Attachment P

Preliminary Stormwater Management Report

Vogel Northwest Townhomes

September 20, 2023

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Let's Build Your Vision Together

Engineer's Declaration

I, Scott Goodall, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that this stormwater site plan was prepared by, or under my personal supervision, and that this report was prepared in accordance with generally accepted engineering practices. I hereby affirm that, to the best of my knowledge, information and belief, this report was prepared in full compliance with the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (2019 DOE SWMM), City of Ferndale Development Standards, and all Technical Standards adopted thereunder.

Respectfully Sealed and Signed,

9-20-23

Scott Goodall, MS, PE
Impact Design LLC

Original document on-file at Impact Design, LLC

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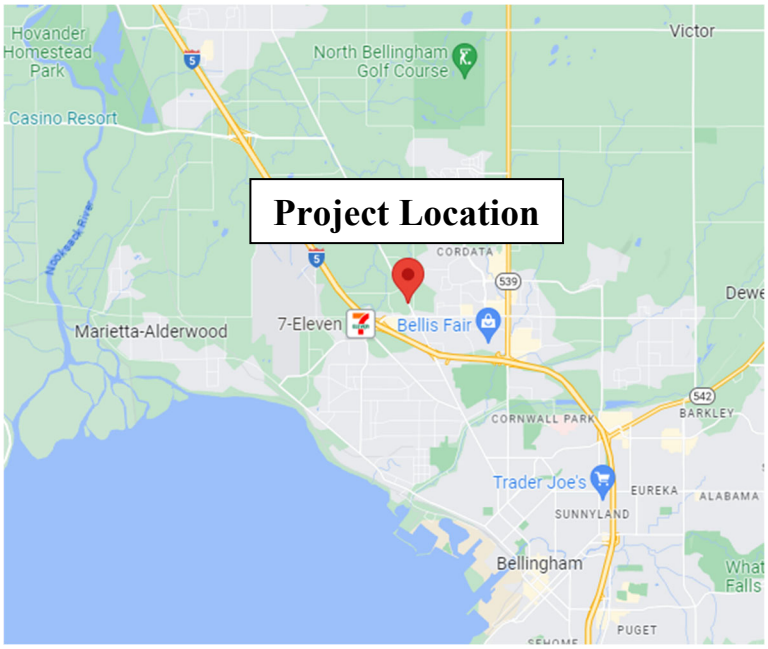


City of Bellingham, WA
Regional Vicinity Map

City of Bellingham, WA
Local Map

Existing Conditions: The project is located on two different properties located on the west side of Northwest Drive between Garland Lane and Mahogany Avenue. The properties are:

- 4193 Northwest Ave (TP#: 3802114351250000)
- 4185 Northwest Ave (TP#: 3802114491080000)

Residences exist north and south of the project site. A power sub-station and Bellingham Bible Church are east across Northwest Drive. The property to the west is undeveloped.

Most of the future developed site slopes east towards Northwest Drive. A small portion of the west side slopes west and north.

The eastern half of both sites include one single family residence per lot, driveways and assorted shop/outbuildings. Vegetation on the east side of the site is generally lawn with a few trees along Northwest Drive and along the south property line. The western half of the site appears to have been cleared and filled in the past. Vegetation has grown back over the fill in the form of blackberries, ferns, and other brush. Some larger trees exist in this area as well. The underlying soil is a pebbly sandy silt based on the preliminary geotechnical investigation.

Existing Site Conditions

Four different stormwater Threshold Discharge Areas exist on the site. Basin #1 drains to the Northwest Road municipal ditchline south. Basin #2 drains to the wetland to the north on the 4193 Northwest Ave project. Basin #3 flows west toward a separate wetland to west and Basin #4 flows south down Dover Street to the municipal stormwater system. See Section 4 for an in-depth downstream analysis. All four of these basins are identified in separate Threshold Discharge Areas.

Proposed Conditions: The proposed project will include 19 townhomes in various layouts surrounding parking areas and alleys. Two main access points will bring vehicles and utility services to the site – at the southwest corner from Dover Street and at the northeast corner as a shared access with the property to the north.

Basin 1-A, 1-B, 2-A and 2-B are included in the WWHM2012 modeled basin areas. Basin 1-A drains to Vault #1 and Basin 2-A drains to Vault #2. Basin 1-B and 2-B are a bypass basins that drain to the respective areas do the south and north, respectively.

WWHM2012 Modeled Basins						
Basin 1-A						
Pre-Developed	SF	Acre	Post-Developed		SF	Acre
Undeveloped	32,824	0.754	PROPOSED ROOF	ROADS/FLAT	8,017	0.184
			PROPOSED PAVEMENT	ROOF TOPS/FLAT	7,344	0.169
			PROPOSED SIDEWALK	SIDEWALKS/FLAT	2,221	0.051
			PROPOSED LANDSCAPE	C, Pasture, Flat	15,242	0.350
Total	32,824	0.754	Total		32,824	0.754
Basin 1-B (Bypass)						
Pre-Developed	SF	Acre	Post-Developed		SF	Acre
Undeveloped	2,584	0.059	PROPOSED SIDEWALK	SIDEWALKS/FLAT	417	0.010
			PROPOSED LANDSCAPE	C, Pasture, Flat	2,167	0.050
Total	2,584	0.059	Total		2,584	0.059
Basin 2-A						
Pre-Developed	SF	Acre	Post-Developed		SF	Acre
Undeveloped	61,266	1.406	PROPOSED ROOF	ROOF TOPS/FLAT	25,131	0.577
			PROPOSED PAVEMENT	ROADS/FLAT	18,769	0.431
			PROPOSED SIDEWALK	SIDEWALKS/FLAT	1,827	0.042
			PROPOSED LANDSCAPE	C, Pasture, Flat	15,539	0.357
Total	61,266	1.406	Total		61,266	1.406

Unmodeled Basins						
Basin 3						
Pre-Developed	SF	Acre	Post-Developed		SF	Acre
EXISTING LANDSCAPE	2,967	0.068	PROPOSED ROOF	ROOF TOPS/FLAT	1,486	0.034
			PROPOSED LANDSCAPE	C, Pasture, Flat	1,481	0.034
Total	2,967	0.068	Total		2,967	0.068
Basin 4						
Pre-Developed	SF	Acre	Post-Developed		SF	Acre
EXISTING LANDSCAPE	685	0.016	PROPOSED ROOF	ROOF TOPS/FLAT	164	0.004
			PROPOSED SIDEWALK	SIDEWALKS/FLAT	67	0.002
			PROPOSED LANDSCAPE	C, Pasture, Flat	454	0.010
Total	685	0.016	Total		685	0.016

Basin 3 and 4 was not included include in the WWHM modeling as the area is below any area thresholds. Both basins are in separate Threshold Discharge Areas.

This project will result in 68,635 square feet of new plus replaced hard surface. Stormwater runoff generated on the site will be collected in an enclosed stormwater conveyance system and routed to a proposed closed detention vault, which will discharge to a Filterra treatment system to provide enhanced treatment for the site.

The following guidelines and design criteria were used to determine the project's stormwater requirements and design criteria.

Development Standards:

A. ***City of Bellingham Municipal Code Title 15.42***

B. ***Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington***

3.1 Governing Guidelines: This report has been prepared in accordance with the requirements of the City of Bellingham Code Title 15.42. The *2019 Stormwater Management Manual for the Western Washington* (DOE Manual) will also be used, when appropriate, to design the On-Site Stormwater Management BMP's, Stormwater Runoff Treatment and Flow Control measures for this project. This project disturbs more than one acre, so a general construction NDPES permit will be required.

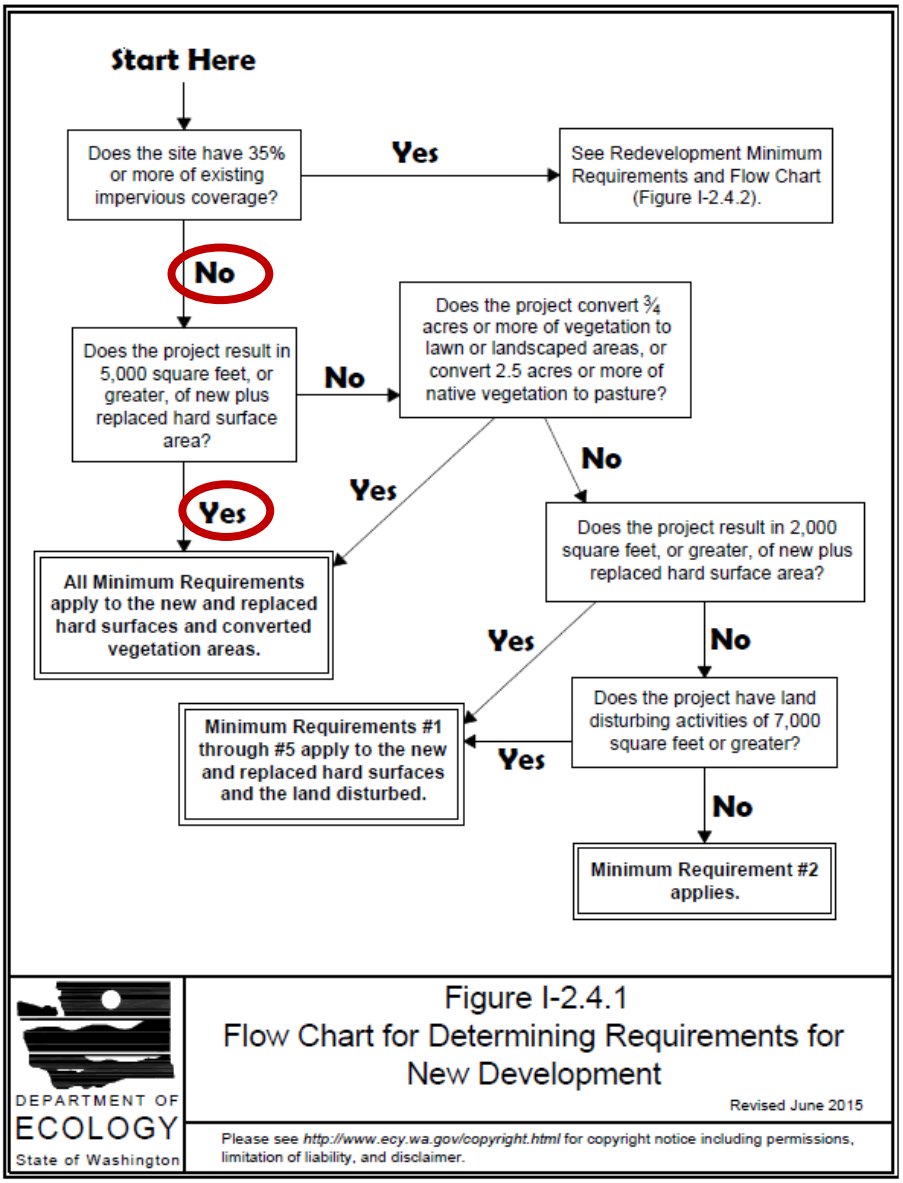
3.2 Design Criteria: The existing site does not consist of hard surfaces covering more than 35% of the site; therefore, the proposed project meets the definition of new development. Because the area of new development is greater than 5,000 square feet, the project must meet all minimum requirements for stormwater management as specified in BMC 15.42.060. All minimum requirements will apply to both new and replaced hard surfaces. In accordance with the requirements of the DOE Manual, the site's hydrologic analysis was performed using the Western Washington Hydrologic Model (WWHM), version 2012, a continuous simulation hydrologic model developed by the DOE.

3.3 Design Assumptions:

On-Site Stormwater Management: On-site stormwater management for hard surfaces will be required as is outlined in the DOE Manual, under minimum requirement #5. Due to the high groundwater table, no LID techniques will be employed on this project.

Stormwater Treatment: Stormwater treatment for new pollution hard generating surfaces will be required as is outlined in the DOE Manual, under minimum requirement #6. This requirement will be met by using DOE approved GULD enhanced treatment technologies. See the Minimum Requirement #6: Runoff Treatment of this report for further information.

Stormwater Detention and Flow Control: Stormwater detention and flow control for new hard surfaces will be required as outlined in the DOE Manual, under minimum requirement #7. This will be accomplished by using underground sand detention vaults. See the Minimum Requirement #7: Flow Control of this report for further information.



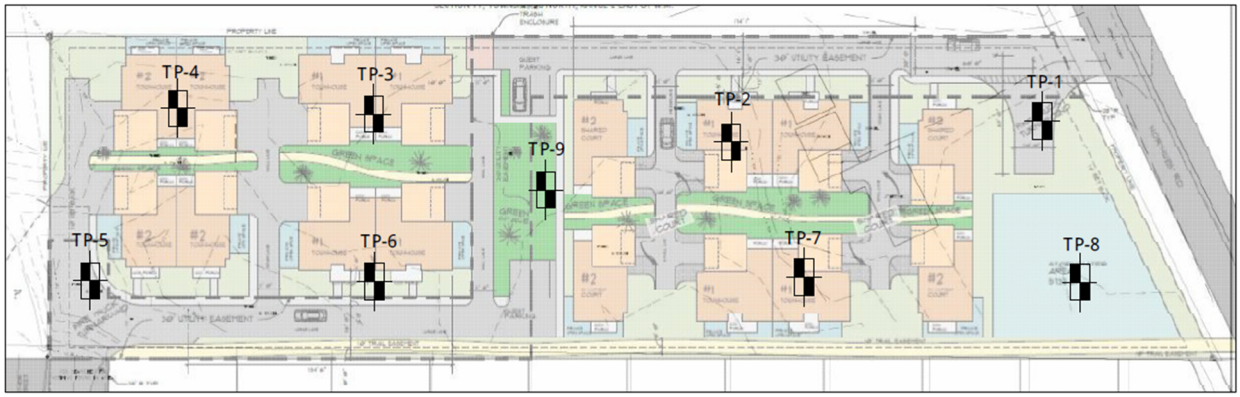
4.1 Soils Testing

Surface Conditions

The proposed construction involves a parcel identified by the Whatcom County Assessor as parcel number 380211449108. The parcel is approximately 2.16-acres and currently developed. Development is generally located near the east end of the parcel and includes a 1,104.0 square- foot (s.f.) single-family residence with 976.0 s.f. of detached garages and storage buildings, and 684.0 s.f. of porches and decks. From Northwest Avenue moving west the area surrounding the house pad is covered with maintained lawn and a gravel driveway to the north. The septic tank and drainfield are located southwest of the existing residence. West of the residence, approximately 2 feet higher in elevation, begins the undeveloped area of the parcel. The majority of the undeveloped area of the parcel is generally level and covered with some mature evergreen and deciduous trees with native grasses and other low growing shrubs and with some areas covered with a thin layer of hog fuel. The western most edge of the parcel undulates in topography and is more heavily forested. Slopes on the west end of the parcel are approximately 4.0 feet higher in elevation. This parcel is approximately rectangular in shape and generally grades west to east losing approximately 10.0 feet overall. The parcel is bordered by Northwest Avenue along the east property boundary, developed single-family parcels to the north, south, and west, and Dover Street terminates at the southwest corner of the parcel.

Subsurface Conditions

For this project, we observed and logged nine test pits utilizing a Kubota KX040-4 rubber track excavator that was operated by a third party. Test pits were excavated to depths between 3.8 and 7.9 feet below present ground (BPG). A dynamic cone penetrometer (DCP) was deployed at intervals throughout the test pits. During advancement soils were classified and logged in accordance with the Unified Soil Classification System (USCS), bagged and discretely labeled to be transported to the laboratory for supplemental testing. Test pits were advanced throughout the subject property, as shown in the figure below:



Test Pit Locations

Test pits were advanced through 0.4 to 1.9 feet of topsoil consisting of silty sand with gravel that contained organics including roots, was moist, loose, and dark brown in color. Exclusively at TP-9 an approximately 2-inch layer of hog fuel was observed at the ground surface. Observed beneath the topsoil in all test pits except TP-4 and TP-5, to depths between 1.3 and 2.7 feet BPG, was a loose becoming medium dense silty sand with gravel and varying amounts of organics. This unit was dry and ranged in color from brown to red-brown.

Beginning at depths between 0.4 and 2.4 feet BPG an approximately 0.8 to 4.7-foot thick unit of silty sand with varying amounts of gravel was observed in each of the test pits except TP-8. This unit ranged in color from yellow-brown to gray-brown with orange mottling and some gray fine-grained sand lenses throughout. The silty sand ranged from medium dense to dense and damp to moist the maximum depth this unit was observed at was 6.3 feet BPG. In each of the test pits except TP-2 and TP-4 a sandy silt with varying amounts of gravel was observed to the maximum depths explored between 4.4 and 7.9 feet BPG. This unit was very dense, moist, and ranged in color from brown-gray to brown and gray to dark gray.

Exclusively in TP-8 from 2.7 to 5.3 feet BPG a relic topsoil was observed. This unit was highly organic silty sand that was dark brown in color, loose and moist to very moist. Seepage within this unit was observed at 4.4 feet BPG. Additionally, seepage was observed in TP-1 at 6.7 feet BPG

A distinct groundwater surface representative of the phreatic zone was not observed. However, mottled soils and seepage were observed as described above. Groundwater levels are expected to vary with seasonal conditions. See the test pit logs in Appendix A for additional information.

The Geologic Map of Western Whatcom County, Washington, published by the United States Geological Survey (Easterbrook, 1976), maps the site surface geology as Pleistocene Bellingham Drift of the Everson Interstade (Qb). Qb is generally described unsorted and unstratified pebbly, sandy silt and pebbly clay that was deposited as the glaciers melted and deposited sediment on the sea floor. Additionally, below elevations of 600 feet this unit includes glaciomarine drift that consists of varying amounts of sand, gravel, silt, and clay.

The United States Department of Agriculture Natural Resources Conservation Service (NRCS) maps the site soils as Whatcom-Labounty silt loams, 0 to 8 percent slopes. The Whatcom unit consists of volcanic ash and loess over glaciomarine deposits found on slopes from 0 to 8 percent. The depth to restrictive features is generally more than 80 inches and is moderately well drained with a depth to water table between 18 and 36 inches and is classified as Hydrologic Soil Group C. The Labounty unit consists of similar parent material to the Whatcom unit with a similar depth to restrictive features of more than 80 inches. This unit is poorly drained with 0 to 12 inches of depth to restrictive features and is classified in the Hydrologic Soil Group C to D.

Soil conditions encountered in the field consisted of silty sand overlying sandy silt both with varying amounts of gravel. These conditions are typical native deposits in the region and are consistent with area geology sources.

Groundwater Conditions

Seepage was observed in TP-1 and TP-8 at 6.7 and 4.4 feet BPG, respectively. Additionally, mottled soils and perched groundwater conditions were observed at depths as shallow as 2 feet.

Mottled soils and low chroma colors generally indicate wetting and drying cycles that occur within a soil column as surface water and fluctuating interflow are transmitted through stratigraphic variations of permeability in the soil column.

Seepage and modeling at this depth provides indicators that groundwater levels, or perched groundwater, may exist as shallow as two feet.

4.2 Pre-Developed Conditions: The project is located on two different properties located on the west side of Northwest Drive between Garland Lane and Mahogany Avenue.

Residences exist north and south of the project site. A power sub-station and Bellingham Bible Church are east across Northwest Drive. The property to the west is undeveloped.

Most of the future developed site slopes east towards Northwest Drive. A small portion of the west side slopes west and north.

The pre-developed flowrates were determined assuming a forested condition with flat slopes and hydrologic soil group C for the areas of the site that will undergo development. Portions of the site that will not be modified were modeled as their actual existing condition in the pre-developed model.

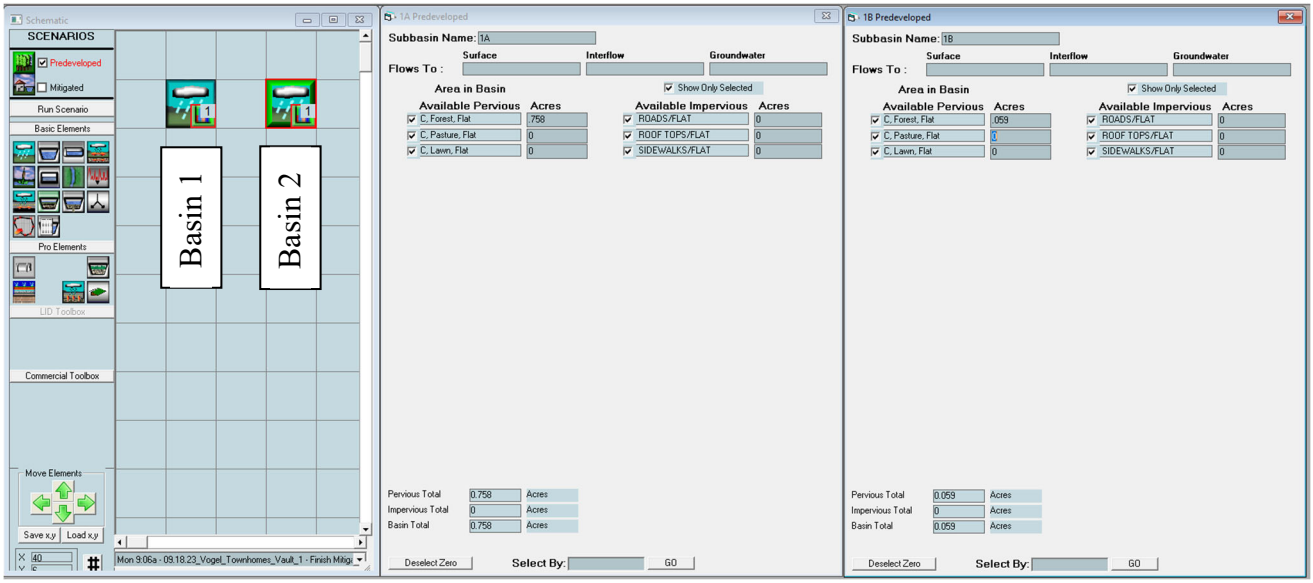
4.3 Post-Developed Conditions

Basin 1

Basin 1 discharges to the ditch on Northwest Avenue to the south. Appendix A of this report provides the construction plans to describe the proposed site development. Appendix B shows the post-developed basin map. The pre-developed and post-developed flow rates calculated by the WWHM2012 model (See 'Vogel Townhomes Vogel Townhomes Vault 1' Appendix B) and calculations below:

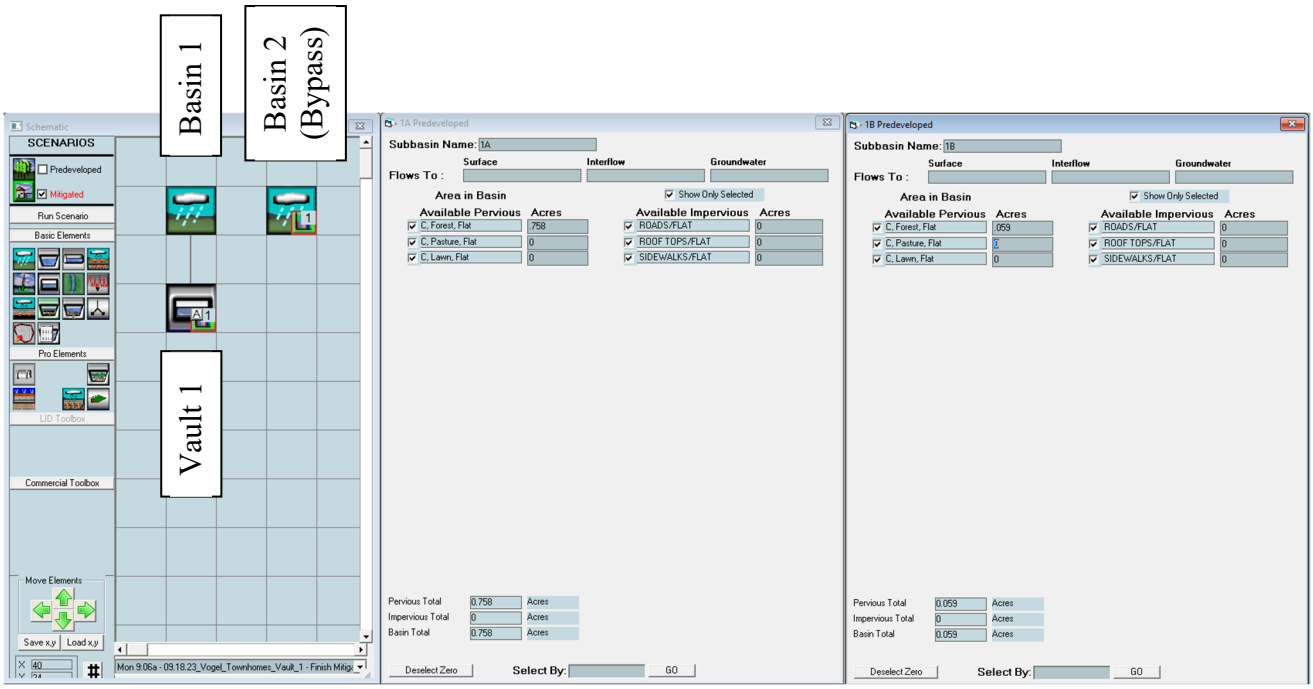
	Basin 1	
Flow(cfs)	Predeveloped	Mitigated
2 Year	0.016	0.011
5 Year	0.024	0.016
10 Year	0.028	0.020
25 Year	0.033	0.025
50 Year	0.036	0.030
100 Year	0.038	0.035

See Predeveloped WWHM2012 setup is shown below:

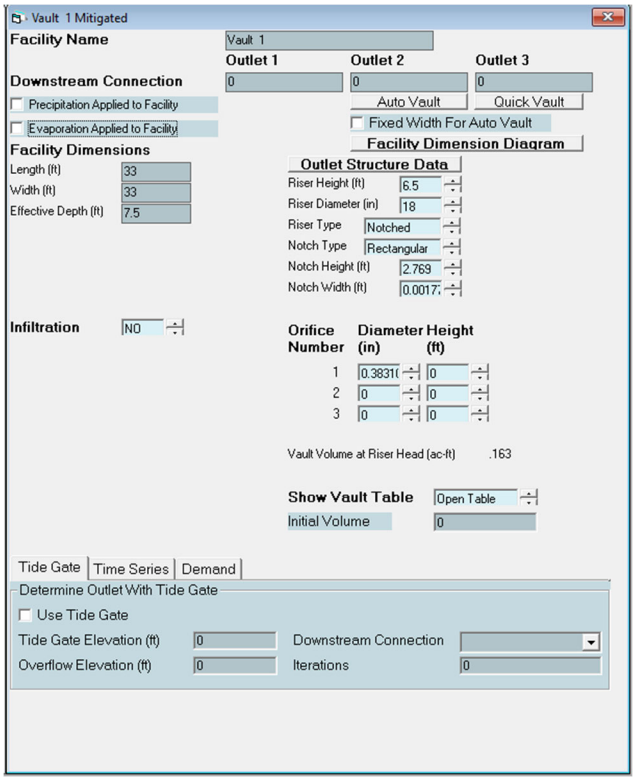


WWHM 2012 Model Setup – Pre-Developed Basin 1

See Post-developed WWHM2012 setup is shown below:



WWHM 2012 Model Setup – Post-Developed Basin 1



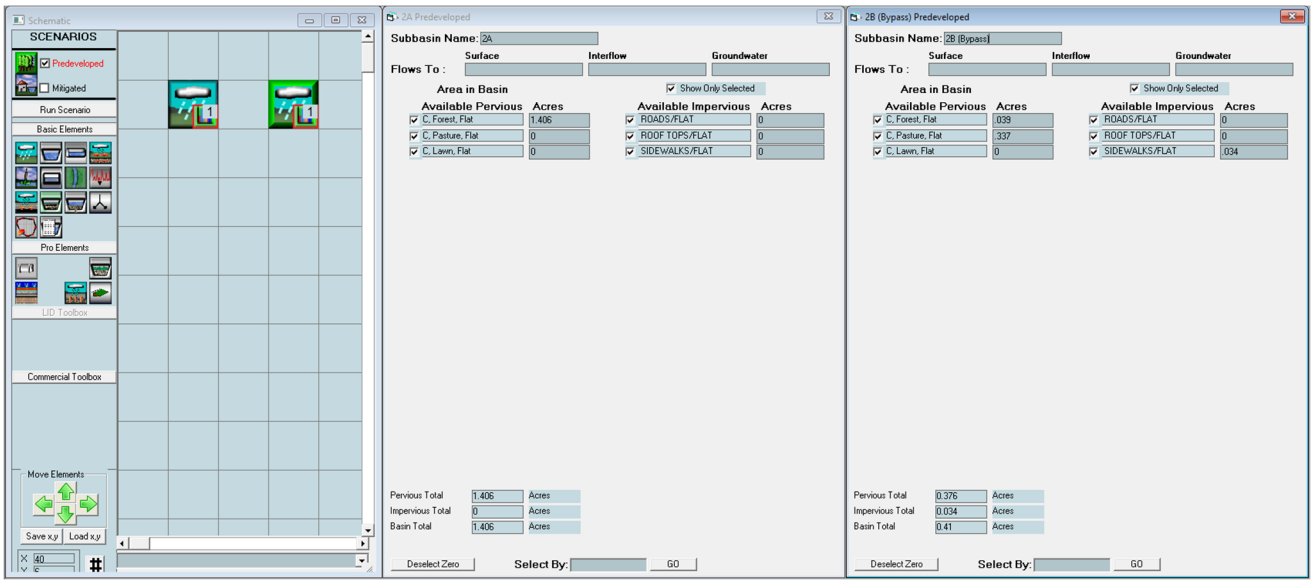
WWHM 2012 Model Setup – Vault Design Basin 1

Basin 2

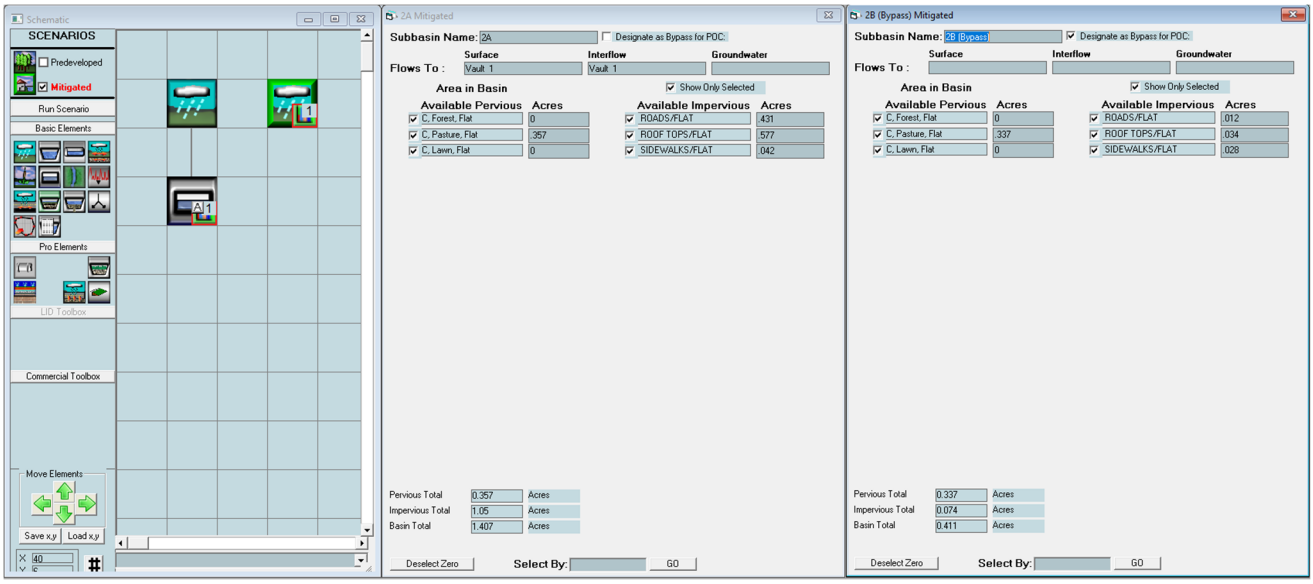
Basin 2 discharges to the ditch on Northwest Avenue to the south. Appendix A of this report provides the construction plans to describe the proposed site development.

The pre-developed and post-developed flow rates calculated by the WWHM2012 model (See 'Vogel Townhomes Vogel Townhomes Vault 2' Appendix B) and calculations below:

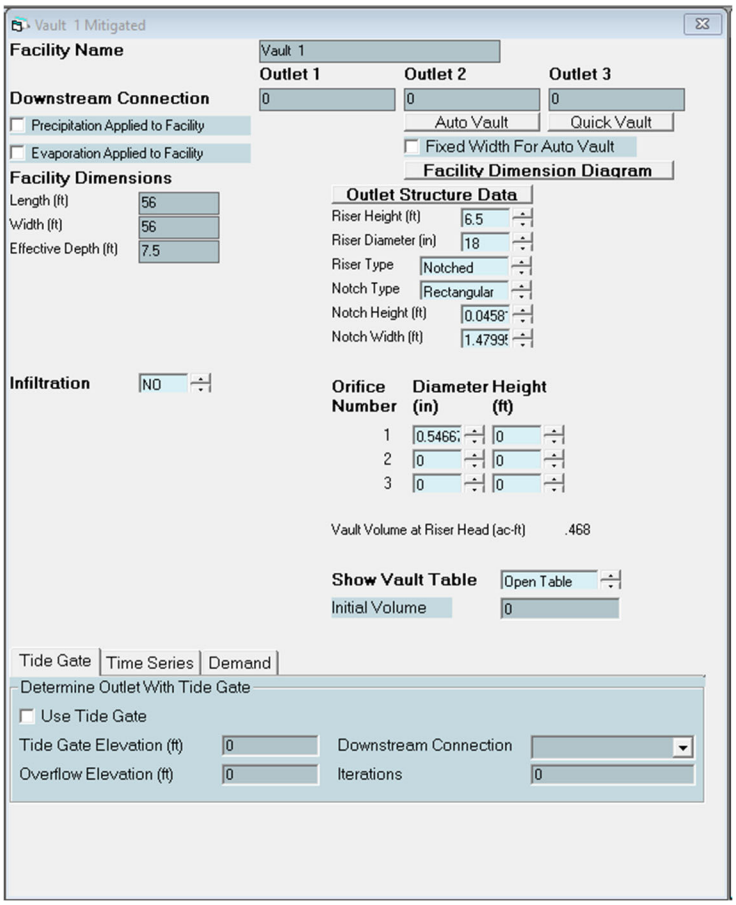
	Basin 2	
Flow(cfs)	Predeveloped	Mitigated
2 Year	0.041	0.041
5 Year	0.062	0.056
10 Year	0.076	0.066
25 Year	0.095	0.079
50 Year	0.108	0.090
100 Year	0.122	0.101



WWHM 2012 Model Setup – Pre-Developed Basin 2



WWHM 2012 Model Setup – Post-Developed Basin 2



WWHM 2012 Model Setup – Vault Design Basin 2

4.4 Downstream Flowpath Conveyance:

On September 18, 2023 a field investigation was conducted at the Vogel Northwest Townhomes site to determine the flowpath of stormwater leaving the proposed development. The site is composed of four basins, and runoff will flow from each of them in a different direction.

Basin 1

Basin 1 is in the southeast quadrant of the site and occupies the low point of the property. The east edge of the basin is parallel to Northwest Avenue and south of the high point which marks the border with the easternmost edge of Basin 2. There is an unmaintained ditch marking the southern border of Basin 1, and runoff will flow towards it. At the terminus of the ditch where the southeast corner of the property meets the sidewalk, Catch Basin 1463 drains to the south with functioning 12-inch Corrugated Plastic Pipe along Northwest Avenue 475 feet to another catch basin with an outfall into a wetland.

Basin 2

Basin 2 is the largest of the basins, and from its east edge runoff will flow northerly from the high point where the property driveway meets Northwest Avenue. 12-inch CPP from Catch Basin 1464 delivers runoff to a network of catch basins at the intersection of Northwest Avenue and Mahogany Avenue and presumably to the wetland to the north of Mahogany Avenue. The northern edge of Basin 2 slopes down to a wetland which borders the site to the north. Runoff from the majority of Basin 2 will flow into this wetland.

Basin 3

Basin 3 occupies a small section in the northwestern quadrant of the site. It is differentiated from Basin 2 due to the nature of the landscape contours which will have its runoff draining westerly into two smaller wetland areas.

Basin 4

Basin 4 is the smallest basin of the site and differentiated by the landscape of the southwestern corner of the property. A high point separates it from Basins 2 and 3,and runoff will flow southwesterly toward catch basins at the dead end of Dover Street. Catch basin 1797 receives runoff from Dover Street catch basins using 12-inch CPP and discharges into the City of Bellingham detention pond to the west of Dover Street.

The following sections describe how the project meets the minimum requirements for stormwater management as specified in the DOE Manual.

Minimum Requirement #1: Preparation of a Stormwater Site Plan: This project is required to prepare a Stormwater Site Plan, as defined by the DOE Manual

Stormwater Site Plans are prepared for local government review. Stormwater Site Plans shall use site-appropriate development principles, as required and encouraged by local development codes, to retain native vegetation and minimize impervious surfaces to the extent feasible. Stormwater Site Plans shall be prepared in accordance with the DOE Manual.

> **Drainage Report:** A guiding document prepared with associated site testing, engineering analysis, site planning, supporting calculations, and supporting documentation defining a permanent stormwater control plan for the subject site.
>
> **SWPPP Plan:** Construction Stormwater Pollution Prevention Plan consists of the preparation of a Temporary Erosion and Sediment Control Plan (TESC). Please see the attached project plans for the TESC plan. This is just an initial plan. The plan must be monitored and modified for field conditions by a Certified Erosion and Sedimentation Control Lead (CESCL) throughout the duration of the project construction phase.
>
> **SPCC Plan:** A Spill Prevention, Control and Counter Measures Plan (SPCC) will be provided by the Contractor.

Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP) This project is required to prepare SWPP Plan, as defined by thresholds in the DOE Manual.

A Stormwater Pollution Prevention Plan (SWPP Plan) has been prepared as part of the construction drawings for the proposed site improvements, which are included in Appendix A of this report. This plan provides erosion and sediment control information, locations where Best Management Practices (BMPs) shall be implemented, and requirements that the contractor must follow throughout construction. See the Construction Plans for a copy of the SWPP Site Plan, SWPP Notes, and BMP details.

During construction, the contractor shall maintain a copy of the SWPP Plan on site and shall update or modify the SWPP Plan as necessary for the current conditions of the site. The contractor's schedule and available crew, equipment, and materials will be determined prior to construction. Accordingly, some BMPs that have been specified may not be necessary, while other additional BMPs may be required.

Construction stormwater prevention is documented in the SWPP Plan that has been prepared for this project.

Element 1: Preserve Vegetation / Mark Clearing Limits

A. Before beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
B. Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

Additional Guidance For Element 1

- Plastic, metal, fabric fence, or other physical barriers may be used to mark the clearing limits. Note the difference between the practical use and proper installation of BMP C233: silt fence and the proper use and installation of BMP C103: high-visibility fence.
- If it is not practical to retain the duff layer in place, then stockpile it on site, cover it to prevent erosion, and replace it immediately when you finish disturbing the site.
-

Suggested BMPs For Element 1

- BMP C103: High-Visibility
- BMP C233: Silt Fence

Element 2: Establish Construction Access

A. Limit construction vehicle access and exit to one route, if possible.
B. Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking of sediment onto public roads.
C. Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.
D. If sediment is tracked off site, clean the affected roadway(s) thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or picking up and transporting the sediment to a controlled sediment disposal area.
E. Conduct street washing only after sediment is removed in accordance with 2.d (above).
F. Control street wash wastewater by pumping back on site, or otherwise prevent it from discharging into systems tributary to waters of the state.

Additional Guidance For Element 2

Minimize construction site access points along linear projects, such as roadways. Street washing may require local jurisdiction approval.

Suggested BMPs For Element 2

- BMP C105: Stabilized Construction Access

Element 3: Control Flow Rates

A. Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
B. Where necessary to comply with 3.a (above), construct stormwater infiltration or detention BMPs as one of the first steps in grading. Assure that detention BMPs function properly before constructing site improvements (e.g., impervious surfaces).
C. If permanent infiltration BMPs are used for temporary flow control during construction, protect these BMPs from siltation during the construction phase.

Additional Guidance For Element 3

- Conduct a downstream analysis if changes in flows could impair or alter conveyance systems, streambanks, bed sediment, or aquatic habitat. See iii-3.2 preparing a stormwater site plan for off-site analysis guidelines.
- Even gently sloped areas need flow controls such as BMP C235: wattles or other energy dissipation / filtration structures. Place dissipation facilities closer together on steeper slopes. These methods prevent water from building higher velocities as it flows downstream within the construction site.
- Control structures designed for permanent detention BMPs are not appropriate for use during construction without modification. If used during construction, modify the control structure to allow for long-term storage of runoff and enable sediment to settle. Verify that the BMP is sized appropriately for this purpose. Restore BMPs to their original design dimensions, remove sediment, and install a final control structure at completion of the project.
- Erosion has the potential to occur because of increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site. The local permitting agency may require infiltration or detention BMP designs that provide additional or different stormwater flow control than the designs detailed in this manual. These requirements may be necessary to address local conditions or to protect properties and waterways downstream.
- Velocity of water leaving the site should not exceed 3 feet/second, if the discharge is to a stream or ditch. Install velocity dissipation, such as BMP C207: check dams or BMP C202: riprap channel lining to ensure reduction of the flow velocity to a non-erosive level.
- If the discharge from a project site is to a municipal storm drainage system, the allowable discharge rate may be limited by the capacity of the public system. It may be necessary to clean the municipal storm drainage system prior to the start of the discharge to prevent scouring solids from the drainage system. Obtain permission from the owner of the collection system before discharging to it. Ensure that no downstream pipes are surcharged as a result of increased flows from the project site.

- If the discharge from a project site is directly to a flow control exempt receiving water listed in appendix I-A: Flow Control Exempt Receiving Waters or to an infiltration system, there is no discharge flow limit.

Suggested BMPs For Element 3

- BMP C209: Outlet Protection
- BMP C235: Wattles

Element 4: Install Sediment Controls

A. Construct sediment control BMPs (sediment ponds, traps, filters, etc.) As one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.
B. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.
C. Direct stormwater runoff from disturbed areas through BMP C241: sediment pond (temporary) or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must control flow rates per element 3: control flow rates.
D. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
E. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.
F. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

Additional Guidance For Element 4

- Outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column are for the construction period only. If installing a floating pump structure, include a stopper to prevent the pump basket from hitting the bottom of the pond.
- If a sediment trapping BMP utilizes a control structure that will also be used in a permanent detention BMP application, the control structure construction must be finalized for the permanent BMP application upon project completion.
- Install sediment controls in a manner that protects the sensitive areas and their buffers marked in accordance with element 1: preserve vegetation / mark clearing limits.
- Where feasible, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration.
- Seed and mulch earthen structures such as dams, dikes, and diversions according to the timing indicated in element 5: stabilize soils.

- Full stabilization includes concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion.
- The local permitting authority may inspect and approve areas fully stabilized by means other than pavement or quarry spalls.

Suggested BMPs For Element 4

- BMP C233: Silt Fence
- BMP C234: Vegetated Strip
- BMP C235: Wattles
- BMP C241: Sediment Pond (Temporary)

Element 5: Stabilize Soils

A. Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (pam), the early application of gravel base on areas to be paved, and dust control.
B. Control stormwater volume and velocity within the site to minimize soil erosion.
C. Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
D. Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
    a. During the dry season (May 1 - September 30): 7 days
    b. During the wet season (October 1 - April 30): 2 days
E. Stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.
F. Stabilize soil stockpiles from erosion, protect with sediment trapping measures, and where possible, locate away from storm drain inlets, waterways and drainage channels.
G. Minimize the amount of soil exposed during construction activity.
H. Minimize the disturbance of steep slopes.
I. Minimize soil compaction and, unless infeasible, preserve topsoil.

Additional Guidance For Element 5

- Soil stabilization BMPs should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water.
- Ensure that gravel base used for stabilization is clean and does not contain fines or sediment.

Suggested BMPs For Element 5

- BMP C120: Temporary And Permanent Seeding
- BMP C121: Mulching
- BMP C123: Plastic Covering
- BMP C124: Sodding
- BMP C125: Topsoiling/Composting
- BMP C140: Dust Control

Element 6: Protect Slopes

A. Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).
B. Divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be man- aged separately from stormwater generated on site.
C. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion. Temporary pipe slope drains must be sized to convey the flow rate calculated by one of the following methods:
    a. Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm.

    OR

    b. Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step.
D. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydro- logy Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped" area.
E. Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
F. Place check dams at regular intervals within constructed channels that are cut down a slope.

Additional Guidance for Element 6

- Consider soil type and its potential for erosion.
- Stabilize soils on slopes, as specified in Element 5: Stabilize Soils.
- BMP combinations are the most effective method of protecting slopes with disturbed soils. For example, use both BMP C121: Mulching and BMP C122: Nets and Blankets in combination.

Suggested BMPs for Element 6

- BMP C121: Mulching
- BMP C122: Nets and Blankets
- BMP C124: Sodding

Element 7: Protect Drain Inlets

A. Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.
B. Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

Additional Guidance for Element 7

Protect all existing storm drain inlets so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

- Keep all approach roads clean. Do not allow sediment and street wash water to enter storm drains without prior and adequate treatment (as defined above) unless treatment is provided before the storm drain discharges to waters of the State.
- Inlets should be inspected weekly at a minimum and daily during storm events.

Suggested BMPs for Element 7

- BMP C220: Inlet Protection

Element 8: Stabilize Channels and Outlets

A. Design, construct, and stabilize all on-site conveyance channels to prevent erosion from the flow rate calculated by one of the following methods:
    a. Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm.
    OR
    b. Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step.

    The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydro- logy Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped" area.
B. Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches at the outlets of all conveyance systems.

Additional Guidance for Element 8

The best method for stabilizing channels is to completely line the channel with BMP C122: Nets and Blankets first, then add BMP C207: Check Dams as necessary to function as an anchor and to slow the flow of water.

Element 9: Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The project proponent must:

A. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.
B. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.
C. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.
D. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, or to the sanitary sewer, with local sewer district approval.
E. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.
F. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: recycled concrete stockpiles, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.
G. Adjust the pH of stormwater if necessary to prevent violations of water quality standards.
H. Assure that washout of concrete trucks is performed off site or in designated concrete washout areas only. Do not wash out concrete truck drums or concrete handling equipment onto the ground, or into storm drains, open ditches, streets, or streams. Washout of small concrete handling equipment may be disposed of in a formed area awaiting concrete where it will not contaminate surface or ground water. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge directly to ground water or surface waters of the State is prohibited. Do not wash out to formed areas awaiting infiltration BMPs.
I. Obtain written approval from Ecology before using chemical treatment other than CO2, dry ice, or food grade vinegar to adjust pH.
J. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that

prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

Additional Guidance for Element 9

- Wheel wash and/or tire bath wastewater can be combined with wastewater from concrete washout areas if the wastewaters will be properly disposed of at an offsite location or treatment facility.
- Do not use upland land applications for discharging wastewater from concrete washout areas.
- Woody debris may be chopped and spread on site.
- Conduct oil changes, hydraulic system drain down, solvent and degreasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff using spill prevention measures, such as drip pans.
- Clean contaminated surfaces immediately following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.

Suggested BMPs for Element 9

- BMP C152: Sawcutting and Surfacing Pollution Prevention

Element 10: Control Dewatering

A. Discharge foundation, vault, and trench dewatering water, which have similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary).
B. Discharge clean, non-turbid dewatering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element 8: Stabilize Channels and Outlets, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment BMPs. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.
C. Handle highly turbid or otherwise contaminated dewatering water separately from storm-water.
D. Other dewatering treatment or disposal options may include:
    a. Infiltration.
    b. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
    c. Ecology-approved on-site chemical treatment or other suitable treatment technologies.
    d. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

e. Use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering.

Additional Guidance for Element 10

- Channels must be stabilized, as specified in Element 8: Stabilize Channels and Outlets.
- Construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam can create highly turbid or contaminated dewatering water.
- Discharging sediment-laden (muddy) water into waters of the State likely constitutes violation of water quality standards for turbidity. The easiest way to avoid discharging muddy water is through infiltration and preserving vegetation.
- Dewatering water from contaminated sites must be handled separately from stormwater. Direct contaminated stormwater to a sanitary sewer where allowed by the local sewer authority, or to other approved treatment.

Suggested BMPs for Element 10

- BMP C236: Vegetative Filtration

Element 11: Maintain BMPs

A. Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
B. Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Additional Guidance for Element 11

- Some temporary erosion and sediment control BMPs are biodegradable and designed to remain in place following construction. BMP C122: Nets and Blankets is an example of a BMP with biodegradable options.
- Provide protection to all BMPs installed for the permanent control of stormwater from sediment and compaction. All BMPs that are to remain in place following completion of construction shall be examined and placed in full operating conditions. If sediment enters the BMPs during construction, it shall be removed and the facility shall be returned to the conditions specified in the construction documents.
- Remove or stabilize trapped sediment on site. Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.
-

Suggested BMPs for Element 11

- BMP C160: Certified Erosion and Sediment Control Lead

Element 12: Manage the Project

A. Phase development projects to the maximum degree practicable and take into account seasonal work limitations.
B. Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit (CSWGP) must conduct site inspections and monitoring in accordance with Special Condition S4 of the CSWGP.
C. Maintain, update, and implement the Construction SWPPP.
D. Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By the initiation of construction, the Construction SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times.

Additional Guidance for Element 12

The project manager must ensure that the project is built in such a way to comply with all Construction SWPPP Elements, as detailed in this section. Considerations for the project manager include, but are not limited to:

- Construction Phasing
- Seasonal Work Limitations
- Coordination With Utilities And Other Contractors
- Inspection
- Monitoring
- Maintaining An Updated Construction SWPPP

Phasing of Construction

Phase development projects where feasible in order to prevent soil erosion and transporting of sediment from the site during construction. Revegetate exposed areas and maintain that vegetation as an integral part of the clearing activities for any phase.

Clearing and grading activities for developments shall be permitted only if conducted using an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. Minimize removing trees and disturbing or compacting native soils when establishing permitted clearing and grading areas. Show on the site plans and the development site permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions.

Inspection

All BMPs must be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections must be conducted by a person knowledgeable in the principles and practices of erosion and sediment control. The person must have the skills to 1)

assess the site conditions and construction activities that could impact the quality of stormwater, and 2) assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

For construction sites one acre or larger that discharge stormwater to surface waters of the state, a CESCL must be identified in the construction SWPPP; this person must be on-site or on-call at all times. Certification must be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology. See BMP C160: Certified Erosion and Sediment Control Lead.

Appropriate BMPs or design changes shall be implemented as soon as possible whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of /or potential to discharge a significant amount of any pollutant.

The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

Based on the results of the inspection, construction site operators must correct the problems identified by:

- Reviewing the Construction SWPPP for compliance with the 13 elements and making appropriate revisions within 7 days of the inspection.
- Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request an extension within the initial 10- day response period.
- Documenting BMP implementation and maintenance in the site log book (applies only to sites that have coverage under the Construction Stormwater General Permit).

The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month

Maintaining an Updated Construction SWPPP

Retain the Construction SWPPP on-site or within reasonable access to the site.

Modify the Construction SWPPP whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The Construction SWPPP must be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the Construction SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater dis- charges from the site. Modify the Construction SWPPP as necessary to include additional or modified BMPs designed to correct problems identified. Complete revisions to the Construction SWPPP within seven (7) days following the inspection.

Suggested BMPs for Element 12

- BMP C160: Certified Erosion and Sediment Control Lead

Element 13: Protect Low Impact Development BMPs

The primary purpose of On-Site Stormwater Management is to reduce the disruption of the natural site hydrology through infiltration. BMPs used to meet I-3.4.5 MR5: On-Site Stormwater Management (often called LID BMPs) are permanent facilities.

A. Protect all LID BMPs (including, but not limited to BMP T7.30: Bioretention, BMP T5.14: Rain Gardens, and BMP T5.15: Permeable Pavements) from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the LID BMPs. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden Bioretention/Rain Garden soils, and replacing the removed soils with soils meeting the design specification.
B. Maintain the infiltration capabilities of LID BMPs by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
C. Control erosion and avoid introducing sediment from surrounding land uses onto BMP T5.15: Permeable Pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.
D. Permeable pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer's procedures.
E. Keep all heavy equipment off existing soils under LID BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

Additional Guidance for Element 13

See Chapter 5: Precision Site Preparation, Construction & Inspection of LID Facilities in the LID Technical Guidance Manual for Puget Sound (Hinman and Wulkan, 2012) for more detail on protecting LID integrated management practices.

Note that the LID Technical Guidance Manual for Puget Sound (Hinman and Wulkan, 2012) is for additional informational purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the LID Technical Guidance Manual for Puget Sound

Suggested BMPs for Element 13

- BMP C103: High-Visibility Fence
- BMP C233: Silt Fence

Minimum Requirement #3: Source Control of Pollution: This project is required to have pollution source controls, as defined by thresholds in the DOE Manual.

Pollutant sources of concern for the project include the proposed roadways and parking areas. Pollution will be controlled at the source to maximize extent possible. All known, available and reasonable source control BMPs have been applied to the design and layout of the site and stormwater plans.

These Operational and Structural Source Control BMPs (as specified in the DOE Manual) should be implemented upon construction completion and remain in place for the operational life of the facility:

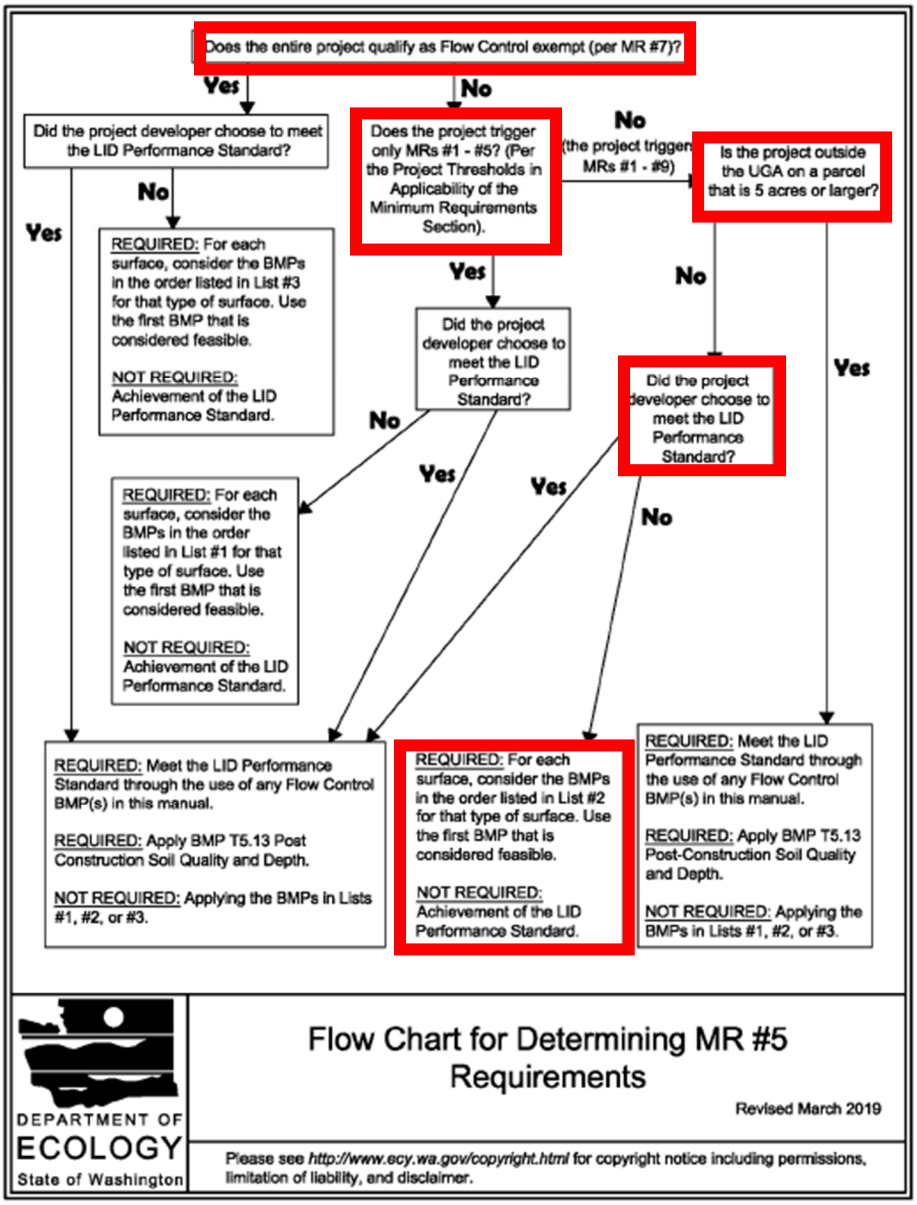
S406 BMPs for Streets / Highways
S411 BMPs for Landscaping and Lawn / Vegetation Management
S415 BMPs for Maintenance of Public and Private Utility Corridors and Facilities
S416 BMPs for Maintenance of Roadside Ditches
S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls: This project is required to preserve natural drainage system and outfalls, as defined by thresholds in the DOE Manual. The four different basin areas as described in Section 4 and drainage was maintained to these flowpaths.

Minimum Requirement #5: On-Site Stormwater Management: This project is required to have on-site stormwater management, as defined by thresholds in the DOE Manual.

To determine the required on-site stormwater management practices for this project, the Flow Chart for Determining Minimum Requirement #5 was used. According to this flow chart, this project is required to either meet the LID Performance Standard or List #2, on this project we will meet the requirements of List #2.

Figure I-3.3: Flow Chart for Determining MR #5 Requirements



List #2:

Lawn and Landscape Areas:

BMP T5.13: Post-Construction Soil Quality and Depth

This project includes lawn or landscaped area. Therefore, the application of BMP T5.13 as outlined in the DOE Manual, is feasible and will be implemented for this project, for all areas subject to clearing and grading that have not been covered by impervious surfaces, and at project completion these areas will demonstrate the following:

A topsoil layer with a minimum organic matter of 10% dry weight in planting beds, and 5% organic matter content in turf areas, and a pH from 6.0 to 8.0 or matching the pH of the undisturbed soil. The topsoil layer shall have a minimum depth of eight inches except where tree roots limit the depth of incorporation of amendments needed to meet the criteria. Subsoils below the topsoil layer should be scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible.

BMP T5.13 will be met using soils identified in the Soils Report in Section 3 to be on site in the upper two feet below ground surface. These soils may be amended as prescribed in the DOE Manual to enhance their treatment capacity.

BMP T5.13: Post-Construction Soil Quality and Depth
Stormwater Management Manual for Western Washington

Excerpted from the Washington State Department of Ecology's *Stormwater Management Manual for Western Washington*, Vol. V: Runoff Treatment BMPs

Purpose and Definition

Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. These functions are largely lost when development strips away native soil and vegetation and replaces it with minimal topsoil and sod. Not only are these important stormwater functions lost, but such landscapes themselves become pollution generating pervious surfaces due to increased use of pesticides, fertilizers and other landscaping and household/industrial chemicals, the concentration of pet wastes, and pollutants that accompany roadside litter.

Establishing soil quality and depth regains greater stormwater functions in the post development landscape, provides increased treatment of pollutants and sediments that result from development and habitation, and minimizes the need for some landscaping chemicals, thus reducing pollution through prevention.

Applications and Limitations

Establishing a minimum soil quality and depth is not the same as preservation of naturally occurring soil and vegetation. However, establishing a minimum soil quality and depth will provide improved on-site management of stormwater flow and water quality.

Soil organic matter can be attained through numerous materials such as compost, composted woody material, biosolids, and forest product residuals. It is important that the materials used to meet the soil quality and depth BMP be appropriate and beneficial to the plant cover to be established. Likewise, it is important that imported

- **Soil quality.** All areas subject to clearing and grading that have not been covered by impervious surface, incorporated into a drainage facility or engineered as structural fill or slope shall, at project completion, demonstrate the following:

  1. A topsoil layer with a minimum organic matter content of 10% dry weight in planting beds, and 5% organic matter content in turf areas, and a pH from 6.0 to 8.0 or matching the pH of the undisturbed soil. The topsoil layer shall have a minimum depth of eight inches except where tree roots limit the depth of incorporation of amendments needed to meet the criteria. Subsoils below the topsoil layer should be scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible.
  2. Mulch planting beds with 2 inches of organic material
  3. Use compost and other materials that meet these organic content requirements:
     a. The organic content for "pre-approved" amendment rates can be met only using compost meeting the compost specification for BMP T7.30: Bioretention Cells, Swales, and Planter Boxes, with the exception that the compost may have up to 35% biosolids or manure.

        The compost must also have an organic matter content of 40% to 65%, and a carbon to nitrogen ratio below 25:1.

        The carbon to nitrogen ratio may be as high as 35:1 for plantings composed

topsoils improve soil conditions and do not have an excessive percent of clay fines.

This BMP can be considered infeasible on till soil slopes greater than 33 percent.

Design Guidelines

- **Soil retention.** Retain, in an undisturbed state, the duff layer and native topsoil to the maximum extent practicable. In any areas requiring grading remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas, to be reapplied to other portions of the site where feasible.

- **Implementation Options**: The soil quality design guidelines listed above can be met by using one of the methods listed below:

  1. Leave undisturbed native vegetation and soil, and protect from compaction during construction.
  2. Amend existing site topsoil or subsoil either at default "pre-approved" rates, or at custom calculated rates based on tests of the soil and amendment.
  3. Stockpile existing topsoil during grading, and replace it prior to planting. Stockpiled topsoil must also be amended if needed to meet the organic matter or depth requirements, either at a default "pre-approved" rate or at a custom calculated rate.
  4. Import topsoil mix of sufficient organic content and depth to meet the requirements.

  More than one method may be used on different portions of the same site. Soil that already meets the depth and organic matter quality standards, and is not compacted, does not need to be amended.

Planning/Permitting/Inspection/Verification Guidelines & Procedures

Local governments are encouraged to adopt guidelines and procedures similar to those recommended in Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington. This document is available at: http://www.soilsforsalmon.org/pdf/Soil_BMP_Manual.pdf

Maintenance

- Establish soil quality and depth toward the end of construction and once established, protect from entirely of plants native to the Puget Sound Lowlands region.

  b. Calculated amendment rates may be met through use of composted material meeting (a.) above; or other organic materials amended to meet the carbon to nitrogen ratio requirements, and not exceeding the contaminant limits identified in Table 220-B, Testing Parameters, in WAC 173-350-220.

The resulting soil should be conducive to the type of vegetation to be established.

Runoff Model Representation

Areas meeting the design guidelines may be entered into approved runoff models as "Pasture" rather than "Lawn."

Flow reduction credits can be taken in runoff modeling when BMP T5.13: Post-Construction Soil Quality and Depth is used as part of a dispersion design under the conditions described in:

- BMP T5.10B: Downspout Dispersion Systems
- BMP T5.11: Concentrated Flow Dispersion
- BMP T5.12: Sheet Flow Dispersion
- BMP T5.18: Reverse Slope Sidewalks
- BMP T5.30: Full Dispersion (for public road projects)

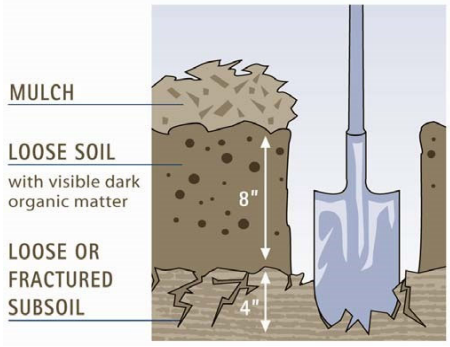


Figure 5.3.3 – Planting Bed Cross-Section (NTS)

compaction, such as from large machinery use, and from erosion. ▪ Plant vegetation and mulch the amended soil area after installation. ▪ Leave plant debris or its equivalent on the soil surface to replenish organic matter. ▪ Reduce and adjust, where possible, the use of irrigation, fertilizers, herbicides and pesticides, rather than continuing to implement formerly established practices.	

Surface Type - Roofs:

BMP T5.30: Full Dispersion
The project has a TDA with greater than 10% impervious surface and is not eligible to be "fully dispersed." There is also no native vegetation in the TDA and it also does not include the required vegetated dispersion area to satisfy the requirements of BMP T5.30: Full Dispersion.

BMP T5.10A: Downspout Full Infiltration, BMP T7.30: Bioretention, BMP T5.10B: Downspout Dispersion Systems and BMP T5.10C: Perforated Sub-out Connections
All infiltration systems are considered infeasible on lots or sites that do not have a minimum of 3 feet or more of permeable soil from the bottom of the infiltration facility to the seasonal high ground water table. Per the groundwater analysis in Chapter 4, there is not 3 feet of separation from the bottom of any infiltration facility to the high groundwater table.

Surface Type – Other Hard Surfaces:

BMP T5.30: Full Dispersion, BMP T5.12 Sheet Flow Dispersion, BMP T5.11 Concentrated Flow Dispersion
This project does not include the required vegetated dispersion area to satisfy the requirements of any of the dispersion BMPs listed.

BMP T5.15: Permeable Pavements, BMP T7.30: Bioretention
All infiltration systems are considered infeasible on lots or sites that do not have a minimum of 3 feet or more of permeable soil from the bottom of the infiltration facility to the seasonal high ground water table. Per the groundwater analysis in Chapter 4, there is not 3 feet of separation from the bottom of any infiltration facility to the high groundwater table is not provided.

Minimum Requirement #6: Runoff Treatment: This project is required to meet runoff treatment requirements, as defined by thresholds in the DOE Manual.

This project is considered a multi-family site by its use. As a result, it is subject to enhanced treatment.

Runoff treatment for pollution generating hard surfaces will be obtained by utilizing DOE approved GULD enhanced treatment technologies. Specifically, the 4x4 Filterra Unit will be used. The full two year release rate was used per DOE Manual Volume Ill Section 111- 2.6.

Basin 1 Full Two-Year Release Rate: 0.011 cfs = 4.9 cfs

As described in the attached Ecology GULD document, the Enhanced Treatment Level Infiltration Rate is 175 in/hr = 0.00405 ft/s

Filterra Area = Full Two Year Release Rate / Media Filtration Rate = 0.011 cfs / 0.00405 ft/s = 2.7 SF. The 4x4 Filterra Unit provides 16 SF of media, which is satisfactory for this treatment design.

Basin 2 Full Two-Year Release Rate: 0.041 cfs = 18.3 cfs

Filterra Area = Full Two Year Release Rate / Media Filtration Rate = 0.041 cfs / 0.00405 ft/s = 10.1 SF. The 4x4 Filterra Unit provides 16 SF of media, which is satisfactory for this treatment design.

BMP T5.13 will be met using vegetated areas left undisturbed on site. These areas may be amended as prescribed in the WSDOE 2019 Manual to enhance their treatment capacity.

Minimum Requirement #7: Flow Control: This project is required to provide Flow Control, as defined by thresholds in the DOE Manual.

This project will attenuate runoff to meet flow control requirements using the proposed detention vault and will be released using a control structure and outfall to the existing drainage course as described in Section 4.

Drainage from Basin #1 and Basin #2 will be collected in seperate enclosed drainage system that is routed to separate concrete detention vaults. Both detention vault will discharge to seperate control structures, then to wetwells each with a triplex pump system. The wetwells will pump to separate Filterra treatment units for the enhanced treatment and both be equipped with a gravity overflow system.

After detention and treatment, Basin #1 will drain to a catch basin in Northwest Ave. Basin #2 will drain to a dispersion trench outfall to the wetland to the north.

Minimum Requirement #8: Wetlands Protection: This project is required to protect wetlands, as defined by thresholds in the DOE Manual.

This project is required to protect wetlands, as defined by thresholds in the DOE Manual.

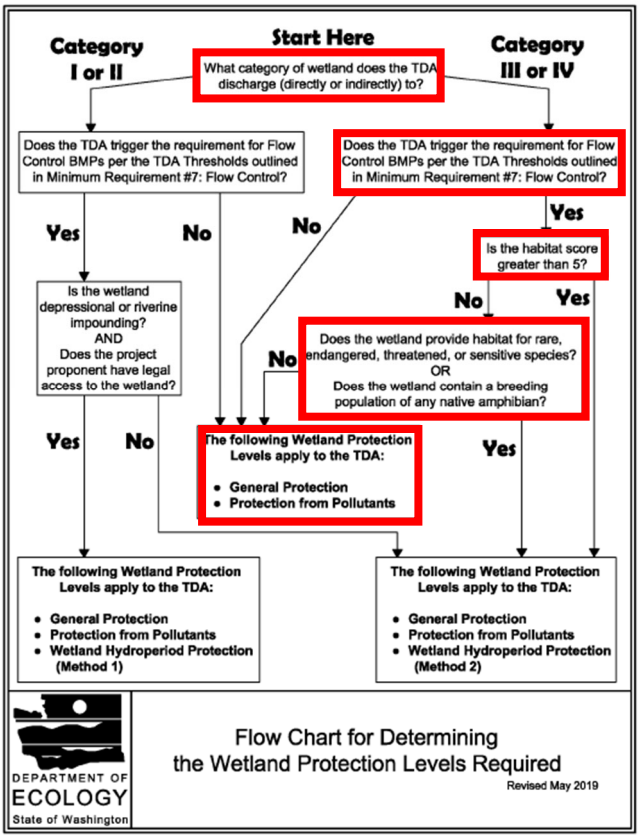
See the following reports which discuss the wetland delineation in detail:

Critical Areas Report: 4185 Northwest Drive - DOE Rating and Buffer Determination: Off-site Wetlands (July 31, 2019).

Basin #2 outfalls to “Wetland North” and Basin #3 outfalls to “Wetland West” as described in the report. Both are Category III wetlands with a habitat score of 4. These wetlands do not provide habitat for rare, endangered or threatened species or contains a breeding population of amphibians.

As shown in the flowchart below, the General Protection and Protection from Pollutants is required for this project.

Figure I-3.5: Flow Chart for Determining Wetland Protection Level Requirements



General Protection

All wetlands (Categories I, II, III and IV) must receive the following general protection:

1. Consult regulations issued under federal and state laws that regulate the discharge of pollutants to surface waters, including the Construction Stormwater General NPDES Permit.
    - See above referenced environmental reports from Miller Environmental Services, LLC
2. Maintain the wetland buffer required by local and/or state regulations.
    - See above referenced environmental reports from Miller Environmental Services, LLC
3. Retain areas of native vegetation connecting the wetland and its buffer with nearby wetlands and other contiguous areas of native vegetation.
    - See above referenced environmental reports from Miller Environmental Services, LLC
4. Avoid compaction of soil and introduction of invasive plant or animal species in the wetland and its buffer.

- See BMP T5.13 and the Stormwater Pollution Prevention Plan

5. Take measures to avoid general physical impacts (e.g., littering and vegetation destruction). Examples are protecting existing buffer zones; discouraging access, especially by vehicles, by planting outside the wetland, and encouragement of stewardship and signage by landowners.

    - Fencing will be required per City of Bellingham Critical Areas Code

6. Any stormwater management practices, such as Runoff Treatment or Flow Control BMP implementation, must be done outside of the wetland buffer boundary, except limited circumstances where the wetland and/or buffer may be used for additional Runoff Treatment and/or Flow Control of stormwater (See I-C.6 Compensatory Mitigation of Wetlands)

    - See Stormwater Pollution Prevention Plan. All stormwater management will be performed outside the wetland buffer.

7. Discharge from a BMP or project site should be dispersed using a method to diffuse the flow before entering the wetland buffer.

    - The runoff will be dispersed as described in the Stormwater Pollution Prevention Plan

8. Consider fences to restrict human access, but make sure it doesn't interfere with wildlife move- ment. They should be used when wildlife passage is not a major issue and the potential for intrusive impacts is high. When wildlife movement and intrusion are both issues, the cir- cumstances will have to be weighed to make a decision about fencing. Check with the local and/or state agencies to determine if fencing would be allowed.

    - Fencing will be required per City of Bellingham Critical Areas Code

Protection from Pollutants

All wetlands (Categories I, II, III and IV) must receive the following protection from pollutants:

1. Provide Construction Stormwater BMPs as directed in I-3.4.2 MR2: Construction Stormwater Pollution Prevention Plan (SWPPP) to prevent sediment and other pollutants from entering the wetland.

    - See BMP T5.13 and the Stormwater Pollution Prevention Plan

2. Provide Source Control BMPs as directed in I-3.4.3 MR3: Source Control of Pollution. Refer to Volume IV and local jurisdiction requirements.

    - See BMP T5.13 and the Stormwater Pollution Prevention Plan

3. Provide On-Site Stormwater Management and use LID principles as much as practicable for the site, as directed in I-3.4.5 MR5: On-Site Stormwater Management. LID principles and practices will help meet other wetland hydroperiod protection criteria and provide additional habitat.

    - See Minimum Requirement #8 discussion above

4. Provide Runoff Treatment BMPs as directed in I-3.4.6 MR6: Runoff Treatment to treat runoff prior to entering the wetland and its buffer.

    - See Minimum Requirement #6

    Note: If the thresholds for I-3.4.6 MR6: Runoff Treatment are not met for a TDA, then it is not required to

provide Runoff Treatment BMPs for that TDA to comply with I-3.4.8 MR8: Wetlands Protection.

Minimum Requirement #9: Operation and Maintenance: This project is required to have an operation and maintenance manual, as defined by thresholds in the DOE Manual.

The property owner(s) will be responsible for operating and maintaining these proposed facilities as required to meet City and State requirements. The Operation and Maintenance Manual included in Appendix E of this report contains applicable information needed to maintain the stormwater facilities constructed by this project, as well as relevant operational and structural source control BMPs.

Replacement of the media in the GULD enhanced treatment devices should be per manufacturer recommendations as provided in Appendix E.

Conclusion

The proposed project will include 19 townhomes in various layouts surrounding parking areas and alleys. Two main access points will bring vehicles and utility services to the site – at the southwest corner from Dover Street and at the northeast corner as a shared access with the property to the north. If constructed according to this report and accompanying figures, the proposed stormwater management system will meet the requirements for on-site stormwater management, stormwater treatment, and stormwater flow control as required by the DOE Manual.

This analysis is based on data and records either supplied to or obtained by Impact Design. These documents are referenced within the text of this report and included in the figures and/or appendices of this report.

Appendices

Section	Contents
A	Vogel Northwest Townhomes Construction Plans
B	Hydrologic and Hydraulic Analysis
	Basin Maps
	WWHM 2012 Modeling
C	Wetland Information
D	Geotechnical Information
E	Vogel Northwest Townhomes Operations and Maintenance Manual

VOGEL NORTHWEST TOWNHOMES
EXISTING CONDITIONS

CRITICAL AREAS (CRA) NOTES:

1. WETLAND WEST PSSC CAT III AND WETLAND NORTH PSSC CAT III WERE LOCATED PER CAI CANTRELL & ASSOCIATES, INC FIGURE 2. "WETLAND BUFFER AND DETERMINATION MAP" DATED JULY 31, 2019 .
2. PROJECT SURVEY POINTS LOCATED FLAGS ALONG THE EASTERLY EDGE OF WETLAND WEST PSSC CAT III.
3. SIXTY FOOT (60-FT) BUFFER SHOWN IS A BUFFER REDUCTION NOTED IN LETTER DATED JULY 31, 2019. THAT LETTER TO CHARLES VOGLE FROM WILLIAM CANTRELL APPEARS TO HAVE ESTABLISHED THE BUFFER RECUDITON OF 25%, WHICH IS THEN SHOWN AS THE 60-FT BUFFER LINE SHOWN BELOW.
4. WITH THE BUFFER REDUCTION, THERE APPEARS TO BE NO BUFFER IMPACTS ON-SITE FOR THIS PROJECT AND THE PROPOSED BUILDING IS GREATER THAN 15-FT FURTHER EAST THAN SAID BUFFER.

30' 15' 0 30' 60'

SCALE: 1" = 30'

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PRELIMINARY

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
EXISTING CONDITIONS
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

PROJECT NUMBER: 20052
DESIGNED/DRAWN BY: SCR
CHECKED BY: SIG
ISSUE DATE: 09.27.2023

SH1
OF: SH1-SH8

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VOGEL NORTHWEST TOWNHOMES
EXISTING CONDITIONS - NEIGHBORHOOD CONTEXT

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VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
EXISTING CONDITIONS - NEIGHBORHOOD CONTEXT
4185 NORTHWEST AVENUE
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OF: SH1-SH8

VOGEL NORTHWEST TOWNHOMES
PRELIMINARY PLAT MAP

20' WIDE SHARED (PRIVATE) DRAINAGE EASEMENT IN FAVOR OF H.O.A. TO SOUTH AND PARCEL TO NORTH (APN 380/211 435/125)

SHARED (PRIVATE) STORM DRAINAGE EASEMENT WITH NEIGHBOR TO NORTH. SURVEYOR TO PROVIDE AGREEMENT TERMS AND LEGAL EXHIBIT AT TIME OF RECORDING

WESTERLY EXTENT OF 28' PUBLIC UTILITIES EASEMENT (SHARED PRIVATE STORM DRAINAGE PROPOED TO WEST)

EASEMENT WIDTH NORTH OF SHARED LOT LINE TO BE DETERMINED PER PLAT APPROVAL PLANS FOR PARCEL (APN 380/211 435/125) 4193 NORTHWEST AVE VICTOR & GALINA SHINTAR

28' PUBLIC UTILITY & ACCESS EASEMENT IN FAVOR OF CITY OF BELLINGHAM (SEPARATE EASEMENT FOR H.O.A. ACCESS REQUIRED)

PRIVATE ACCESS & UTILITY EASEMENT IN FAVOR OF H.O.A. (WIDTH VARIES)

30' FIRE TURNAROUND EASEMENT (PUBLIC)

PRIVATE ACCESS & UTILITY EASEMENT IN FAVOR OF LOT 1 – 5 (WIDTH VARIES)

10' PRIVATE H.O.A. DRAINAGE EASEMENT

25' FIRE TURNAROUND EASEMENT (PUBLIC)

30' PUBLIC UTILITY & ACCESS EASEMENT IN FAVOR OF CITY OF BELLINGHAM (SEPARATE EASEMENT FOR H.O.A. ACCESS REQUIRED)

30' PUBLIC UTILITY & ACCESS EASEMENT IN FAVOR OF CITY OF BELLINGHAM (SEPARATE EASEMENT FOR H.O.A. ACCESS REQUIRED)

15' PRIVATE STORM & SEWER SERVICE EASEMENT IN FAVOR OF H.O.A

PRIVATE ACCESS & UTILITY EASEMENT IN H.O.A (WIDTH VARIES)

20' PRIVATE H.O.A. DRAINAGE EASEMENT

CONSERVATION 20' EASEMENT

10' EASEMENT

LOT 1 2927 SF
LOT 2 3658 SF
LOT 3 5945 SF
LOT 4 4942 SF
LOT 5 3448 SF
LOT 6 3448 SF
LOT 7 5733 SF
LOT 8 6947 SF
LOT 9 6305 SF
LOT 10 3196 SF
LOT 11 3562 SF
LOT 12 6762 SF
LOT 13 5342 SF
LOT 14 3562 SF
LOT 15 3447 SF
LOT 16 3585 SF
LOT 17 2746 SF
LOT 18 3833 SF
LOT 19 8305 SF

NORTHWEST AVENUE
DOVER ST.
30'

20' 10' 0 20' 40'
SCALE: 1" = 20'

PRELIMINARY

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VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
PRELIMINARY PLAT MAP
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

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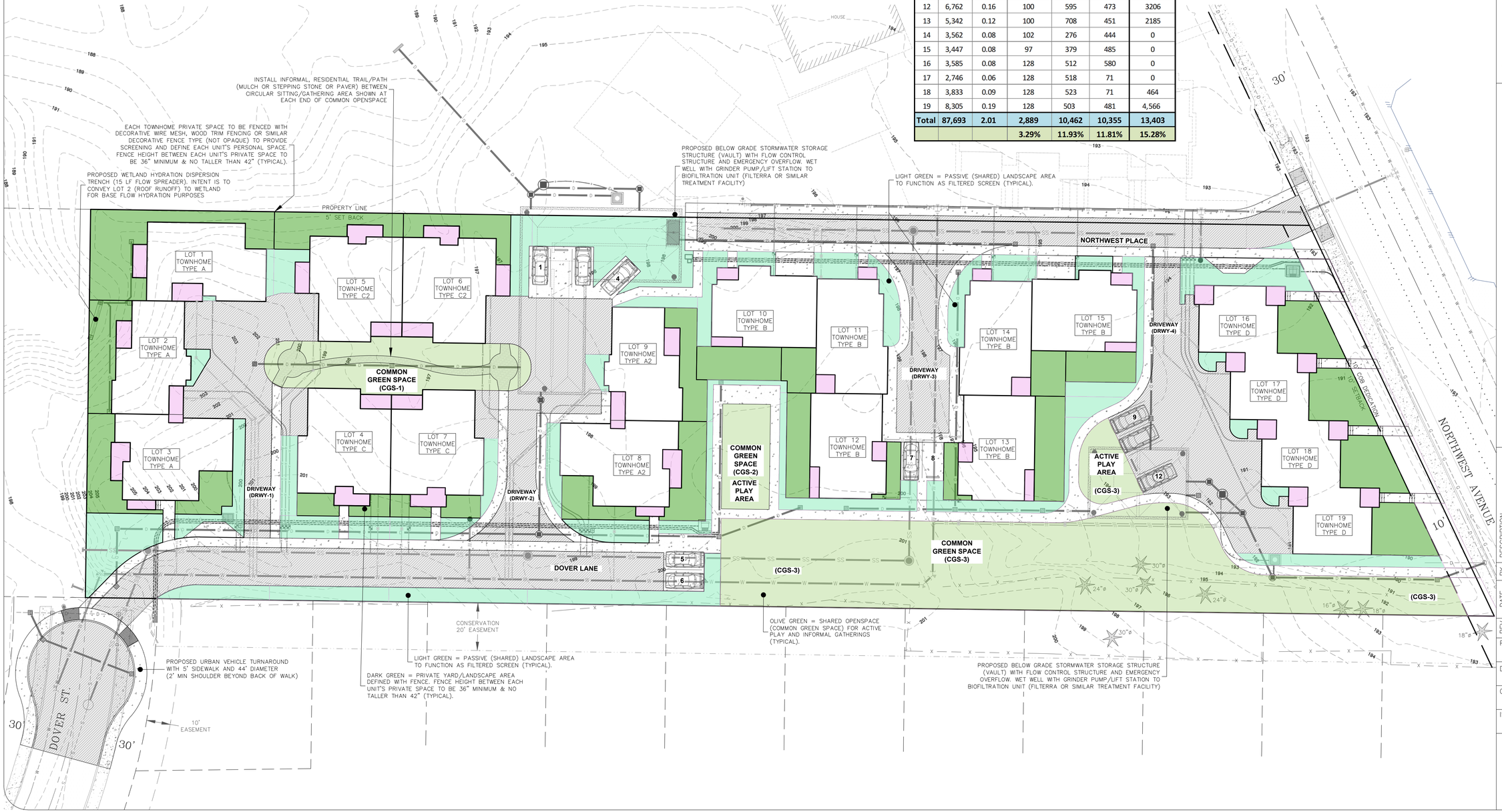
VOGEL NORTHWEST TOWNHOMES
LAND USE AND OPENSPACE EXHIBIT

Vogle NW Avenue Townhouse (BMC: 20.28.140)						
Lot No.	Lot Area (SF)	Acres (AC)	Private Covered Porch (SF)	Private Landscape (SF)	Passive Landscape (SF)	Common/ Openspace (SF)
1	2,927	0.07	181	1,220	73	0
2	3,658	0.08	147	575	93	38
3	5,945	0.14	273	833	1347	0
4	4,942	0.11	175	277	769	518
5	3,448	0.08	254	550	199	558
6	3,448	0.08	254	281	281	544
7	5,733	0.13	175	615	778	584
8	6,947	0.16	173	881	1327	670
9	6,305	0.14	147	456	1702	70
10	3,196	0.07	97	496	365	0
11	3,562	0.08	102	264	365	0
12	6,762	0.16	100	595	473	3206
13	5,342	0.12	100	708	451	2185
14	3,562	0.08	102	276	444	0
15	3,447	0.08	97	379	485	0
16	3,585	0.08	128	512	580	0
17	2,746	0.06	128	518	71	0
18	3,833	0.09	128	523	71	464
19	8,305	0.19	128	503	481	4,566
Total	**87,693**	**2.01**	**2,889**	**10,462**	**10,355**	**13,403**
			3.29%	**11.93%**	**11.81%**	**15.28%**

LAND USE TABLE NOTES:
1. TOTAL SITE AREA POST RIGHT-OF-WAY (R/W) DEDICATION USED FOR PERCENT (%) COVERAGE: 87,691 SF (2.01 AC).
2. PATH SHOWN THROUGH COMMON GREEN SPACE(S) WERE NOT INCLUDED IN THE COMMON OPENSPACE CALCULATION.
3. SIDEWALK/PATH RUNNING ALONG SIDE OF EACH OF THE EAST TO WEST RUNNING FIRE ACCESS LANES WERE NOT INCLUDED IN PASSIVE LANDSCAPE CALCULATION COLUMN. NOR WERE THEY INCLUDED IN COMMON OPENSPACE CALCULATION.

20' 10' 0 20' 40'

SCALE: 1" = 20'



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SCOTT CHRISTOPHER RIGGINS
CERTIFICATE NO. 1254

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
LAND USE AND OPENSPACE EXHIBIT
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

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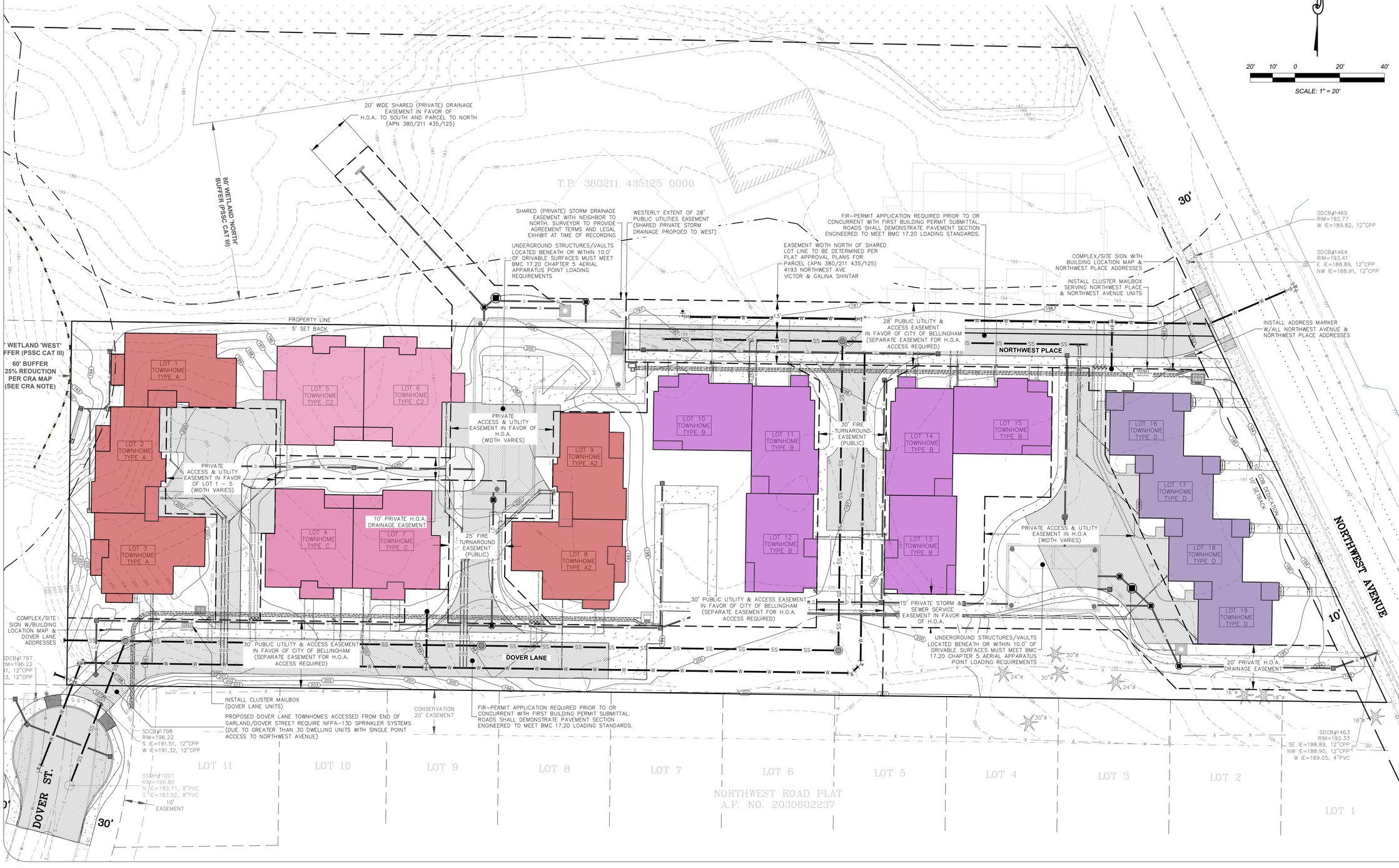
VOGEL NORTHWEST TOWNHOMES
SCHEMATIC UTILITY AND PRELIMINARY GRADING



20' 10' 0 20' 40'

SCALE: 1" = 20'

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PRELIMINARY

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT

SCOTT CHRISTOPHER RIGGINS
CERTIFICATE NO. 1254

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
SCHEMATIC UTILITY AND PRELIMINARY GRADING
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

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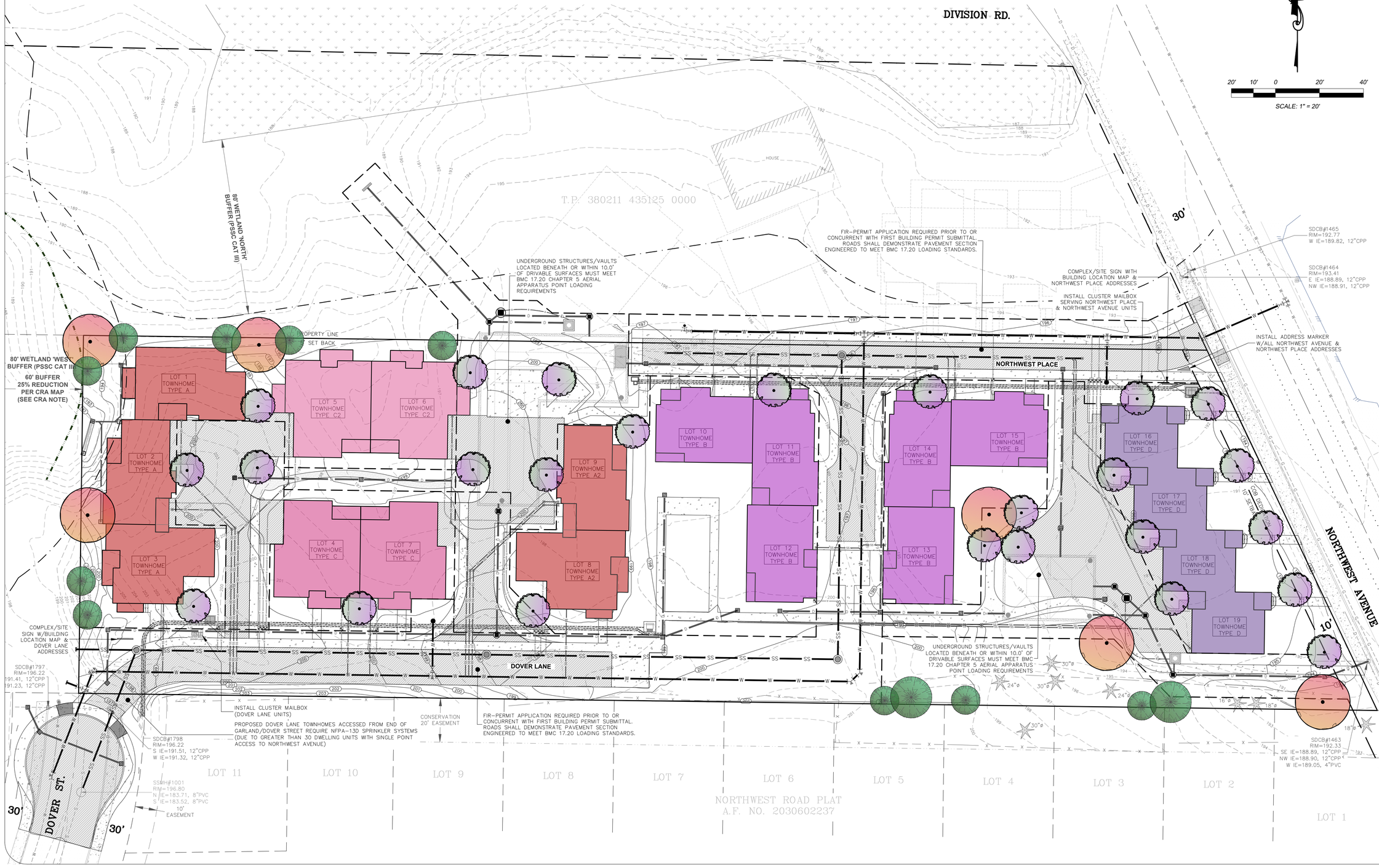
VOGEL NORTHWEST TOWNHOMES
SCHEMATIC UTILITY AND TREE PLANTING PLAN



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PRELIMINARY

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT
SCOTT CHRISTOPHER RIGGINS
CERTIFICATE NO. 1254

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
SCHEMATIC UTILITY AND TREE PLANTING PLAN
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

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VOGEL NORTHWEST TOWNHOMES
GREEN FACTOR LANDSCAPE EXHIBIT

City of Bellingham Green Factor Calculations Sheet

Date: 09.15.2021

4185 Northwest Avenue, Bellingham WA

Parcel size *: 87,691 (enter sq ft of parcel) | Green Factor Score: 0.446

	Landscape Elements**	Totals from GF worksheet	Mulitplier	Total
1	Landscaped areas (select one of the following for each area)			
a	Landscaped areas with a soil depth of less than 24"	enter sq ft: 0	0.1	-
b	Landscaped areas with a soil depth of 24" or greater	enter sq ft: 35,585	0.8	28,468.0
c	Bioretention facilities	enter sq ft: 0	1.0	-
2	Plantings (credit for plants in landscaped areas above)			
a	Mulch, ground covers, or other plants less than 2' tall at maturity	enter sq ft: 35,585	0.2	7,117.0
b	Shrubs or perennials 2'+ at maturity - calculated at 16 sq ft per plant (typically planted no closer than 18" on center)	enter number of plants: 100	1600	0.3 480
c	Tree canopy for "small trees" in Bellingham List of Approved Trees or equ (canopy spread of 15') - calculated at 50 sq ft per tree	enter number of plants: 18	900	0.3 270
b	Tree canopy for "small/medium trees" in Bellingham List of Approved Tre (canopy spread of 20') - calculated at 100 sq ft per tree	enter number of plants: 25	2500	0.3 750.0
e	Tree canopy for "medium trees" in Bellingham List of Approved Trees or ((canopy spread of 25') - calculated at 150 sq ft per tree	enter number of plants: 0	0	0.4 -
f	Tree canopy for "large trees" in Bellingham List of Approved Trees or equ (canopy spread of 30') - calculated at 200 sq ft per tree	enter number of plants: 6	1200	0.5 600.0
g	Tree canopy for preservation of "exceptional trees" or other large existing 6"or greater in diameter - calculated at 15 sq ft per inch DBH (dia. 4.5' above ground)	enter inches DBH: 120	1800	0.8 1,440.0
3	Green roofs			
a	Over at least 2" and less than 4" of growth medium	enter sq ft: 0	0.4	-
b	Over at least 4" of growth medium	enter sq ft: 0	0.7	-
4	Vegetated walls	enter sq ft: 0	0.7	-
5	Approved water features	enter sq ft: 0	0.7	-
6	Permeable paving			
a	Permeable paving over at least 6" and less than 24" of soil or gravel	enter sq ft: 0	0.3	-
b	Permeable paving over at least 24" of soil or gravel	enter sq ft: 0	0.5	-
7	Structural soil systems	enter sq ft: 0	0.4	-
	sub-total of sq ft = 79,170			
8	Bonuses			
a	Drought-tolerant or native plant species	enter sq ft: 0	0.1	-
b	Landscaped areas where at least 50 percent of annual irrigation needs are met through the use of harvested rainwater	enter sq ft: 0	0.2	-
c	Landscaping in food cultivation	enter sq ft: 0	0.3	-
		Total Green Factor Area =		39,125

* Do not count public rights-of-way in parcel size calculation.
** Landscape improvements in rights-of-way contiguous with the parcel are used in calculations. All landscaping on private and public property must comply with the standards set in Bellingham Municiple Code 20.12.030.

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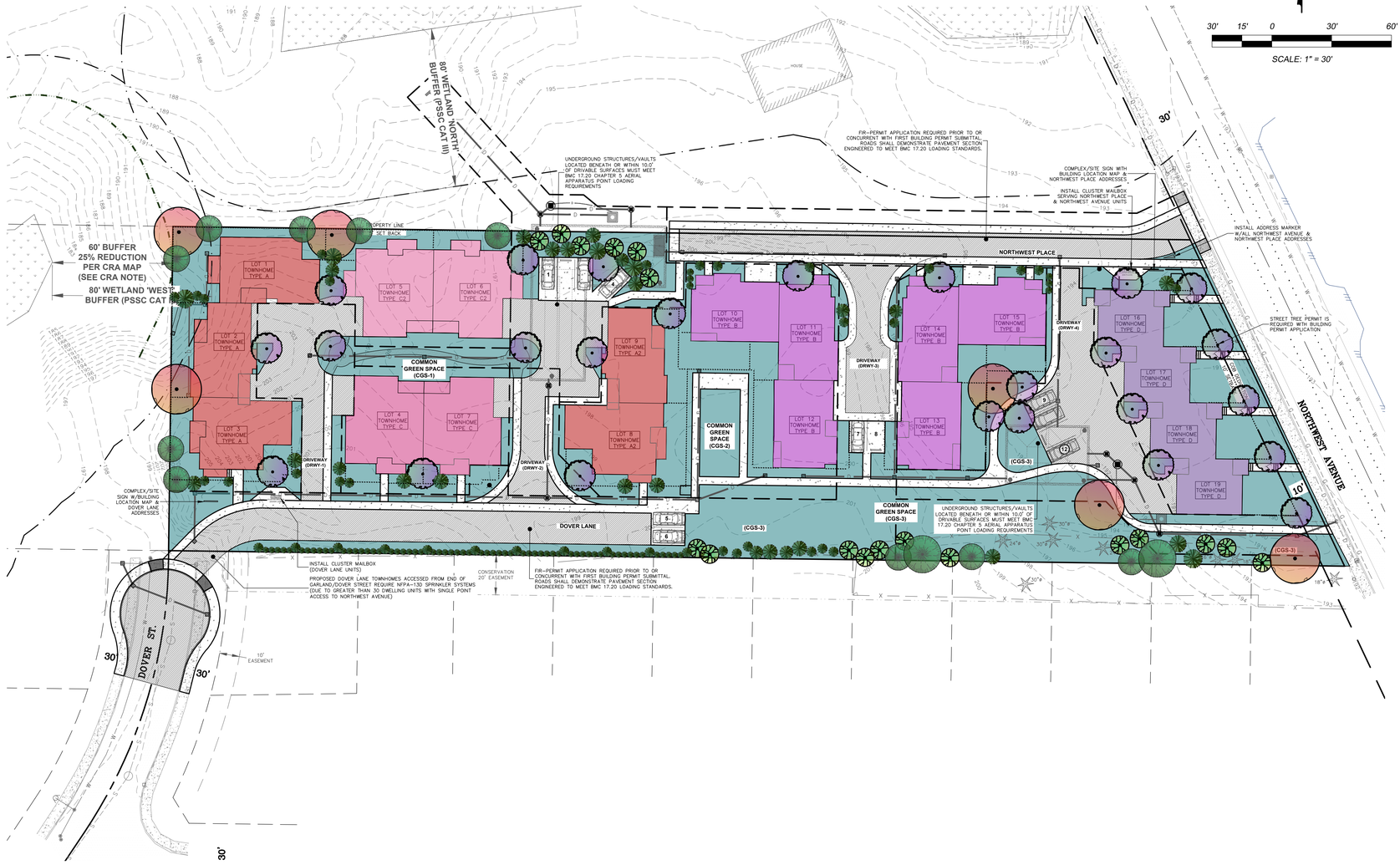
GREEN FACTOR LANDSCAPE LEGEND

- SMALL/MEDIUM TREE (20'ø CANOPY)
- LARGE DECIDUOUS TREE (30'ø CANOPY)
- SMALL TREE (15'ø CANOPY)
- SMALL CONIFER TREE GROUPING (SCREEN)
- LARGE CONIFER TREE (25'ø CANOPY)
- SOIL DEPTH GREATER THAN 24" (X ≥ 24")
- 36" HT FENCE (NOT INCLUDED AS VEGETATED WALL)



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PRELIMINARY

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT
SCOTT CHRISTOPHER RIGGINS
CERTIFICATE NO. 1254

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
GREEN FACTOR LANDSCAPE EXHIBIT
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

PROJECT NUMBER: 20052
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SH7
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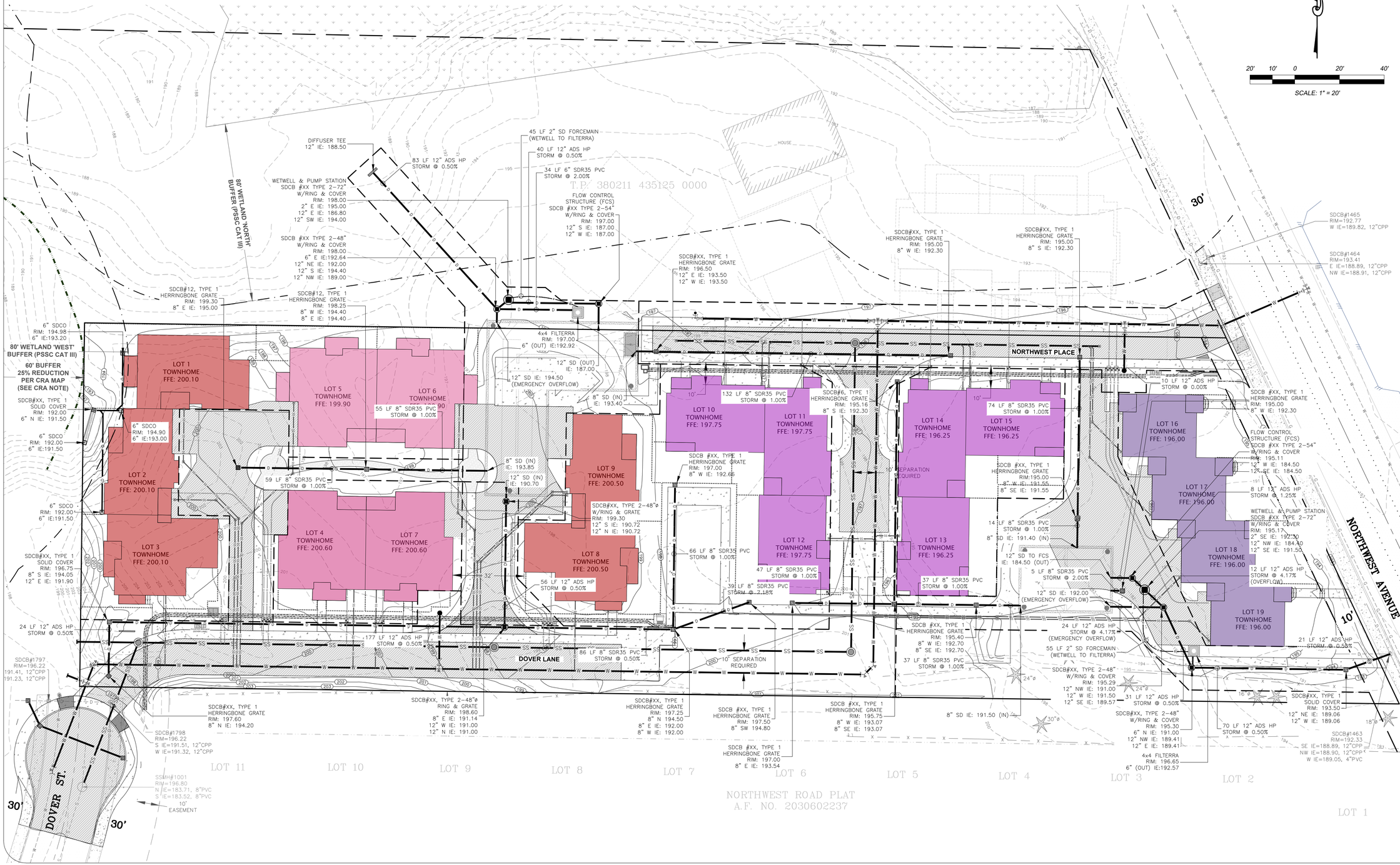
VOGEL NORTHWEST TOWNHOMES
SCHEMATIC DRAINAGE PLAN



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SCOTT CHRISTOPHER RIGGINS
CERTIFICATE NO. 1254

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
SCHEMATIC DRAINAGE PLAN
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

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VOGEL NORTHWEST TOWNHOMES
ON-SITE STORMWATER FLOW PATH AND BASIN MAP

FLOW PATH/BASIN:

- BASIN #1
- BASIN #2
- BASIN #3
- BASIN #4

DIVISION RD.

20' 10' 0 20' 40'

SCALE: 1" = 20'

T.P. 380211 435125 0000

80' WETLAND 'NORTH' BUFFER (PSSC CAT III)

WETLAND 'WEST' (PSSC CAT III)

50' BUFFER REDUCTION PER CRA MAP (SEE CRA NOTE)

BASIN #1

BASIN #2

BASIN #3

BASIN #4

30'

10'

NORTHWEST AVENUE

DOVER ST.

CONSERVATION 20' EASEMENT

10' EASEMENT

LOT 11 LOT 10 LOT 9 LOT 8 LOT 7 LOT 6 LOT 5 LOT 4 LOT 3 LOT 2 LOT 1

NORTHWEST ROAD PLAT
A.F. NO. 2030602237

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PRELIMINARY

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
ON-SITE STORMWATER FLOW PATH AND BASIN MAP
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

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EX1
OF: EX3

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VOGEL NORTHWEST TOWNHOMES
PRE-DEVELOPMENT STORMWATER BASIN MAP

PRE-DEVELOPMENT BASIN #1:
- EXISTING ROOF 2,521 SF OR (0.058 AC)
- EXISTING GRAVEL 2,191 SF OR (0.050 AC)
- EXISTING LANDSCAPE 34,930 SF OR (0.802 AC)

TOTAL SF: 39,642 SF OR (0.910 AC)

PRE-DEVELOPMENT BASIN #2:
- EXISTING ROOF 2,195 SF OR (0.050 AC)
- EXISTING GRAVEL 11,394 SF OR (0.262 AC)
- EXISTING LANDSCAPE 70,013 SF OR (1.607 AC)

TOTAL SF: 73,602 SF (1.607 AC)

PRE-DEVELOPMENT BASIN #3:
- EXISTING LANDSCAPE 3,586 SF OR (0.082 AC)

TOTAL SF: 3,586 SF (0.082 AC)

PRE-DEVELOPMENT BASIN #4:
- EXISTING LANDSCAPE 1,332 SF OR (0.031 AC)

TOTAL SF: 1,332 SF (0.031 AC)

20' 10' 0 20' 40'

SCALE: 1" = 20'

DIVISION RD.

80' WETLAND 'NORTH' BUFFER (PSSC CAT III)

BASIN #1

BASIN #2

BASIN #3

BASIN #4

NORTHWEST AVENUE

DOVER ST.

SDCB#1465
RIM=192.77
W IE=189.82, 12"CPP

SDCB#1464
RIM=193.41
E IE=188.89, 12"CPP
NW IE=188.91, 12"CPP

SDCB#1463
RIM=192.33
SE IE=188.89, 12"CPP
NW IE=188.90, 12"CPP
W IE=189.05, 4"PVC

SDCB#1798
RIM=196.22
S IE=191.51, 12"CPP
W IE=191.32, 12"CPP

CONSERVATION 20' EASEMENT

10' EASEMENT

30'

10'

IMPACT DESIGN
5426 BARRETT ROAD, SUITE A103
360-389-4838 WWW.BOLD-IMPACT.COM

SCOTT IAN GOODRICH — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
PRE-DEVELOPMENT STORMWATER BASIN MAP
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

PROJECT NUMBER: 20052
DESIGNED/DRAWN BY: SCR
CHECKED BY: SIG
ISSUE DATE: 09.27.2023

EX2
OF: EX1-EX2

Z:\Shared\PROJECTS\20052 4185 NW Ave Vogel Townhomes\PRE\20052PSB Vogel NW Ave (09.27.2023).dwg Sep 27, 2023--12:07pm

VOGEL NORTHWEST TOWNHOMES
POST-DEVELOPMENT STORMWATER BASIN MAP

POST-DEVELOPMENT BASIN #1A:
- PROPOSED ROOF 8,017 SF OR (0.184 AC)
- PROPOSED PAVEMENT 7,344 SF OR (0.170 AC)
- PROPOSED SIDEWALK 2,221 SF OR (0.051 AC)
- PROPOSED LANDSCAPE 15,242 SF OR (0.350 AC)

TOTAL SF: 32,824 SF (0.754 AC)

POST-DEVELOPMENT BASIN #1B:
- PROPOSED SIDEWALK (BY-PASS) 417 SF OR (0.010 AC)
- PROPOSED LANDSCAPE (BY-PASS) 2,167 SF OR (0.050 AC)

TOTAL SF: 2,584 SF (0.060 AC)

POST-DEVELOPMENT BASIN #2A:
- PROPOSED ROOF 25,131 SF OR (0.577 AC)
- PROPOSED PAVEMENT 18,769 SF OR (0.431 AC)
- PROPOSED SIDEWALK 1,827 SF OR (0.042 AC)
- PROPOSED LANDSCAPE 15,539 SF OR (0.357 AC)

TOTAL SF: 61,266 SF (1.410 AC)

POST-DEVELOPMENT BASIN #2B:
- EXISTING ROOF (BY-PASS) 1,486 SF OR (0.034 AC)
- PROPOSED PAVEMENT (BY-PASS) 505 SF OR (0.012 AC)
- PROPOSED SIDEWALK (BY-PASS) 1,201 SF OR (0.028 AC)
- EXISTING LANDSCAPE (BY-PASS) 14,689 SF OR (0.337 AC)

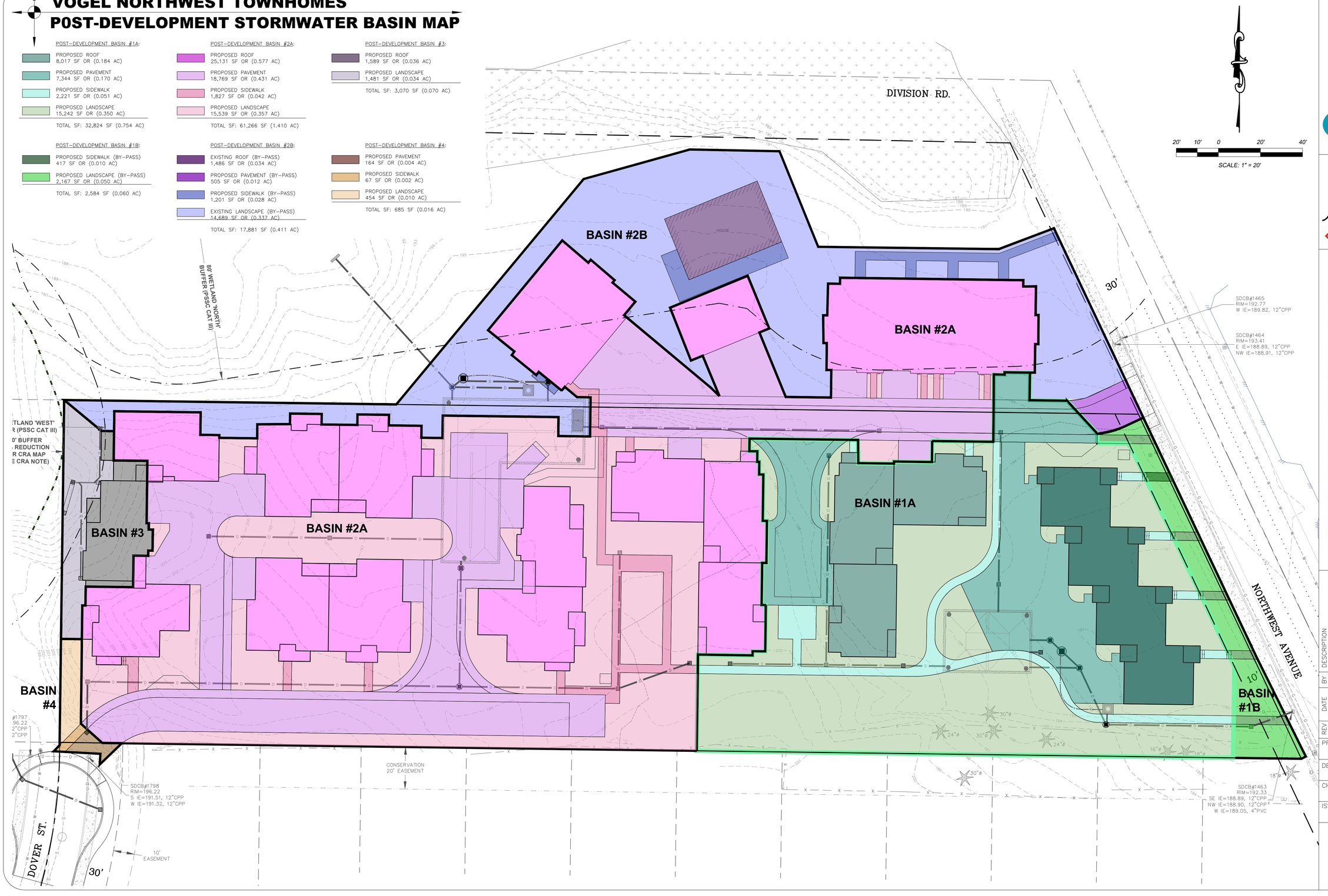
TOTAL SF: 17,881 SF (0.411 AC)

POST-DEVELOPMENT BASIN #3:
- PROPOSED ROOF 1,589 SF OR (0.036 AC)
- PROPOSED LANDSCAPE 1,481 SF OR (0.034 AC)

TOTAL SF: 3,070 SF (0.070 AC)

POST-DEVELOPMENT BASIN #4:
- PROPOSED PAVEMENT 164 SF OR (0.004 AC)
- PROPOSED SIDEWALK 67 SF OR (0.002 AC)
- PROPOSED LANDSCAPE 454 SF OR (0.010 AC)

TOTAL SF: 685 SF (0.016 AC)



IMPACT DESIGN
5426 BARRETT ROAD, SUITE A103
360-389-4838 WWW.BOLD-IMPACT.COM

SCOTT IAN GOODRICH — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
POST-DEVELOPMENT STORMWATER BASIN MAP
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

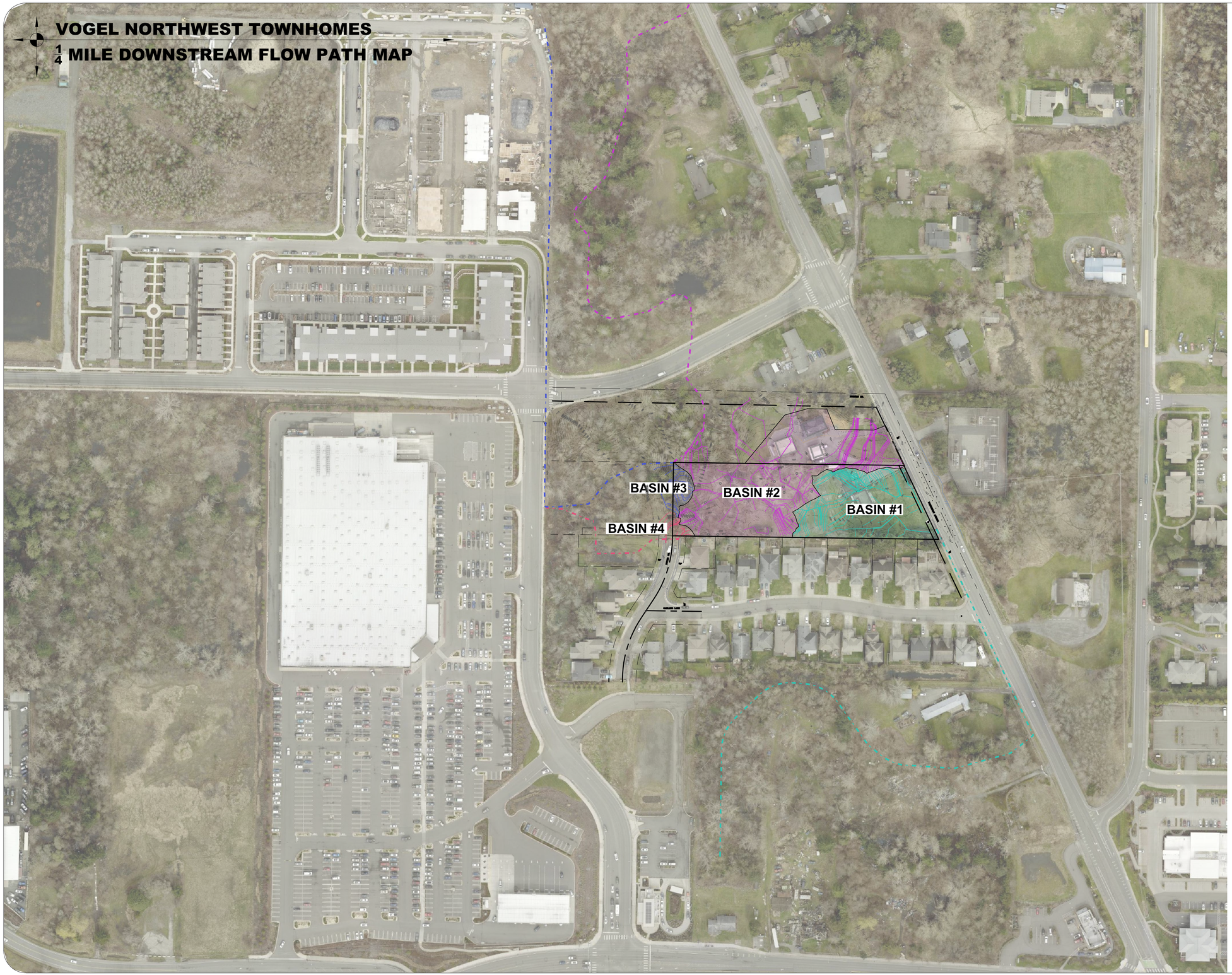
PROJECT NUMBER: 20052
DESIGNED/DRAWN BY: SCR
CHECKED BY: SIG
ISSUE DATE: 09.27.2023

EX3

OF: EX1-EX3

Z:\Shared\PROJECTS\20052 4185 NW Ave Vogel Townhomes\DWG\20052EP25 Vogel NW Ave (09.27.2023).dwg Sep 27, 2023--12:09pm

VOGEL NORTHWEST TOWNHOMES
1/4 MILE DOWNSTREAM FLOW PATH MAP



100' 50' 0 100' 200'

SCALE: 1" = 100'

FLOW PATH/BASIN:

- BASIN #1
- BASIN #2
- BASIN #3
- BASIN #4

IMPACT DESIGN
5424 BARRETT ROAD, SUITE A03
360-389-4838 WWW.BOLD-IMPACT.COM

SCOTT IAN GOODRICH
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

VOGEL NORTHWEST TOWNHOMES
PLAT APPLICATION
1/4 MILE DOWNSTREAM FLOW PATH MAP
4185 NORTHWEST AVENUE
CITY OF BELLINGHAM, WASHINGTON

REV	DATE	BY	DESCRIPTION

PROJECT NUMBER: 20052

DESIGNED/DRAWN BY: SCR

CHECKED BY: SIG

ISSUE DATE: 09.27.2023

FP1

OF: FP1

Z:\Shared\PROJECTS\20052 4185 NW Ave Vogel Townhomes\CIVIL\20052SP25 Vogel NW Ave (09.27.2023).dwg Sep 27, 2023--12:07pm

WWHM2012
PROJECT REPORT

Project Name: 09.18.23_Vogel_Townhomes_Vault_1
Site Name: Vogel Townhomes
Site Address:
City : Bellingham
Report Date: 9/18/2023
Gage : Blaine
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.86
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : 1A
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.758
Pervious Total	0.758

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.758

Element Flows To:

Surface	Interflow	Groundwater

Name : 1B
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.059

Pervious Total	**0.059**

Impervious Land Use	**acre**
Impervious Total	**0**
Basin Total	**0.059**

Element Flows To:

Surface	**Interflow**	**Groundwater**

MITIGATED LAND USE

Name : 1A
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.354**
Pervious Total	**0.354**

Impervious Land Use	**acre**
ROADS FLAT	**0.184**
ROOF TOPS FLAT	**0.169**
SIDEWALKS FLAT	**0.051**
Impervious Total	**0.404**
Basin Total	**0.758**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Vault 1	Vault 1	

Name : Vault 1
Width : 33 ft.
Length : 33 ft.
Depth: 7.5 ft.
Discharge Structure
Riser Height: 6.5 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.002 ft.

Notch Height: 2.769 ft.
Orifice 1 Diameter: 0.383103102533239 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.025	0.000	0.000	0.000
0.0833	0.025	0.002	0.001	0.000
0.1667	0.025	0.004	0.001	0.000
0.2500	0.025	0.006	0.002	0.000
0.3333	0.025	0.008	0.002	0.000
0.4167	0.025	0.010	0.002	0.000
0.5000	0.025	0.012	0.002	0.000
0.5833	0.025	0.014	0.003	0.000
0.6667	0.025	0.016	0.003	0.000
0.7500	0.025	0.018	0.003	0.000
0.8333	0.025	0.020	0.003	0.000
0.9167	0.025	0.022	0.003	0.000
1.0000	0.025	0.025	0.004	0.000
1.0833	0.025	0.027	0.004	0.000
1.1667	0.025	0.029	0.004	0.000
1.2500	0.025	0.031	0.004	0.000
1.3333	0.025	0.033	0.004	0.000
1.4167	0.025	0.035	0.004	0.000
1.5000	0.025	0.037	0.004	0.000
1.5833	0.025	0.039	0.005	0.000
1.6667	0.025	0.041	0.005	0.000
1.7500	0.025	0.043	0.005	0.000
1.8333	0.025	0.045	0.005	0.000
1.9167	0.025	0.047	0.005	0.000
2.0000	0.025	0.050	0.005	0.000
2.0833	0.025	0.052	0.005	0.000
2.1667	0.025	0.054	0.005	0.000
2.2500	0.025	0.056	0.006	0.000
2.3333	0.025	0.058	0.006	0.000
2.4167	0.025	0.060	0.006	0.000
2.5000	0.025	0.062	0.006	0.000
2.5833	0.025	0.064	0.006	0.000
2.6667	0.025	0.066	0.006	0.000
2.7500	0.025	0.068	0.006	0.000
2.8333	0.025	0.070	0.006	0.000
2.9167	0.025	0.072	0.006	0.000
3.0000	0.025	0.075	0.006	0.000
3.0833	0.025	0.077	0.007	0.000
3.1667	0.025	0.079	0.007	0.000
3.2500	0.025	0.081	0.007	0.000
3.3333	0.025	0.083	0.007	0.000
3.4167	0.025	0.085	0.007	0.000
3.5000	0.025	0.087	0.007	0.000
3.5833	0.025	0.089	0.007	0.000
3.6667	0.025	0.091	0.007	0.000

3.7500	0.025	0.093	0.007	0.000
3.8333	0.025	0.095	0.008	0.000
3.9167	0.025	0.097	0.008	0.000
4.0000	0.025	0.100	0.008	0.000
4.0833	0.025	0.102	0.009	0.000
4.1667	0.025	0.104	0.009	0.000
4.2500	0.025	0.106	0.010	0.000
4.3333	0.025	0.108	0.010	0.000
4.4167	0.025	0.110	0.011	0.000
4.5000	0.025	0.112	0.011	0.000
4.5833	0.025	0.114	0.012	0.000
4.6667	0.025	0.116	0.012	0.000
4.7500	0.025	0.118	0.013	0.000
4.8333	0.025	0.120	0.014	0.000
4.9167	0.025	0.122	0.014	0.000
5.0000	0.025	0.125	0.015	0.000
5.0833	0.025	0.127	0.016	0.000
5.1667	0.025	0.129	0.019	0.000
5.2500	0.025	0.131	0.020	0.000
5.3333	0.025	0.133	0.021	0.000
5.4167	0.025	0.135	0.022	0.000
5.5000	0.025	0.137	0.024	0.000
5.5833	0.025	0.139	0.025	0.000
5.6667	0.025	0.141	0.026	0.000
5.7500	0.025	0.143	0.027	0.000
5.8333	0.025	0.145	0.028	0.000
5.9167	0.025	0.147	0.029	0.000
6.0000	0.025	0.150	0.031	0.000
6.0833	0.025	0.152	0.032	0.000
6.1667	0.025	0.154	0.033	0.000
6.2500	0.025	0.156	0.034	0.000
6.3333	0.025	0.158	0.036	0.000
6.4167	0.025	0.160	0.037	0.000
6.5000	0.025	0.162	0.038	0.000
6.5833	0.025	0.164	0.421	0.000
6.6667	0.025	0.166	1.113	0.000
6.7500	0.025	0.168	1.977	0.000
6.8333	0.025	0.170	2.921	0.000
6.9167	0.025	0.172	3.851	0.000
7.0000	0.025	0.175	4.678	0.000
7.0833	0.025	0.177	5.333	0.000
7.1667	0.025	0.179	5.793	0.000
7.2500	0.025	0.181	6.111	0.000
7.3333	0.025	0.183	6.508	0.000
7.4167	0.025	0.185	6.824	0.000
7.5000	0.025	0.187	7.126	0.000
7.5833	0.025	0.189	7.415	0.000
7.6667	0.000	0.000	7.694	0.000

Name : 1B
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.05**

Pervious Total	0.05

Impervious Land Use	acre
SIDEWALKS FLAT	0.009
Impervious Total	0.009
Basin Total	0.059

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.817
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.404
Total Impervious Area:0.413

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.01585
5 year	0.023841
10 year	0.028239
25 year	0.032821
50 year	0.035622
100 year	0.037986

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.010964
5 year	0.015798
10 year	0.019585
25 year	0.025099
50 year	0.029773
100 year	0.034967

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.018	0.009
1950	0.018	0.009
1951	0.026	0.023
1952	0.006	0.007
1953	0.008	0.008
1954	0.015	0.009
1955	0.011	0.014
1956	0.012	0.017
1957	0.025	0.010
1958	0.008	0.009
1959	0.011	0.009
1960	0.017	0.009
1961	0.012	0.009
1962	0.011	0.008
1963	0.012	0.008
1964	0.023	0.020
1965	0.027	0.017
1966	0.024	0.010
1967	0.021	0.018
1968	0.022	0.016
1969	0.012	0.008
1970	0.005	0.006
1971	0.022	0.010
1972	0.015	0.012
1973	0.013	0.014
1974	0.016	0.009
1975	0.012	0.009
1976	0.022	0.025
1977	0.012	0.011
1978	0.017	0.010
1979	0.011	0.010
1980	0.025	0.026
1981	0.011	0.010
1982	0.028	0.018
1983	0.012	0.010
1984	0.045	0.027
1985	0.021	0.010
1986	0.038	0.017
1987	0.018	0.010
1988	0.014	0.008
1989	0.016	0.013
1990	0.021	0.013
1991	0.016	0.016
1992	0.018	0.013
1993	0.015	0.009
1994	0.007	0.006
1995	0.017	0.013
1996	0.023	0.011
1997	0.033	0.036
1998	0.005	0.007
1999	0.036	0.029
2000	0.006	0.008
2001	0.002	0.007
2002	0.015	0.009
2003	0.003	0.007

2004	0.012	0.013
2005	0.020	0.012
2006	0.016	0.011
2007	0.017	0.010
2008	0.007	0.007
2009	0.017	0.014

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

Rank	Predeveloped	Mitigated
1	0.0449	0.0356
2	0.0383	0.0287
3	0.0361	0.0271
4	0.0334	0.0258
5	0.0276	0.0248
6	0.0274	0.0233
7	0.0261	0.0201
8	0.0249	0.0178
9	0.0245	0.0176
10	0.0238	0.0174
11	0.0233	0.0170
12	0.0227	0.0166
13	0.0223	0.0161
14	0.0223	0.0155
15	0.0222	0.0144
16	0.0214	0.0143
17	0.0213	0.0138
18	0.0213	0.0131
19	0.0197	0.0129
20	0.0182	0.0129
21	0.0179	0.0128
22	0.0178	0.0126
23	0.0176	0.0122
24	0.0175	0.0120
25	0.0172	0.0114
26	0.0170	0.0110
27	0.0167	0.0105
28	0.0165	0.0104
29	0.0162	0.0103
30	0.0161	0.0102
31	0.0157	0.0102
32	0.0156	0.0100
33	0.0153	0.0099
34	0.0152	0.0098
35	0.0150	0.0097
36	0.0149	0.0096
37	0.0141	0.0096
38	0.0127	0.0094
39	0.0125	0.0094
40	0.0125	0.0094
41	0.0124	0.0094
42	0.0122	0.0092
43	0.0122	0.0092
44	0.0122	0.0091
45	0.0122	0.0089
46	0.0121	0.0087

47	0.0115	0.0086
48	0.0114	0.0086
49	0.0111	0.0084
50	0.0108	0.0084
51	0.0106	0.0083
52	0.0085	0.0083
53	0.0077	0.0078
54	0.0074	0.0077
55	0.0070	0.0073
56	0.0059	0.0069
57	0.0059	0.0067
58	0.0049	0.0067
59	0.0047	0.0066
60	0.0030	0.0063
61	0.0021	0.0058

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0079	20606	19042	92	Pass
0.0082	19199	15590	81	Pass
0.0085	17830	13278	74	Pass
0.0088	16593	11680	70	Pass
0.0090	15494	10444	67	Pass
0.0093	14497	9550	65	Pass
0.0096	13528	8849	65	Pass
0.0099	12675	8218	64	Pass
0.0102	11873	7685	64	Pass
0.0104	11141	7161	64	Pass
0.0107	10530	6673	63	Pass
0.0110	9879	6237	63	Pass
0.0113	9323	5820	62	Pass
0.0116	8763	5405	61	Pass
0.0118	8248	5014	60	Pass
0.0121	7758	4676	60	Pass
0.0124	7240	4325	59	Pass
0.0127	6785	4013	59	Pass
0.0130	6419	3745	58	Pass
0.0132	6042	3495	57	Pass
0.0135	5730	3249	56	Pass
0.0138	5437	2999	55	Pass
0.0141	5146	2766	53	Pass
0.0144	4845	2573	53	Pass
0.0146	4567	2430	53	Pass
0.0149	4308	2289	53	Pass
0.0152	4083	2138	52	Pass
0.0155	3869	1998	51	Pass
0.0158	3668	1844	50	Pass
0.0160	3459	1723	49	Pass
0.0163	3281	1609	49	Pass
0.0166	3097	1482	47	Pass
0.0169	2922	1365	46	Pass

0.0172	2748	1232	44	Pass
0.0174	2575	1110	43	Pass
0.0177	2417	1038	42	Pass
0.0180	2274	1018	44	Pass
0.0183	2124	1002	47	Pass
0.0186	2027	980	48	Pass
0.0188	1934	962	49	Pass
0.0191	1838	945	51	Pass
0.0194	1739	926	53	Pass
0.0197	1635	903	55	Pass
0.0200	1536	885	57	Pass
0.0202	1449	862	59	Pass
0.0205	1374	849	61	Pass
0.0208	1300	837	64	Pass
0.0211	1243	815	65	Pass
0.0214	1180	783	66	Pass
0.0216	1122	737	65	Pass
0.0219	1061	690	65	Pass
0.0222	997	639	64	Pass
0.0225	936	586	62	Pass
0.0228	896	534	59	Pass
0.0230	865	484	55	Pass
0.0233	813	440	54	Pass
0.0236	762	404	53	Pass
0.0239	718	378	52	Pass
0.0242	671	347	51	Pass
0.0244	623	315	50	Pass
0.0247	582	290	49	Pass
0.0250	544	262	48	Pass
0.0253	509	240	47	Pass
0.0256	469	225	47	Pass
0.0258	431	202	46	Pass
0.0261	396	190	47	Pass
0.0264	374	177	47	Pass
0.0267	345	160	46	Pass
0.0269	321	141	43	Pass
0.0272	299	125	41	Pass
0.0275	276	120	43	Pass
0.0278	261	112	42	Pass
0.0281	247	104	42	Pass
0.0283	238	96	40	Pass
0.0286	227	86	37	Pass
0.0289	214	79	36	Pass
0.0292	202	73	36	Pass
0.0295	190	68	35	Pass
0.0297	171	66	38	Pass
0.0300	154	64	41	Pass
0.0303	144	63	43	Pass
0.0306	126	61	48	Pass
0.0309	113	60	53	Pass
0.0311	101	57	56	Pass
0.0314	97	53	54	Pass
0.0317	90	46	51	Pass
0.0320	82	40	48	Pass
0.0323	77	38	49	Pass
0.0325	72	33	45	Pass
0.0328	67	30	44	Pass

0.0331	60	26	43	Pass
0.0334	54	22	40	Pass
0.0337	49	20	40	Pass
0.0339	41	16	39	Pass
0.0342	35	15	42	Pass
0.0345	28	12	42	Pass
0.0348	23	9	39	Pass
0.0351	18	5	27	Pass
0.0353	13	4	30	Pass
0.0356	10	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0145 **acre-feet**
On-line facility target flow: 0.0073 **cfs.**
Adjusted for 15 min: 0.0073 **cfs.**
Off-line facility target flow: 0.0048 **cfs.**
Adjusted for 15 min: 0.0048 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Percent Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Comment Water Quality Treated
Vault 1 POC	N	60.02			N	0.00	
Total Volume Infiltrated		60.02	0.00	0.00	0.00	0.00	0% No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

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WWHM2012
PROJECT REPORT

Project Name: 09.12.23_Vogel_Townhomes_Vault_2
Site Name: Vogel Townhomes Basin 2
Site Address:
City : Bellingham
Report Date: 9/19/2023
Gage : Blaine
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.86
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : 2A
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	1.406
Pervious Total	1.406

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.406

Element Flows To:

Surface	Interflow	Groundwater

Name : 2B (Bypass)
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.039

C, Pasture, Flat	.337
Pervious Total	0.376

Impervious Land Use	acre
SIDEWALKS FLAT	0.034
Impervious Total	0.034
Basin Total	0.41

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : 2A
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.357
Pervious Total	0.357

Impervious Land Use	acre
ROADS FLAT	0.431
ROOF TOPS FLAT	0.577
SIDEWALKS FLAT	0.042
Impervious Total	1.05
Basin Total	1.407

Element Flows To:

Surface	Interflow	Groundwater
Vault 2	Vault 2	

Name : Vault 2
Width : 56 ft.
Length : 56 ft.
Depth: 7.5 ft.
Discharge Structure
Riser Height: 6.5 ft.
Riser Diameter: 18 in.

Notch Type: Rectangular
Notch Width: 1.480 ft.
Notch Height: 0.046 ft.
Orifice 1 Diameter: 0.5466726 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.072	0.000	0.000	0.000
0.0833	0.072	0.006	0.002	0.000
0.1667	0.072	0.012	0.003	0.000
0.2500	0.072	0.018	0.004	0.000
0.3333	0.072	0.024	0.004	0.000
0.4167	0.072	0.030	0.005	0.000
0.5000	0.072	0.036	0.005	0.000
0.5833	0.072	0.042	0.006	0.000
0.6667	0.072	0.048	0.006	0.000
0.7500	0.072	0.054	0.007	0.000
0.8333	0.072	0.060	0.007	0.000
0.9167	0.072	0.066	0.007	0.000
1.0000	0.072	0.072	0.008	0.000
1.0833	0.072	0.078	0.008	0.000
1.1667	0.072	0.084	0.008	0.000
1.2500	0.072	0.090	0.009	0.000
1.3333	0.072	0.096	0.009	0.000
1.4167	0.072	0.102	0.009	0.000
1.5000	0.072	0.108	0.009	0.000
1.5833	0.072	0.114	0.010	0.000
1.6667	0.072	0.120	0.010	0.000
1.7500	0.072	0.126	0.010	0.000
1.8333	0.072	0.132	0.011	0.000
1.9167	0.072	0.138	0.011	0.000
2.0000	0.072	0.144	0.011	0.000
2.0833	0.072	0.150	0.011	0.000
2.1667	0.072	0.156	0.011	0.000
2.2500	0.072	0.162	0.012	0.000
2.3333	0.072	0.168	0.012	0.000
2.4167	0.072	0.174	0.012	0.000
2.5000	0.072	0.180	0.012	0.000
2.5833	0.072	0.186	0.013	0.000
2.6667	0.072	0.192	0.013	0.000
2.7500	0.072	0.198	0.013	0.000
2.8333	0.072	0.204	0.013	0.000
2.9167	0.072	0.210	0.013	0.000
3.0000	0.072	0.216	0.014	0.000
3.0833	0.072	0.222	0.014	0.000
3.1667	0.072	0.228	0.014	0.000
3.2500	0.072	0.234	0.014	0.000
3.3333	0.072	0.240	0.014	0.000
3.4167	0.072	0.246	0.015	0.000
3.5000	0.072	0.252	0.015	0.000

3.5833	0.072	0.258	0.015	0.000
3.6667	0.072	0.264	0.015	0.000
3.7500	0.072	0.270	0.015	0.000
3.8333	0.072	0.276	0.015	0.000
3.9167	0.072	0.282	0.016	0.000
4.0000	0.072	0.288	0.016	0.000
4.0833	0.072	0.294	0.016	0.000
4.1667	0.072	0.300	0.016	0.000
4.2500	0.072	0.306	0.016	0.000
4.3333	0.072	0.312	0.016	0.000
4.4167	0.072	0.318	0.017	0.000
4.5000	0.072	0.324	0.017	0.000
4.5833	0.072	0.330	0.017	0.000
4.6667	0.072	0.336	0.017	0.000
4.7500	0.072	0.342	0.017	0.000
4.8333	0.072	0.348	0.017	0.000
4.9167	0.072	0.354	0.018	0.000
5.0000	0.072	0.360	0.018	0.000
5.0833	0.072	0.366	0.018	0.000
5.1667	0.072	0.372	0.018	0.000
5.2500	0.072	0.378	0.018	0.000
5.3333	0.072	0.384	0.018	0.000
5.4167	0.072	0.390	0.018	0.000
5.5000	0.072	0.396	0.019	0.000
5.5833	0.072	0.402	0.019	0.000
5.6667	0.072	0.408	0.019	0.000
5.7500	0.072	0.414	0.019	0.000
5.8333	0.072	0.420	0.019	0.000
5.9167	0.072	0.426	0.019	0.000
6.0000	0.072	0.432	0.019	0.000
6.0833	0.072	0.438	0.020	0.000
6.1667	0.072	0.444	0.020	0.000
6.2500	0.072	0.450	0.020	0.000
6.3333	0.072	0.456	0.020	0.000
6.4167	0.072	0.462	0.020	0.000
6.5000	0.072	0.468	0.069	0.000
6.5833	0.072	0.474	0.451	0.000
6.6667	0.072	0.480	1.143	0.000
6.7500	0.072	0.486	2.007	0.000
6.8333	0.072	0.491	2.952	0.000
6.9167	0.072	0.497	3.882	0.000
7.0000	0.072	0.503	4.708	0.000
7.0833	0.072	0.509	5.363	0.000
7.1667	0.072	0.515	5.824	0.000
7.2500	0.072	0.521	6.141	0.000
7.3333	0.072	0.527	6.539	0.000
7.4167	0.072	0.533	6.855	0.000
7.5000	0.072	0.539	7.157	0.000
7.5833	0.072	0.545	7.446	0.000
7.6667	0.000	0.000	7.725	0.000

Name : 2B (Bypass)
Bypass: Yes

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.337
Pervious Total	0.337

Impervious Land Use	acre
ROADS FLAT	0.012
ROOF TOPS FLAT	0.034
SIDEWALKS FLAT	0.028
Impervious Total	0.074
Basin Total	0.411

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.782
Total Impervious Area:0.034

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.694
Total Impervious Area:1.124

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.040844
5 year	0.0619
10 year	0.076205
25 year	0.094458
50 year	0.108102
100 year	0.121742

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.041308
5 year	0.055758
10 year	0.065873
25 year	0.079295
50 year	0.089767

100 year 0.100653

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

Year	Predeveloped	Mitigated
1949	0.045	0.038
1950	0.044	0.050
1951	0.061	0.040
1952	0.016	0.024
1953	0.021	0.029
1954	0.040	0.045
1955	0.035	0.039
1956	0.035	0.051
1957	0.075	0.052
1958	0.024	0.042
1959	0.029	0.027
1960	0.041	0.036
1961	0.032	0.027
1962	0.029	0.042
1963	0.031	0.038
1964	0.071	0.062
1965	0.096	0.075
1966	0.078	0.061
1967	0.057	0.047
1968	0.054	0.041
1969	0.033	0.034
1970	0.013	0.021
1971	0.055	0.038
1972	0.044	0.057
1973	0.035	0.037
1974	0.037	0.032
1975	0.034	0.034
1976	0.063	0.053
1977	0.033	0.065
1978	0.053	0.048
1979	0.042	0.046
1980	0.060	0.045
1981	0.027	0.053
1982	0.067	0.056
1983	0.036	0.039
1984	0.128	0.084
1985	0.060	0.048
1986	0.107	0.073
1987	0.044	0.044
1988	0.034	0.032
1989	0.041	0.071
1990	0.055	0.051
1991	0.039	0.039
1992	0.043	0.034
1993	0.039	0.036
1994	0.019	0.023
1995	0.042	0.033
1996	0.064	0.051
1997	0.080	0.131
1998	0.015	0.026
1999	0.094	0.063

2000	0.018	0.031
2001	0.014	0.038
2002	0.038	0.033
2003	0.014	0.027
2004	0.033	0.047
2005	0.047	0.044
2006	0.043	0.042
2007	0.047	0.044
2008	0.021	0.022
2009	0.042	0.036

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

Rank	Predeveloped	Mitigated
1	0.1284	0.1309
2	0.1067	0.0838
3	0.0965	0.0747
4	0.0942	0.0732
5	0.0797	0.0711
6	0.0779	0.0655
7	0.0753	0.0633
8	0.0710	0.0616
9	0.0672	0.0605
10	0.0637	0.0568
11	0.0628	0.0556
12	0.0612	0.0534
13	0.0604	0.0532
14	0.0600	0.0517
15	0.0572	0.0511
16	0.0551	0.0511
17	0.0550	0.0510
18	0.0543	0.0502
19	0.0529	0.0479
20	0.0472	0.0477
21	0.0472	0.0470
22	0.0449	0.0470
23	0.0445	0.0464
24	0.0442	0.0452
25	0.0440	0.0448
26	0.0430	0.0445
27	0.0428	0.0440
28	0.0424	0.0437
29	0.0419	0.0424
30	0.0418	0.0417
31	0.0412	0.0416
32	0.0405	0.0410
33	0.0404	0.0403
34	0.0393	0.0392
35	0.0387	0.0392
36	0.0382	0.0386
37	0.0372	0.0385
38	0.0363	0.0383
39	0.0353	0.0375
40	0.0351	0.0375
41	0.0347	0.0367
42	0.0344	0.0362

43	0.0340	0.0356
44	0.0331	0.0355
45	0.0330	0.0344
46	0.0326	0.0341
47	0.0320	0.0338
48	0.0310	0.0329
49	0.0292	0.0326
50	0.0289	0.0322
51	0.0272	0.0319
52	0.0237	0.0310
53	0.0207	0.0292
54	0.0207	0.0274
55	0.0187	0.0274
56	0.0176	0.0266
57	0.0159	0.0264
58	0.0147	0.0239
59	0.0145	0.0233
60	0.0143	0.0216
61	0.0133	0.0206

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0204	17410	17154	98	Pass
0.0213	15804	13922	88	Pass
0.0222	14367	11375	79	Pass
0.0231	13161	9259	70	Pass
0.0240	12063	7563	62	Pass
0.0249	11028	6184	56	Pass
0.0257	10125	5114	50	Pass
0.0266	9285	4207	45	Pass
0.0275	8547	3463	40	Pass
0.0284	7901	2873	36	Pass
0.0293	7279	2336	32	Pass
0.0302	6690	1889	28	Pass
0.0310	6130	1532	24	Pass
0.0319	5608	1215	21	Pass
0.0328	5157	978	18	Pass
0.0337	4753	817	17	Pass
0.0346	4372	642	14	Pass
0.0355	4053	528	13	Pass
0.0364	3777	455	12	Pass
0.0372	3516	382	10	Pass
0.0381	3260	322	9	Pass
0.0390	3029	264	8	Pass
0.0399	2796	235	8	Pass
0.0408	2565	206	8	Pass
0.0417	2340	188	8	Pass
0.0426	2152	171	7	Pass
0.0434	1975	153	7	Pass
0.0443	1810	140	7	Pass
0.0452	1676	124	7	Pass

0.0461	1545	117	7	Pass
0.0470	1439	108	7	Pass
0.0479	1333	95	7	Pass
0.0488	1243	90	7	Pass
0.0496	1151	85	7	Pass
0.0505	1068	78	7	Pass
0.0514	1002	70	6	Pass
0.0523	924	65	7	Pass
0.0532	855	61	7	Pass
0.0541	796	54	6	Pass
0.0550	731	52	7	Pass
0.0558	667	49	7	Pass
0.0567	603	46	7	Pass
0.0576	541	43	7	Pass
0.0585	487	41	8	Pass
0.0594	432	38	8	Pass
0.0603	378	37	9	Pass
0.0612	335	35	10	Pass
0.0620	307	34	11	Pass
0.0629	280	33	11	Pass
0.0638	257	31	12	Pass
0.0647	237	29	12	Pass
0.0656	219	27	12	Pass
0.0665	199	27	13	Pass
0.0674	181	25	13	Pass
0.0682	165	24	14	Pass
0.0691	149	21	14	Pass
0.0700	138	20	14	Pass
0.0709	123	19	15	Pass
0.0718	110	16	14	Pass
0.0727	99	16	16	Pass
0.0736	91	15	16	Pass
0.0744	82	14	17	Pass
0.0753	73	12	16	Pass
0.0762	64	10	15	Pass
0.0771	55	10	18	Pass
0.0780	46	10	21	Pass
0.0789	39	9	23	Pass
0.0798	32	8	25	Pass
0.0806	30	6	20	Pass
0.0815	27	6	22	Pass
0.0824	25	6	24	Pass
0.0833	22	6	27	Pass
0.0842	21	5	23	Pass
0.0851	19	5	26	Pass
0.0860	17	5	29	Pass
0.0868	14	5	35	Pass
0.0877	12	5	41	Pass
0.0886	12	4	33	Pass
0.0895	12	4	33	Pass
0.0904	11	4	36	Pass
0.0913	11	4	36	Pass
0.0922	11	3	27	Pass
0.0930	11	3	27	Pass
0.0939	10	3	30	Pass
0.0948	8	3	37	Pass
0.0957	7	3	42	Pass

0.0966	6	3	50	Pass
0.0975	5	3	60	Pass
0.0984	5	3	60	Pass
0.0992	5	3	60	Pass
0.1001	3	3	100	Pass
0.1010	3	3	100	Pass
0.1019	3	3	100	Pass
0.1028	3	3	100	Pass
0.1037	3	3	100	Pass
0.1046	3	3	100	Pass
0.1054	3	3	100	Pass
0.1063	3	3	100	Pass
0.1072	2	2	100	Pass
0.1081	2	2	100	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0337 **acre-feet**
On-line facility target flow: 0.0176 **cfs.**
Adjusted for 15 min: 0.0176 **cfs.**
Off-line facility target flow: 0.0111 **cfs.**
Adjusted for 15 min: 0.0111 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Infiltration Credit	Percent Volume Infiltrated	Comment Water Quality Treated
Vault 2 POC	N	137.26			N	0.00	
Total Volume Infiltrated		137.26	0.00	0.00		0.00	0.00
						0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

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bcantrell@cantrellassociates.com

July 31, 2019

Mr. Charles Vogel
2500 ELM ST #14
Bellingham, WA 98225

RE: 4185 Northwest Drive
DOE Rating and Buffer Determination: Off-site Wetlands

Mr. Vogel,

This letter follows a July 15, 2019 letter from City of Bellingham Planning Department responding to your questions about applicable wetland buffers on the approximately 2.06 acre parcel at 4185 Northwest Drive. We had examined the property during December 2017 and concluded there were no wetland conditions on-site. The COB letter discussed a wetland to the north that had been delineated by Widener & Associates in March 2016 as part of permitting for the Mahogany and Arctic Avenue Arterials Project. Because no wetland rating had been provided in the report by Widener & Associates, COB requested that we make a site visit to observe the current conditions of the wetland and to fill out an up-to-date DOE rating form to determine the buffer under COB 16.55.340.B. The COB letter also discussed providing an updated DOE rating form for a wetland to the west that had been delineated by our firm in March 2017. The letter discussed buffer reduction by 25% through a critical area permit if the reduction criteria can be met. This letter provides the DOE wetland ratings and buffer determination for the off-site Wetland North and off-site Wetland West as requested.

We used a scaled map image with linework of the delineated wetland to the west and north as generated by Bellingham's City IQ map Viewer. We found both wetlands to rate as Category III with a low score for wildlife and carry an 80' buffer under 16.55.340.B.3 Table 16.55.340(C) assuming a high intensity land use.

Sincerely,

William G. Cantrell, MS
Senior Consulting Ecologist
Cantrell & Associates, Inc.

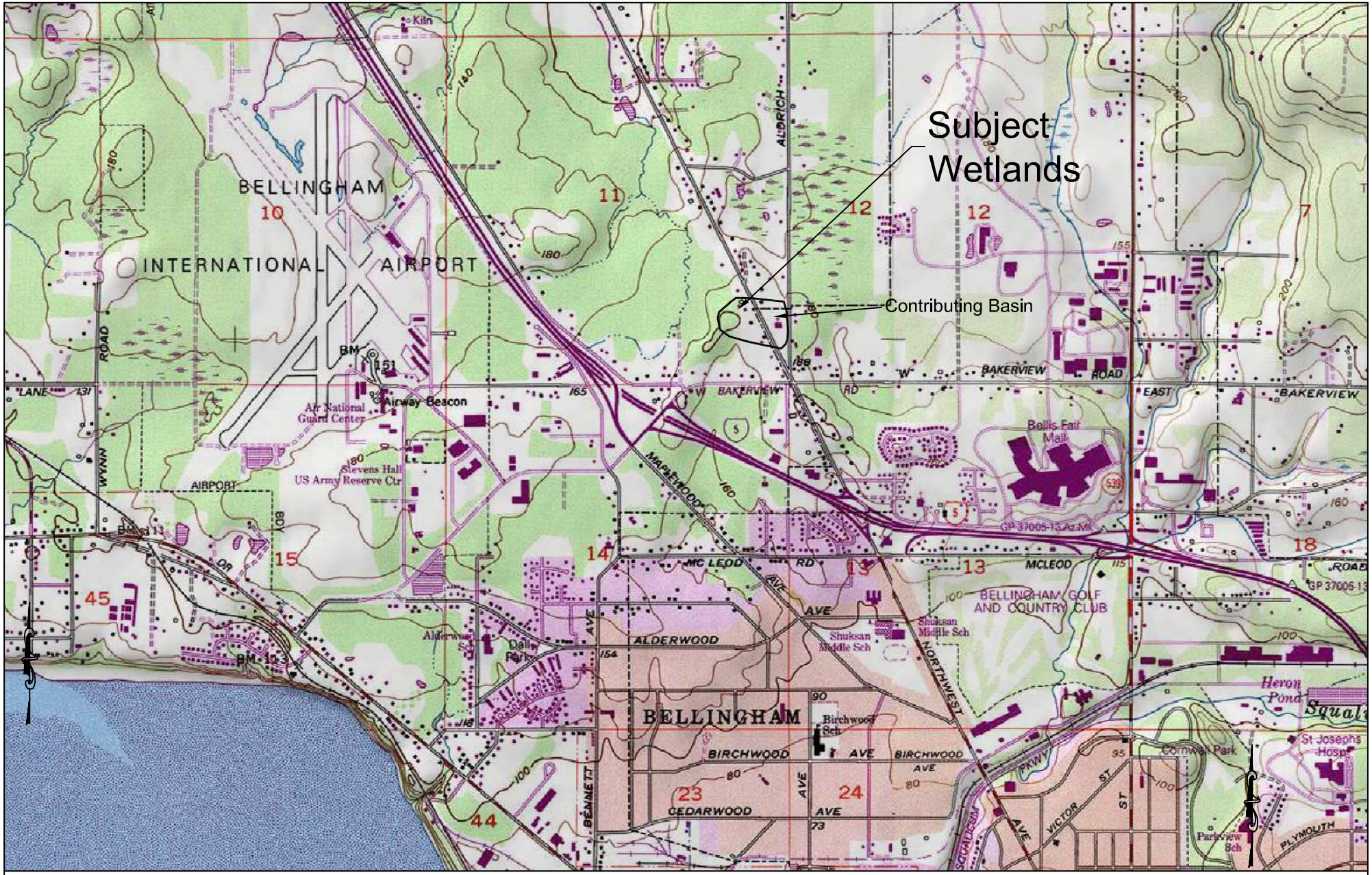

Figure 1. USGS Vicinity Map
4185 Northwest Drive
Parcel # 380211 449 108

July 31, 2019

0 2,000'

CAi Cantrell & Associates, Inc.

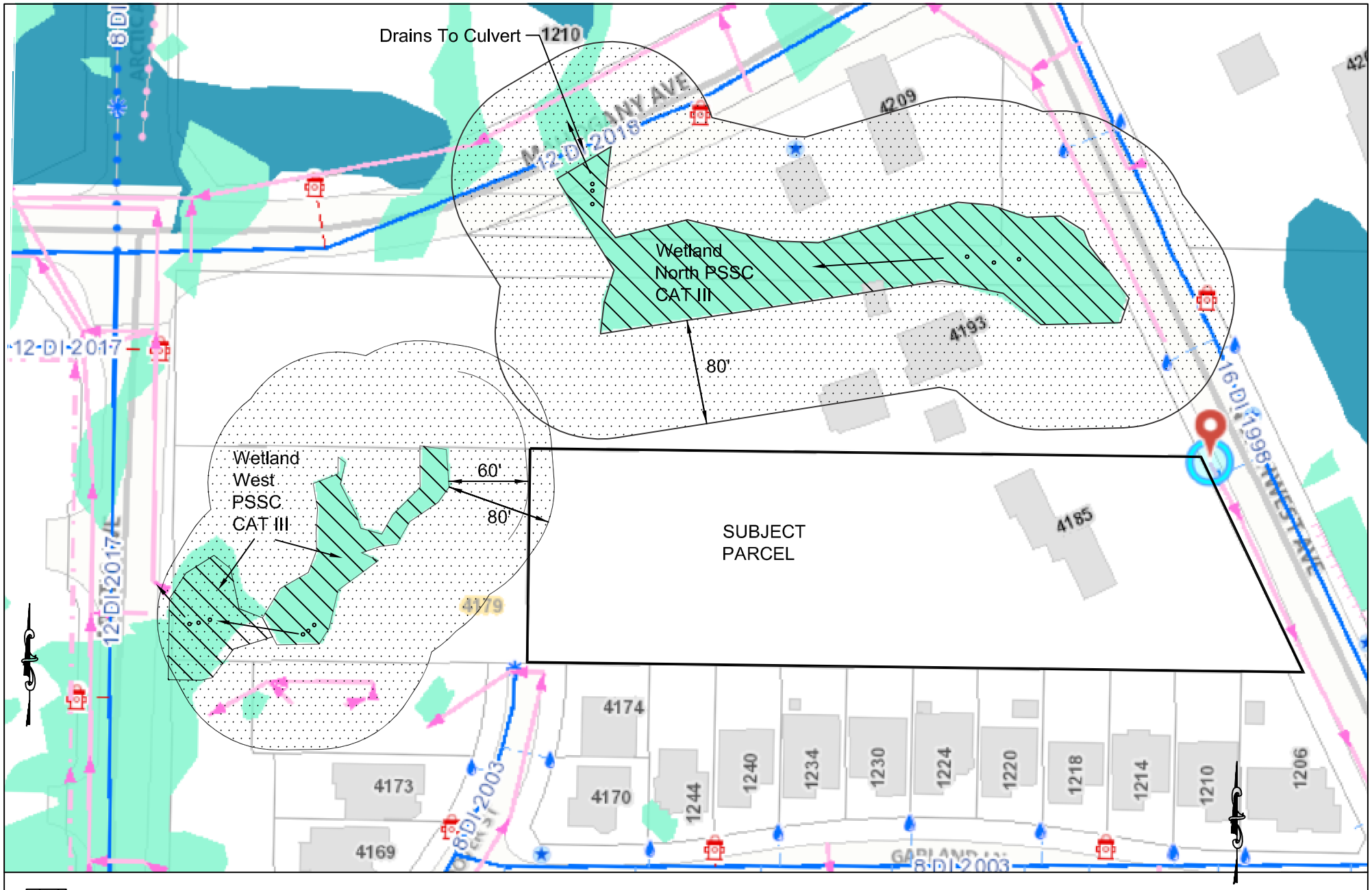

Figure 2. Wetland Buffer Determination Map
4185 Northwest Drive
Parcel # 380211 449 108

July 31, 2019

CAi Cantrell & Associates, Inc.

Figure 3. Wetland West DOE Rating Aerial Photograph
4185 Northwest Drive
Parcel # 380211 449 108

0 1,000'

July 31, 2019

CAi Cantrell & Associates, Inc.

Figure 4. Wetland North DOE Rating Aerial Photograph
4185 Northwest Drive
Parcel # 380211 449 108

0 1,000'

July 31, 2019

Cantrell & Associates, Inc.

Figure 5. 303d Map
4185 Northwest Drive
Parcel # 380211 449 108

July 31, 2019

CAi Cantrell & Associates, Inc.

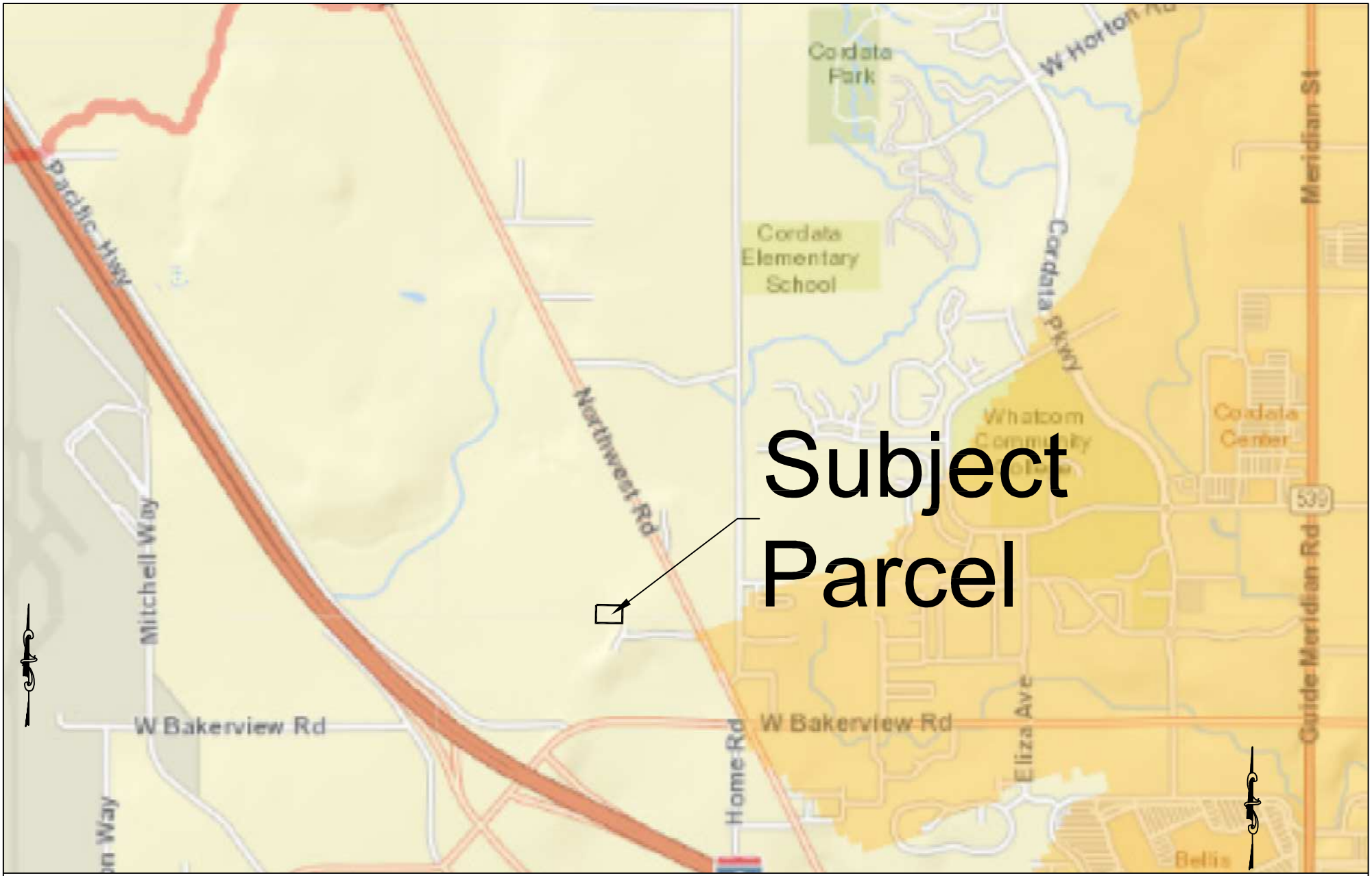

Figure 6. TDML Water Quality Projects Map
4185 Northwest Drive
Parcel # 380211 449 108

March 30, 2017

CAi Cantrell & Associates, Inc.

RATING SUMMARY – Western Washington

Name of wetland:	Wetland West	**Date of site visit:**	July 31, 2019
HGM Class used	Depressional	**HGM Classes**	Depressional
Category	III (Low Habitat Score)	**Buffer Width**	80' (High Intensity)
Rated by:	Bill Cantrell	**Date of Training**	November 2015

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

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**	**TOTAL**
Circle the appropriate ratings				
Site Potential	H **M** L	H **M** L	H M **L**	
Landscape Potential	H **M** L	H **M** L	H M **L**	
Value	H **M** L	H **M** L	H **M** L	
Score Based on Ratings	6	6	4	16

2. Category based on SPECIAL CHARACTERISTICS of wetland: None of the above

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

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

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
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
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
4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
____The water leaves the wetland **without being impounded**.
NO – go to 5
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
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**

DEPRESSIONAL AND FLATS WETLANDS

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

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	2
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions).* Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > 1/10 of area points = 1 Wetland has persistent, ungrazed plants <1/10 of area points = 0	1
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	4
Total for D 1 Add the points in the boxes above	7
Rating of Site Potential If score is: **12-16 = H** **6-11 = M** **0-5 = L** *Record the rating on the first page*	
D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	1
Rating of Landscape Potential If score is: **3 or 4 = H** **1 or 2 = M** **0 = L** *Record the rating on the first page*	
D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	1
Rating of Value If score is: **2-4 = H** **1 = M** **0 = L** *Record the rating on the first page*	

DEPRESSIONAL AND FLATS WETLANDS

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

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outletpoints = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	2
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	3
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	3
Total for D 4 Add the points in the boxes above	8
Rating of Site Potential If score is: **12-16 = H** **6-11 = M** **0-5 = L** *Record the rating on the first page*	
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	2
Rating of Landscape Potential If score is: **3 = H** **1 or 2 = M** **0 = L** *Record the rating on the first page*	
D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): □ Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 □ Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1
Rating of Value If score is: **2-4 = H** **1 = M** **0 = L** *Record the rating on the first page*	

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland*. Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed 4 structures or more: points = 4 ____Emergent 3 structures: points = 2 ____Scrub-shrub (areas where shrubs have > 30% cover) 2 structures: points = 1 ____Forested (areas where trees have > 30% cover) 1 structure: points = 0 *If the unit has a Forested class, check if:* ____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon	0
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated 4 or more types present: points = 3 ____Seasonally flooded or inundated 3 types present: points = 2 ____Occasionally flooded or inundated 2 types present: points = 1 ____Saturated only 1 type present: points = 0 ____Permanently flowing stream or river in, or adjacent to, the wetland ____Seasonally flowing stream in, or adjacent to, the wetland ____**Lake Fringe wetland 2 points** ____**Freshwater tidal wetland 2 points**	1
H 1.3. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft2. *Different patches of the same species can be combined to meet the size threshold and you do not have to name the species.* ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle*** If you counted: > 19 species points = 2 5 - 19 species points = 1 < 5 species points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.* **None** = 0 points **Low** = 1 point **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points	0

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	2
Total for H 1 Add the points in the boxes above	4
Rating of Site Potential If score is: **15-18 = H** **7-14 = M** **0-6 = L** *Record the rating on the first page*	
H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate: 0* % undisturbed habitat **+** [(3.8% moderate and low intensity land uses)/2] **=** __1.9_____% If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate: 0*% undisturbed habitat **+** [(27.3% moderate and low intensity land uses)/2] **=** __13.6_____% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	-2
Total for H 2 Add the points in the boxes above	-1
Rating of Landscape Potential If score is**:** **4-6 = H** **1-3 = M** **< 1 = L** *Record the rating on the first page*	
H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 ⍰ It has 3 or more priority habitats within 100 m (see next page) ⍰ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ⍰ It is mapped as a location for an individual WDFW priority species ⍰ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources ⍰ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	1
Rating of Value If score is: **2 = H** **1 = M** **0 = L** *Record the rating on the first page*	

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

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

- **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

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

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

- **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

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

- **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

- **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

- **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

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

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

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

- **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western

Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No = **Is not a bog**	**Cat. I**

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

RATING SUMMARY – WETLAND WEST

Name of wetland:	Wetland West	**Date of site visit:**	July 31, 2019
HGM Class used	Depressional	**HGM Classes**	Depressional
Category	III (Low Habitat Score)	**Buffer Width**	80' (High Intensity)
Rated by:	Bill Cantrell	**Date of Training**	November 2015

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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**	**TOTAL**
Circle the appropriate ratings				
Site Potential	H **M** L	H M **L**	H M **L**	
Landscape Potential	H **M** L	**H** M L	H M **L**	
Value	H **M** L	H **M** L	H **M** L	
Score Based on Ratings	6	6	4	16

2. Category based on SPECIAL CHARACTERISTICS of wetland: None of the above

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

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

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
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
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
4. Does the entire wetland unit **meet all** of the following criteria?
___The wetland is on a slope (*slope can be very gradual*),
___The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
___The water leaves the wetland **without being impounded**.
NO – go to 5
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
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**

DEPRESSIONAL AND FLATS WETLANDS

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

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	2
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions).* Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > 1/10 of area points = 1 Wetland has persistent, ungrazed plants <1/10 of area points = 0	3
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	4
Total for D 1 Add the points in the boxes above	9
Rating of Site Potential If score is: **12-16 = H** **6-11 = M** **0-5 = L** *Record the rating on the first page*	
D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	2
Rating of Landscape Potential If score is: **3 or 4 = H** **1 or 2 = M** **0 = L** *Record the rating on the first page*	
D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	1
Rating of Value If score is: **2-4 = H** **1 = M** **0 = L** *Record the rating on the first page*	

DEPRESSIONAL AND FLATS WETLANDS

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

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outletpoints = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	2
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	0
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	3
Total for D 4 Add the points in the boxes above	5
Rating of Site Potential If score is: **12-16 = H** **6-11 = M** **0-5 = L** *Record the rating on the first page*	
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	1
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	3
Rating of Landscape Potential If score is: **3 = H** **1 or 2 = M** **0 = L** *Record the rating on the first page*	
D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): □ Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 □ Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1
Rating of Value If score is**:** **2-4 = H** **1 = M** **0 = L** *Record the rating on the first page*	

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland*. Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed 4 structures or more: points = 4 ____Emergent 3 structures: points = 2 ____Scrub-shrub (areas where shrubs have > 30% cover) 2 structures: points = 1 ____Forested (areas where trees have > 30% cover) 1 structure: points = 0 *If the unit has a Forested class, check if:* ____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon	0
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated 4 or more types present: points = 3 ____Seasonally flooded or inundated 3 types present: points = 2 ____Occasionally flooded or inundated 2 types present: points = 1 ____Saturated only 1 type present: points = 0 ____Permanently flowing stream or river in, or adjacent to, the wetland ____Seasonally flowing stream in, or adjacent to, the wetland ____**Lake Fringe wetland 2 points** ____**Freshwater tidal wetland 2 points**	1
H 1.3. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft2. *Different patches of the same species can be combined to meet the size threshold and you do not have to name the species.* ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle*** If you counted: > 19 species points = 2 5 - 19 species points = 1 < 5 species points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.* **None** = 0 points **Low** = 1 point **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points	0

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 Add the points in the boxes above	3
Rating of Site Potential If score is: **15-18 = H** **7-14 = M** **0-6 = L** *Record the rating on the first page*	
H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate: 0* % undisturbed habitat **+** [(4.1% moderate and low intensity land uses)/2] **=** 2.05 % If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate: 0*% undisturbed habitat **+** [(29% moderate and low intensity land uses)/2] **=** 14.5 % Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	-2
Total for H 2 Add the points in the boxes above	-1
Rating of Landscape Potential If score is**:** **4-6 = H** **1-3 = M** **< 1 = L** *Record the rating on the first page*	
H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 □ It has 3 or more priority habitats within 100 m (see next page) □ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) □ It is mapped as a location for an individual WDFW priority species □ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources □ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	1
Rating of Value If score is: **2 = H** **1 = M** **0 = L** *Record the rating on the first page*	

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

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

☐ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

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

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

☐ **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

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

☐ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

☐ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

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

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

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

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

long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? □ The dominant water regime is tidal, □ Vegetated, and □ With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? □ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) □ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. □ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No = **Is not a bog**	**Cat. I**

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

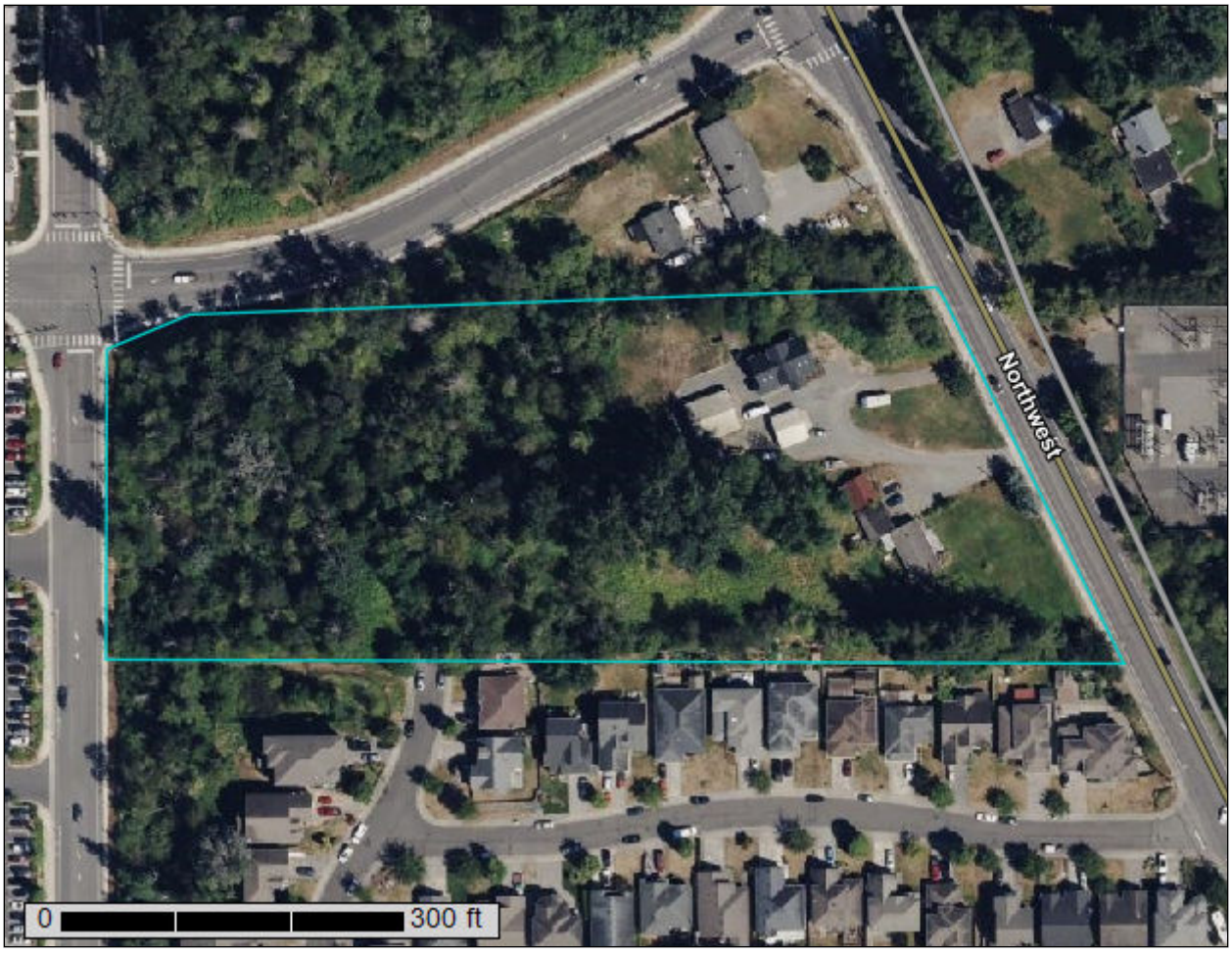
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Whatcom County Area, Washington



September 17, 2023

Preface

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

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

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

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

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

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

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Contents

Soil Map

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

Custom Soil Resource Report
Soil Map

MAP 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: Whatcom County Area, Washington
Survey Area Data: Version 22, Sep 8, 2022

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

Date(s) aerial images were photographed: Aug 14, 2022—Sep 1, 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
182	Whatcom-Labounty silt loams, 0 to 8 percent slopes	5.8	100.0%
Totals for Area of Interest		**5.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Whatcom County Area, Washington

182—Whatcom-Labounty silt loams, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2j3j
Elevation: 50 to 600 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 190 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Whatcom and similar soils: 55 percent
Labounty, undrained, and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whatcom

Setting

Landform: Hillslopes
Parent material: Volcanic ash and loess over glaciomarine deposits

Typical profile

H1 - 0 to 9 inches: ashy silt loam
H2 - 9 to 16 inches: ashy silt loam
H3 - 16 to 26 inches: loam
H4 - 26 to 60 inches: loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Seasonally Wet Soils (G002XN202WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Description of Labounty, Undrained

Setting

Landform: Depressions
Parent material: Volcanic ash, loess, glaciomarine deposits

Typical profile

H1 - 0 to 10 inches: ashy silt loam
H2 - 10 to 16 inches: loam
H3 - 16 to 35 inches: loam
H4 - 35 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Wet Soils (G002XN102WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Minor Components

Labounty, drained

Percent of map unit: 7 percent
Landform: Depressions
Other vegetative classification: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: Yes

Bellingham, undrained

Percent of map unit: 6 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Shalcar, undrained

Percent of map unit: 4 percent
Landform: Flood plains
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Skipopa

Percent of map unit: 3 percent
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Appendix E

The maintenance standards in this appendix section are intended to be used by the property owners for determining inspection and maintenance actions. They are not standards of the facility's required condition between inspections. It is understood that conditions are variable with weather and vegetative debris and conditions between inspections and/or maintenance do not constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires maintenance.

Inspector: _____

Date: _____

Location: 6482 Portal Way, Ferndale, WA

Date of Last Inspection: _____

Amount of Rainfall Since Last Inspection: _____

Facilities to Inspect: Detention Vault, Catch Basin

Abbreviated Checklist. See following tables for additional information and maintenance procedures
Circle one

Detention Vault

- Sediment present in the vault? YES NO Depth of Sediment? _____
- Moss/Weeds present in the vault? YES NO
- Standing Water in the vault? YES NO
- Are the air vents open? YES NO
- Rodent Evidence? YES NO
- Damage to Vault? YES NO

Catch Basin

- Sediment present in Catch Basin? YES NO Depth of Sediment? _____

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.

Table V-A.1: Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Per-formed
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 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storagearea.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (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 1/2-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 1/2-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 1/4-inch wide at the joint ofthe inlet/outlet pipe.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Per-formed
Manhole	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 1/2 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 onemaintenance 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 main-tenance person safe access.
Catch Basins	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.4: Maintenance Standards - Control Structure/Flow Restrictor

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.
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 regrouted 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.