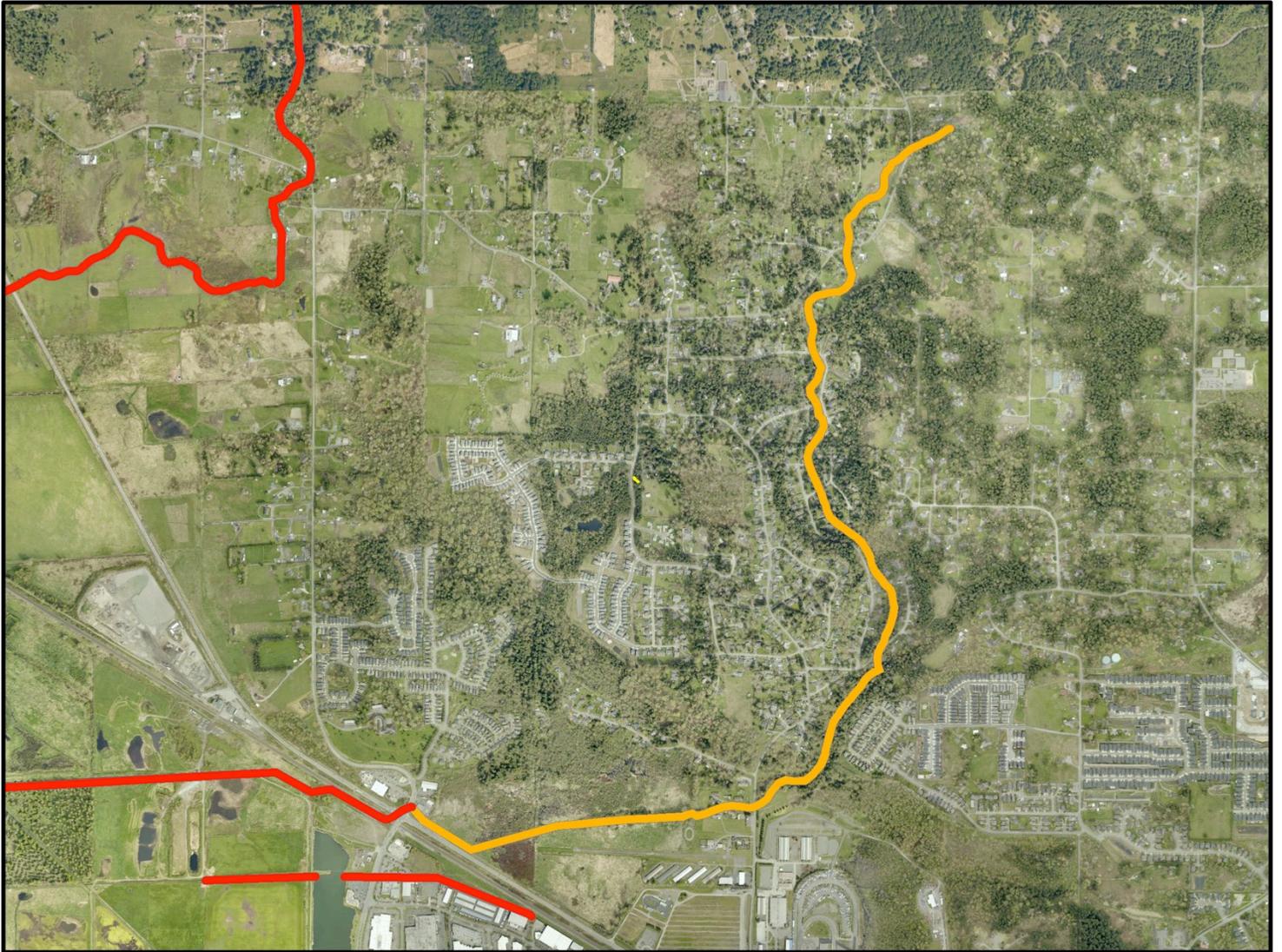
**CONTRIBUTING BASIN  
 AREA RELATIVE TO  
 WETLAND UNIT IS 236:1**

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**WETLAND RATING  
 Wetland A**

Figure A-2  
 WRI Job # 24231  
 Rated by: EC

SOUTH LAKE RIDGE - MONROE 30 - PKA NORTH 41  
WETLAND RATING FIGURE 3- WETLAND A



**LEGEND**



WETLAND



AQUATIC RESOURCES  
WITH ACTIVE TMDL



AQUATIC RESOURCES  
ON THE 303(d) LIST



Scale 1" = 2,000'

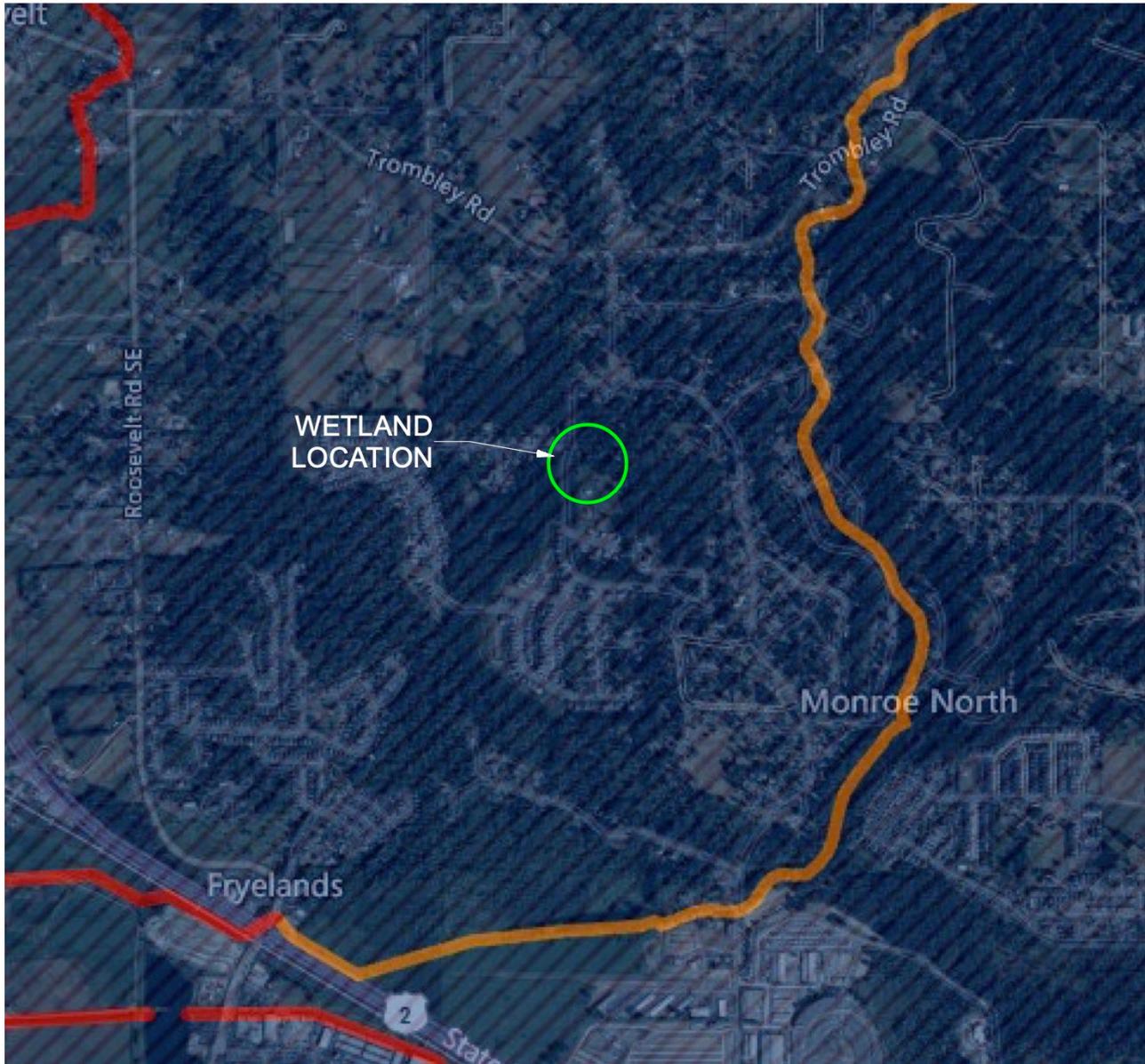


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**WETLAND RATING**  
**Wetland A**

Figure A-3  
WRI Job # 24231  
Rated by: EC

SOUTH LAKE RIDGE - MONROE 30 - PKA NORTH 41  
WETLAND RATING FIGURE 4- WETLAND A



**LEGEND**

 APPROVED TMDL /  
TMDL IN DEVELOPMENT

 AQUATIC RESOURCES  
WITH ACTIVE TMDL

 AQUATIC RESOURCES  
ON THE 303(d) LIST



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**WETLAND RATING**  
**Wetland A**

Figure A-4  
WRI Job # 24231  
Rated by: EC

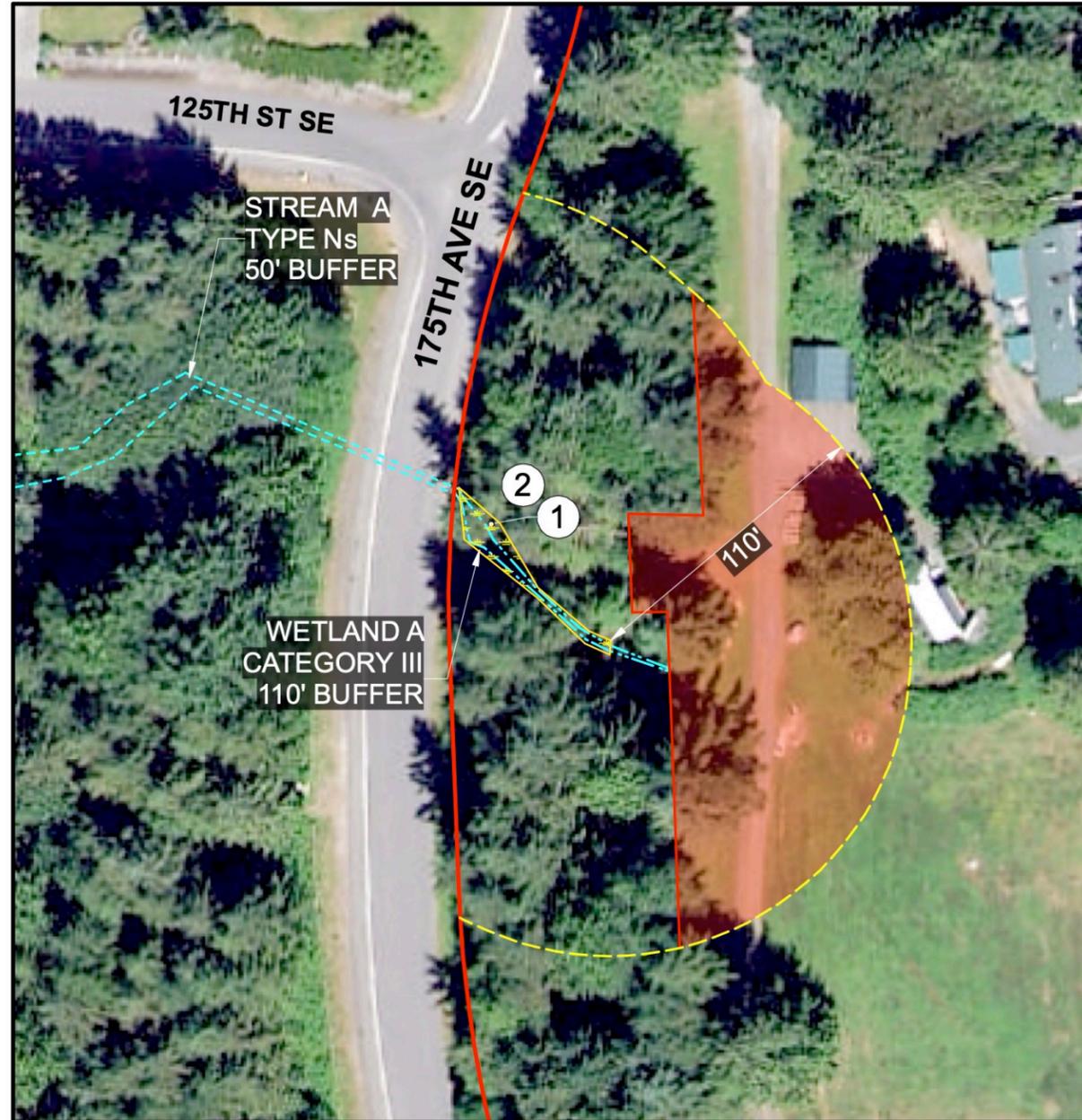
**APPENDIX C:  
CRITICAL AREA REPORT MAPS  
(SHEETS 1-2)**

# CRITICAL AREA REPORT MAP - EXISTING CONDITIONS

## MONROE 30

PORTION OF SECTION 26, TOWNSHIP 28N, RANGE 6E, W.M.

INSET



SITE OVERVIEW

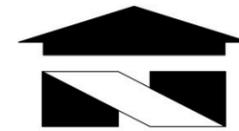
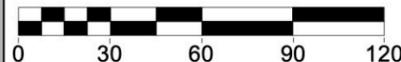


### LEGEND

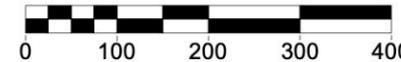
-  WETLAND
-  STREAM (OHWM)
-  STREAM (ESTIMATED)
-  BUFFER
-  DEGRADED BUFFER AREAS
-  DATA SITES (S1-S6)



Scale 1" = 60'



Scale 1" = 200'



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CRITICAL AREA REPORT MAP  
MONROE 30  
 Monroe, WA

South Lake Ridge, LLC  
 c/o Land Pro Group, Inc.  
 10515 20th St SE, #202  
 Lake Stevens, WA 98258

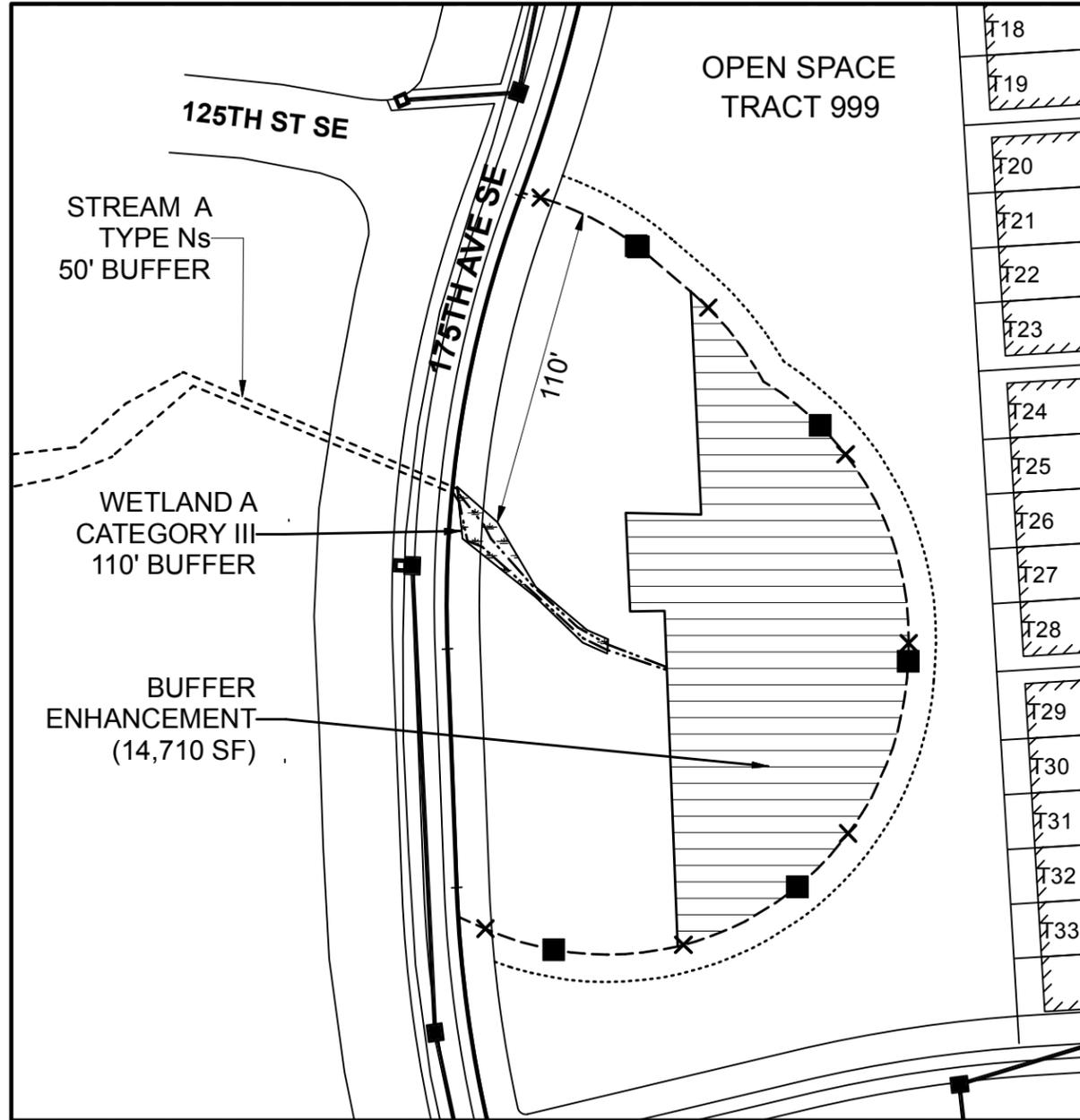
Sheet 1/2  
 WRI #: 24231  
 Drawn by: EC  
 Date: 4/24/2025

# CRITICAL AREA REPORT MAP - SITE DEVELOPMENT AND BUFFER ENHANCEMENT MAP

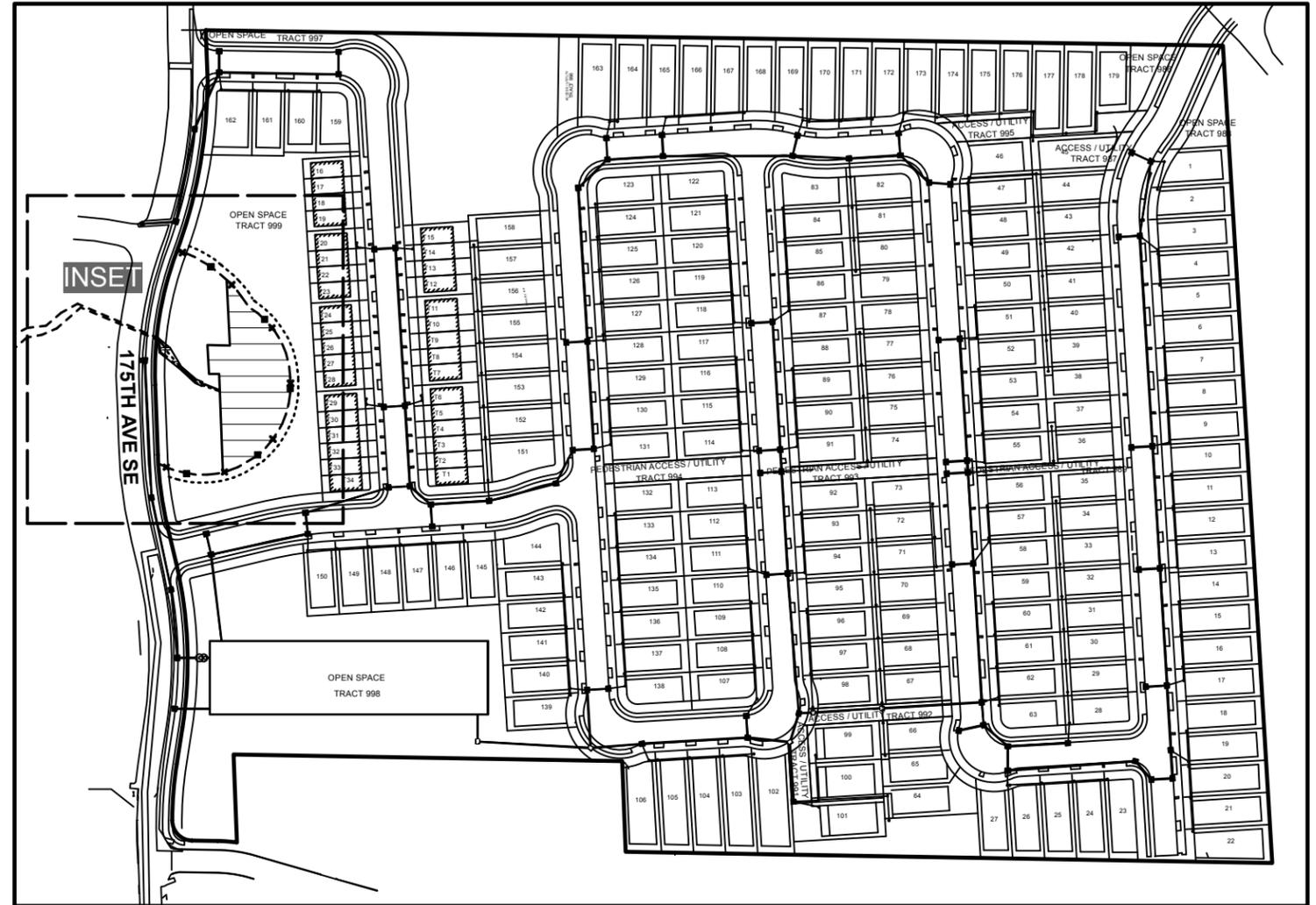
## MONROE 30

PORTION OF SECTION 26, TOWNSHIP 28N, RANGE 6E, W.M.

INSET

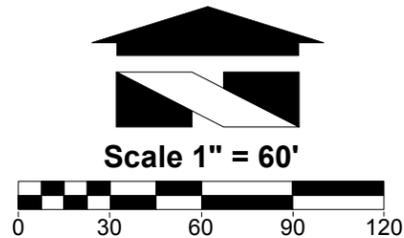


SITE OVERVIEW



**LEGEND**

- |  |                    |  |                       |
|--|--------------------|--|-----------------------|
|  | WETLAND            |  | BUFFER ENHANCEMENT    |
|  | STREAM             |  | BUILDING SETBACK LINE |
|  | STREAM (ESTIMATED) |  | SIGN                  |
|  | BUFFER FENCE       |  |                       |



Scale 1" = 200'



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CRITICAL AREA REPORT MAP  
**MONROE 30**  
 Monroe, WA

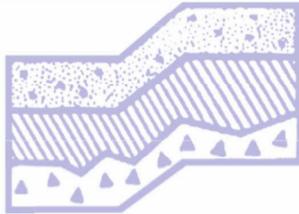
South Lake Ridge, LLC  
 c/o Land Pro Group, Inc.  
 10515 20th St SE, #202  
 Lake Stevens, WA 98258

Sheet 2/2  
 WRI #: 24231  
 Drawn by: EC  
 Date: 4/24/2025

# **GEOTECHNICAL REPORT**

**Monroe 30  
13611 - 175th Avenue Southeast  
Snohomish, Washington**

**Project No. T-9089**



## **Terra Associates, Inc.**

**Prepared for:**

**South Lake Ridge, LLC  
c/o Land Pro Group  
Lake Stevens, Washington**

**April 3, 2025**



# TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology  
and  
Environmental Earth Sciences

April 3, 2025  
Project No. T-9089

Ms. Abi Toyer  
South Lake Ridge, LLC  
c/o Land Pro Group  
10515 – 20th Street Southeast, Suite 202  
Lake Stevens, Washington 98258

Subject: Geotechnical Report  
Monroe 30  
12611 – 175th Avenue Southeast  
Snohomish, Washington

Dear Ms. Toyer:

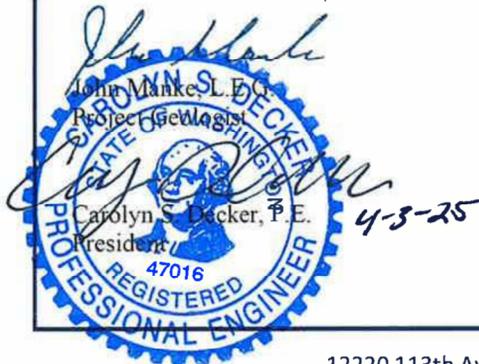
As requested, we conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the site is generally underlain by glacial till soils consisting predominantly of medium dense to very dense silty sand with gravel. We did not observe groundwater seepage in any of the test pits.

In our opinion, there are no geotechnical conditions that would preclude development of the site, as currently planned. The residences can be supported on conventional spread footings bearing on competent native soils or on structural fill that is placed on a competent native soil subgrade. Floor slabs and pavements can be similarly supported.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,  
**TERRA ASSOCIATES, INC.**



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**Geotechnical Report  
Monroe 30  
12611 – 175th Avenue Southeast  
Snohomish, Washington**

**1.0 PROJECT DESCRIPTION**

The project consists of developing the site with residential building lots along with associated access, utilities, and landscaping. Based on review of the “Monroe 30 Layout with Townhomes”, the site will be developed with 174 townhome units divided into 4-plex, 5-plex, and 6-plex buildings. Site stormwater will be collected and directed to a facility in the southwest portion of the site. Grading plans were not available at the time of this report. Based on existing topography grading is expected to be minimal with cuts and fills from one to five feet.

We expect that the residences would be two- to four- story, wood-frame structures, with their main floors constructed at grade or framed over a crawl space. Foundation loads should be relatively light, in the range of 2 to 4 kips per foot for bearing walls and 25 to 75 kips for isolated columns.

The recommendations contained in the following sections of this report are based on our understanding of the above design features. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and incorporated into project design and to amend or supplement our recommendations, if required.

**2.0 SCOPE OF WORK**

Our work was completed in accordance with our authorized proposal dated June 25, 2024. Accordingly, on September 12 and 13, 2024, we explored subsurface conditions at the site by observing soil conditions in 23 test pits excavated to depths of about 9 to 12 feet below existing surface grades using a track-mounted excavator. Using the results of our field study and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the Snohomish County Code.
- Seismic site class per the current International Building Code (IBC).
- Site preparation and grading.
- Excavations.
- Foundations.
- Floor slabs.
- Infiltration feasibility.
- Stormwater facilities.

- Drainage.
- Utilities.
- Pavements.

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates' purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

### **3.0 SITE CONDITIONS**

#### **3.1 Surface**

The project site is an approximately 24.87-acre assemblage of 8 tax parcels located at, north, and east of 12611 – 175th Avenue Southeast in Snohomish, Washington. The site location is shown on Figure 1.

The site is currently developed with four single-family residential buildings, some outbuildings, and associated access and landscaping in the western portion of the site. The northeast corner of the site has been cleared and is used for storage of various objects. The remainder of the site is predominantly undeveloped and covered with a moderate forest and associated understory. Site topography consists of a slope that descends from the east to the west with a gradient of approximately 10 percent and an overall relief of approximately 130 feet.

#### **3.2 Soils**

The soil conditions observed in the test pits generally consisted of approximately six inches of topsoil overlying medium dense to very dense silty sand and silty sand with gravel to the termination of the test pits. The upper approximately two to three feet of the formation is generally in a medium dense and moist condition. The soils observed below these depths are generally dense to very dense, weakly to moderately cemented, and moist.

The *Geologic map of the Lake Roesiger 7.5-minute quadrangle, Snohomish County, Washington* by Dragovich, et al. (2015) shows the site mapped as Vashon lodgment till (Qgt<sub>v</sub>) and Vashon advance outwash deposits (Qva<sub>v</sub>). The dense to very dense, weakly to moderately cemented, silty sand with gravel that we observed in the test pits is generally consistent with the mapped Vashon lodgment till.

The preceding discussion is intended to be a general review of the soil conditions encountered. Detailed descriptions of the subsurface conditions are presented on the Test Pit Logs in Appendix A. The approximate locations of the test pits are shown on Figure 2.

#### **3.3 Groundwater**

We did not observe groundwater seepage in the test pits. However, we observed mottling of the soils between depths of about one and one-half and three feet, indicating that they have been impacted by perched groundwater at times. The occurrence of shallow perched groundwater is typical for sites underlain by relatively impermeable till and till-like soils. Perched groundwater levels and seepage flow rates will typically fluctuate on a seasonal basis with the highest levels developing during the wet winter months.

### **3.4 Geologic Hazards**

We evaluated current site conditions for the presence of geologic hazards per the Snohomish County Unified Development Code (SCC). Per SCC Chapter 30.91G.020 (Geologic hazard areas), geologically hazardous areas include erosion hazard areas, landslide hazard areas, seismic hazard areas, and mine hazard areas.

#### ***3.4.1 Erosion Hazard Areas***

SCC Chapter 30.91E.160 (Erosion hazard areas) defines erosion hazard areas as:

- (1) “Areas containing soils which are at high risk from water erosion according to the mapped description units of the United States Department of Agriculture Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, National Soil Classification System;
- (2) Channel migration zones; and
- (3) The shorelines of water bodies subject to wind and wave erosion.”

Conditions meeting the criteria provided in items 2 and 3 above do not exist at the site. The NRCS has mapped the soils in the proposed development areas of the site as *Tokul gravelly medial loam, 0 to 8 percent slopes* and *Tokul gravelly medial loam, 8 to 15 percent slopes*. Based on our observations, the site soils are more with the *Tokul gravelly medial loam* soils, which are described by the NRCS as derived from till. The *Tokul gravelly medial loam, 0 to 8 percent slopes* and *8 to 15 percent slopes* are not mapped as having a severe erosion hazard.

As discussed, we did not observe any indications of significant active erosion at the site. Regardless, the site soils will be susceptible to erosion when exposed during construction. In our opinion, proper installation and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control would adequately mitigate the erosion potential in the proposed development areas. All BMPs for erosion prevention and sedimentation control should conform to Snohomish County requirements.

#### ***3.4.2 Landslide Hazard Areas***

SCC Chapter 30.91L.040 (Landslide hazard areas) defines landslide hazard areas as “...areas potentially subject to mass earth movement based on a combination of geologic, topographic, and hydrologic factors, with a vertical height of 10 feet or more. These include the following:

- (1) Areas of historic landslides as evidenced by landslide deposits, avalanche tracks, and areas susceptible to basal undercutting by streams, rivers or waves;
- (2) Areas with slopes steeper than 33 percent which intersect geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock, and which contain springs or ground water seeps;
- (3) Areas located in a canyon or an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding.

For subsections (1), (2), and (3) of this section, the landslide hazard area also includes lands within a distance from the top of the slope equal to the height of the slope or within a distance of the toe of the slope equal to two times the height of the slope.”

In our opinion, the site conditions do not meet the above criteria defining landslide hazard areas. Therefore, in our opinion, the site does not contain a landslide hazard area as defined by the SCC.

#### *LiDAR Review*

We reviewed LiDAR digital terrain (bare earth) modeling of the site for indications of characteristic landslide topography and potentially unstable landforms using the Washington State Department of Natural Resources Lidar Portal website (<https://lidarportal.dnr.wa.gov/>). Our review of the LiDAR model identified no surface features indicative of deep-seated landsliding or unstable conditions. This is consistent with our field observations.

#### *DNR Map Review*

Review of landslide compilation mapping from the Washington State Department of Natural Resources (DNR) Geologic Information Portal interactive website ([https://geologyportal.dnr.wa.gov/#natural\\_hazards](https://geologyportal.dnr.wa.gov/#natural_hazards)) shows no deep-seated landslides or landslide morphology mapped on the subject site. This is consistent with our field observations.

### **3.4.3 Seismic Hazard Areas**

SCC Chapter 30.91S.121 (Seismic hazard areas) defines seismic hazard areas as “...areas that have been determined by the building official to have known or inferred faults, ground rupture potential, liquefaction potential, or seismically induced slope instability, where such information is provided to Snohomish County through any of the following means: geotechnical studies and reports prepared by licensed professionals pursuant to chapter 19.27 RCW, SCC 30.62B.140 or 30.62B350; geotechnical studies and reports prepared by federal, state or local agencies; and geotechnical studies, reports or environmental impact statements prepared through the requirements of the State Environmental Policy Act (SEPA) chapter 43.21C RCW.”

The closest known Class A fault (existence of Quaternary fault of tectonic origin demonstrated by geologic evidence) to the project site is the Southern Whidbey Island Fault Zone (SWIFZ). The SWIFZ is described as a northwest-trending (average strike N51°W), 5- to 7-kilometer-wide fault zone that extends more than 65 kilometers from the Strait of Juan de Fuca southeast to Mukilteo on the eastern side of Possession Sound (USGS Quaternary Faults Web Mapping Application, <https://www.usgs.gov/tools/interactive-us-fault-map>, accessed September 20, 2024).

Projection of the fault zone striking north 51 degrees west to the southeast passes approximately three miles southwest of the subject site. We did not observe any indications of faulting or surface rupture at the project site and are unaware of any reported documentation of surface rupture due to past movement along the SWIFZ in the project area. Considering this, it is our opinion that the potential for ground rupture at the project site during a severe seismic event is low.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sand that is below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

The DNR Geologic Information Portal liquefaction susceptibility mapping shows site conditions having a very low susceptibility to soil liquefaction. Based on the soil and groundwater conditions we observed at the site, it is our opinion that the risk for damage resulting from seismically-induced slope failure and soil liquefaction at the site is negligible. Therefore, in our opinion, the site is not a seismic hazard area as defined by the SCC.

#### **3.4.4 Mine Hazard Areas**

SCC Chapter 30.91M.090 (Mine hazard areas) defines mine hazard areas as "...areas underlain by or affected by underground mine workings such as tunnels, air shafts and those areas adjacent to steep slopes produced by open pit mining or quarrying, but excluding any areas where the mine workings have been properly stabilized and closed and made safe consistent with all applicable federal, state and local laws."

The DNR Geologic Information Portal mines and minerals mapping shows no active or historic mines on or adjacent the project site. No evidence of mine works such as sink holes, tunnel entrances or shafts were observed on site. Therefore, it is our opinion that the site is not a coal mine hazard area as defined by the SCC.

#### **3.5 Seismic Site Class**

Based on the site soil conditions and our knowledge of the area geology, per the current International Building Code (IBC), site class "C" should be used in structural design.

### **4.0 DISCUSSION AND RECOMMENDATIONS**

#### **4.1 General**

Based on our study, there are no geotechnical conditions that would preclude development of the site as currently planned. Residences can be supported on conventional spread footings bearing on competent native soils underlying organic topsoil or on structural fill placed on a competent native soil subgrade. Floor slabs and pavements can be similarly supported.

The site soils contain a sufficient amount of fines (silt- and clay-sized particles) such that they will be difficult to compact as structural fill when too wet or too dry. Accordingly, the ability to use the soils from site excavations as structural fill will depend upon their moisture content and the prevailing weather conditions at the time of construction. If grading activities take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections of this report. These recommendations should be incorporated into the final design drawings and construction specifications.

#### **4.2 Site Preparation and Grading**

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials should be stripped and removed from the site. We expect surface stripping depths of approximately 6 to 12 inches will generally be required to remove the organic surficial soils in the planned development areas. Stripped vegetation debris should be removed from the site. Organic soils will not be suitable for use as structural fill but may be used for limited depths in nonstructural areas or for landscaping purposes. In the developed portions of the site, demolition of existing structures should include removal of existing foundations, slabs, and pavements, and abandonment of drainfields and buried utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

Once clearing and grubbing operations are complete, cut and fill operations to establish desired building pad and roadway elevations can be initiated. A representative of Terra Associates, Inc. should examine all bearing surfaces to verify that conditions encountered are as anticipated and are suitable for placement of structural fill or direct support of building and pavement elements. Our representative may request proofrolling exposed surfaces with a heavy rubber-tired vehicle to determine if any isolated soft and yielding areas are present. If unstable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth of excavation to remove unstable soils is excessive, use of geotextile fabric such as Mirafi 500X or equivalent in conjunction with structural fill can be considered in order to limit the depth of removal. In general, our experience has shown that a minimum of 18 inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

Our study indicates that the site soils typically contain a significant percentage of fines (silt and clay sized particles) that will make the soils difficult to compact as structural fill when too wet or too dry. Provided these soils are near optimum moisture when excavated, and are placed during dry weather conditions, we anticipate they will be suitable for direct use as structural fill. Soils that are wet of optimum when excavated or become wet prior to use as structural fill will require drying by aeration during dry weather conditions or using soil amendments such as lime or Portland cement to reduce and stabilize the soil's moisture content. If soil amendment products are used, additional Temporary Erosion and Sedimentation Control (TESC) BMPs will need to be implemented to mitigate potential impacts to stormwater runoff associated with possible elevated pH levels.

If grading activities are planned during the wet winter months, or if they extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

<b>U.S. Sieve Size</b>	<b>Percent Passing</b>
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

\*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials planned to be imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction may be reduced to 90 percent.

#### **4.3 Excavations**

All excavations at the site associated with confined spaces must be completed in accordance with local, state, and federal requirements. Based on the Washington State Safety and Health Administration (WSHA) regulations, the medium dense, weathered soils would typically be classified as Type B soils. The dense to very dense, cemented, glacial till soils would typically be classified as Type A soil.

Accordingly, for temporary excavations of more than 4 feet and less than 20 feet in depth, the side slopes in Type B soils should be laid back at a slope inclination of 1:1 (Horizontal: Vertical) or flatter. Temporary excavations in Type A soils can be laid back at inclinations of 0.75:1 or flatter. For temporary excavation slopes less than 8 feet in height in Type A soils, the lower 3.5 feet can be cut to a vertical condition with a 0.75:1 slope graded above. For temporary excavation slopes greater than 8 feet in height up to a maximum height of 12 feet, the slope above the 3.5-foot high vertical portion should be laid back to an inclination of 1:1 or flatter. No vertical cut with a backslope immediately above is allowed for excavation depths that exceed 12 feet. In this case, a 4-foot high vertical cut with an equivalent horizontal bench to the cut slope toe is required. If there is insufficient room to complete the excavations in the manners discussed above, or if excavations greater than 20 feet deep are planned, you may need to use temporary shoring to support the excavations.

Perched groundwater seepage should be anticipated within excavations extending to the surface of the dense to very dense glacial till, particularly during the wet winter months. In our opinion, the volume of water and rate of seepage flow into the excavation should be relatively minor and would not be expected to impact the stability of the excavations that are sloped as described above. Conventional sump pumping procedures along with a system of collection trenches, if necessary, should be capable of maintaining a relatively dry excavation for construction purposes in these soils.

The above information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

#### **4.4 Foundations**

Residential structures may be supported on conventional spread footing foundations bearing on competent native soils or on structural fill placed above these native soils. Foundation subgrades should be prepared as recommended in Section 4.2 of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of one and one-half feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth. We recommend designing foundations bearing on competent soil for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used in design. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-half inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 350 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent native soil or the excavations are backfilled with structural fill, as described in Section 4.2 of this report. The recommended passive and friction values include a safety factor of 1.5.

#### **4.5 Slab-on-Grade Floors**

Slab-on-grade floors may be supported on a subgrade prepared as recommended in Section 4.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of clean, coarse sand or fine gravel that has less than five percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture seeping through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

#### **4.6 Lateral Earth Pressures for Below Grade Walls**

The magnitude of earth pressures developing on below-grade walls will depend upon the quality and compaction of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To prevent overstressing the walls during backfilling, heavy construction machinery should not be operated within five feet of the wall. Wall backfill in this zone should be compacted with hand-operated equipment. To prevent hydrostatic pressure development, wall drainage must also be installed. A typical wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended, and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 psf should be added to the 35 pcf. To account for typical traffic surcharge loading, the walls can be designed for an additional imaginary height of two feet (two-foot soil surcharge). For evaluation of wall performance under seismic loading, a uniform pressure equivalent to  $8H$  psf, where  $H$  is the height of the below-grade portion of the wall should be applied in addition to the static lateral earth pressure. These values assume a horizontal backfill condition and that no other surcharge loading, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 4.4 of this report.

#### **4.7 Infiltration Feasibility**

In our opinion, infiltration of stormwater runoff will not be feasible at the site. The glacially consolidated till soils observed in the test pits are dense to very dense, weakly to moderately cemented, and generally contain a high percentage of soil fines, which all contribute to making the till relatively impermeable. The ability of the site soils to infiltrate is further reduced by the indication of the presence of the seasonally perched groundwater above the till, as observed in our test pits. Even low impact development (LID) would likely fill up, over top, and cause minor local flooding.

#### **4.8 Stormwater Facilities**

Site stormwater plans were not available at the time of this report.

##### ***Detention Vault***

We expect the bottom of the excavations for the detention vaults will expose dense to very dense silty sand with gravel. Vault foundations supported by these very dense native soils may be designed for an allowable bearing capacity of 5,000 psf. For short-term loads, such as seismic, a one-third increase in this allowable capacity can be used.

Vault walls should be designed as below-grade retaining walls. The magnitude of earth pressure development on engineered retaining walls will partly depend on the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To prevent overstressing the walls during backfilling, heavy construction machinery should not be operated within five feet of the wall. Wall backfill in this zone should be compacted with hand-operated equipment. To prevent hydrostatic pressure development, wall drainage must also be installed. A typical wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 pounds per square foot (psf) should be added to the 35 pcf. To account for typical traffic surcharge loading, the walls can be designed for an additional imaginary height of two feet (two-foot soil surcharge). For evaluation of below-grade walls under seismic loading, an additional uniform lateral pressure equivalent to  $8H$  psf, where  $H$  is the height of the below-grade portion of the wall in feet, can be used.

These values assume a horizontal backfill condition and that no other surcharge loading such as traffic, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are given in Section 4.4 of this report.

If it is not possible to discharge collected water at the footing invert elevation, the invert elevation of the wall drainpipe could be set equivalent to the outfall invert. For any portion of the wall that falls below the invert elevation of the wall drain, an earth pressure equivalent to a fluid weighing 85 pcf should be used.

### ***Stormwater Ponds***

If fill berms are constructed, the berm locations should be stripped of topsoil, duff, and soils containing organic material prior to the placement of fill. The fill berms should be constructed by placing structural fill in accordance with recommendations outlined in Section 4.2 of this report. Material used to construct pond berms should consist of predominately granular soils with a maximum size of three inches and a minimum of 20 percent fines. Terra Associates, Inc. should examine and test all onsite or imported materials proposed for use as berm fill prior to their use.

Due to the exposure to fluctuating stored water levels and wave action, soils exposed on the interior side slopes of the ponds may be subject to some risk of periodic shallow instability or sloughing. Establishing interior slopes at a 3:1 gradient will significantly reduce or eliminate this potential. Exterior berm slopes and interior slopes above the maximum water surface should be graded to a finished inclination no steeper than 2:1. Finished slope faces should be thoroughly compacted and vegetated to guard against erosion.

We should review the stormwater plans when they are completed and revise our recommendations, if required.

## **4.9 Drainage**

### ***Surface***

Final exterior grades should promote free and positive drainage away from the building areas. We recommend providing a positive drainage gradient away from the building perimeter. If a positive gradient cannot be provided, provisions for collection and disposal of surface water adjacent to the structure should be provided.

Surface water from developed areas must not be allowed to flow in an uncontrolled and concentrated manner toward or onto site slopes. Surface water should be directed away from the slopes to a point of collection and controlled discharge. If site grades do not allow for directing surface water away from the slope, then the water should be collected and tightlined to an approved point of controlled discharge.

### ***Subsurface***

We recommend installing a continuous drain along the outside lower edge of the perimeter building foundations. The drains can be laid to grade at an invert elevation equivalent to the bottom of footing grade. The drains can consist of four-inch diameter perforated PVC pipe that is enveloped in washed 1/2- to 3/4-inch gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. The foundation drains and roof downspouts should be tightlined separately to an approved point of controlled discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once each year.

#### **4.10 Utilities**

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or local jurisdictional requirements. At minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. As noted, soils excavated onsite should generally be suitable for use as backfill material provided, they are near optimum moisture when excavated, and are placed during dry weather conditions. However, the site soils are fine grained and moisture sensitive; therefore, moisture conditioning may be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

#### **4.11 Pavements**

Pavements should be constructed on subgrades prepared as recommended in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. Proofrolling the subgrade with heavy construction equipment should be completed to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. For traffic consisting mainly of light passenger vehicles with only occasional heavy traffic, and a stable subgrade prepared as recommended, we recommend the following pavement sections:

- Two inches of hot mix asphalt (HMA) over four inches of crushed rock base (CRB).
- Three and one-half inches full depth HMA over prepared subgrade.

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRB.

Long-term pavement performance will depend upon surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

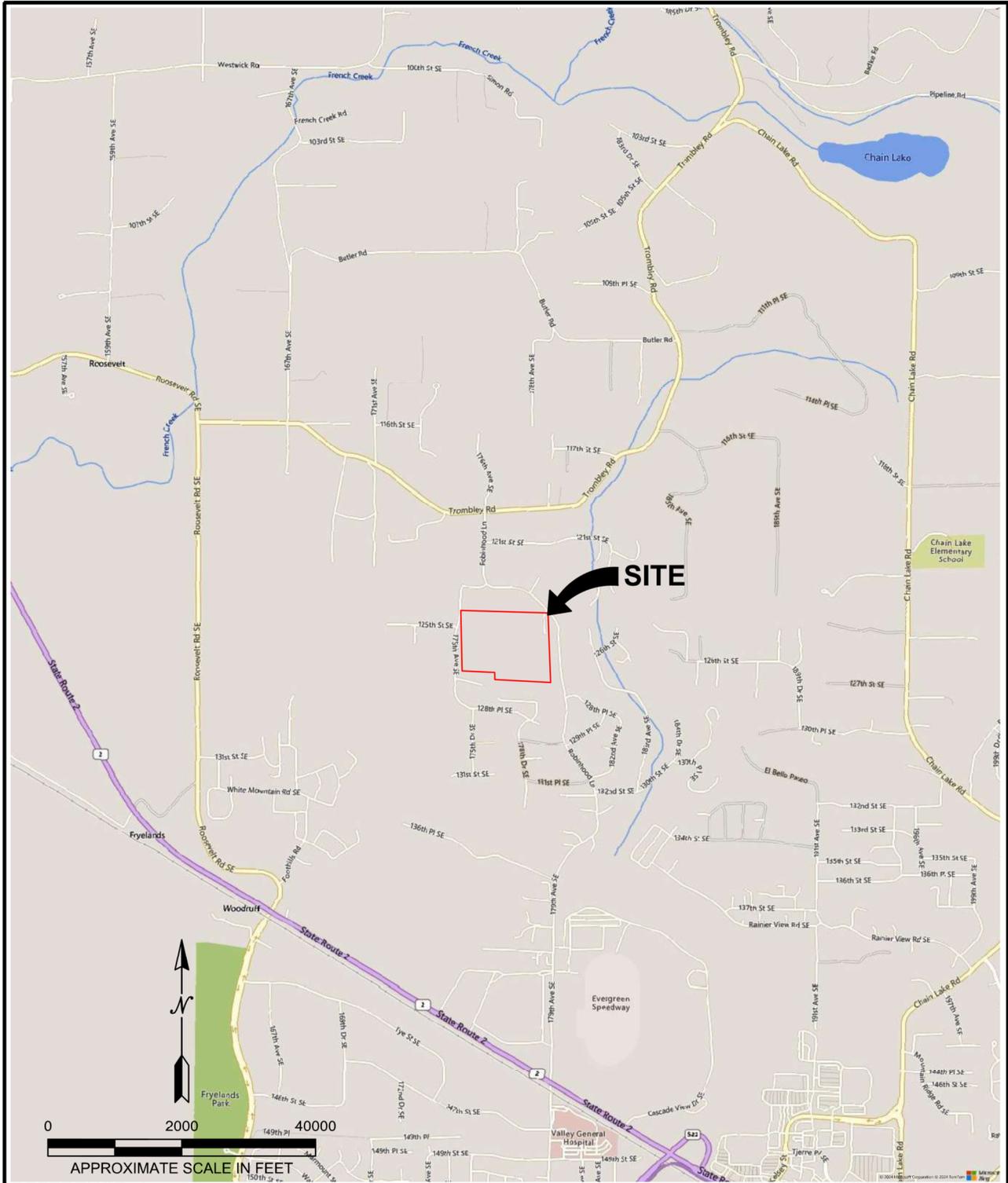
#### **5.0 ADDITIONAL SERVICES**

Terra Associates, Inc. should review the final designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction in order to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

## **6.0 LIMITATIONS**

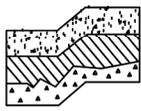
We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Monroe 30 project in Snohomish County, Washington. This report is for the exclusive use of South Lake Ridge, LLC, Land Pro Group, and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based on data obtained from our on-site test pits. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



REFERENCE: <https://www.bing.com/maps>

ACCESSED 2024



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 Consultants in Geotechnical Engineering  
 Geology and Environmental Earth Sciences

VICINITY MAP  
 MONROE 30  
 SNOHOMISH, WASHINGTON

Proj.No. T-9089	Date: APR 2025	Figure 1
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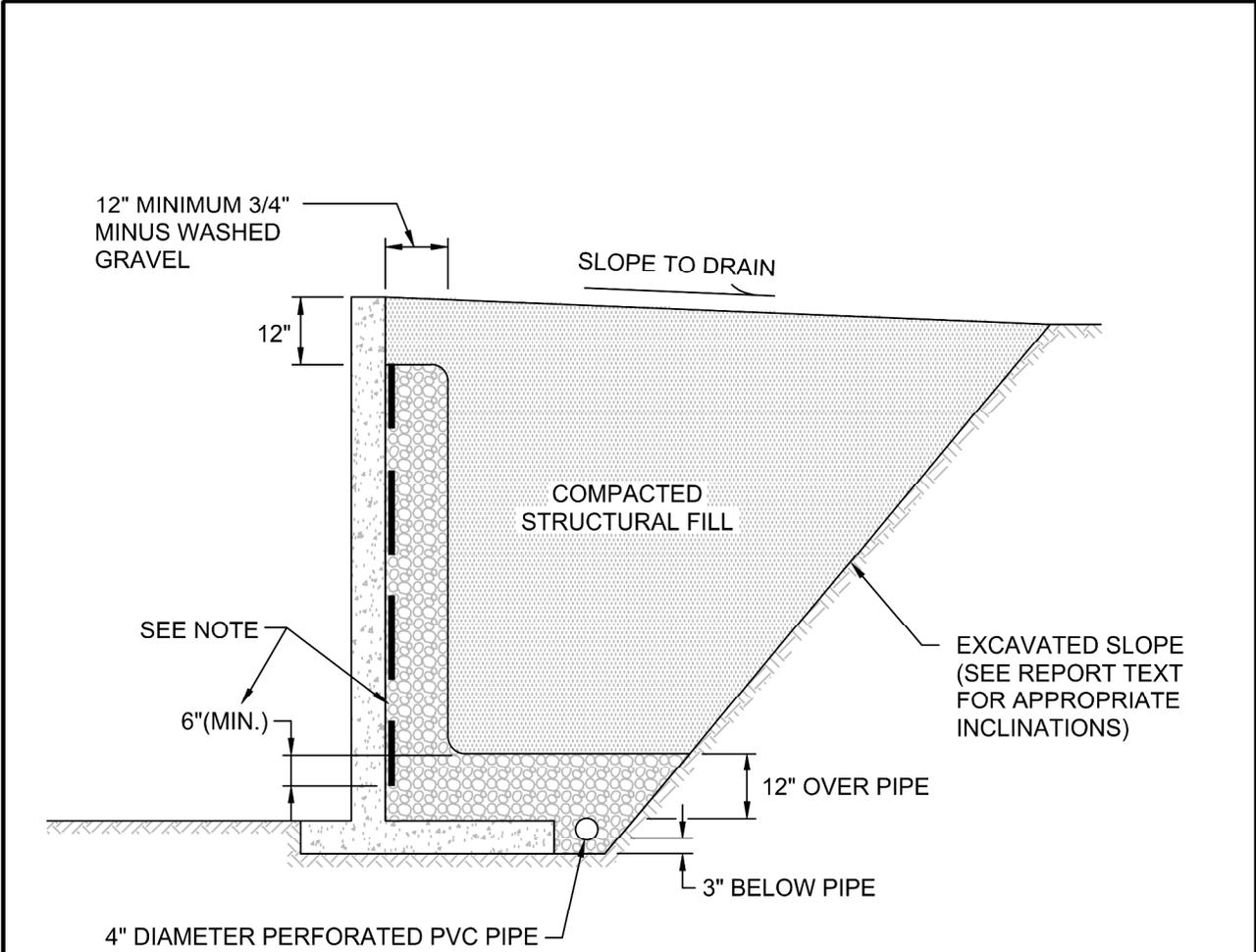
**NOTE:**  
 THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.  
**REFERENCE:** SITE PLAN PROVIDED BY CLIENT.



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 Environmental Earth Sciences

EXPLORATION LOCATION PLAN  
 MONROE 30  
 SNOHOMISH, WASHINGTON

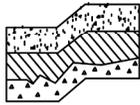
Proj/No. T-9089      Date: APR 2025      Figure 2



**NOT TO SCALE**

**NOTE:**

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.



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TYPICAL WALL DRAINAGE DETAIL  
 MONROE 30  
 SNOHOMISH, WASHINGTON

Proj.No. T-9089

Date: APR 2025

Figure 3

**APPENDIX A**  
**FIELD EXPLORATION AND LABORATORY TESTING**

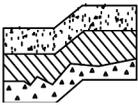
**Monroe 30**  
**12611 – 175th Avenue Southeast**  
**Snohomish, Washington**

On September 12 and 13, 2024, we explored subsurface conditions at the site in 23 test pits excavated to maximum depths of approximately 9 to 12 feet below existing surface grades using a track-mounted excavator. The test pit locations were approximately determined in the field with GPS and by sighting relative to existing surface features. The approximate test pit locations are shown on Figure 2. The Test Pit Logs are presented on Figures A-2 through A-24.

An engineering geologist from our office maintained a log of each test pit as it was excavated, classified the soil conditions encountered, and obtained representative soil samples. All soil samples were visually classified in the field in accordance with the Unified Soil Classification System. A copy of this classification is presented as Figure A-1.

Representative soil samples obtained from the test pits were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Pit Logs. Grain size analyses were performed on select soil samples. The results are shown on Figures A-25 through A-28.

Project No. T-9089

MAJOR DIVISIONS		LETTER SYMBOL	TYPICAL DESCRIPTION
<b>COARSE GRAINED SOILS</b>	<b>GRAVELS</b> More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	<b>SANDS</b> More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW Well-graded sands, sands with gravel, little or no fines.
			SP Poorly-graded sands, sands with gravel, little or no fines.
		Sands with fines	SM Silty sands, sand-silt mixtures, non-plastic fines.
			SC Clayey sands, sand-clay mixtures, plastic fines.
<b>FINE GRAINED SOILS</b>	<b>SILTS AND CLAYS</b> Liquid Limit is less than 50%	ML Inorganic silts, rock flour, clayey silts with slight plasticity.	
		CL Inorganic clays of low to medium plasticity. (Lean clay)	
		OL Organic silts and organic clays of low plasticity.	
	<b>SILTS AND CLAYS</b> Liquid Limit is greater than 50%	MH Inorganic silts, elastic.	
		CH Inorganic clays of high plasticity. (Fat clay)	
		OH Organic clays of high plasticity.	
<b>HIGHLY ORGANIC SOILS</b>		PT Peat.	
<b>DEFINITION OF TERMS AND SYMBOLS</b>			
<b>COHESIONLESS</b>	<u>Density</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	 2" OUTSIDE DIAMETER SPILT SPOON SAMPLER  2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER  WATER LEVEL (Date) Tr TORVANE READINGS, tsf
	Very Loose	0-4	
	Loose	4-10	Pp PENETROMETER READING, tsf
	Medium Dense	10-30	DD DRY DENSITY, pounds per cubic foot
	Dense	30-50	LL LIQUID LIMIT, percent
	Very Dense	>50	PI PLASTIC INDEX
<b>COHESIVE</b>	<u>Consistency</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	N STANDARD PENETRATION, blows per foot
	Very Soft	0-2	
	Soft	2-4	
	Medium Stiff	4-8	
	Stiff	8-16	
	Very Stiff	16-32	
	Hard	>32	
 <b>Terra Associates, Inc.</b> Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences		<b>UNIFIED SOIL CLASSIFICATION SYSTEM</b> MONROE 30 SNOHOMISH, WASHINGTON	
		Proj.No. T-9089	Date: APR 2025

# LOG OF TEST PIT NO. TP-1

FIGURE A-2

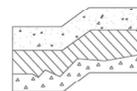
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4				
5	2		Dense to Very Dense	9.6
6				
7				
8				
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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## LOG OF TEST PIT NO. TP-2

FIGURE A-3

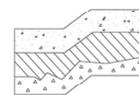
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2		Dense to Very Dense	
6				
7				
8				
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-3

FIGURE A-4

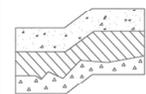
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4	2			6.7
5				
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-4

FIGURE A-5

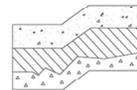
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4	2			
5				
6			Dense to Very Dense	
7				
8				
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-5

FIGURE A-6

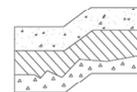
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-6

FIGURE A-7

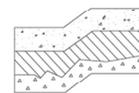
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	10.1
3				
4	2			
5				
6				
7				
8				
9				
10				
11				
12	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
13				
14				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-7

FIGURE A-8

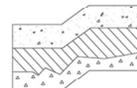
**PROJECT NAME:** Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		5.2
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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## LOG OF TEST PIT NO. TP-8

FIGURE A-9

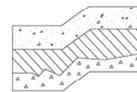
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-9

FIGURE A-10

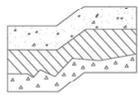
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)		
2				
3	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-10

FIGURE A-11

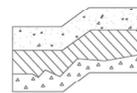
**PROJECT NAME:** Monroe 30      **PROJ. NO.:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV.:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
3				
4	2			10.4
5				
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-11

FIGURE A-12

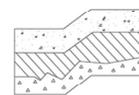
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	30.0
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented, approximately 2-foot diameter boulder from 3 to 5 feet. (SM) (Vashon Till)		
4				
5	2		Dense to Very Dense	
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-12

FIGURE A-13

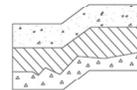
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Reddish brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-13

FIGURE A-14

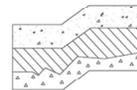
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2		Dense to Very Dense	6.9
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-14

FIGURE A-15

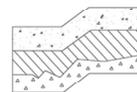
**PROJECT NAME:** Monroe 30      **PROJ. NO.:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV.:** NA

**DATE LOGGED:** September 12, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-15

FIGURE A-16

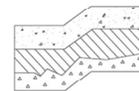
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	7.2
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
3			Dense to Very Dense	7.2
4	2			
5				
6				
7				
8				
9	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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## LOG OF TEST PIT NO. TP-16

FIGURE A-17

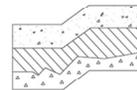
**PROJECT NAME:** Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
3				
4	2			
5			Dense to Very Dense	
6				
7				
8				
9	3			
10		Test pit terminated at approximately 9 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-17

FIGURE A-18

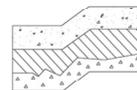
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4	2			8.1
5				
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-18

FIGURE A-19

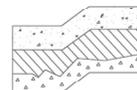
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
3				
4				
5	2			
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-19

FIGURE A-20

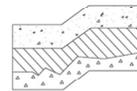
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
3				
4				
5	2		Dense to Very Dense	7.3
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-20

FIGURE A-21

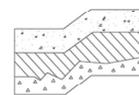
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
3				
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-21

FIGURE A-22

**PROJECT NAME:** Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	----- Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	8.8
3				
4				
5	2			
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-22

FIGURE A-23

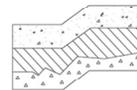
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-23

FIGURE A-24

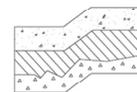
**PROJECT NAME:** Monroe 30      **PROJ. NO:** T-9089      **LOGGED BY:** JAM

**LOCATION:** Snohomish County, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** September 13, 2024      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Forest Duff and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			6.7
6			Dense to Very Dense	
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	7.9	33.6	12.4	23.8	12.4		9.9		
□	0.0	0.0	10.0	8.0	16.4	25.6		40.0		
△	0.0	0.0	3.0	5.0	13.3	23.3		55.4		
⊗	LL	PL	D85	D60	D50	D30	D15	D10	C <sub>c</sub>	C <sub>u</sub>
○			15.0791	5.4020	2.5891	0.6816	0.2525	0.0788	1.09	68.59
□			2.7079	0.2949	0.1641					
△			0.7563	0.1127						

Material Description	USCS	AASHTO
○ Silty SAND with gravel	SM	
□ Silty SAND with gravel	SM	
△ Sandy SILT	ML	

<b>Project No.</b> T-9089 <b>Project:</b> Monroe 30  ○ <b>Location:</b> TP-7 <b>Depth:</b> 10' □ <b>Location:</b> TP-10 <b>Depth:</b> 4' △ <b>Location:</b> TP-11 <b>Depth:</b> 2'	<b>Client:</b> South Lake Ridge, LLC c/o Land Pro Group  <p style="text-align: center;"><b>Terra Associates, Inc.</b></p> <p style="text-align: center;"><b>Kirkland, WA</b></p>	<b>Remarks:</b> ○ Tested October 8, 2024 □ Tested October 8, 2024 △ Tested October 8, 2024
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Figure A-26

Tested By: ZA





## **Appendix 1: Project Overview**

1. Vicinity Map
2. Existing Conditions Map
3. Proposed Development Map

# MONROE 30

## PRELIMINARY PLANS

### CITY OF MONROE, WA

#### LEGEND AND ABBREVIATIONS

EXISTING SYMBOLS	DESCRIPTION	ABBREVIATIONS	DESCRIPTION
	MONUMENT IN CASE	CPP	CORRUGATED PLASTIC PIPE
	SET REBAR W/ CAP	IE	INVERT ELEVATION
	EXISTING CORNER MONUMENT AS NOTED	INV	INVERT ELEVATION
	QUARTER SECTION TIE	CB	CATCH BASIN
	SECTION TIE	SD	STORM DRAIN
	CATCH BASIN	SS	SANITARY SEWER
	STORM MANHOLE	SSMH	SANITARY SEWER MANHOLE
	CULVERT	PVC	POLYVINYL CHLORIDE PIPE
	FIRE HYDRANT	F	FIBER
	GUY ANCHOR	DEC	DECIDUOUS
	GUY POLE	P	PINE
	LIGHT POLE		
	SEWER MANHOLE		
	SIGN		
	SPRINKLER HEAD		
	WATER VAULT		
	WATER MANHOLE		
	WATER METER		
	WATER VALVE		
	WETLAND FLAG		
	CONIFEROUS TREE		
	DECIDUOUS TREE		

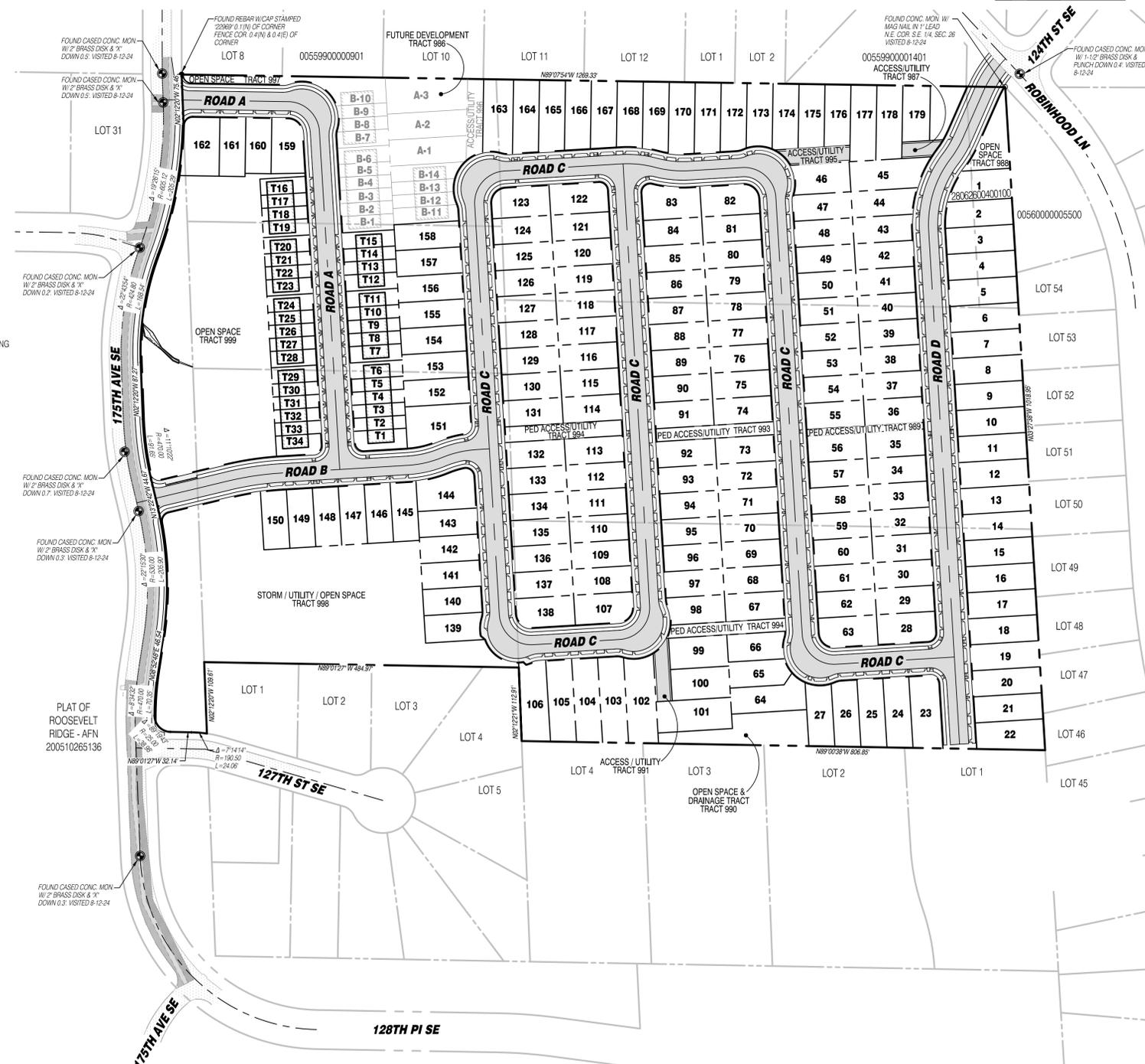
PROPOSED STORM SYMBOLS	DESCRIPTION	PROPOSED WATER SYMBOLS	DESCRIPTION
	SD CAP		WATER CAP
	TYPE 1 CATCH BASIN, GRATED LID		CONCRETE THRUST BLOCKING
	TYPE 1 CATCH BASIN, SOLID LID		11.25° BEND
	TYPE 2 CATCH BASIN, GRATED LID		22.5° BEND
	TYPE 2 CATCH BASIN, SOLID LID		45° BEND
	BEEHIVE MANHOLE COVER		90° BEND
	SQUARE YARD DRAIN		VALVE
	ROUND YARD DRAIN		HYDRANT ASSEMBLY
	STORM CLEAN OUT		BLOW-OFF VALVE
	STORM PIPE		REDUCER
	SEWER CAP		AIR-VAC ASSEMBLY
	SEWER CLEANOUT		WATER METER
	SEWER MANHOLE		WATER PIPE
	SEWER PIPE		DESCRIPTION
			SURVEY MONUMENT IN PROPOSED ROAD

#### CONTACT LIST

<b>DEVELOPER:</b> SOUTH LAKE RIDGE, LLC 10515 20TH ST SE #202 LAKE STEVENS, WA 98258 CONTACT: RYAN LARSEN PHONE: (360) 631-1820 EMAIL: rlarson@landprogrp.com	<b>CIVIL ENGINEER:</b> SOLID GROUND ENGINEERING 8105 166TH AVE NE REDMOND, WA 98052 CONTACT: TOM ABBOTT, PE PHONE: (425) 281-8324 EMAIL: tabbot@solidgroundpnw.com
<b>GEOTECHNICAL ENGINEER:</b> TERRA ASSOCIATES 12220 113TH AVE NE, SUITE 130 KIRKLAND, WA 98034 CONTACT: CAROLYN DECKER, PE PHONE: (206) 225-4989 EMAIL: cdecke@terra-associates.com	<b>LANDSCAPE ARCHITECT:</b> ORIGIN DESIGN GROUP, LLC 1031 185TH AVE NE SNOHOMISH, WA 98290 CONTACT: KRISTAL LOWE PHONE: (425) 348-1905 EMAIL: kristal@origindesigngroup.com
<b>SURVEYOR:</b> PACIFIC COAST SURVEYS 16300 MILL CREEK BLVD STE G4 MILL CREEK, WA 98012 CONTACT: DOUGLAS ROUPE, PLS PHONE: (425) 512-7089 EMAIL: doug@pcsurveys.net	<b>WETLAND BIOLOGIST:</b> WETLAND RESOURCES, INC. 9505 19TH AVE SE, SUITE 106 EVERETT, WA 98208 CONTACT: JOHN LAUFENBERG PHONE: (425) 238-5811 EMAIL: john@wetlandresources.com

#### PROJECT INFORMATION

<b>TAX PARCELS:</b> 2806260040100, 2806260040000, 2806260040100, 2806260040050, 2806260040100, 2806260040100, 2806260040100, 0103800009900, 2806260040070, 12611 175TH AVE SE SNOHOMISH, WA 98290 1,252,106 SF (28.72 AC)	<b>SITE ADDRESS:</b> 175TH AVE SE 175TH AVE SE SNOHOMISH, WA 98290 1,252,106 SF (28.72 AC)
<b>PROPOSED ZONING:</b> R-7 179 SINGLE FAMILY LOTS (PHASE 1) AND 34 TOWNHOMES (PHASE 2)	<b>PROPOSED LOTS:</b> 20 FRONT 5 SIDE 10 REAR
<b>BUILDING SETBACKS:</b> ROOSEVELT WATER ASSOCIATION CITY OF MONROE SEWER SERVICE SNOHOMISH COUNTY PUD PUGET SOUND ENERGY	<b>WATER:</b> ROOSEVELT WATER ASSOCIATION CITY OF MONROE SEWER SERVICE SNOHOMISH COUNTY PUD PUGET SOUND ENERGY
<b>SEWER:</b> ROOSEVELT WATER ASSOCIATION CITY OF MONROE SEWER SERVICE SNOHOMISH COUNTY PUD PUGET SOUND ENERGY	<b>POWER:</b> PUGET SOUND ENERGY
<b>GAS:</b> PUGET SOUND ENERGY	<b>TELEPHONE:</b> ZIRPLY COMCAST
<b>CABLE:</b> COMCAST	<b>SCHOOL DISTRICT:</b> SNOHOMISH SCHOOL DISTRICT NO 201
<b>FIRE DISTRICT:</b> SNOHOMISH REGIONAL FIRE & RESCUE	



#### SURVEY INFORMATION

**LEGAL DESCRIPTION**  
(THE METES AND BOUNDS DESCRIPTION BELOW DESCRIBES THE PERIMETER OF THE PARCELS SURVEYED HEREON.)  
THAT PORTION OF THE SOUTHEAST QUARTER OF SECTION 26, TOWNSHIP 28 NORTH, RANGE 6 EAST, WILLAMETTE MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS:  
BEGINNING AT THE EAST QUARTER CORNER OF SAID SECTION 26 ALSO BEING THE NORTHWEST CORNER OF THE PLAT OF ROBINHOOD PARK DIVISION NO. 2, FILED UNDER AUDITORS FILE NO. 1986460, RECORDS OF SNOHOMISH COUNTY, WASHINGTON;  
THENCE SOUTH 03°27'38" EAST ALONG THE WEST LINE OF SAID PLAT OF ROBINHOOD PARK DIVISION NO. 2 AND THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 26 A DISTANCE OF 1018.35 FEET TO THE NORTHEAST CORNER OF LOT 1, SNOHOMISH COUNTY SUD PLAT NO. 272 (8-86), FILED UNDER AUDITORS FILE NO. 8708190170, RECORDS OF SNOHOMISH COUNTY, WASHINGTON;  
THENCE NORTH 89°00'38" WEST ALONG THE NORTH LINES OF LOTS 1, 2, 3 AND 4 OF SAID SHORT PLAT A DISTANCE OF 806.85 FEET TO THE EAST LINE OF LOT 4, PLAT OF ROSE PARK, FILED UNDER AUDITORS FILE NO. 201003035001, RECORDS OF SNOHOMISH COUNTY, WASHINGTON;  
THENCE NORTH 02°12'21" WEST ALONG SAID EAST LINE A DISTANCE OF 112.91 FEET;  
THENCE NORTH 88°01'27" WEST ALONG THE NORTH LINES OF LOTS 1, 2, 3 AND 4 OF SAID PLAT OF ROSE PARK A DISTANCE OF 484.97 FEET TO THE EAST LINE OF TRACT 999, ALTERATION OF THE PLAT OF ROOSEVELT RIDGE, FILED UNDER AUDITORS FILE NO. 2008040252 10, RECORDS OF SNOHOMISH COUNTY, WASHINGTON;  
THENCE THE FOLLOWING COURSES ALONG THE EASTERLY RIGHT OF WAY MARGIN OF 175TH AVE SE, ALSO BEING THE EAST, SOUTH, WEST AND NORTH LINES OF SAID TRACT 999:  
THENCE SOUTH 02°12'20" EAST A DISTANCE OF 109.61 FEET TO THE BEGINNING OF A NON-TANGENT CURVE, CONCAVE TO THE SOUTHWEST, HAVING A RADIUS OF 190.50 FEET, AND TO WHICH BEGINNING A RADIAL LINE BEARS NORTH 08°12'46" EAST;  
THENCE WESTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 7°14'14", AN ARC LENGTH OF 24.06 FEET;  
THENCE NORTH 88°01'27" WEST A DISTANCE OF 32.14 FEET TO THE BEGINNING OF A CURVE, CONCAVE TO THE NORTHEAST, AND HAVING A RADIUS OF 25.00 FEET;  
THENCE NORTHWESTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 8°19'43", AN ARC LENGTH OF 38.98 FEET TO THE BEGINNING OF A COMPOUND CURVE, HAVING A RADIUS OF 470.00 FEET;  
THENCE NORTHERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 8°34'32", AN ARC LENGTH OF 70.35 FEET;  
THENCE NORTHEASTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 19°26'15", AN ARC LENGTH OF 205.29 FEET;  
THENCE NORTH 88°01'27" EAST A DISTANCE OF 1.01 FEET TO THE NORTHEAST CORNER OF SAID TRACT 999 AND THE WEST LINE OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 26;  
THENCE LEAVING SAID TRACT 999 NORTH 02°12'20" WEST ALONG SAID WEST LINE A DISTANCE OF 75.46 FEET TO THE NORTHWEST CORNER OF SAID SOUTHEAST QUARTER;  
THENCE SOUTH 89°07'54" EAST ALONG THE NORTH LINE OF SAID SOUTHEAST QUARTER A DISTANCE OF 1269.33 FEET TO THE POINT OF BEGINNING;  
CONTAINING AN AREA OF 29.81 ACRES, MORE OR LESS  
SITUATE IN THE COUNTY OF SNOHOMISH, STATE OF WASHINGTON.

#### VERTICAL DATUM

NAVD 88 (NAVD88 -3.67' = NGVD29)

#### BENCHMARK

FOUND CASED CONC. MON. W/ 2" BRASS DISK AT PC 124TH ST SE FIRST MON. E OF W/ 1/4 CORNER, 25-28-06  
WGS SURVEY DATA WAREHOUSE I.D. # 15306

ELEVATION = 305.01 FEET.

#### BASIS OF BEARING

PER THE PLAT OF ROOSEVELT RIDGE RECORDED UNDER A.F. #200510265136, THE MONUMENTED CENTERLINE OF 175TH ST SE AS THE BEARING OF N00°14'28"W, AS SHOWN HEREON.

#### EQUIPMENT & PROCEDURES

**METHOD OF SURVEY:**  
SURVEY PERFORMED BY FIELD TRAVERSE AND REAL TIME KINEMATICS GPS POSITIONING UTILIZING THE HXGN SMARTNET NETWORK  
**INSTRUMENTATION:**  
LEICA TS16 ROBOTIC ELECTRONIC TOTAL STATION  
LEICA VIVA GNSS G208 RECEIVER  
ALL EQUIPMENT HAS BEEN MAINTAINED IN ADJUSTMENT TO MANUFACTURERS SPECIFICATIONS AS REQUIRED BY IAC 332-130-100  
**PRECISION:**  
MEETS OR EXCEEDS STATE STANDARDS SET BY IAC 332-130-080 THROUGH 332-130-110

#### SURVEY REFERENCES

(R1) PLAT OF ROOSEVELT RIDGE - A.F. #200510265136  
(R2) PLAT OF ROSE PARK - A.F. #201003035001

#### SURVEY NOTES

THIS SURVEY HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF PARTIES WHOSE NAMES APPEAR HEREON ONLY, AND DOES NOT EXTEND TO ANY UNNAMED THIRD PARTIES WITHOUT EXPRESS RECERTIFICATION BY THE LAND SURVEYOR OF RECORD.  
BOUNDARY LINES SHOWN AND CORNERS SET REPRESENT DEED LOCATIONS. OWNERSHIP LINES MAY VARY. NO GUARANTEE OF OWNERSHIP IS EXPRESSED OR IMPLIED. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE REPORT AND DOES NOT PURPORT TO SHOW ALL EASEMENTS, RESTRICTIONS, RESERVATIONS, AND OCCUPATION WHICH MAY ENCUMBER TITLE OR USE OF SUBJECT PROPERTY.

#### EARTHWORK QUANTITIES

STRIPPING:	46,374 CY
CUT:	134,888 CY
FILL:	134,096 CY
NET:	792 CY (CUT/FILL)
DISTURBED AREA:	1,325,273 SF (30.42 AC)

THE ABOVE QUANTITIES ARE FOR PERMITTING PURPOSES. CONTRACTOR TO VERIFY.

#### TABLE OF CONTENTS

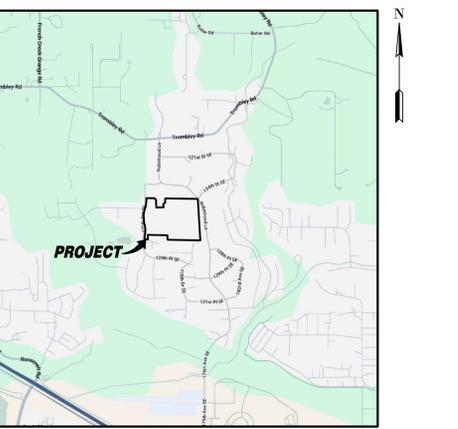
1	COVER SHEET
2-6	EXISTING CONDITIONS MAP
7-11	PRELIMINARY PLAT MAP
12-16	PRELIMINARY ROAD AND GRADING
17-21	PRELIMINARY STORM DRAINAGE
22-31	PRELIMINARY ROAD PROFILES AND SECTIONS
32-36	PRELIMINARY UTILITY PLAN

#### SURVEY DISCLAIMER

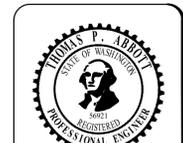
THE TOPOGRAPHIC SURVEY WAS PERFORMED BY PACIFIC COAST SURVEYS. SOLID GROUND ENGINEERING ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

#### UTILITY NOTE

THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.



VICINITY MAP  
SCALE: NOT TO SCALE



ENGINEERS STAMP

REVISIONS	DESCRIPTION	DATE



COVER SHEET

LAND PRO GROUP  
MONROE 30  
MONROE, WASHINGTON

DRAWN BY:	KMA
CHECKED BY:	TPA
DATE:	10-2-24
JURISDICTION:	CITY OF MONROE
JOB NUMBER:	24-0072P

CS-01  
1 OF 36



PORTION OF THE SE 1/4, SEC 26, T28N, R6E, WM, SNOHOMISH COUNTY, WASHINGTON



ENGINEERS STAMP

#	DATE	DESCRIPTION



**Solid Ground Engineering**  
8105 168th Ave NE  
Redmond, WA 98052

**EXISTING CONDITIONS MAP**

**LAND PRO GROUP**  
**MONROE 30**  
**MONROE, WASHINGTON**

DRAWN BY: RCR  
CHECKED BY: TRA  
DATE: 7-10-24  
JURISDICTION: CITY OF MONROE  
JOB NUMBER: 24-0072

PORTION OF THE SE 1/4, SEC 26, T28N, R6E, WM, SNOHOMISH COUNTY, WASHINGTON



ENGINEERS STAMP

#	DATE	DESCRIPTION



**SITE PLAN**

**LAND PRO GROUP**  
**MONROE 30**  
**MONROE, WASHINGTON**

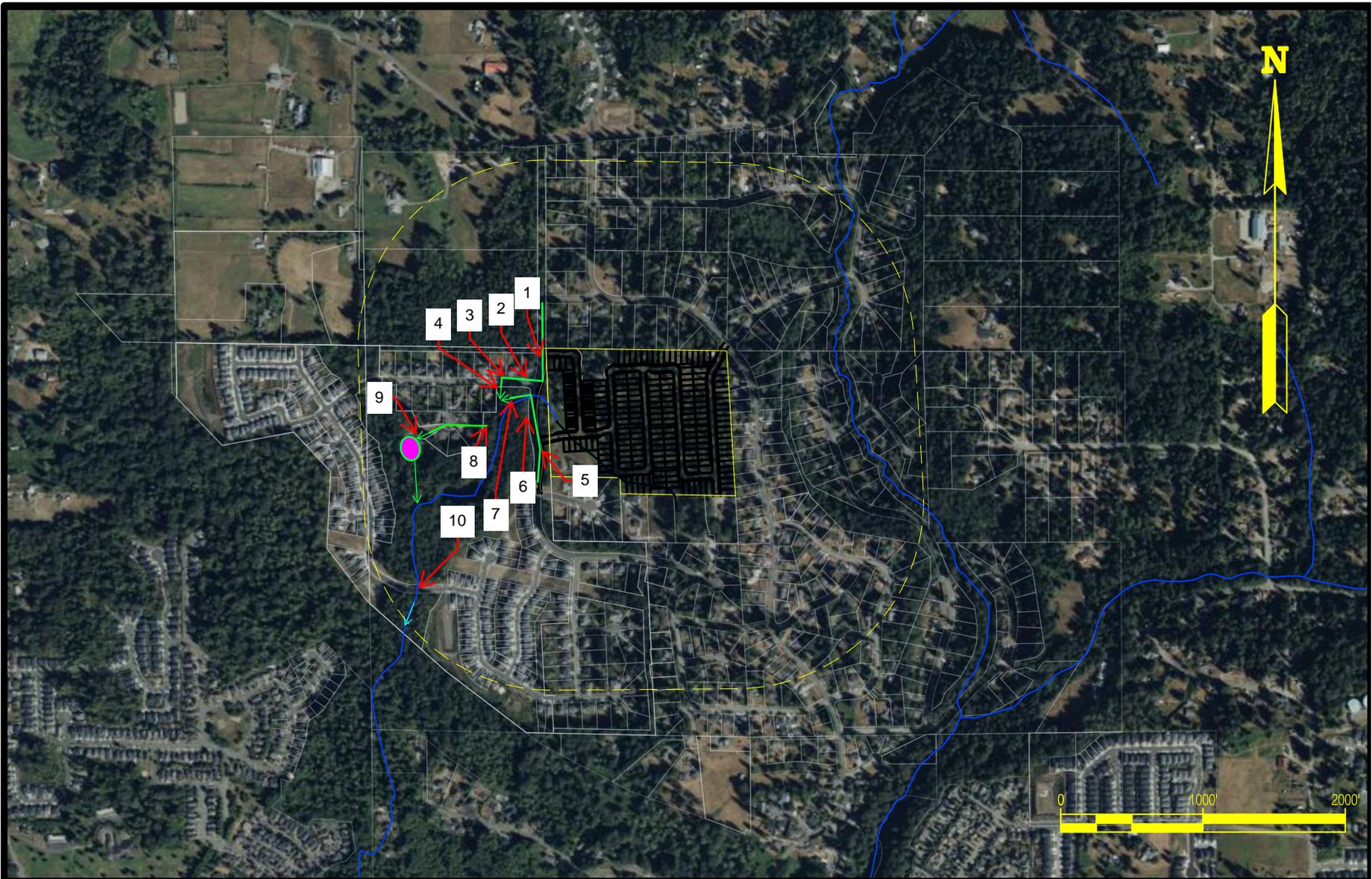
DRAWN BY: RCR  
CHECKED BY: TRA  
DATE: 7-10-21  
JURISDICTION: CITY OF MONROE  
JOB NUMBER: 24-0072

## **Appendix 2: Temporary Erosion and Sediment Control Design**

### **1. TESC Plans**

### **Appendix 3: Downstream Analysis**

1. Downstream Analysis Map
2. Downstream Analysis Site Visit Pictures
3. USDA Soils Map & Description



**Solid Ground Engineering**

8105 166th Ave NE  
Redmond, WA 98052

**SOUTH LAKE RIDGE, LLC**

**MONROE 30**

**DOWNSTREAM ANALYSIS MAP**

JOB NUMBER:	24-0072	DATE:	01/09/2025
JURISDICTION:	LAKE STEVENS	DRAWN BY:	CMP

## Downstream Analysis Photographs

**Image 1: Flow path 1 travels into existing stormwater structure and then travels south down 175<sup>th</sup> Ave SE**



**Image 2: Flow path 1 travels west in existing stormwater structure**



**Image 3: Water then turns south under 125<sup>th</sup> St SE and outfalls into drainage stream**



**Image 4: Existing drainage stream**



**Image 5: Flow path 2 will discharge into the existing drainage system that travels north on 175th**



Image 6: Water outfalls in wetlands



**Image 7: bubbler outfalls into existing drainage ditch where flow paths converge**



Image 8: Wetland drainage trench funnels into catch basin here



Image 9: water flows to detention pond and outfalls south



**Image 10: Water outfalls south across 129<sup>th</sup> St SE past the ¼ mile boundary**



Soil Map—Snohomish County Area, Washington  
(Monroe 30 Soil Survey)



Map Scale: 1:3,440 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 150 300 600 900 Feet

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

## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Snohomish County Area, Washington

Survey Area Data: Version 26, Aug 27, 2024

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

Date(s) aerial images were photographed: Aug 6, 2022—Sep 8, 2022

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
72	Tokul gravelly medial loam, 0 to 8 percent slopes	24.9	55.5%
73	Tokul gravelly medial loam, 8 to 15 percent slopes	19.8	44.2%
74	Tokul gravelly medial loam, 15 to 30 percent slopes	0.1	0.3%
<b>Totals for Area of Interest</b>		<b>44.9</b>	<b>100.0%</b>

#### **Appendix 4: Detention and Water Quality Design Analysis**

1. Predeveloped Hydrology Map
2. Developed Hydrology Map
3. Stormfilter Detail
4. WWHM2012 Output – Detention Vault

PORTION OF THE SE 1/4, SEC 26, T28N, R6E, WM, SNOHOMISH COUNTY, WASHINGTON

**Bypass Basin A**  
1.01 Acres

**Future Development Basin**  
1.08 Acres

**Bypass Basin C**  
0.41 Acres

**Onsite Basin**  
27.05 Acres

**Bypass Basin B**  
0.49 Acres

Onsite Basin		Bypass Basin	
Ground Cover	Area (acre)	Ground Cover	Area (acre)
Forest, steep	27.05	Forest, steep	1.91
<b>Total</b>	<b>27.05</b>	<b>Total</b>	<b>1.91</b>

Future Development Basin	
Ground Cover	Area (acre)
Forest, steep	1.08
<b>Total</b>	<b>1.08</b>

ENGINEERS STAMP

#	DATE	DESCRIPTION

REVISIONS

**EGE**  
Solid Ground Engineering  
8105 168th Ave NE  
Redmond, WA 98052

**EXISTING CONDITIONS MAP**

LAND PRO GROUP  
**MONROE 30**  
MONROE, WASHINGTON

DRAWN BY: RCR  
CHECKED BY: TRA  
DATE: 7-10-24  
JURISDICTION: CITY OF MONROE  
JOB NUMBER: 24-0072

**EX-01**  
1 OF 1

PORTION OF THE SE 1/4, SEC 26, T28N, R6E, WM, SNOHOMISH COUNTY, WASHINGTON

**Bypass Basin A**  
1.01 Acres

**Future Development Basin**  
1.08 Acres

**Bypass Basin C**  
0.41 Acres

**Onsite Basin**  
27.05 Acres

**Bypass Basin B**  
0.49 Acres

Onsite Basin		Bypass Basins	
Ground Cover	Area (acre)	Ground Cover	Area (acre)
Roof, flat	10.37	Pasture, Steep	0.69
Road, Steep	3.38	Roads, Steep	0.69
Sidewalks, steep	1.08	Roof Tops, Flat	0.22
Pasture, steep	12.22	Sidewalk, Steep	0.31
<b>Total</b>	<b>27.05</b>	<b>Total</b>	<b>1.91</b>

Future Development Basin	
Ground Cover	Area (acre)
Roof Tops, Flat	0.70
Pasture, Steep	0.38
<b>Total</b>	<b>1.08</b>

LOT 4  
PLAT OF  
ROSE PARK  
A.P. #201003035001

ENGINEERS STAMP

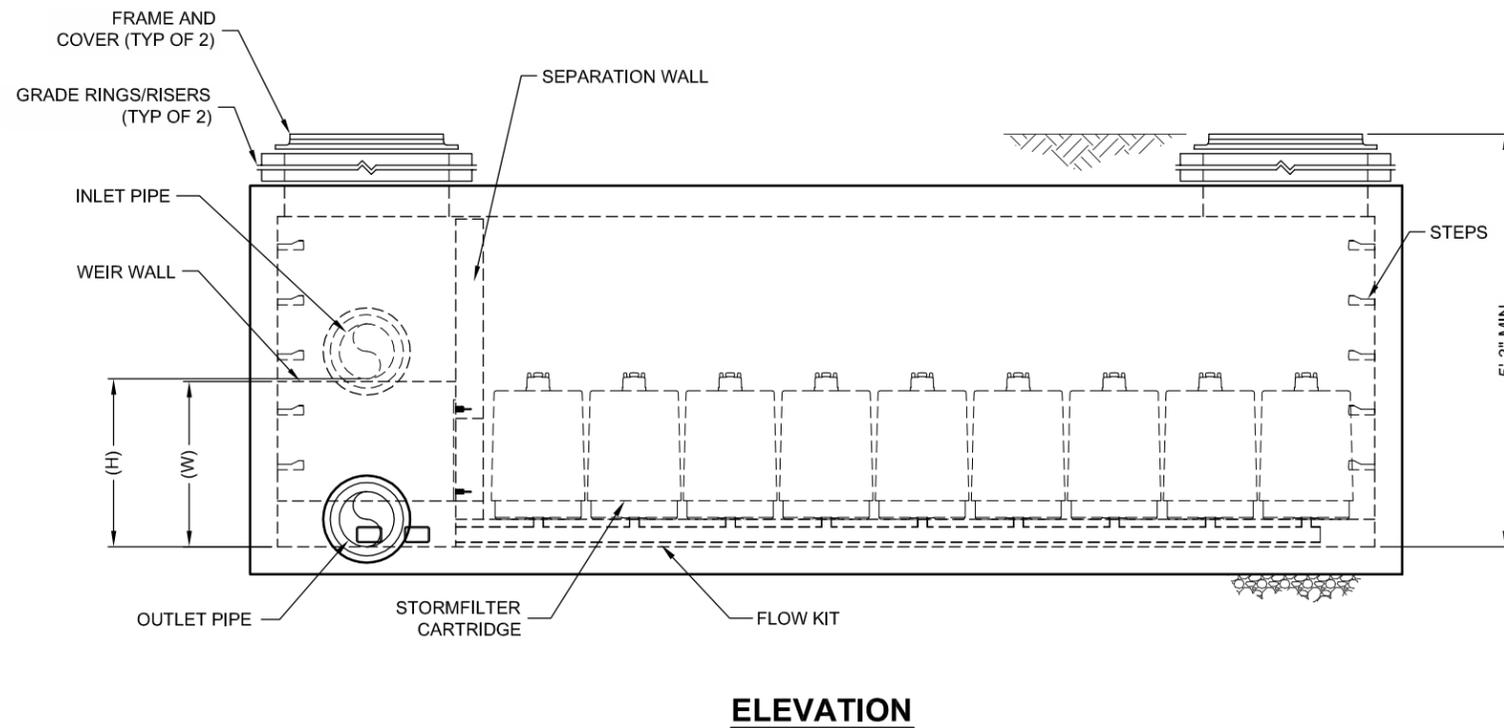
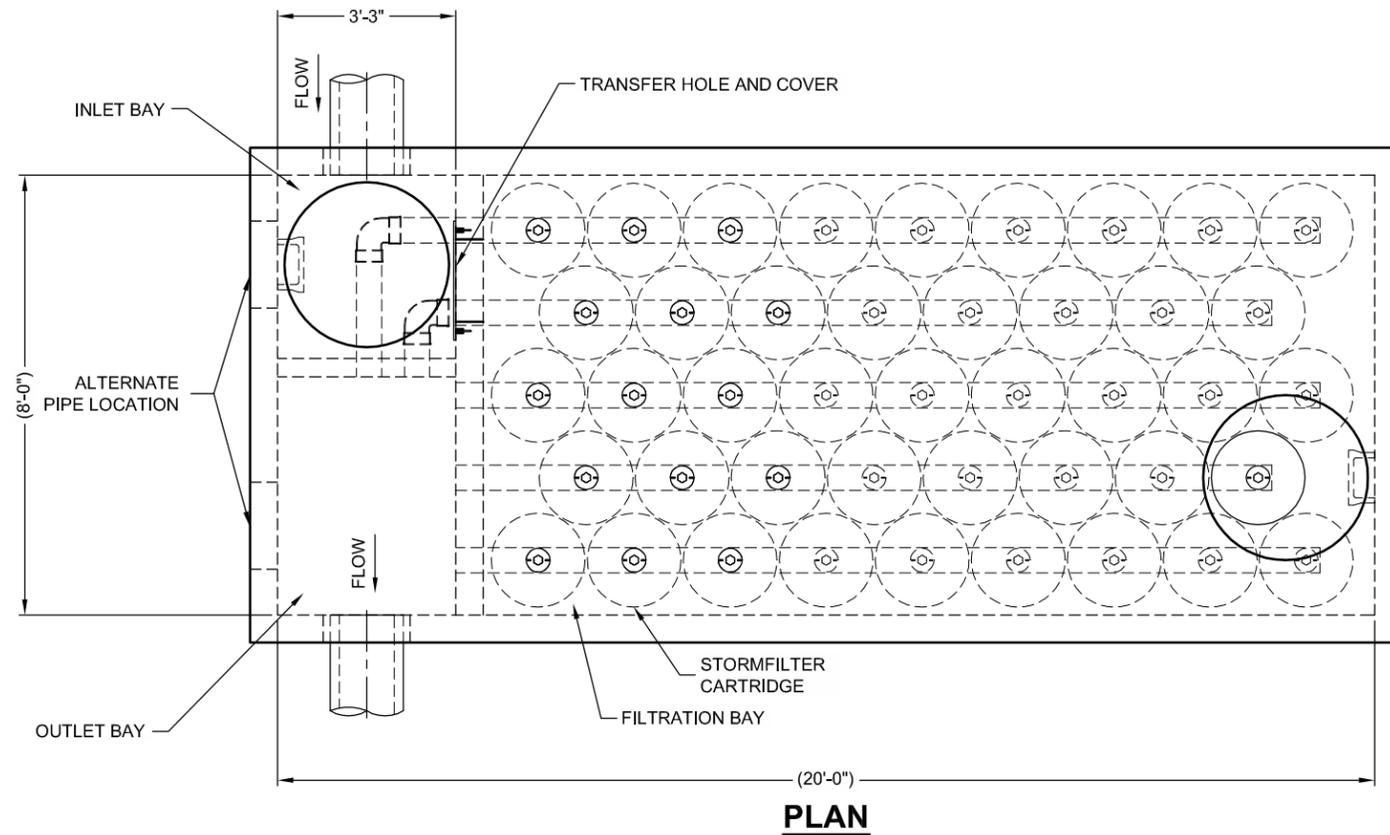
#	DATE	DESCRIPTION



**SITE PLAN**

**LAND PRO GROUP**  
**MONROE 30**  
**MONROE, WASHINGTON**

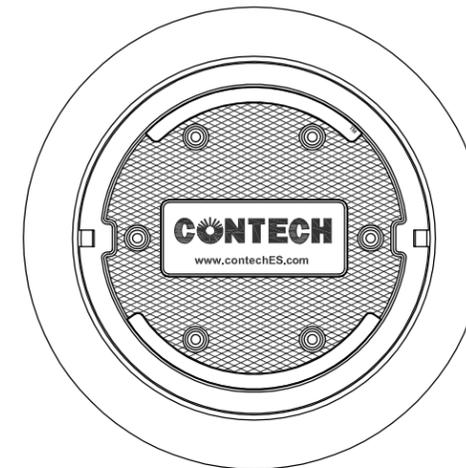
DRAWN BY: RCR  
CHECKED BY: TRA  
DATE: 7-10-24  
JURISDICTION: CITY OF MONROE  
JOB NUMBER: 24-0072



### STORMFILTER DESIGN TABLE

- THE 8' x 20' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
SYSTEM HYDRAULIC DROP (H - REQ'D. MIN.)	3.05'		2.3'		1.8'	
HEIGHT OF WEIR (W)	3.00'		2.25'		1.75'	
TREATMENT BY MEDIA SURFACE AREA	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5



**FRAME AND COVER**  
(DIAMETER VARIES)  
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS	
STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	1.6836
PEAK FLOW RATE (cfs)	6.0145
RETURN PERIOD OF PEAK FLOW (yrs)	100
# OF CARTRIDGES REQUIRED	41
CARTRIDGE FLOW RATE	*
MEDIA TYPE (CSF, PERLITE, ZPG)	Psorb
PIPE DATA:	I.E. MATERIAL DIAMETER
INLET PIPE	* * *
OUTLET PIPE	* * *
INLET BAY RIM ELEVATION	*
FILTER BAY RIM ELEVATION	*
ANTI-FLOTATION BALLAST	WIDTH HEIGHT
	* *
NOTES/SPECIAL REQUIREMENTS:	

#### PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **37 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM)**.

#### GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. [www.contechES.com](http://www.contechES.com)
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

#### INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.



**CONTECH**  
ENGINEERED SOLUTIONS LLC  
[www.contechES.com](http://www.contechES.com)  
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069  
800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER  
8' x 20' PEAK DIVERSION STORMFILTER  
STANDARD DETAIL

## STORMFILTER STEEL CATCHBASIN DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 1 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF ONE CARTRIDGE. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL. PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

### CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			3.3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	15	12.53	7.5
PEAK HYDRAULIC CAPACITY	1.0			1.0			2.25		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

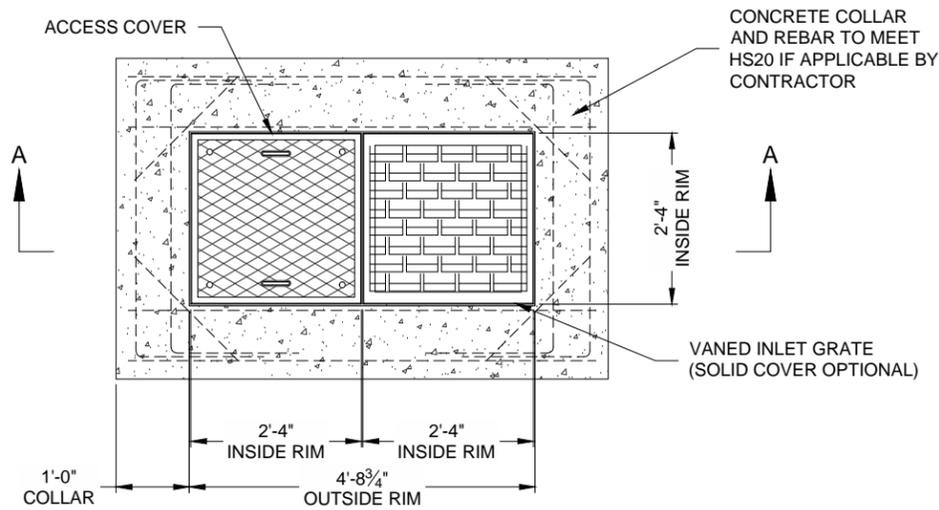
\* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

### GENERAL NOTES

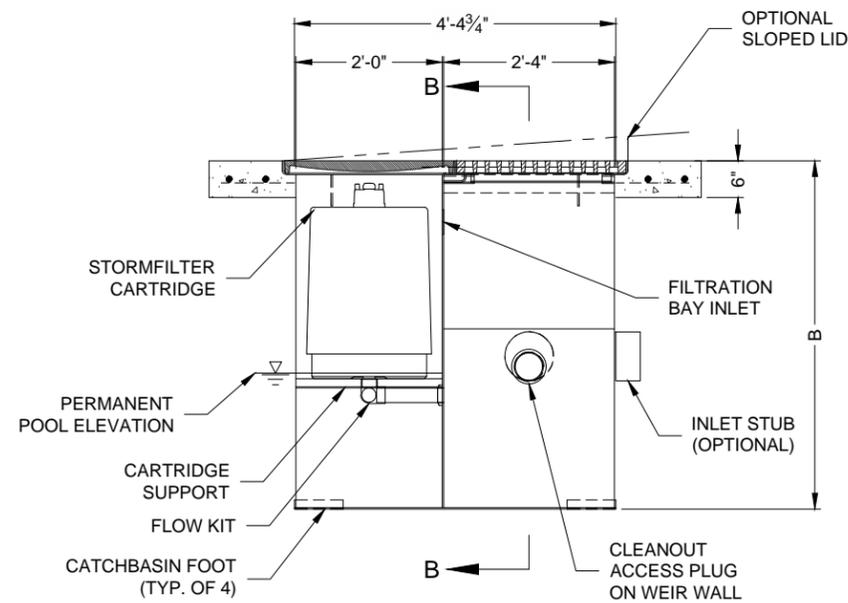
- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. [www.contechES.com](http://www.contechES.com)
- STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
- MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
- STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER. MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
- STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET HS20 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

### INSTALLATION NOTES

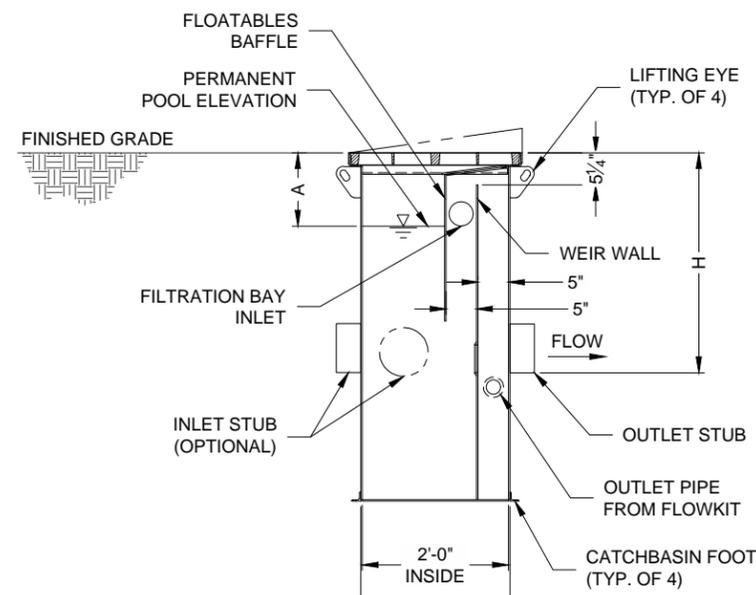
- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.



**PLAN VIEW**



**SECTION A-A**

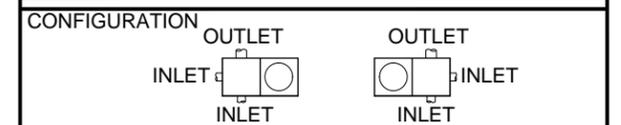


**SECTION B-B**

### 1-CARTRIDGE CATCHBASIN STORMFILTER DATA

STRUCTURE ID	SFCB1
WATER QUALITY FLOW RATE (cfs)	0.0249
PEAK FLOW RATE (<1 cfs)	0.4179
RETURN PERIOD OF PEAK FLOW (yrs)	100
CARTRIDGE HEIGHT (27", 18", 18" DEEP)	18"
CARTRIDGE FLOW RATE (gpm)	XX
MEDIA TYPE (PERLITE, ZPG, PSORB)	PSORB
RIM ELEVATION	XXX.XX'

PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"



SLOPED LID	YES/NO
SOLID COVER	YES/NO

NOTES/SPECIAL REQUIREMENTS:



THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 8,322,828; 8,324,816; 8,324,817; 8,324,818; 8,324,819; 8,324,820; 8,324,821; 8,324,822; 8,324,823; 8,324,824; 8,324,825; 8,324,826; 8,324,827; 8,324,828; 8,324,829; 8,324,830; 8,324,831; 8,324,832; 8,324,833; 8,324,834; 8,324,835; 8,324,836; 8,324,837; 8,324,838; 8,324,839; 8,324,840; 8,324,841; 8,324,842; 8,324,843; 8,324,844; 8,324,845; 8,324,846; 8,324,847; 8,324,848; 8,324,849; 8,324,850; 8,324,851; 8,324,852; 8,324,853; 8,324,854; 8,324,855; 8,324,856; 8,324,857; 8,324,858; 8,324,859; 8,324,860; 8,324,861; 8,324,862; 8,324,863; 8,324,864; 8,324,865; 8,324,866; 8,324,867; 8,324,868; 8,324,869; 8,324,870; 8,324,871; 8,324,872; 8,324,873; 8,324,874; 8,324,875; 8,324,876; 8,324,877; 8,324,878; 8,324,879; 8,324,880; 8,324,881; 8,324,882; 8,324,883; 8,324,884; 8,324,885; 8,324,886; 8,324,887; 8,324,888; 8,324,889; 8,324,890; 8,324,891; 8,324,892; 8,324,893; 8,324,894; 8,324,895; 8,324,896; 8,324,897; 8,324,898; 8,324,899; 8,324,900; 8,324,901; 8,324,902; 8,324,903; 8,324,904; 8,324,905; 8,324,906; 8,324,907; 8,324,908; 8,324,909; 8,324,910; 8,324,911; 8,324,912; 8,324,913; 8,324,914; 8,324,915; 8,324,916; 8,324,917; 8,324,918; 8,324,919; 8,324,920; 8,324,921; 8,324,922; 8,324,923; 8,324,924; 8,324,925; 8,324,926; 8,324,927; 8,324,928; 8,324,929; 8,324,930; 8,324,931; 8,324,932; 8,324,933; 8,324,934; 8,324,935; 8,324,936; 8,324,937; 8,324,938; 8,324,939; 8,324,940; 8,324,941; 8,324,942; 8,324,943; 8,324,944; 8,324,945; 8,324,946; 8,324,947; 8,324,948; 8,324,949; 8,324,950; 8,324,951; 8,324,952; 8,324,953; 8,324,954; 8,324,955; 8,324,956; 8,324,957; 8,324,958; 8,324,959; 8,324,960; 8,324,961; 8,324,962; 8,324,963; 8,324,964; 8,324,965; 8,324,966; 8,324,967; 8,324,968; 8,324,969; 8,324,970; 8,324,971; 8,324,972; 8,324,973; 8,324,974; 8,324,975; 8,324,976; 8,324,977; 8,324,978; 8,324,979; 8,324,980; 8,324,981; 8,324,982; 8,324,983; 8,324,984; 8,324,985; 8,324,986; 8,324,987; 8,324,988; 8,324,989; 8,324,990; 8,324,991; 8,324,992; 8,324,993; 8,324,994; 8,324,995; 8,324,996; 8,324,997; 8,324,998; 8,324,999; 8,325,000.

**CONTECH**  
ENGINEERED SOLUTIONS LLC

www.contechES.com  
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069  
800-526-3999 513-645-7000 513-645-7993 FAX

1 CARTRIDGE CATCHBASIN  
STORMFILTER  
STANDARD DETAIL

## STORMFILTER STEEL CATCHBASIN DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 2 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF TWO CARTRIDGES. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL. PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

### CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			3.3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	15	12.53	7.5
PEAK HYDRAULIC CAPACITY	1.0			1.0			2.25		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

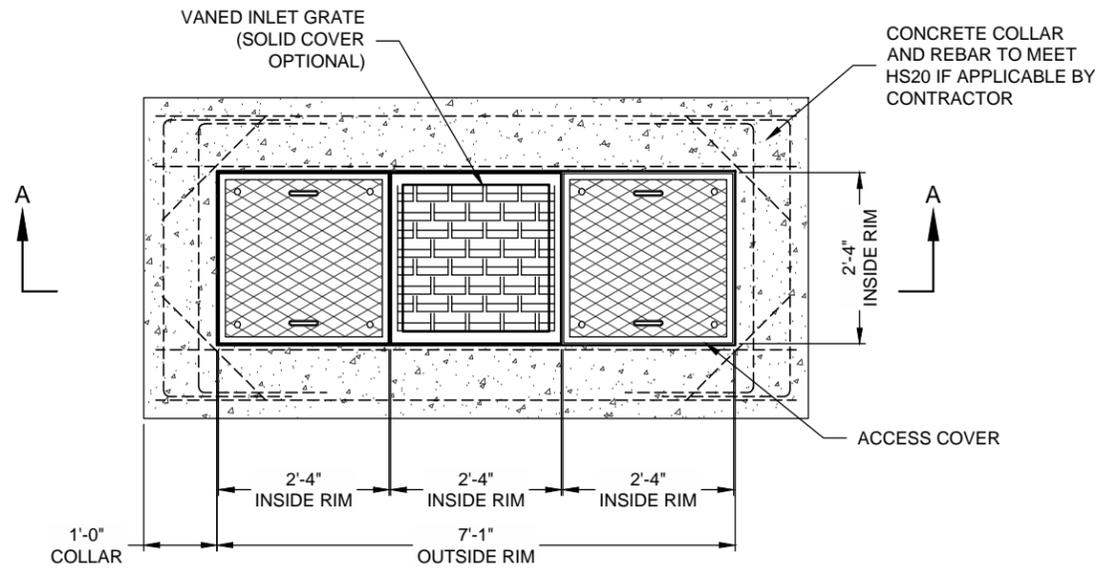
\* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

### GENERAL NOTES

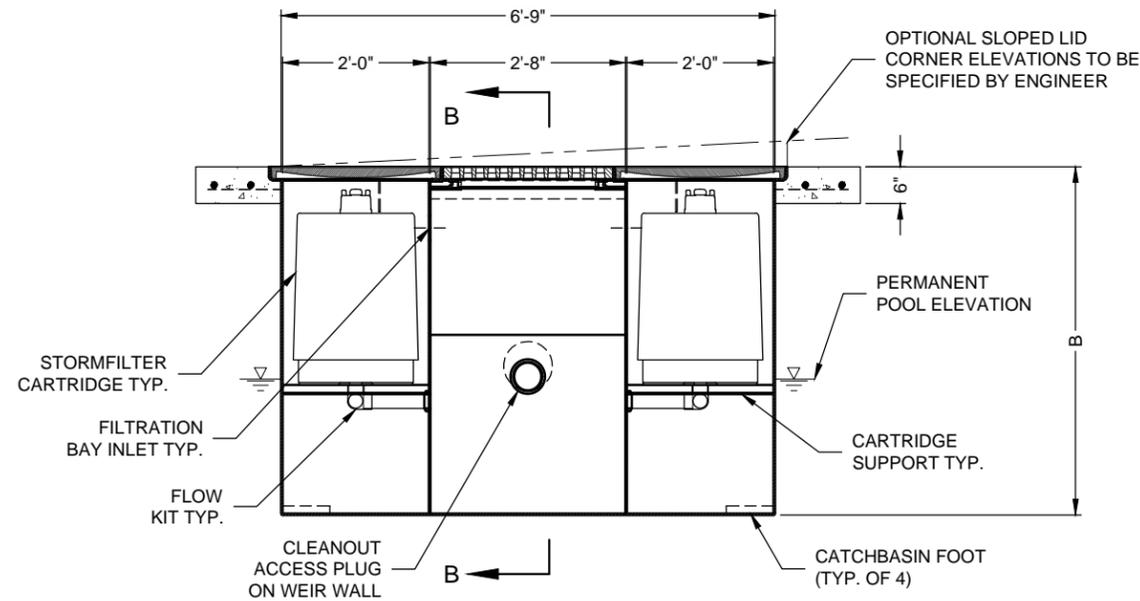
- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. WWW.CONTECHES.COM
- STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
- MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
- STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER. MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
- STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET HS20 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

### INSTALLATION NOTES

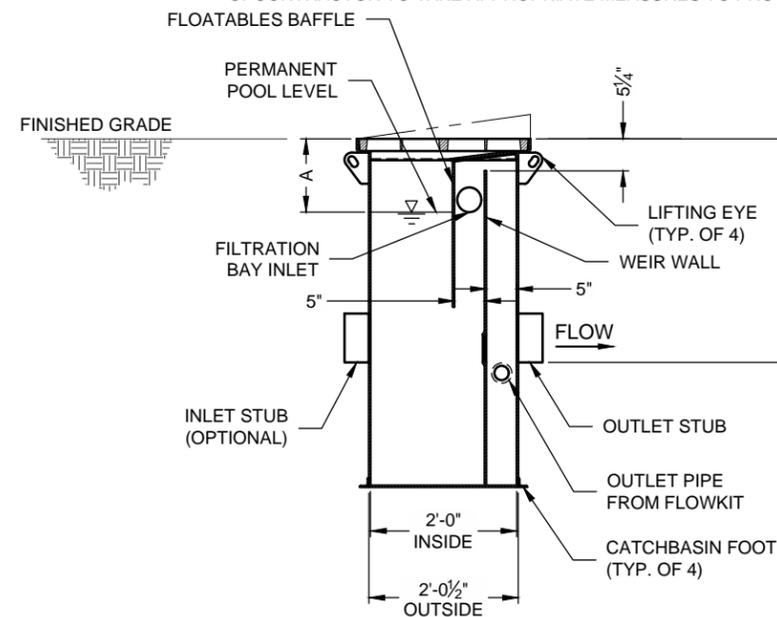
- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.



**PLAN VIEW**



**SECTION A-A**

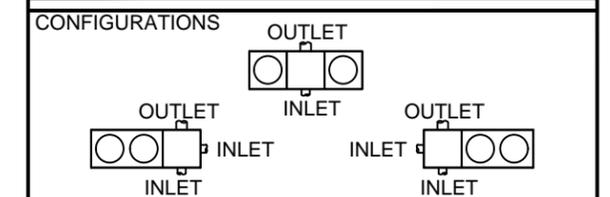


**SECTION B-B**

### 2-CARTRIDGE DEEP CATCHBASIN STORMFILTER DATA

STRUCTURE ID	SFCB2
WATER QUALITY FLOW RATE (cfs)	0.0445
PEAK FLOW RATE (<1.8 cfs)	0.6522
RETURN PERIOD OF PEAK FLOW (yrs)	100
CARTRIDGE FLOW RATE (gpm)	XX
MEDIA TYPE (PERLITE, ZPG, PSORB)	PSORB
RIM ELEVATION	XXX.XX'

PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"



SLOPED LID	YES/NO
SOLID COVER	YES/NO
NOTES/SPECIAL REQUIREMENTS:	

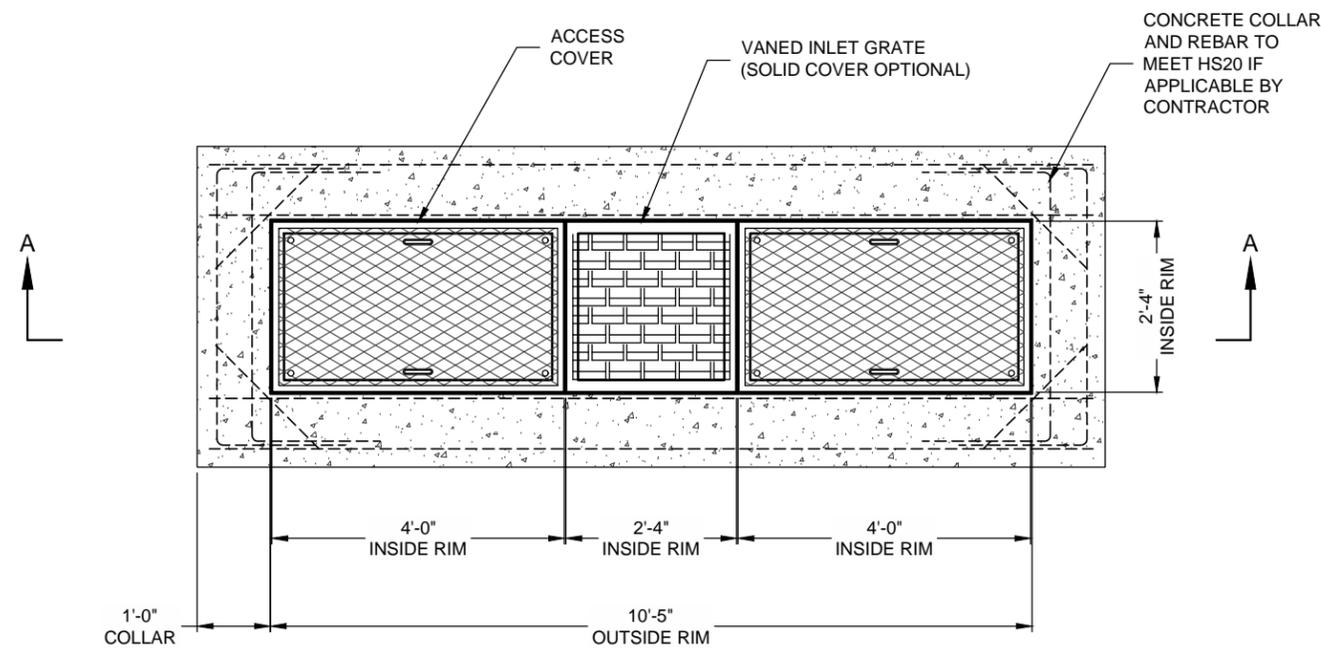
**CONTECH**  
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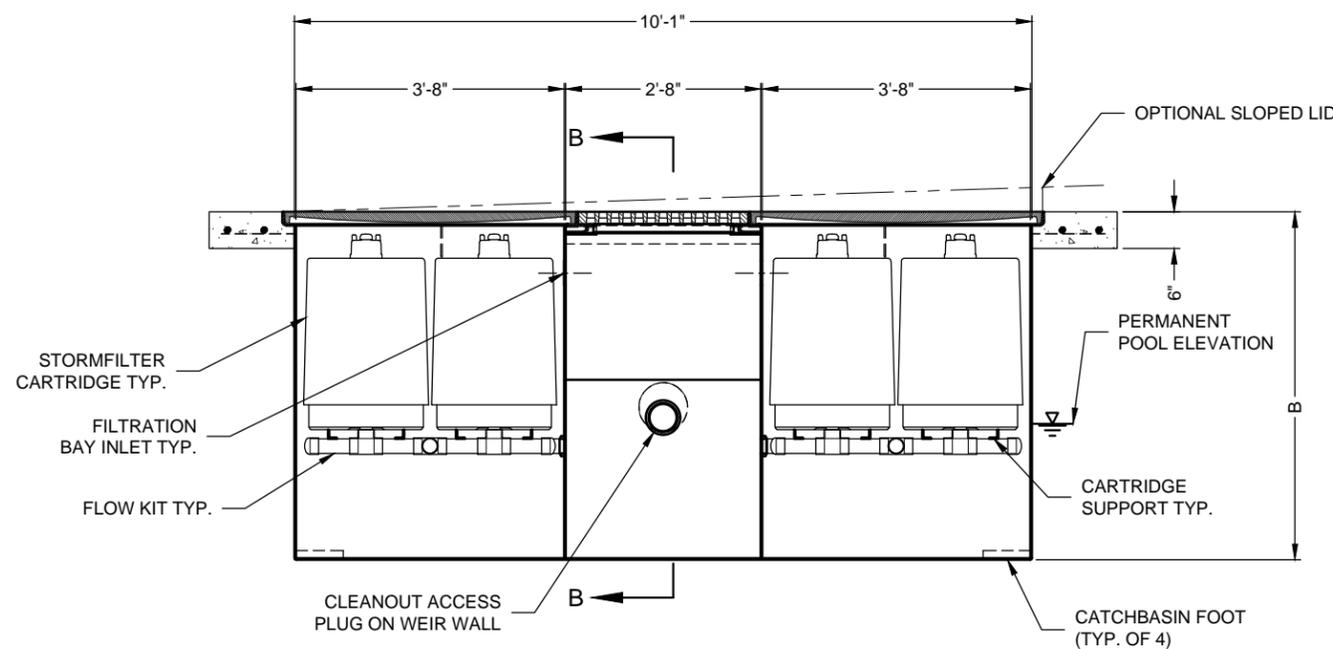
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

800-526-3999 513-645-7000 513-645-7993 FAX

2 CARTRIDGE CATCHBASIN  
STORMFILTER  
STANDARD DETAIL



**PLAN VIEW**  
27" CARTRIDGES



**SECTION A-A**

STORMFILTER STEEL CATCHBASIN DESIGN NOTES									
STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 4 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF FOUR CARTRIDGES. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL. PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.									
CARTRIDGE SELECTION									
CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			3.3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	15	12.53	7.5
PEAK HYDRAULIC CAPACITY	1.0			1.0			2.25		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

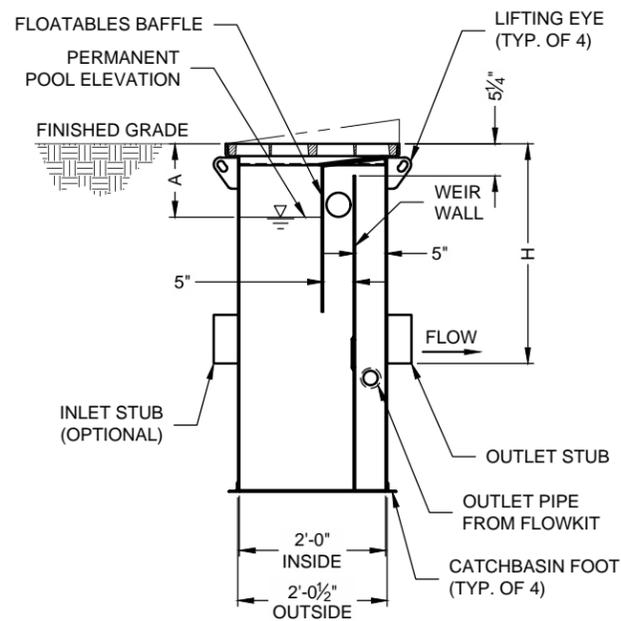
\* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

**GENERAL NOTES**

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. [www.contechES.com](http://www.contechES.com)
- STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
- MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
- STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER. MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
- STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET HS20 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

**INSTALLATION NOTES**

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

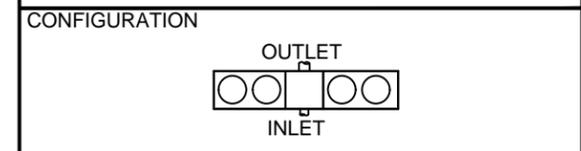


**SECTION C-C**

**4-CARTRIDGE CATCHBASIN  
STORMFILTER DATA**

STRUCTURE ID	SFCB4
WATER QUALITY FLOW RATE (cfs)	0.1461
PEAK FLOW RATE (<1 cfs)	AA
RETURN PERIOD OF PEAK FLOW (yrs)	100
CARTRIDGE FLOW RATE (gpm)	AA
MEDIA TYPE (PERLITE, ZPG, PSORB)	PSORB
RIM ELEVATION	AAA.AA

PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"



SLOPED LID	YES/NO
SOLID COVER	YES/NO

NOTES/SPECIAL REQUIREMENTS:

\*PER ENGINEER OF RECORD

I:\COMMON\ADTREATMENT\10 STORMFILTER\40 STANDARD DRAWINGS\SFCB4\SFCB4-DWG FROM COMMOPS 11-6-23\SFCB4-DTL.DWG 11/6/2023 9:28 AM



THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,322,426; 5,324,326; 5,324,327; 5,324,328; 5,324,329; 5,324,330; 5,324,331; 5,324,332; 5,324,333; 5,324,334; 5,324,335; 5,324,336; 5,324,337; 5,324,338; 5,324,339; 5,324,340; 5,324,341; 5,324,342; 5,324,343; 5,324,344; 5,324,345; 5,324,346; 5,324,347; 5,324,348; 5,324,349; 5,324,350; 5,324,351; 5,324,352; 5,324,353; 5,324,354; 5,324,355; 5,324,356; 5,324,357; 5,324,358; 5,324,359; 5,324,360; 5,324,361; 5,324,362; 5,324,363; 5,324,364; 5,324,365; 5,324,366; 5,324,367; 5,324,368; 5,324,369; 5,324,370; 5,324,371; 5,324,372; 5,324,373; 5,324,374; 5,324,375; 5,324,376; 5,324,377; 5,324,378; 5,324,379; 5,324,380; 5,324,381; 5,324,382; 5,324,383; 5,324,384; 5,324,385; 5,324,386; 5,324,387; 5,324,388; 5,324,389; 5,324,390; 5,324,391; 5,324,392; 5,324,393; 5,324,394; 5,324,395; 5,324,396; 5,324,397; 5,324,398; 5,324,399; 5,324,400; 5,324,401; 5,324,402; 5,324,403; 5,324,404; 5,324,405; 5,324,406; 5,324,407; 5,324,408; 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5,324,864; 5,324,865; 5,324,866; 5,324,867; 5,324,868; 5,324,869; 5,324,870; 5,324,871; 5,324,872; 5,324,873; 5,324,874; 5,324,875; 5,324,876; 5,324,877; 5,324,878; 5,324,879; 5,324,880; 5,324,881; 5,324,882; 5,324,883; 5,324,884; 5,324,885; 5,324,886; 5,324,887; 5,324,888; 5,324,889; 5,324,890; 5,324,891; 5,324,892; 5,324,893; 5,324,894; 5,324,895; 5,324,896; 5,324,897; 5,324,898; 5,324,899; 5,324,900; 5,324,901; 5,324,902; 5,324,903; 5,324,904; 5,324,905; 5,324,906; 5,324,907; 5,324,908; 5,324,909; 5,324,910; 5,324,911; 5,324,912; 5,324,913; 5,324,914; 5,324,915; 5,324,916; 5,324,917; 5,324,918; 5,324,919; 5,324,920; 5,324,921; 5,324,922; 5,324,923; 5,324,924; 5,324,925; 5,324,926; 5,324,927; 5,324,928; 5,324,929; 5,324,930; 5,324,931; 5,324,932; 5,324,933; 5,324,934; 5,324,935; 5,324,936; 5,324,937; 5,324,938; 5,324,939; 5,324,940; 5,324,941; 5,324,942; 5,324,943; 5,324,944; 5,324,945; 5,324,946; 5,324,947; 5,324,948; 5,324,949; 5,324,950; 5,324,951; 5,324,952; 5,324,953; 5,324,954; 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**4 CARTRIDGE CATCHBASIN  
STORMFILTER  
STANDARD DETAIL**

**WWHM2012**  
**PROJECT REPORT**

# General Model Information

WWHM2012 Project Name: 20250417 Monroe 30 detention model v2

Site Name:

Site Address:

City:

Report Date: 5/5/2025

Gage: Everett

Data Start: 1948/10/01

Data End: 2009/09/30

Timestep: 15 Minute

Precip Scale: 1.200

Version Date: 2024/06/28

Version: 4.3.1

## POC Thresholds

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

High Flow Threshold for POC1: 50 Year

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*Landuse Basin Data*  
*Predeveloped Land Use*

**Basin 1**

Bypass:	No
GroundWater:	No
Pervious Land Use C, Forest, Steep	acre 27.05
Pervious Total	27.05
Impervious Land Use	acre
Impervious Total	0
Basin Total	27.05

Element Flow Components:		
Surface	Interflow	Groundwater
Component Flows To:		
POC 1	POC 1	

future basin

Bypass:	No
GroundWater:	No
Pervious Land Use C, Forest, Steep	acre 1.08
Pervious Total	1.08
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.08

Element Flow Components:

Surface	Interflow	Groundwater
Component Flows To:		
POC 1	POC 1	

## Bypass

Bypass:	No
GroundWater:	No
Pervious Land Use C, Forest, Steep	acre 1.91
Pervious Total	1.91
Impervious Land Use ROADS STEEP	acre 0.52
Impervious Total	0.52
Basin Total	2.43

## Element Flow Components:

Surface	Interflow	Groundwater
Component Flows To:		
POC 1	POC 1	

## Mitigated Land Use

### Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use C, Pasture, Steep	acre 12.22
Pervious Total	12.22
Impervious Land Use	acre
ROADS STEEP	3.38
ROOF TOPS FLAT	10.37
SIDEWALKS STEEP	1.08
Impervious Total	14.83
Basin Total	27.05

### Element Flow Components:

Surface	Interflow	Groundwater
Component Flows To:		
Vault 1	Vault 1	

future Basin

Bypass:	No
GroundWater:	No
Pervious Land Use C, Pasture, Steep	acre 0.38
Pervious Total	0.38
Impervious Land Use ROOF TOPS FLAT	acre 0.7
Impervious Total	0.7
Basin Total	1.08

Element Flow Components:

Surface	Interflow	Groundwater
Component Flows To:		
Vault 1	Vault 1	

## Bypass

Bypass: Yes

GroundWater: No

Pervious Land Use acre  
C, Pasture, Steep 0.69

Pervious Total 0.69

Impervious Land Use acre  
ROADS STEEP 1.21  
ROOF TOPS FLAT 0.22  
SIDEWALKS STEEP 0.31

Impervious Total 1.74

Basin Total 2.43

### Element Flow Components:

Surface Interflow

Groundwater

Component Flows To:

POC 1 POC 1

*Routing Elements*  
*Predeveloped Routing*

## Mitigated Routing

### Vault 1

Width: 92 ft.  
 Length: 300 ft.  
 Depth: 11 ft.  
 Discharge Structure  
 Riser Height: 10 ft.  
 Riser Diameter: 24 in.  
 Orifice 1 Diameter: 3.813 in. Elevation:0 ft.  
 Orifice 2 Diameter: 3.594 in. Elevation:4 ft.  
 Orifice 3 Diameter: 4.750 in. Elevation:6.1 ft.  
 Element Outlets:  
 Outlet 1                      Outlet 2  
 Outlet Flows To:

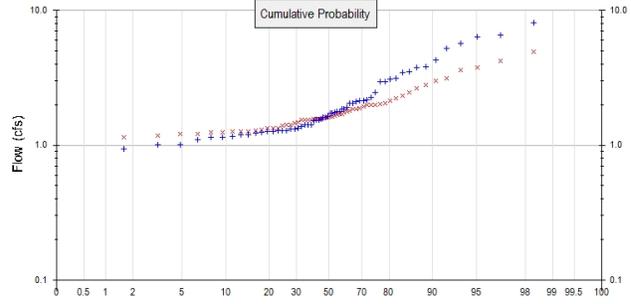
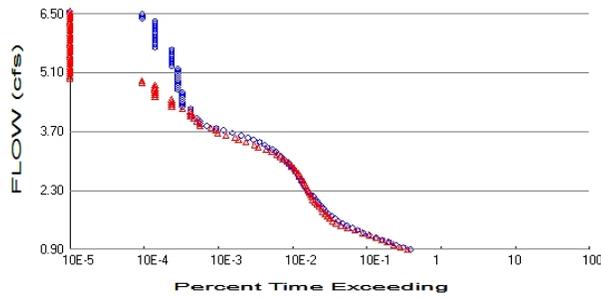
Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.633	0.000	0.000	0.000
0.1222	0.633	0.077	0.137	0.000
0.2444	0.633	0.154	0.195	0.000
0.3667	0.633	0.232	0.238	0.000
0.4889	0.633	0.309	0.275	0.000
0.6111	0.633	0.387	0.308	0.000
0.7333	0.633	0.464	0.337	0.000
0.8556	0.633	0.542	0.364	0.000
0.9778	0.633	0.619	0.390	0.000
1.1000	0.633	0.697	0.413	0.000
1.2222	0.633	0.774	0.436	0.000
1.3444	0.633	0.851	0.457	0.000
1.4667	0.633	0.929	0.477	0.000
1.5889	0.633	1.006	0.497	0.000
1.7111	0.633	1.084	0.516	0.000
1.8333	0.633	1.161	0.534	0.000
1.9556	0.633	1.239	0.551	0.000
2.0778	0.633	1.316	0.568	0.000
2.2000	0.633	1.393	0.585	0.000
2.3222	0.633	1.471	0.601	0.000
2.4444	0.633	1.548	0.616	0.000
2.5667	0.633	1.626	0.631	0.000
2.6889	0.633	1.703	0.646	0.000
2.8111	0.633	1.781	0.661	0.000
2.9333	0.633	1.858	0.675	0.000
3.0556	0.633	1.936	0.689	0.000
3.1778	0.633	2.013	0.703	0.000
3.3000	0.633	2.090	0.716	0.000
3.4222	0.633	2.168	0.729	0.000
3.5444	0.633	2.245	0.742	0.000
3.6667	0.633	2.323	0.755	0.000
3.7889	0.633	2.400	0.767	0.000
3.9111	0.633	2.478	0.780	0.000
4.0333	0.633	2.555	0.856	0.000
4.1556	0.633	2.633	0.942	0.000
4.2778	0.633	2.710	1.000	0.000
4.4000	0.633	2.787	1.049	0.000

4.5222	0.633	2.865	1.092	0.000
4.6444	0.633	2.942	1.131	0.000
4.7667	0.633	3.020	1.168	0.000
4.8889	0.633	3.097	1.202	0.000
5.0111	0.633	3.175	1.235	0.000
5.1333	0.633	3.252	1.266	0.000
5.2556	0.633	3.330	1.297	0.000
5.3778	0.633	3.407	1.326	0.000
5.5000	0.633	3.484	1.354	0.000
5.6222	0.633	3.562	1.381	0.000
5.7444	0.633	3.639	1.408	0.000
5.8667	0.633	3.717	1.434	0.000
5.9889	0.633	3.794	1.459	0.000
6.1111	0.633	3.872	1.548	0.000
6.2333	0.633	3.949	1.732	0.000
6.3556	0.633	4.026	1.841	0.000
6.4778	0.633	4.104	1.931	0.000
6.6000	0.633	4.181	2.011	0.000
6.7222	0.633	4.259	2.083	0.000
6.8444	0.633	4.336	2.151	0.000
6.9667	0.633	4.414	2.214	0.000
7.0889	0.633	4.491	2.275	0.000
7.2111	0.633	4.569	2.332	0.000
7.3333	0.633	4.646	2.388	0.000
7.4556	0.633	4.723	2.441	0.000
7.5778	0.633	4.801	2.493	0.000
7.7000	0.633	4.878	2.543	0.000
7.8222	0.633	4.956	2.591	0.000
7.9444	0.633	5.033	2.639	0.000
8.0667	0.633	5.111	2.685	0.000
8.1889	0.633	5.188	2.731	0.000
8.3111	0.633	5.266	2.775	0.000
8.4333	0.633	5.343	2.818	0.000
8.5556	0.633	5.420	2.861	0.000
8.6778	0.633	5.498	2.903	0.000
8.8000	0.633	5.575	2.944	0.000
8.9222	0.633	5.653	2.984	0.000
9.0444	0.633	5.730	3.024	0.000
9.1667	0.633	5.808	3.063	0.000
9.2889	0.633	5.885	3.101	0.000
9.4111	0.633	5.963	3.139	0.000
9.5333	0.633	6.040	3.176	0.000
9.6556	0.633	6.117	3.213	0.000
9.7778	0.633	6.195	3.250	0.000
9.9000	0.633	6.272	3.285	0.000
10.022	0.633	6.350	3.391	0.000
10.144	0.633	6.427	4.518	0.000
10.267	0.633	6.505	6.274	0.000
10.389	0.633	6.582	8.364	0.000
10.511	0.633	6.659	10.53	0.000
10.633	0.633	6.737	12.53	0.000
10.756	0.633	6.814	14.15	0.000
10.878	0.633	6.892	15.29	0.000
11.000	0.633	6.969	16.05	0.000
11.122	0.633	7.047	16.96	0.000
11.244	0.000	0.000	17.70	0.000

# Analysis Results

## POC 1



+ Predeveloped    x Mitigated

### Predeveloped Landuse Totals for POC #1

Total Pervious Area: 30.04  
 Total Impervious Area: 0.52

### Mitigated Landuse Totals for POC #1

Total Pervious Area: 13.29  
 Total Impervious Area: 17.27

Flow Frequency Method: Log Pearson Type III 17B

### Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.792251
5 year	2.895905
10 year	3.820701
25 year	5.240977
50 year	6.502435
100 year	7.956495

### Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.683598
5 year	2.272438
10 year	2.719968
25 year	3.354933
50 year	3.881237
100 year	4.455729

## Annual Peaks

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

Year	Predeveloped	Mitigated
1949	2.054	1.560
1950	2.276	1.656
1951	1.610	1.788
1952	1.575	1.425
1953	1.532	1.628
1954	6.357	2.338
1955	2.157	1.708
1956	1.775	1.701
1957	2.463	1.984
1958	6.537	3.155

1959	1.535	1.545
1960	1.862	1.560
1961	8.072	4.237
1962	1.896	1.598
1963	2.977	1.808
1964	2.106	1.219
1965	1.193	1.258
1966	0.940	1.254
1967	1.757	2.472
1968	2.149	1.761
1969	5.671	2.810
1970	1.140	1.298
1971	2.126	1.553
1972	1.522	2.032
1973	1.268	1.556
1974	3.494	2.042
1975	1.730	1.607
1976	1.327	1.555
1977	1.103	1.334
1978	1.268	1.179
1979	3.445	2.148
1980	1.785	1.678
1981	1.221	1.240
1982	1.608	1.861
1983	2.948	1.642
1984	1.412	1.532
1985	2.035	1.879
1986	4.283	3.784
1987	1.854	2.236
1988	1.338	1.603
1989	1.643	1.405
1990	1.254	1.333
1991	1.416	1.552
1992	1.416	1.453
1993	1.280	1.412
1994	1.012	1.269
1995	1.376	1.478
1996	3.074	2.004
1997	5.242	4.968
1998	1.317	1.853
1999	1.150	1.110
2000	1.167	3.004
2001	0.507	1.143
2002	1.291	1.216
2003	1.015	1.330
2004	1.720	2.649
2005	1.275	1.270
2006	3.811	1.980
2007	3.122	1.935
2008	3.787	3.633
2009	1.191	1.275

### Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	8.0717	4.9676
2	6.5366	4.2373
3	6.3572	3.7844

4	5.6710	3.6328
5	5.2420	3.1548
6	4.2834	3.0035
7	3.8110	2.8100
8	3.7873	2.6485
9	3.4943	2.4722
10	3.4454	2.3385
11	3.1217	2.2357
12	3.0742	2.1479
13	2.9774	2.0416
14	2.9484	2.0321
15	2.4627	2.0045
16	2.2758	1.9836
17	2.1569	1.9802
18	2.1493	1.9353
19	2.1256	1.8792
20	2.1055	1.8608
21	2.0542	1.8526
22	2.0348	1.8077
23	1.8965	1.7876
24	1.8619	1.7605
25	1.8545	1.7078
26	1.7850	1.7012
27	1.7745	1.6780
28	1.7572	1.6557
29	1.7304	1.6418
30	1.7205	1.6283
31	1.6433	1.6067
32	1.6102	1.6033
33	1.6083	1.5976
34	1.5752	1.5602
35	1.5349	1.5598
36	1.5317	1.5562
37	1.5215	1.5551
38	1.4162	1.5534
39	1.4161	1.5522
40	1.4119	1.5455
41	1.3764	1.5322
42	1.3375	1.4784
43	1.3265	1.4531
44	1.3166	1.4246
45	1.2914	1.4123
46	1.2801	1.4051
47	1.2753	1.3344
48	1.2682	1.3331
49	1.2681	1.3301
50	1.2536	1.2979
51	1.2209	1.2748
52	1.1934	1.2698
53	1.1910	1.2690
54	1.1668	1.2585
55	1.1497	1.2540
56	1.1400	1.2396
57	1.1029	1.2193
58	1.0149	1.2160
59	1.0120	1.1794
60	0.9398	1.1426
61	0.5067	1.1098



## Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.8961	8269	7535	91	Pass
0.9528	6611	6006	90	Pass
1.0094	5294	4915	92	Pass
1.0660	4235	4081	96	Pass
1.1226	3437	3401	98	Pass
1.1793	2804	2806	100	Pass
1.2359	2329	2293	98	Pass
1.2925	1917	1872	97	Pass
1.3492	1612	1485	92	Pass
1.4058	1381	1181	85	Pass
1.4624	1164	958	82	Pass
1.5190	1011	822	81	Pass
1.5757	885	736	83	Pass
1.6323	791	679	85	Pass
1.6889	711	632	88	Pass
1.7456	649	591	91	Pass
1.8022	601	550	91	Pass
1.8588	553	523	94	Pass
1.9155	517	487	94	Pass
1.9721	481	450	93	Pass
2.0287	461	421	91	Pass
2.0853	434	404	93	Pass
2.1420	408	387	94	Pass
2.1986	377	371	98	Pass
2.2552	351	354	100	Pass
2.3119	331	341	103	Pass
2.3685	316	330	104	Pass
2.4251	301	317	105	Pass
2.4817	287	309	107	Pass
2.5384	275	298	108	Pass
2.5950	262	279	106	Pass
2.6516	254	265	104	Pass
2.7083	242	255	105	Pass
2.7649	229	238	103	Pass
2.8215	220	226	102	Pass
2.8782	202	209	103	Pass
2.9348	189	192	101	Pass
2.9914	176	178	101	Pass
3.0480	162	158	97	Pass
3.1047	150	146	97	Pass
3.1613	137	131	95	Pass
3.2179	128	112	87	Pass
3.2746	115	94	81	Pass
3.3312	98	73	74	Pass
3.3878	90	65	72	Pass
3.4444	77	50	64	Pass
3.5011	64	40	62	Pass
3.5577	54	36	66	Pass
3.6143	43	27	62	Pass
3.6710	33	21	63	Pass
3.7276	25	20	80	Pass
3.7842	20	17	85	Pass
3.8409	15	12	80	Pass

3.8975	12	12	100	Pass
3.9541	12	11	91	Pass
4.0107	11	10	90	Pass
4.0674	9	9	100	Pass
4.1240	9	9	100	Pass
4.1806	9	9	100	Pass
4.2373	9	7	77	Pass
4.2939	7	5	71	Pass
4.3505	7	5	71	Pass
4.4071	7	5	71	Pass
4.4638	7	5	71	Pass
4.5204	7	3	42	Pass
4.5770	7	3	42	Pass
4.6337	7	3	42	Pass
4.6903	6	3	50	Pass
4.7469	6	3	50	Pass
4.8036	6	3	50	Pass
4.8602	6	2	33	Pass
4.9168	6	2	33	Pass
4.9734	6	0	0	Pass
5.0301	6	0	0	Pass
5.0867	6	0	0	Pass
5.1433	6	0	0	Pass
5.2000	6	0	0	Pass
5.2566	5	0	0	Pass
5.3132	5	0	0	Pass
5.3698	5	0	0	Pass
5.4265	5	0	0	Pass
5.4831	5	0	0	Pass
5.5397	5	0	0	Pass
5.5964	5	0	0	Pass
5.6530	5	0	0	Pass
5.7096	3	0	0	Pass
5.7663	3	0	0	Pass
5.8229	3	0	0	Pass
5.8795	3	0	0	Pass
5.9361	3	0	0	Pass
5.9928	3	0	0	Pass
6.0494	3	0	0	Pass
6.1060	3	0	0	Pass
6.1627	3	0	0	Pass
6.2193	3	0	0	Pass
6.2759	3	0	0	Pass
6.3325	3	0	0	Pass
6.3892	2	0	0	Pass
6.4458	2	0	0	Pass
6.5024	2	0	0	Pass

## Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 1.3427 acre-feet

On-line facility target flow: 0.7188 cfs.

Adjusted for 15 min: 0.7188 cfs.

Off-line facility target flow: 0.4601 cfs.

Adjusted for 15 min: 0.4601 cfs.

## *Model Default Modifications*

Total of 0 changes have been made.

### *PERLND Changes*

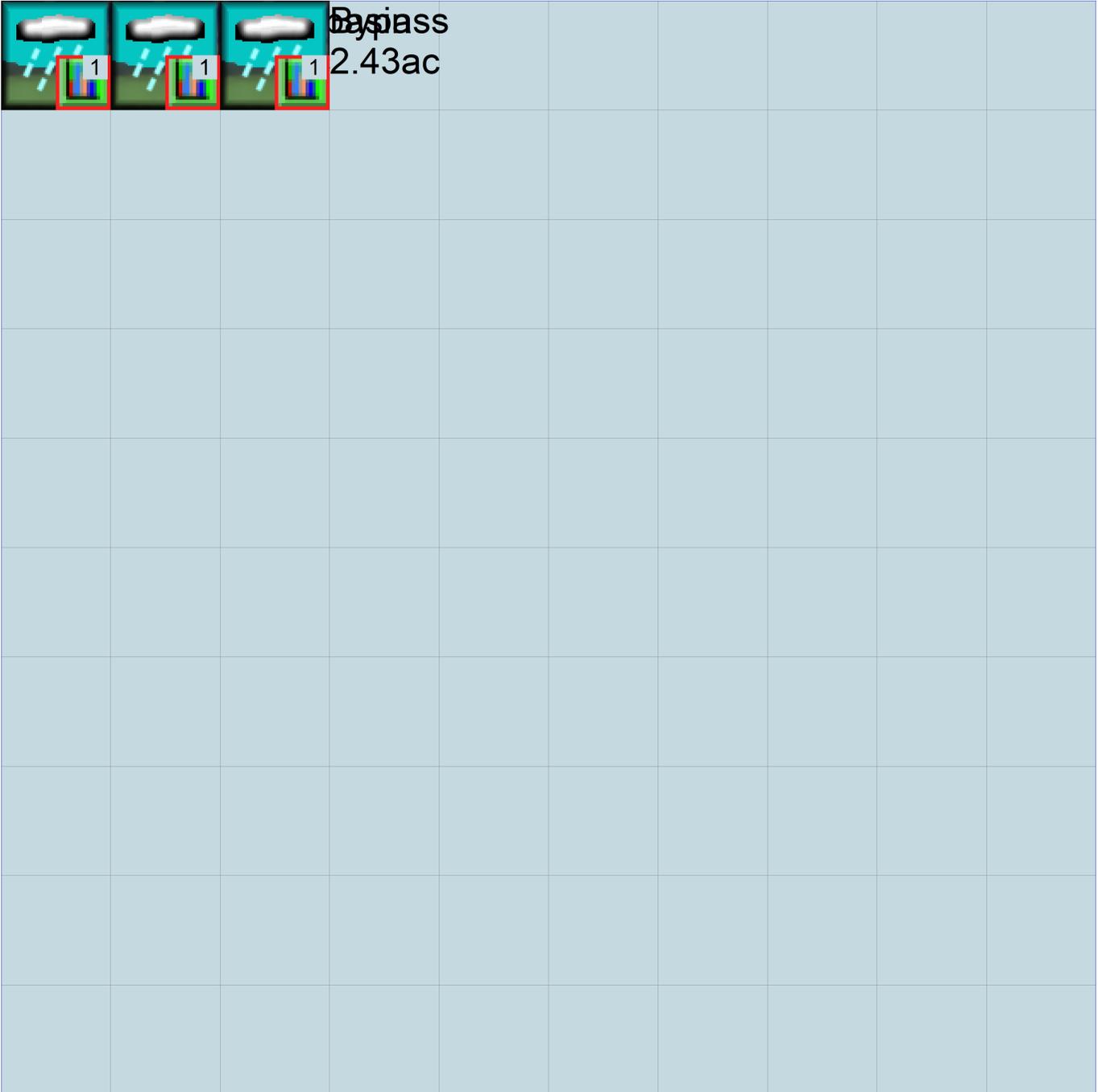
No PERLND changes have been made.

### *IMPLND Changes*

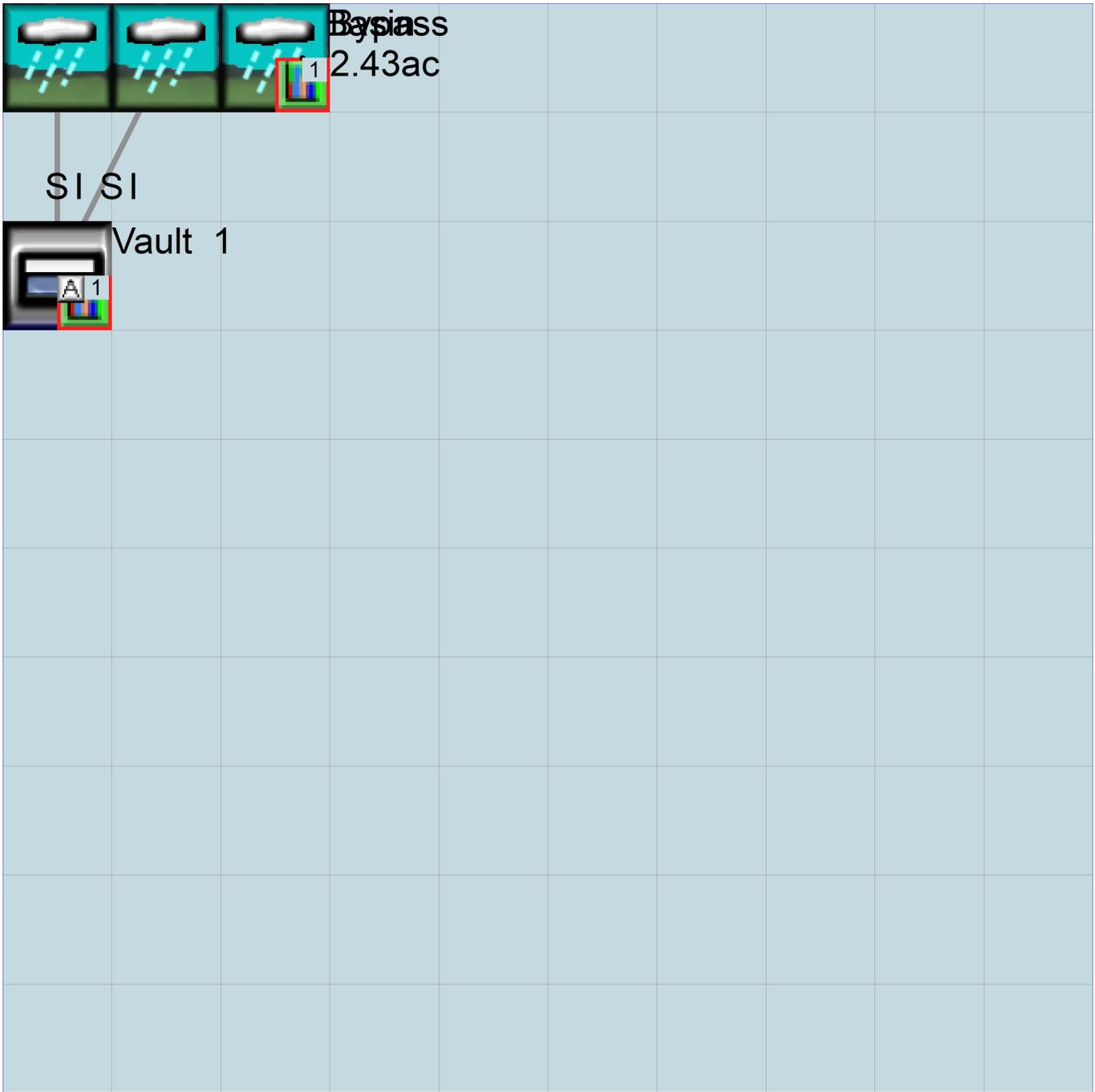
No IMPLND changes have been made.

# Appendix

## Predeveloped Schematic



Mitigated Schematic



# Predeveloped UCI File

RUN

GLOBAL

```
WVHM4 model simulation
START      1948 10 01      END      2009 09 30
RUN INTERP OUTPUT LEVEL    3      0
RESUME     0 RUN      1
UNIT SYSTEM      1
END GLOBAL
```

FILES

```
<File> <Un#> <-----File Name----->***
<-ID->                                     ***
WDM      26      20250417 Monroe 30 detention model v2.wdm
MESSU    25      Pre20250417 Monroe 30 detention model v2.MES
          27      Pre20250417 Monroe 30 detention model v2.L61
          28      Pre20250417 Monroe 30 detention model v2.L62
          30      POC20250417 Monroe 30 detention model v21.dat
END FILES
```

OPN SEQUENCE

```
INGRP          INDELT 00:15
  PERLND        12
  IMPLND        3
  COPY          501
  DISPLY        1
END INGRP
```

END OPN SEQUENCE

DISPLY

```
DISPLY-INFO1
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1   Basin 1          MAX          1   2   30   9
END DISPLY-INFO1
```

END DISPLY

COPY

```
TIMESERIES
# - # NPT NMN ***
1   1   1   1
501 1   1   1
END TIMESERIES
```

END COPY

GENER

```
OPCODE
#   # OPCD ***
END OPCODE
PARM
#   #           K ***
END PARM
```

END GENER

PERLND

```
GEN-INFO
<PLS ><-----Name----->NBLKS  Unit-systems  Printer ***
# - #      User  t-series  Engl Metr ***
          in  out      ***
12      C, Forest, Steep      1   1   1   1   27   0
END GEN-INFO
*** Section PWATER***
```

ACTIVITY

```
<PLS > ***** Active Sections *****
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC ***
12      0      0      1      0      0      0      0      0      0      0      0      0
END ACTIVITY
```

PRINT-INFO

```
<PLS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC *****
12      0      0      4      0      0      0      0      0      0      0      0      0      1      9
END PRINT-INFO
```

```

PWAT-PARM1
  <PLS > PWATER variable monthly parameter value flags ***
  # - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
  12 0 0 0 0 0 0 0 0 0 0 0
END PWAT-PARM1

PWAT-PARM2
  <PLS > PWATER input info: Part 2 ***
  # - # ***FOREST LZSN INFILT LSUR SLSUR KVARY AGWRC
  12 0 4.5 0.08 400 0.15 0.5 0.996
END PWAT-PARM2

PWAT-PARM3
  <PLS > PWATER input info: Part 3 ***
  # - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
  12 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
  <PLS > PWATER input info: Part 4 ***
  # - # CEPSC UZSN NSUR INTFW IRC LZETP ***
  12 0.2 0.3 0.35 6 0.3 0.7
END PWAT-PARM4

PWAT-STATE1
  <PLS > *** Initial conditions at start of simulation
  ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
  # - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
  12 0 0 0 0 2.5 1 0
END PWAT-STATE1

END PERLND

IMPLND
GEN-INFO
  <PLS ><-----Name-----> Unit-systems Printer ***
  # - # User t-series Engl Metr ***
  in out ***
  3 ROADS/STEEP 1 1 1 27 0
END GEN-INFO
*** Section IWATER***

ACTIVITY
  <PLS > ***** Active Sections *****
  # - # ATMP SNOW IWAT SLD IWG IQAL ***
  3 0 0 1 0 0 0
END ACTIVITY

PRINT-INFO
  <ILS > ***** Print-flags ***** PIVL PYR
  # - # ATMP SNOW IWAT SLD IWG IQAL *****
  3 0 0 4 0 0 4 1 9
END PRINT-INFO

IWAT-PARM1
  <PLS > IWATER variable monthly parameter value flags ***
  # - # CSNO RTOP VRS VNN RTLI ***
  3 0 0 0 0 0
END IWAT-PARM1

IWAT-PARM2
  <PLS > IWATER input info: Part 2 ***
  # - # *** LSUR SLSUR NSUR RETSC
  3 400 0.1 0.1 0.05
END IWAT-PARM2

IWAT-PARM3
  <PLS > IWATER input info: Part 3 ***
  # - # ***PETMAX PETMIN
  3 0 0

```



```

*** ac-ft          for each possible exit          for each possible exit
<-----><-----> <----><----><----><----><----> *** <----><----><----><----><---->
END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # tem strg<-factor->strg <Name> # # <Name> # # ***
WDM      2 PREC      ENGL      1.2          PERLND    1 999 EXTNL  PREC
WDM      2 PREC      ENGL      1.2          IMPLND    1 999 EXTNL  PREC
WDM      1 EVAP      ENGL      0.76         PERLND    1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL      0.76         IMPLND    1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name> # <Name> # #<-factor->strg <Name> # <Name> tem strg strg***
COPY  501 OUTPUT MEAN  1 1 48.4 WDM  501 FLOW ENGL REPL
END EXT TARGETS

MASS-LINK
<Volume> <-Grp> <-Member-><--Mult--> <Target> <-Grp> <-Member->***
<Name> <Name> # #<-factor-> <Name> <Name> # #***
MASS-LINK 12
PERLND PWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 12

MASS-LINK 13
PERLND PWATER IFWO 0.083333 COPY INPUT MEAN
END MASS-LINK 13

MASS-LINK 15
IMPLND IWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 15

END MASS-LINK

END RUN

```

# Mitigated UCI File

RUN

GLOBAL

```
WVHM4 model simulation
START      1948 10 01      END      2009 09 30
RUN INTERP OUTPUT LEVEL   3      0
RESUME     0 RUN         1
UNIT SYSTEM 1
```

END GLOBAL

FILES

```
<File> <Un#> <-----File Name----->***
<-ID->                                     ***
WDM      26      20250417 Monroe 30 detention model v2.wdm
MESSU    25      Mit20250417 Monroe 30 detention model v2.MES
          27      Mit20250417 Monroe 30 detention model v2.L61
          28      Mit20250417 Monroe 30 detention model v2.L62
          30      POC20250417 Monroe 30 detention model v21.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  PERLND        15
  IMPLND         3
  IMPLND         4
  IMPLND        10
  RCHRES         1
  COPY           1
  COPY          501
  COPY          601
  DISPLY         1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INFO1

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1      Vault 1          MAX          1      2      30      9
```

END DISPLY-INFO1

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1      1      1
501    1      1
601    1      1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
# # OPCD ***
```

END OPCODE

PARM

```
# # K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS Unit-systems Printer ***
# - # User t-series Engl Metr ***
          in out ***
```

```
15      C, Pasture, Steep      1      1      1      1      27      0
```

END GEN-INFO

\*\*\* Section PWATER\*\*\*

ACTIVITY

```
<PLS > ***** Active Sections *****
```

```
# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
15      0      0      1      0      0      0      0      0      0      0      0      0
```

END ACTIVITY

```

PRINT-INFO
<PLS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC  *****
15   0   0   4   0   0   0   0   0   0   0   0   0   0   1   9
END PRINT-INFO

```

```

PWAT-PARM1
<PLS >  PWATER variable monthly parameter value flags  ***
# - # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT  ***
15   0   0   0   0   0   0   0   0   0   0   0   0
END PWAT-PARM1

```

```

PWAT-PARM2
<PLS >      PWATER input info: Part 2          ***
# - # ***FOREST      LZSN      INFILT      LSUR      SLSUR      KVARY      AGWRC
15   0      4.5      0.06      400      0.15      0.5      0.996
END PWAT-PARM2

```

```

PWAT-PARM3
<PLS >      PWATER input info: Part 3          ***
# - # ***PETMAX      PETMIN      INFEXP      INFILD      DEEPFR      BASETP      AGWETP
15   0      0      2      2      0      0      0
END PWAT-PARM3

```

```

PWAT-PARM4
<PLS >      PWATER input info: Part 4          ***
# - #      CEPSC      UZSN      NSUR      INTFW      IRC      LZETP  ***
15   0.15      0.25      0.3      6      0.3      0.4
END PWAT-PARM4

```

```

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
      ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS      SURS      UZS      IFWS      LZS      AGWS      GWVS
15   0      0      0      0      2.5      1      0
END PWAT-STATE1

```

END PERLND

IMPLND

```

GEN-INFO
<PLS ><-----Name----->  Unit-systems  Printer ***
# - #      User  t-series  Engl Metr  ***
      in  out      ***
3      ROADS/STEEP      1  1  1  27  0
4      ROOF TOPS/FLAT  1  1  1  27  0
10     SIDEWALKS/STEEP  1  1  1  27  0
END GEN-INFO
*** Section IWATER***

```

```

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT  SLD  IWG IQAL  ***
3   0   0   1   0   0   0
4   0   0   1   0   0   0
10  0   0   1   0   0   0
END ACTIVITY

```

```

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW IWAT  SLD  IWG IQAL  *****
3   0   0   4   0   0   0   1   9
4   0   0   4   0   0   0   1   9
10  0   0   4   0   0   0   1   9
END PRINT-INFO

```

```

IWAT-PARM1
<PLS >  IWATER variable monthly parameter value flags  ***
# - # CSNO RTOP  VRS  VNN RTLI      ***
3   0   0   0   0   0

```

```

4      0  0  0  0  0
10     0  0  0  0  0
END IWAT-PARM1

```

```

IWAT-PARM2
<PLS >      IWATER input info: Part 2      ***
# - # ***  LSUR      SLSUR      NSUR      RETSC
3      400      0.1      0.1      0.05
4      400      0.01     0.1      0.1
10     400      0.1      0.1      0.05
END IWAT-PARM2

```

```

IWAT-PARM3
<PLS >      IWATER input info: Part 3      ***
# - # ***PETMAX      PETMIN
3      0      0
4      0      0
10     0      0
END IWAT-PARM3

```

```

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # ***  RETS      SURS
3      0      0
4      0      0
10     0      0
END IWAT-STATE1

```

END IMPLND

```

SCHEMATIC
<-Source->      <--Area-->      <-Target->      MBLK      ***
<Name> #      <-factor-->      <Name> #      Tbl#      ***
Basin 1***
PERLND 15      12.22      RCHRES 1      2
PERLND 15      12.22      RCHRES 1      3
IMPLND 3      3.38      RCHRES 1      5
IMPLND 4      10.37     RCHRES 1      5
IMPLND 10     1.08      RCHRES 1      5
future Basin***
PERLND 15      0.38      RCHRES 1      2
PERLND 15      0.38      RCHRES 1      3
IMPLND 4      0.7      RCHRES 1      5
Bypass***
PERLND 15      0.69      COPY 501      12
PERLND 15      0.69      COPY 601      12
PERLND 15      0.69      COPY 501      13
PERLND 15      0.69      COPY 601      13
IMPLND 3      1.21      COPY 501      15
IMPLND 3      1.21      COPY 601      15
IMPLND 4      0.22      COPY 501      15
IMPLND 4      0.22      COPY 601      15
IMPLND 10     0.31      COPY 501      15
IMPLND 10     0.31      COPY 601      15

```

```

*****Routing*****
PERLND 15      12.22     COPY 1      12
IMPLND 3      3.38     COPY 1      15
IMPLND 4      10.37    COPY 1      15
IMPLND 10     1.08     COPY 1      15
PERLND 15      12.22    COPY 1      13
PERLND 15      0.38     COPY 1      12
IMPLND 4      0.7      COPY 1      15
PERLND 15      0.38     COPY 1      13
RCHRES 1      1      COPY 501     16
END SCHEMATIC

```

```

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> #      <Name> # #<-factor-->strg <Name> # #      <Name> # #      ***

```



1.466667	0.633609	0.929293	0.477688
1.588889	0.633609	1.006734	0.497193
1.711111	0.633609	1.084175	0.515962
1.833333	0.633609	1.161616	0.534071
1.955556	0.633609	1.239057	0.551586
2.077778	0.633609	1.316498	0.568562
2.200000	0.633609	1.393939	0.585046
2.322222	0.633609	1.471380	0.601077
2.444444	0.633609	1.548822	0.616692
2.566667	0.633609	1.626263	0.631922
2.688889	0.633609	1.703704	0.646792
2.811111	0.633609	1.781145	0.661329
2.933333	0.633609	1.858586	0.675553
3.055556	0.633609	1.936027	0.689483
3.177778	0.633609	2.013468	0.703137
3.300000	0.633609	2.090909	0.716532
3.422222	0.633609	2.168350	0.729680
3.544444	0.633609	2.245791	0.742596
3.666667	0.633609	2.323232	0.755291
3.788889	0.633609	2.400673	0.767776
3.911111	0.633609	2.478114	0.780061
4.033333	0.633609	2.555556	0.856143
4.155556	0.633609	2.632997	0.942297
4.277778	0.633609	2.710438	1.000523
4.400000	0.633609	2.787879	1.049038
4.522222	0.633609	2.865320	1.092061
4.644444	0.633609	2.942761	1.131402
4.766667	0.633609	3.020202	1.168036
4.888889	0.633609	3.097643	1.202564
5.011111	0.633609	3.175084	1.235384
5.133333	0.633609	3.252525	1.266779
5.255556	0.633609	3.329966	1.296959
5.377778	0.633609	3.407407	1.326083
5.500000	0.633609	3.484848	1.354278
5.622222	0.633609	3.562290	1.381645
5.744444	0.633609	3.639731	1.408267
5.866667	0.633609	3.717172	1.434213
5.988889	0.633609	3.794613	1.459541
6.111111	0.633609	3.872054	1.548841
6.233333	0.633609	3.949495	1.732108
6.355556	0.633609	4.026936	1.841806
6.477778	0.633609	4.104377	1.931906
6.600000	0.633609	4.181818	2.011393
6.722222	0.633609	4.259259	2.083888
6.844444	0.633609	4.336700	2.151290
6.966667	0.633609	4.414141	2.214748
7.088889	0.633609	4.491582	2.275017
7.211111	0.633609	4.569024	2.332630
7.333333	0.633609	4.646465	2.387980
7.455556	0.633609	4.723906	2.441366
7.577778	0.633609	4.801347	2.493023
7.700000	0.633609	4.878788	2.543141
7.822222	0.633609	4.956229	2.591874
7.944444	0.633609	5.033670	2.639350
8.066667	0.633609	5.111111	2.685680
8.188889	0.633609	5.188552	2.730956
8.311111	0.633609	5.265993	2.775259
8.433333	0.633609	5.343434	2.818657
8.555556	0.633609	5.420875	2.861213
8.677778	0.633609	5.498316	2.902980
8.800000	0.633609	5.575758	2.944008
8.922222	0.633609	5.653199	2.984339
9.044444	0.633609	5.730640	3.024013
9.166667	0.633609	5.808081	3.063063
9.288889	0.633609	5.885522	3.101524
9.411111	0.633609	5.962963	3.139423
9.533333	0.633609	6.040404	3.176787
9.655556	0.633609	6.117845	3.213641
9.777778	0.633609	6.195286	3.250007
9.900000	0.633609	6.272727	3.285907

```

10.02222 0.633609 6.350168 3.391688
10.14444 0.633609 6.427609 4.518251
10.26667 0.633609 6.505051 6.274077
10.38889 0.633609 6.582492 8.364873
10.51111 0.633609 6.659933 10.53762
10.63333 0.633609 6.737374 12.53862
10.75556 0.633609 6.814815 14.15636
10.87778 0.633609 6.892256 15.29309
11.00000 0.633609 6.969697 16.05474
11.12222 0.633609 7.047138 16.96914

```

END FTABLE 1

END FTABLES

EXT SOURCES

```

<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # tem strg<-factor->strg <Name> # # <Name> # # ***
WDM 2 PREC ENGL 1.2 PERLND 1 999 EXTNL PREC
WDM 2 PREC ENGL 1.2 IMPLND 1 999 EXTNL PREC
WDM 1 EVAP ENGL 0.76 PERLND 1 999 EXTNL PETINP
WDM 1 EVAP ENGL 0.76 IMPLND 1 999 EXTNL PETINP

```

END EXT SOURCES

EXT TARGETS

```

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RCHRES 1 HYDR RO 1 1 1 WDM 1000 FLOW ENGL REPL
RCHRES 1 HYDR STAGE 1 1 1 WDM 1001 STAG ENGL REPL
COPY 1 OUTPUT MEAN 1 1 48.4 WDM 701 FLOW ENGL REPL
COPY 501 OUTPUT MEAN 1 1 48.4 WDM 801 FLOW ENGL REPL
COPY 601 OUTPUT MEAN 1 1 48.4 WDM 901 FLOW ENGL REPL

```

END EXT TARGETS

MASS-LINK

```

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<Name> <Name> # #<-factor-> <Name> <Name> # #***
MASS-LINK 2
PERLND PWATER SURO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 2

MASS-LINK 3
PERLND PWATER IFWO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 3

MASS-LINK 5
IMPLND IWATER SURO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 5

MASS-LINK 12
PERLND PWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 12

MASS-LINK 13
PERLND PWATER IFWO 0.083333 COPY INPUT MEAN
END MASS-LINK 13

MASS-LINK 15
IMPLND IWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 15

MASS-LINK 16
RCHRES ROFLOW COPY INPUT MEAN
END MASS-LINK 16

```

END MASS-LINK

END RUN

*Predeveloped HSPF Message File*

*Mitigated HSPF Message File*

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### *Legal Notice*

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## **Appendix 5: Conveyance Analysis**

Nothing is necessary for this appendix at this time

## **Appendix 6: Operations and Maintenance Manual**

1. Operations and Maintenance Manual

# Storm and Drainage System Operations and Maintenance Manual

Prepared for:  
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## **Introduction:**

Inspection and maintenance requirements may change in the future, and this manual does not exempt this facility from any future changes in inspection and maintenance requirements. Flows generated onsite are collected by a series of catch basins and conveyed to the open-space detention system with associated flow control riser. Stormwater runoff will be treated using a StormFilter structure located downstream of the open-space detention facility. Flows from the site are discharged to the southwest into existing stormwater infrastructure. These facilities will require periodic maintenance and inspection. Inspection and maintenance procedures are contained on the following pages.

This manual includes standard maintenance procedures as listed by the Department of Ecology. This information can be found in the pages listed in the table of contents. The procedures were taken from the 2024 Department of Ecology (DOE) Manual. As well as Detention Vault Maintenance checklist and StormFilter maintenance procedures. The record drawings should be consulted prior to inspection and maintenance repair activities. A copy of the Record Drawings is included in this manual and is also kept at the Snohomish County Public Works Department.

At the conclusion of this manual is an example maintenance log and any manufacturers maintenance checklist. A log like this and the maintenance checklist should be kept and filled out as maintenance is required and performed on the storm drainage system.

## Facility Descriptions:

### Stormwater Detention Vault

- The detention vault is designed to contain and release stormwater at historical rates. This is done with the control structure and the storage volume provided by the facility.
- Control structure consists of a vertical pipe with elevated orifices designed to release a specific volume of water over time. Outfall is routed through a pipe located at the same elevation as the bottom of live storage.
- The bottom ½ ft of the vault is dedicated to dead storage, where sediment and debris collect and are not discharged.
- An overflow structure is in place in case of emergency (severe stormwater surges, downstream blockage, etc.) that discharges any excess water above the pond's capacity. Discharge is routed through a structure that directs the overflow water back into the stormwater conveyance systems.
- Maintenance can access the vault via the maintenance hatch. Vault is to be maintained as per the **Detention Ponds** table in the next section.
- Failure to clean these units results in sediment buildup, clogging and potential localized flooding issues. See maintenance tables for more information.

### StormFilter

- The StormFilter media cartridge filtration structure provides the water quality treatment of stormwater for the project. This is achieved by water passing through the media filter then discharging downstream of the water quality structure.
- The media cartridges will need periodic maintenance and inspection as outlined in the manufacturer's maintenance manual contained in the next section. See **Manufactured Media Filter** for more detail.
- Failure to service these units results in sediment buildup, clogging and potential localized flooding issues.

## Operations and Maintenance:

**Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor**

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

**Table V-A.5: Maintenance Standards - Catch Basins**

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. 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. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). 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	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. 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.	Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall.

	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

**Table V-A.6: Maintenance Standards - Debris Barriers (e.g., Trash Racks)**

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

**Table V-A.7: Maintenance Standards - Energy Dissipators**

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
External:			
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.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	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
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	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.

	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
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.
	Other Defects	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

**Table V-A.15: Maintenance Standards - Manufactured Media Filters**

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Below Ground	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
Vault	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drainpipes/Clean-Outs	When drainpipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover	Cover repaired to proper working specifications or replaced
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that

		inlet/outlet pipe or evidence of soil particles entering through the cracks.	no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced



## **PerkFilter Inspection and Maintenance Guide:**

See Manufacturer's Inspection and Maintenance Guide Below

**Figure 1 Storm Facilities:**

**Figure 2 Record Drawings:**

## **BMP D.3: Detention Vaults**

Detention vaults are box shaped underground detention BMPs typically constructed with reinforced concrete. A standard detention vault detail is shown in [Figure V-13.16: Typical Detention Vault](#). Control structure details are shown in [V-13.2 Control Structure Design](#).

### ***Design Criteria***

#### **General**

Typical design guidelines for detention vaults are as follows:

1. Detention vaults may be designed as flow-through systems with bottoms level (longitudinally), or sloped toward the inlet to facilitate sediment removal. Maximize the distance between the inlet and outlet as feasible.
2. The detention vault bottom may slope at least 5 percent from each side towards the center, forming a broad “v” to facilitate sediment removal. More than one “v” may be used to minimize vault depth. However, the vault bottom may be flat with 0.5-1 foot of sediment storage if removable panels are provided over the entire vault. It is recommended that the removable panels be at grade, have stainless steel lifting eyes, and weigh no more than 5 tons per panel.
3. Elevate the invert elevation of the outlet above the bottom of the vault to provide an average 6 inches of sediment storage over the entire bottom. Also, elevate the outlet a minimum of 2 feet above the orifice to retain oil within the vault.

#### **Materials**

Minimum 3,000 psi structural reinforced concrete may be used for detention vaults. Provide all construction joints with water stops.

#### **Structural Stability**

All vaults must meet structural requirements for overburden support and H20 traffic loading (See [\(AASHTO, 2002\)](#)). Vaults located under roadways must meet any live load requirements of the local government. Design cast-in place wall sections as retaining walls. Structural designs for cast in place vaults must be stamped by a licensed engineer in the state of Washington with structural expertise. Place vaults on stable, well consolidated native material with suitable bedding. Do not place vaults in fill slopes, unless analyzed in a geotechnical report for stability and constructability.

#### **Primary and Emergency Overflows**

Refer to the guidance in [BMP D.1: Detention Ponds](#) for requirements on primary overflow and emergency overflow spillways. For this BMP, the control structure outlet/overflow may be designed to accommodate both the primary and emergency overflow spillways.

## **Access Openings**

Provide access openings over the inlet pipe and control structure. Use the following guidelines for access.

1. Position access openings a maximum of 50 feet from any location within the vault. Additional access points may be needed on large vaults. Provide access to each “v” if more than one “v” is provided in the vault floor.
2. For vaults with greater than 1,250 square feet of floor area, provide a 5' by 10' removable panel over the inlet pipe (instead of a standard frame, grate and solid cover). Or, provide a separate access vault as shown in [Figure V-13.16: Typical Detention Vault](#).
3. For vaults under roadways, locate the removable panel outside the travel lanes. Or, provide multiple standard locking manhole covers. Ladders and hand holds need only be provided at the outlet pipe and inlet pipe, and as needed to meet OSHA confined space requirements.
4. All access openings, except those covered by removable panels, may have round, solid locking lids, or 3 foot square, locking diamond plate covers.
5. Vaults with widths 10 feet or less must have removable lids.
6. The maximum depth from finished grade to the vault invert should be 20 feet.
7. Provide internal structural walls of large vaults with openings sufficient for maintenance access between cells. Size and situate the openings to allow access to the maintenance “v” in the vault floor.
8. The minimum internal height should be 7 feet from the highest point of the vault floor (not sump), and the minimum width should be 4 feet. However, concrete vaults may be a minimum 3 feet in height and width if used as tanks with access manholes at each end, and if the width is no larger than the height. Also, the minimum internal height requirement may not be needed for any areas covered by removable panels.
9. Vaults must comply with the OSHA confined space requirements, which includes clearly marking entrances to confined space areas. This may be accomplished by hanging a removable sign in the access riser(s), just under the access lid.
10. Provide ventilation pipes (minimum 12 inch diameter or equivalent) in all four corners of vaults to allow for artificial ventilation prior to entry of maintenance personnel into the vault. Or, provide removable panels over the entire vault. Vaults providing manhole access at 12 foot spacing need not provide corner ventilation pipes.

## **Access Roads**

Access roads are needed to the access panel (if applicable), the control structure, and at least one access point per cell, and they may be designed and constructed as specified for detention ponds in [BMP D.1: Detention Ponds](#).

## **Right-of Way**

Right-of-way is needed for detention vault maintenance. It is recommended that any tract not abutting public right of way should have a 15 to 20 foot wide extension of the tract to accommodate an access road to the detention vault.

## **Setbacks**

It is recommended that detention vaults be a minimum of 20 feet from any structure, property line, and any vegetative buffer required by the local government and from any septic drainfield. However, the setback requirements are generally specified by the local government, uniform building code, or other statewide regulation and may be different from those mentioned above.

All detention vaults must be a minimum of 50 feet from the top of any steep (greater than 15%) slope. A geotechnical analysis and report must be prepared addressing the potential impact of the vault on a slope steeper than 15%.

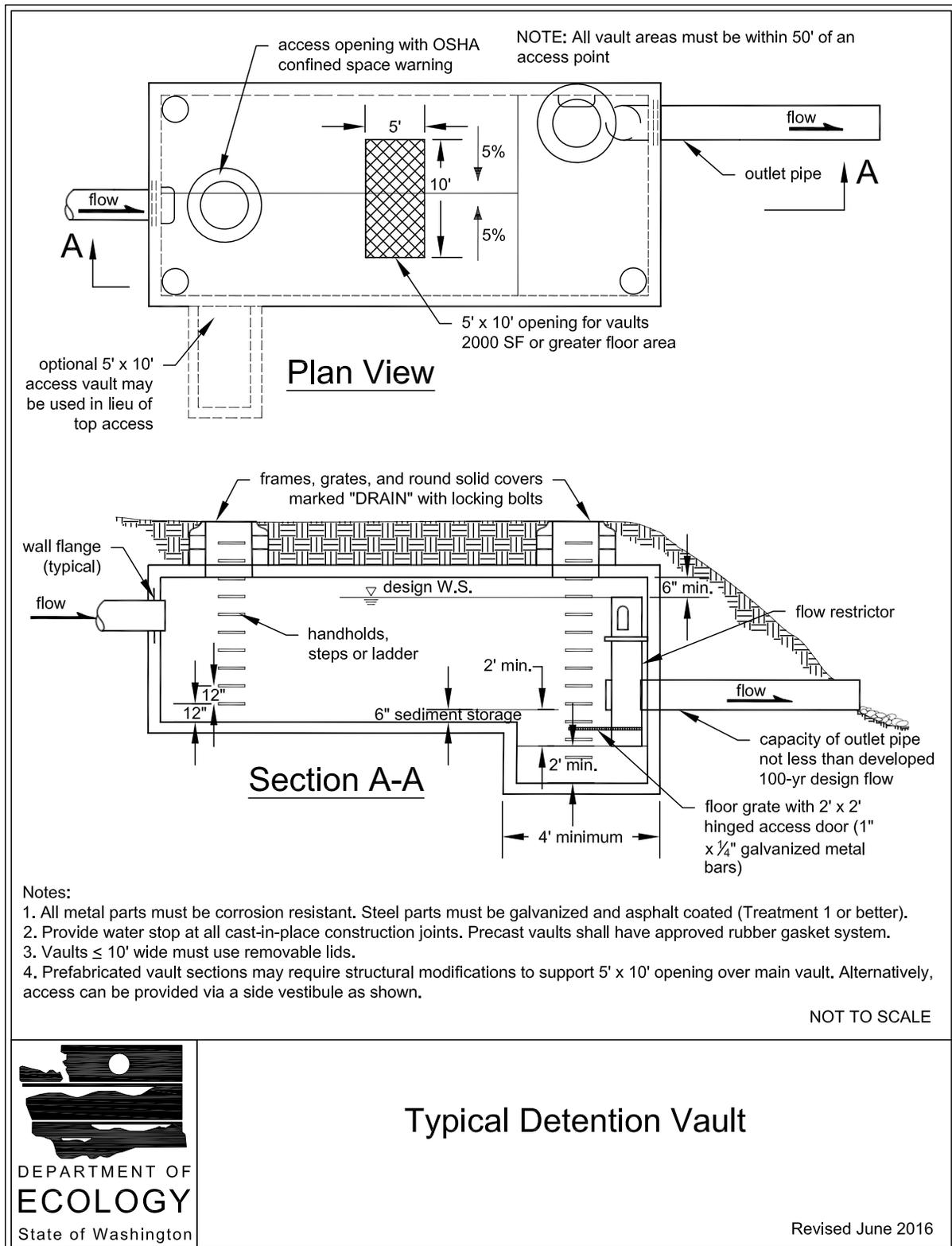
## ***Maintenance***

Build in provisions to facilitate maintenance operations into the project when it is installed. Maintenance must be a basic consideration in design and in determination of first cost. See [Appendix V-A: BMP Maintenance Tables](#) for specific maintenance requirements.

## ***Detention Volume and Outflow***

Design volumes and outflows for detention vaults vary, and are typically designed to meet the performance standards as required in [I-3.4.5 MR5: On-Site Stormwater Management](#), [I-3.4.7 MR7: Flow Control](#), and/or [I-3.4.8 MR8: Wetlands Protection](#) and the hydrologic analysis and design methods in [III-2 Modeling Your BMPs](#). Design guidelines for control structures are given in [V-13.2 Control Structure Design](#).

**Figure V-13.16: Typical Detention Vault**



## V-A.5 Maintenance Standards - Tanks and Vaults

**Table V-A.4: Maintenance Standards - Tanks and Vaults**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point, or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for one-half the length of the storage vault, or any point depth exceeds 15% of the diameter. (Example: 72-inch diameter storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 the length of the tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into the tank/vault. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 0.5-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 0.5-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 0.25-inch wide at the joint of the inlet/outlet pipe.
Access Opening(s)	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 0.5-inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See <a href="#">V-A.7 Maintenance Standards - Catch Basins</a>		

## V-A.6 Maintenance Standards - Control Structures

**Table V-A.5: Maintenance Standards - Control Structures**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (includes sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.

**Table V-A.5: Maintenance Standards - Control Structures (continued)**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Clean-out Gate	Damaged or Missing	Clean-out gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Access Opening	See <a href="#">V-A.5 Maintenance Standards - Tanks and Vaults</a>		
Catch Basin	See <a href="#">V-A.7 Maintenance Standards - Catch Basins</a>		

## V-A.7 Maintenance Standards - Catch Basins

**Table V-A.6: Maintenance Standards - Catch Basins**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60% 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 debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g. methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). 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.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. 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.	Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall.
	Settlement/ Mis-alignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pol-	See <a href="#">V-A.2 Maintenance Standards - Detention Ponds</a>	

**Table V-A.6: Maintenance Standards - Catch Basins (continued)**

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

**V-A.8 Maintenance Standards - Debris Barriers (e.g. Trash Racks)**

**Table V-A.7: Maintenance Standards - Debris Barriers (e.g. Trash Racks)**

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

**V-A.9 Maintenance Standards - Energy Dissipators**

**Table V-A.8: Maintenance Standards - Energy Dissipators**

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
<i>External</i>			
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.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.

Need drainage plan on next page and record drawing coversheet

## Appendix 7: Special Reports and Studies

1. N/A