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MAKING A "WAY" OUT OF "NO WAY"

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PN PA22-007

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2nd Submittal: July 2022

Stormwater Site Plan Report for Lakewood Heights PRD

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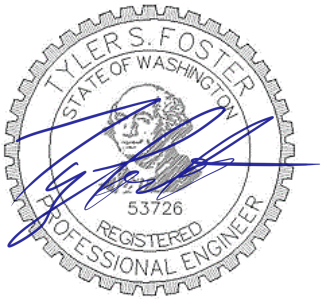

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Acronyms

The following acronyms and abbreviations may or may not be called out within the body of this report.

- ASTM - American Society for Testing and Materials
- BMPs - Best Management Practices
- CB - Catch Basin
- CAO - Critical Areas Ordinance
- CESCL - Certified Erosion and Sediment Control Lead
- DOE - Department of Ecology
- EDDS - Engineering Design & Development Standards
- FEMA - Federal Emergency Management Agency
- HSPF - Hydrological Simulation Program—Fortran
- LiDAR - Light Detecting And Ranging
- LDA - Land disturbing activity
- LID - Low Impact Development
- LID Manual - DOE 2005 LID Technical Guidance Manual for Puget Sound
- MRs - Minimum Requirements (for Stormwater Management)
- MS4 - Municipal Separate Storm Sewer System
- MSL - Mean Sea Level
- NAVD88 - North American Vertical Datum of 1888
- NGVD29 - National Geodetic Vertical Datum of 1929
- NPDES - National Pollutant Discharge Elimination System
- NRCS - Natural Resources Conservation Service
- NPGIS - Non-Pollutant Generating Impervious Surface
- O&M - Operations and Maintenance
- PGIS - Pollutant Generating Impervious Surface
- PGPS - Pollutant Generating Pervious Surface
- PLSS - Public Land Survey System
- POC - Point of Compliance
- RCW - Revised Code of Washington
- ROW - Right-of-Way
- SCDM-2010 - Snohomish County 2010 Drainage Manual
- SMMWW - DOE 2005 Stormwater Management Manual for Western Washington
- SWPPP - Stormwater Pollution Prevention Plan
- TDA - Threshold Discharge Area
- TESC - Temporary Erosion and Sediment Controls
- USDA - United States Department of Agriculture
- US EPA - United States Environmental Protection Agency
- WSDOT - Washington State Department of Transportation
- WWHM - Western Washington Hydrology Model

Section 1 – Report Summary

1.1 Project Description

Robinett Brothers, LLC is proposing the development of 29.80-*acres* of land in Northwest Marysville, WA off of 11th Ave NE. The parcel is vacant and vegetated with pasture. The parcel has an onsite wetland and buffer.

The development of the parcel will result in a Planned Residential Development (PRD) with 182-Lots, public road and shared auto court. Each lot is allocated to accept a maximum of 70% total impervious of roof and driveway with the remaining portion consisting of lawn. Open space areas for both passive and active recreation will be located outside of the proposed lots.

The proposed road access for the PRD will be from 11th Ave NE at three locations. The development consists of public roads, lots, driveways, homes, auto court, on-site recreation and stormwater facilities.

Per NRCS mappings, type "B" Alderwood gravelly sandy loam soils are found throughout the site. No infiltration will be utilized. Infiltration is not feasible in Till soils with infiltration rates less than 0.3 *in/hr*.

The 2014 DOE Stormwater Management Manual for Western Washington will be used for stormwater management guidance. Stormwater management BMPs and engineered designs are specified in this report.

Stormwater facilities will consist of bioretention facilities.

The entire developable project area is in two natural discharge areas with two discharge locations. Stormwater BMPs will be employed to mitigate polluted and unpolluted surface water flows.

Summary Stormwater Management

The project qualifies as 'new development' because there are less than 35% of existing impervious areas. The proposed condition of the fully developed site will have more than 5,000sf impervious areas. Per Figure 2.4.1 Vol. 1 of the 2014 SMMWW, all minimum requirements shall apply for this project.

This project triggers MRs 1-9 and is within the City's UGA. The project will choose to adhere to List #2 of MR #5. On-site stormwater BMPs will consist only of BMPT5.13. Feasibility analysis for individual lot BMPs is provided in MR #5 of the report. However, the overall site stormwater management will mirror the requirements and intent of MR #5.

Flow control requirements for the site will be met by detention. The majority of runoff from impervious surfaces and converted surfaces will be detained. A small portion of the site bypasses facilities for detention. The site as a whole meets the flow control threshold requirement matching the fully-forested condition.

Water quality will be met by percolating stormwater through bioretention treatment soils. The bioretention cell mitigates polluted stormwater through physical, chemical, and biological treatment processes.

1.2 Project Data Summary

Existing and proposed project areas are presented for determination of stormwater management requirements based on prescribed thresholds as outlined in the Marysville Municipal Code (MMC 22C) and the 2014 SMMWW Vol-1, Ch-2, Section 2.4 are summarized in the following tables.

Table 1 - Project Parcel Summary

Project Data:	
Applicant	Robinett Brothers, LLC
Site Owner	Myron Gemmer & Brad Gemmer
Project Name	Lakewood Heights PRD
Project T.S.R. Location	Twn 31 N, Rng 5 E, Sec 19, Qtr-SE
Project Address	1125 & 1507 172nd Street NE, Marysville, Washington 98271
Parcel ID(s)	310519-004-009-00, 310519-004-011-00
Watershed	Snohomish
Basin	Snohomish
Sub-Basin	Quilceda Creek
WRIA Number	7-Snohomish
Analysis Standard	2014 DOE SMMWW

Table 2 - Project Area Analysis & Activities Summary

Existing Conditions:		
Total Site Area	1,298,041	sf (29.80 ac)
Existing Impervious Area	0	sf (0.00 ac) 0.0%
Proposed Activity:		
Proposed Activity	PRD Subdivision	
Total Proposed Disturbance Area	1,194,930	sf (27.43 ac)
Proposed Grading Area	1,194,930	sf (27.43 ac)
Proposed New NPGIS Onsite (Roof)	384,052	sf (8.82 ac)
Proposed New PGIS Onsite (Road, Sidewalk & Driveway)	361,120	sf (8.29 ac)
Proposed Replaced Impervious Area	0	sf (0.00 ac)
Native Vegetation convert to Lawn	0	sf (0.00 ac)
Native Vegetation convert to Pasture	0	sf (0.00 ac)
Total New Impervious Area Onsite	745,172	sf (17.11 ac)
Grading is ≤ 2 feet from P/L	No	
Any excavation 4+' at <1:1 slope to P/L	No	
Fill Slopes 4+' and >33% slope	No	

Section 2 - Minimum Requirements

2.1 Assessment of Minimum Requirements and Thresholds

Minimum requirements and thresholds are established by City of Marysville Municipal Code 14.15.050 – Minimum Requirements. Minimum Requirements for new development and Redevelopment are based on a development's disturbance area. Existing and proposed project areas for determination of stormwater management requirements are presented in Table 2.

The existing impervious area is less than 35% so this project qualifies as 'new development'. The proposed condition of the fully developed site will have impervious area in excess of 5,000 sf. This requires construction activities and stormwater management to comply with Minimum Requirements 1 through 9. A full construction SWPPP is also required.

Minimum Requirements per the SWWMM:

MR-1: Prepare Stormwater Site Plan. MMC 14.15.050 (1)

MR-2: Stormwater Pollution Prevention Plan (SWPPP). MMC 14.15.050 (2)

MR-3: Water pollution source control for new development. MMC 14.15.050 (3)

MR-4: Preservation of natural drainage systems and outfalls. MMC 14.15.050 (4)

MR-5: On-site stormwater management. MMC 14.15.050 (5)

MR-6: Runoff treatment. MMC 14.15.050 (6)

MR-7: Flow control requirements. MMC 14.15.050 (7)

MR-8: Detention or treatment in wetlands and wetland buffers. MMC 14.15.050 (8)

MR-9: Inspection, operation and maintenance requirements. MMC 14.15.050 (9)

Each Minimum Requirements is described in the following sections. There are no additional requirements to be met.

2.2 MR #1: Preparation of Stormwater Site Plans

This document is the Stormwater Site Plan Report that addresses the requirements of MR-1. This section presents the portion of the Stormwater Site Plan that includes recommendations, calculations, and procedures required to adhere to Minimum Requirement #1. The evaluation of the existing site conditions follows.

2.2.1 Site Location

The site is located in the SE quarter of Section 19 of Township 31 North, Range 5 East. The street address is 1125 & 1507 172nd Street NE, Marysville, Washington 98271 and the parcel is located on the north side of 172nd Street NE. See Figure 1 for a vicinity map.

2.2.2 Site Description, Existing Conditions

The project site is a 29.80-*acres* parcel. The parcel is owned by Myron Gemmer & Brad Gemmer. The Snohomish County parcel number is 310519-004-009-00, 310519-004-011-00. It is zoned R-6.5 Multi-Family High and Mixed Use and is located in Snohomish County.

The site is vacant. The existing drainage system(s) are undetermined but largely surface runoff to an existing agriculture ditch over the top silt layer. Surface runoff overall flows southwest and east.

The majority of the site is pasture.

All maps and figures are presented in the Support Data section of this document.

A vicinity map that shows the site location is shown as Figure 1.

A site map that shows the property lines is shown in Figure 2.

A topographic map that shows the site boundaries, study area boundaries, and the downstream flow-paths is also presented in Figure 3.

2.2.3 Existing Basin Analysis

The project is defined by the development within the subject parcel. Existing project flow paths are shown in Figure 2.

The study area is located in the Quilceda Creek sub-basin of the Snohomish Basin in the Snohomish watershed (WRIA-7-Snohomish), which drains to the Puget Sound.

All existing flow assessment and site related basin delineations were established by tracing analysis of a LIDAR surface model.

2.2.4 Other Information on the Study Area

The site is not in or adjacent to a USEPA Sole Source Aquifer.

The site is not in a well-head protection area.

The site is not in a floodway or floodplain.

2.2.5 Critical Areas

There is an onsite Category III wetland on the northwest corner of the site. Category III wetlands carry 75-foot buffer. An offsite Category III wetland is located north of the site. The offsite wetland's buffer encroaches onto the site.

2.2.6 Topography

The site and surrounding topography was analyzed using survey topographic points provided by North Peak Associates. A 3D surface model was generated.

The site has mostly flat slopes with high points around 162 feet MSL in the middle of the site. The site slopes up from the west to a high point 162 feet and then slopes down to the east boundary.

Slopes average in the range of 0 to 5 percent for the majority of the developable area. The site has an average slope of 3.89%.

2.2.7 Soils

Per NRCS mappings, Tokul gravelly sandy loam soils are found throughout the site. Tokul soils are related with glacial Till. Glacial Till is also mapped within the USGS Geologic maps for this site.

Infiltration cannot be used as a primary component of stormwater management due to the relative density of site soils.

Detailed physical and chemical properties of these soils are presented in Section 4.1. The NRCS mapping can be seen in Figure 5.

2.2.8 Field Inspection

The site has not been visited recently. All inspection has been conducted via remote sensing.

2.2.9 Upstream Analysis

The site is at a local high point in the area. No upstream basin flows onto the site.

2.2.10 Downstream Analysis

The downstream area was established by tracing analysis of a LIDAR surface model and evaluation of various GIS data, aerial imagery, and City of Marysville Drainage Inventory. Two onsite basins are present on site. The basins on site are named West and East Basin respective to their location within the site. The Basins meet within West Fork Quilceda Creek more than ¼ mile as measured from the shortest path away.

Stormwater from West Basin flows to the southwest between property lines before reaching an existing ditch, which flows south and is parallel to the west property boundary. The ditch turns east at the southwest corner of the site. There is an existing 8" concrete culvert at the end of the ditch. The ditch is then conveyed through the culvert and across 172nd Street NE. Stormwater flows along the storm system within 172nd Street NE ROW and then within a bypass conveyance system along 11th Ave NE. The storm system eventually discharges to West Fork Quilceda Creek south of the high school stadium.

East Basin flows east to an existing ditch, which is within Burlington Northern RR ROW. Stormwater flows southeast along the ditch and across 172nd Street NE ROW via an existing 12" concrete culvert. Stormwater then drains to an existing ditch which flows northeast along the railroad. The two basins eventually meet within West Fork Quilceda Creek which portion flows along the RR ROW.

Figure 3 shows a portion of the downstream flow path.

2.3 MR #2: Stormwater Pollution Prevention Plans (SWPPPs)

MMC 14.15.050 (2) specifies the requirements for development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. Volume I, Chapter 2.5.2 of the 2014 SMMWW specifies that all new development and redevelopment implement a Stormwater Pollution Prevention Plans (SWPPP), which is a list of 13 elements that present measures and methods for all permanent and temporary erosion and sediment control (TESC), pollution prevention, inspection/monitoring activities, and recordkeeping required during the proposed construction project.

Based on the MR#2 thresholds, this project generates more than 2,000 *square feet* of impervious area, so a full SWPPP is required. Required elements for the SWPPP:

- SWPPP element 1: Preserve vegetation/mark clearing limits
- SWPPP element 2: Establish construction access
- SWPPP element 3: Control flow rates
- SWPPP element 4: Install sediment controls
- SWPPP element 5: Stabilize soils
- SWPPP Element 6: Protect slopes
- SWPPP element 7: Protect permanent drain inlets
- SWPPP element 8: Stabilize channels and outlets
- SWPPP element 9: Control pollutants
- SWWP element 10: Control dewatering
- SWPPP element 11: Maintain best management practices
- SWPPP element 12: Manage the project
- SWPPP element 13: Protect On-Site Stormwater Management BMPs for Runoff from Roofs and Other Hard Surfaces

The SWPPP is assembled as a separate document for portability and reproduction purposes. The document is titled "**Stormwater Pollution Prevention Plan for Robinett Brothers, LLC**", dated 12 July 2022.

2.4 MR #3: Source Control of Pollution

MMC 14.15.050 (3) specifies the requirements for water pollution source control for new development or redevelopment activities in accordance with Volume IV of the SMMWW. These activities are primarily commercial industrial developments that represent significant pollutant generation potential and the associated source control BMPs are designed to suit those activities.

Per Chapter 2.5.3, MR#3 does not apply to residential development, hence such source controls are not specified for this project.

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

MMC 14.15.050 (4) specifies the requirements for preservation of natural drainage systems or outfalls for all new development and redevelopment activities under Minimum Requirement 4 in the 2014 SMMWW.

Natural drainage patterns as they once existed shall be retained. Pre-developed conditions experience a sheet drainage pattern to the site's west and east property boundary. Stormwater generated onsite reaches the property boundary through infiltration or surface runoff prior to being intercepted by exiting ditches. Existing discharge location shall be maintained.

2.6 MR #5: On-Site Stormwater Management

MMC 14.15.050 (5) specifies requirements for on-site stormwater BMPs. This requirement mandates that on-site stormwater runoff be infiltrated, dispersed, and/or retained to the maximum extent feasible without causing flooding or erosion impacts. Projects triggering Minimum Requirements 1 through 5 must use On-site stormwater management BMPs from List #1 for all surfaces or demonstrate compliance with the LID Performance Standard. Projects triggering Minimum Requirements 1 through 9 must meet the requirements of Table 2.5.1 in Vol. 1 of the 2014 SMMWW. Table 2.5.1 specifies the requirements for new or redevelopment depending on UGA and parcel size to meet the requirements of the LID Performance Standard and/or List #2. List #1 and List #2 specify stormwater BMPs in order of preference. The first BMP determined feasible is required.

<u>This project trigger MR's 1-9.</u> This project is within the City's UGA. This project is required to adhere to the LID Performance Standard or List #2 per Table 2.5.1.

List #1 and #2 contain appropriate BMPs to mitigate a particular developed surface. The surfaces included in the list are Lawn and Landscaped Areas, Roofs, and other hard surfaces (road/driveway/parking).

> Lawn/Landscape is required to utilize BMP T5.13, Post-Construction Soil Quality and Depth.
>
> Roofs are required to employ BMP T5.30 Full Dispersion or Downspout Infiltration, Rain Gardens or Bioretention, BMP T5.10A Downspout Dispersion Systems, or perforated stub-out connections. The first feasible BMP in this list must be used.
>
> Other Hard surfaces (Roads, Driveways, Parking Lots, Etc.) must utilize BMP T5.30 Full Dispersion, BMP T5.15 Permeable Pavement, Bioretention, Sheet Flow Dispersion, or Concentrated Flow Dispersion. The first feasible BMP in this list must be used.

Lawn/landscape will utilize BMP T5.13, Post Construction Soil Quality and Depth.

Roofs will not be able to provide BMP T5.30 Full Dispersion. Full Dispersion requires 100-*foot* flow paths within native areas. The project will not be able to maintain 65% open space.

Individual Lot Infiltration is not feasible based on the low-permeability of native soils. Most roofs will be ultimately routed to bioretention areas for treatment and flow control.

BMP T5.10B Downspout Dispersion will not be utilized as each individual lot lacks the prescriptive flow path length. BMP T5.10C perforated stub out connections are also not feasible due to the close proximity of sewer, water, gas, electricity, and cable utilities on these narrow 40 ft wide lots. Perforated stub outs are also not permitted to be installed beneath driveways.

Onsite stormwater BMPs are infeasible.

Road and Driveway/Parking will be routed to bioretention areas, BMP T7.30. The bioretention cells will treat stormwater through filtering, phytoremediation, and microbial action from within the compost.

Permeable pavement will not be used as the pavement areas are likely to have long-term excessive sediment deposition after construction and homeowner turnover. Permeable pavement

may also be constructed over the top of compacted structural fill that does not exhibit infiltration rates consistent with the requirements for this BMP.

A site plan showing the stormwater management and development can be seen in Figure 4.

2.7 MR #6: Runoff Treatment

Minimum Requirement #6 in MMC 14.15.050 (6) specifies the requirements for providing runoff treatment. The threshold for requiring a treatment BMP is 5,000 *square feet* of PGIS (Pollution Generating Impervious Surface) or a total of more than ¾ of an acre of PGPS (Pollution Generating Pervious Surface).

This project is expected to generate 361,120 *square feet* (8.29 *acres*) of PGIS based on road, sidewalk and driveway areas, therefore treatment facility BMPs are required for this project.

Runoff treatment facility selection is outlined in Vol. I, Ch. 4.2, Step V of the 2014 SMMWW. Step V outlines the treatment facility selection flow chart based on the intended use of a project. Treatment selection is based on if the site is a high-use site, if the downstream receiving waters are phosphorous sensitive, and/or if the site is required to provide enhanced treatment. The definitions of high-use, phosphorous control, and enhanced treatment can be found in Step V in Section 4.2 of the 2014 SMMWW.

The project is not a high use site.

The project is not required to treat for phosphorous.

Enhanced treatment is not required for the project.

Enhanced and Basic treatment is provided through the use of a bioretention facility per Vol. III Section 3.3.12 of the 2014 SMMWW. The bioretention specified will provide enhanced treatment. The bio-cell treats stormwater through the infiltration of stormwater through soils and their ability to absorb pollutants. On-site soils are suitable for use. See Vol III. Section 3.3.12 of the 2014 SMMWW for specific soil design criteria.

The project utilizes bioretention cells for treatment. The bioretention cell mitigates polluted stormwater through physical, chemical and biological treatment processes. The treatment process reduces pollutant loads to downstream receiving waters. Stormwater percolates through compost amended soils and plantings to obtain treatment. The total percolated runoff through each bio-cell's amended soils is well over the 91% total runoff volume treatment requirement. See Section 7.

2.8 MR #7: Flow Control

Minimum Requirement #7 in MMC 14.15.050 (7) specifies the requirements for runoff flow control. The threshold for requiring Minimum Requirement #7 is 5,000 *square feet* of impervious surface. Flow control shall be provided if the project creates more than 10,000 *square feet* of effective impervious area in a threshold discharge area, converts ¾ of an acre or more of native vegetation to lawn, 2.5 *acres* or more native vegetation is converted to pasture, or a combination of impervious and converted pervious surfaces cause a 0.1 *cfs* increase in the 100-*year* flow frequency from a continuous simulation runoff model.

The project exceeds this requirement and is required to provide flow control.

All runoff from impervious surfaces and converted surfaces is preferred to be infiltrated if feasible. Standard flow control requires that stormwater discharges match pre-developed discharge durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow to the 50-year peak flow. The pre-developed condition shall be matched to the fully-forested condition (soils and vegetation) to which the Western Washington Hydrologic Model (WWHM) is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement. This requirement may also be met by Full dispersion and infiltration. This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surface and converted vegetation areas.

The site stormwater management practices detention of stormwater generated on site. A small portion of the frontage and rooftops bypass facilities for detention. These bypasses are included in the stormwater model. The site as a whole still meets the flow control threshold requirement.

The site is split into two overall basins, West and East.

Stormwater generated in West Basin flows to Bioretention Cell A, C and D. Bioretention Cell A, C and D release stormwater to a proposed stormwater system within 11th Ave NE ROW.

Stormwater generated in East Basin flows to Bioretention Cell B. The discharge of the cell is to a level spreader.

The combination of bioretention cells A,B,C and D meet compliance with flow-control standard of 50% of the 2-year to the 50% predeveloped stormwater flows.

All bioretention cells are comprised of 1.5 *feet* of bioretention soil media. Those cells utilize ponded area with freeboard to allow stormwater to percolate through the amended soils. Percolated stormwater drains to a filter layer, and then to a storage chamber consisting of 0.5 *ft* to 8.0 *ft* of rock. The rock layer is drained through a perforated underdrain.

See Section 7 for bioretention cells, planter bioswales and rooftop modeling parameters.

2.9 MR #8: Wetlands Protection

MMC 14.15.050 (8) specifies requirements for discharge of stormwater in wetlands and wetland buffers as well as discharge of stormwater to a stream.

Since there is no detention or treatment in the critical areas, MR-8 does not apply to this project.

2.10 MR # 9: Operation and Maintenance

Minimum Requirement #9 specified MMC 14.15.050 (9) contains requirements for inspection, operation and maintenance of stormwater facilities and BMPs. Specific maintenance standards and requirements are outlined in Volume V of the 2014 SMMWW. The 2014 SMMWW requires the regular maintenance and inspection of drainage facilities.

For portability and reproduction purposes, the Operations and Maintenance Manual is presented in a separate stand-alone document titled "**Operations and Maintenance Manual for Lakewood Heights PRD"**, dated **12 July 2022.** This document will be provided with the construction plan submittal.

Section 3 - Maps & Figures

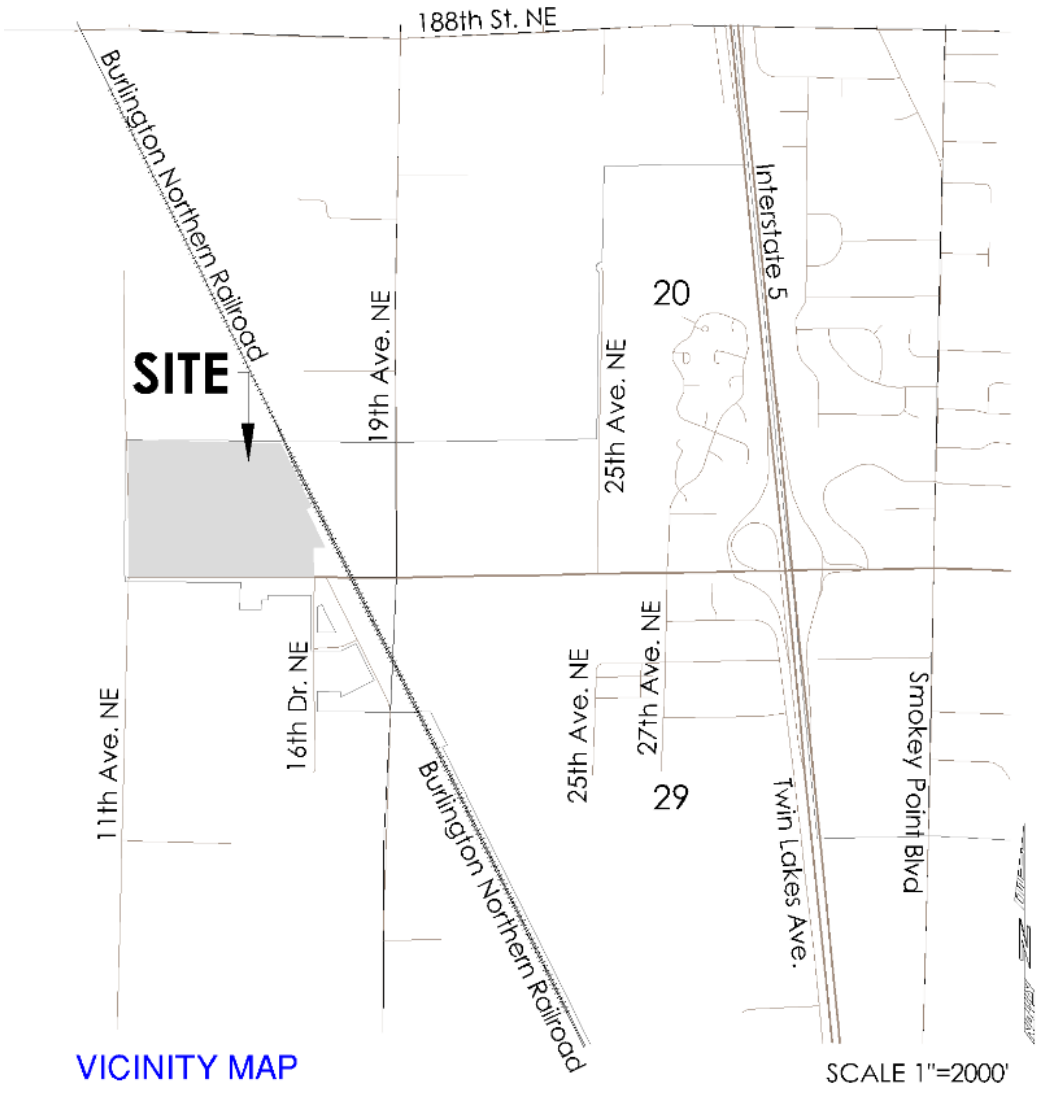


Figure 1 - Vicinity Map

Figure 2 - Existing Conditions (not to scale)

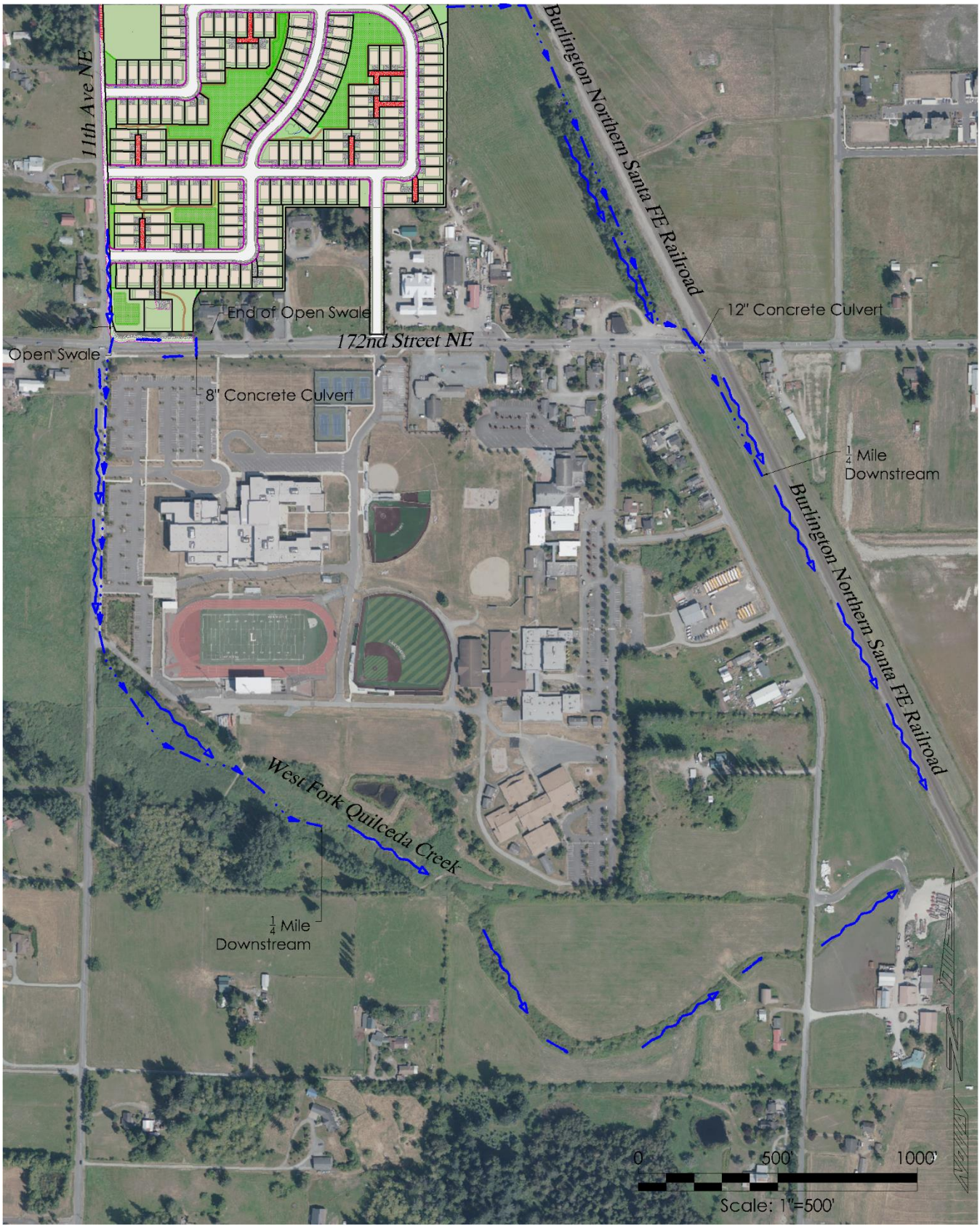


Figure 3 – Downstream Flow Path

Figure 4 - Site Plan

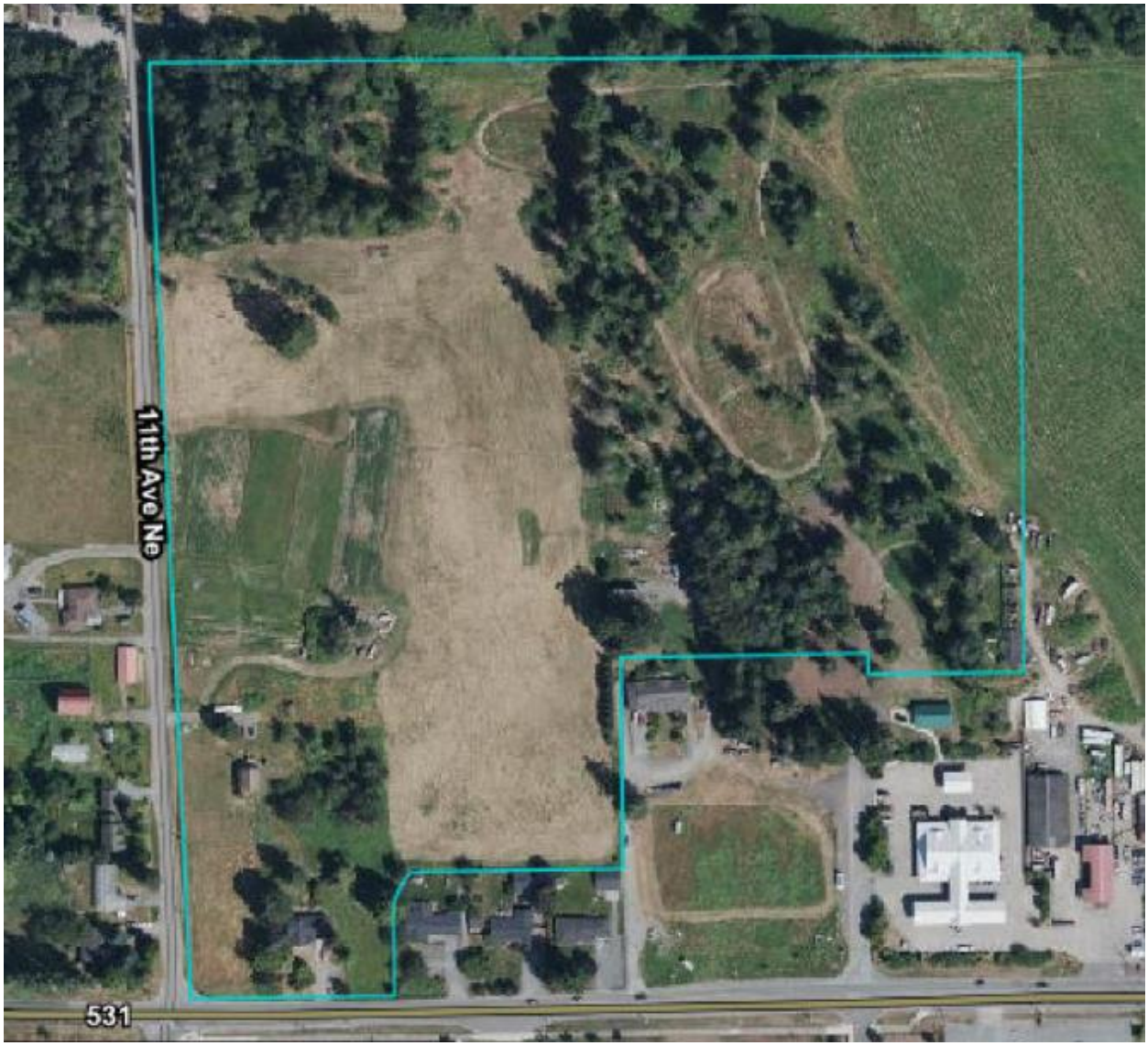


Figure 5 – Soil Map (Not to Scale)

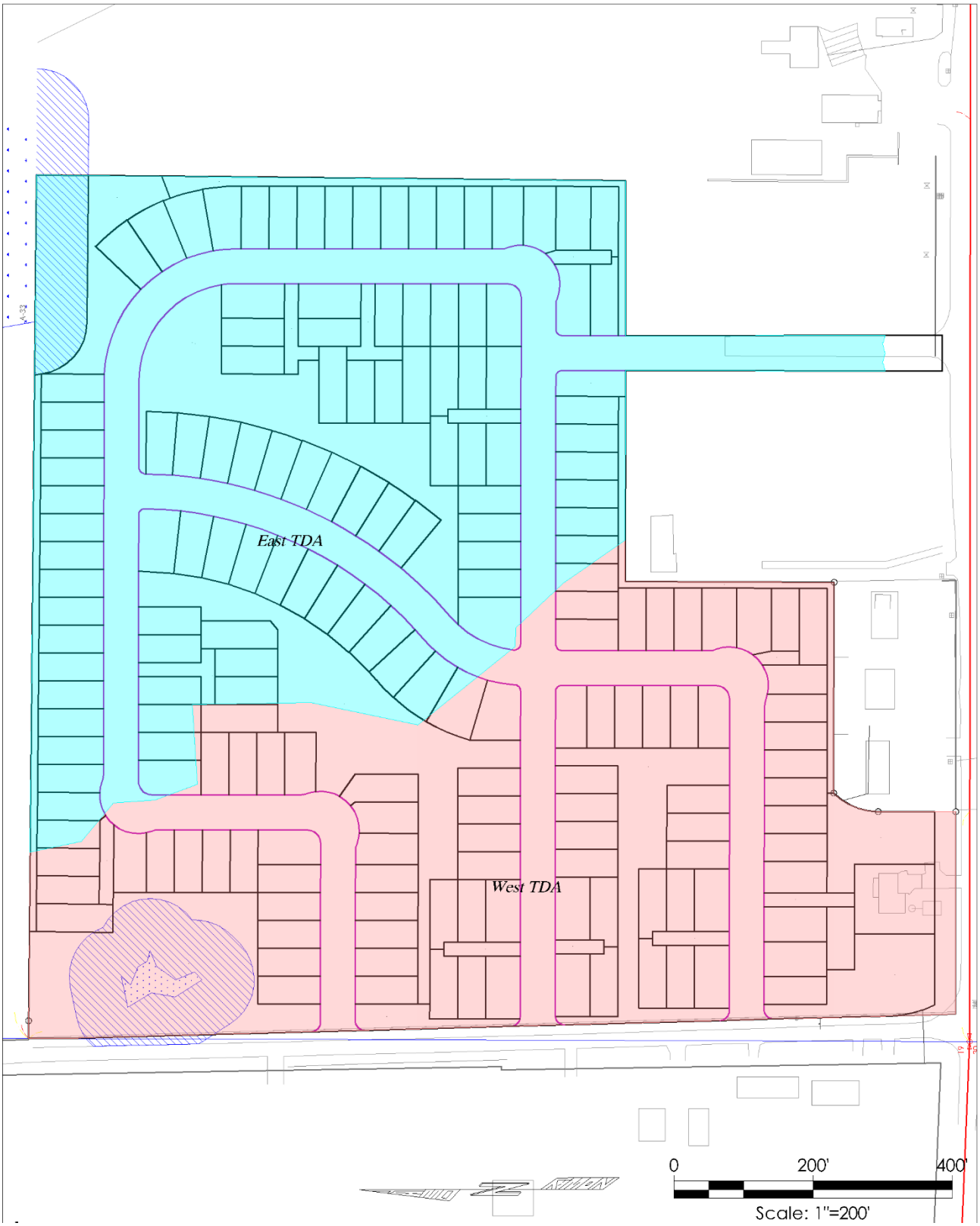


Figure 6 – Predeveloped TDA Map

Figure 7 – Basin Map

Section 4 - Support Data

4.1 Soils Data

1—Alderwood gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2t625
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated
Map Unit Composition
*Alderwood and similar soils:*85 percent
*Minor components:*15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.
Description of Alderwood
Setting
*Landform:*Hills, ridges
*Landform position (two-dimensional):*Summit
*Landform position (three-dimensional):*Crest, talf
*Down-slope shape:*Convex, linear
*Across-slope shape:*Convex
*Parent material:*Glacial drift and/or glacial outwash over dense glaciomarine deposits
Typical profile
A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam
Properties and qualities
*Slope:*0 to 8 percent
*Depth to restrictive feature:*20 to 39 inches to densic material
*Drainage class:*Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):*Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:*About 18 to 37 inches
*Frequency of flooding:*None
*Frequency of ponding:*None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)
Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)

Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No
Minor Components
Mckenna
*Percent of map unit:*5 percent
*Landform:*Drainageways, depressions
*Landform position (three-dimensional):*Dip
*Down-slope shape:*Linear, concave
*Across-slope shape:*Concave
Hydric soil rating: Yes
Everett
*Percent of map unit:*5 percent
*Landform:*Moraines, eskers, kames
*Landform position (two-dimensional):*Summit, shoulder
*Landform position (three-dimensional):*Interfluve, crest
*Down-slope shape:*Convex
*Across-slope shape:*Convex
Hydric soil rating: No
Shalcar
*Percent of map unit:*3 percent
*Landform:*Depressions
*Landform position (three-dimensional):*Dip
*Down-slope shape:*Concave
*Across-slope shape:*Concave
Hydric soil rating: Yes
Norma
*Percent of map unit:*2 percent
*Landform:*Drainageways, depressions
*Landform position (three-dimensional):*Dip
*Down-slope shape:*Linear, concave
*Across-slope shape:*Concave
Hydric soil rating: Yes

27—Kitsap silt loam, 0 to 8 percent slopes
Map Unit Setting
National map unit symbol: 2hyh
Elevation: 0 to 490 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland
Map Unit Composition
*Kitsap and similar soils:*85 percent

*Minor components:*5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.
Description of Kitsap
Setting
*Landform:*Terraces
*Parent material:*Lacustrine deposits
Typical profile
H1 - 0 to 6 inches: ashy silt loam
H2 - 6 to 33 inches: silt loam
H3 - 33 to 60 inches: stratified silt to silty clay 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 30 inches
*Frequency of flooding:*None
*Frequency of ponding:*None
Available water supply, 0 to 60 inches: High (about 11.4 inches)
Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Soils with Few Limitations (G002XF503WA)
Other vegetative classification: Soils with Few Limitations (G002XF503WA)
Hydric soil rating: No
Minor Components
Bellingham, undrained
*Percent of map unit:*5 percent
*Landform:*Depressions
*Other vegetative classification:*Wet Soils (G002XN102WA)

Hydric soil rating: Yes

Section 5 Works Cited

Mays, L. W. (2011). *Water Resources Engineering.* Hoboken: Wiley & Sons, Inc.

Puget Sound Action Team. (2005, January). Low Impact Development Technical Guidance Manual for Puget Sound. *Publication No. PSAT 05-03*. Washington: Washington State University - Pierce County Extension.

Puget Sound LIDAR Consortium. (2003, April). LIDAR Bare Earth DEM File. q47121h24be.e00. Snohomish County, Washington. Retrieved May 2013, from http://pugetsoundlidar.ess.washington.edu/index.htm

Snohomish County Planning and Development Services. (2007, October 1). Aquifer Recharge/Wellhead Protection. Everett, WA.

Snohomish County Surface Water Management Division. (2002, December). Snohomish UGA Drainage Needs Report. Everett, Washington.

5.1 Topographic Data

- The various on and off site topography, utilities, and drainage elements were professionally surveyed by Pacific Coast Surveying in 2019.

- Snohomish County 2003 LiDAR survey was used to augment the existing site topography and the downstream and surrounding areas.

The modeled coordinate system:
Lateral - Washington State Plan Plane - North, FIPS 4601;
Vertical – NAVD 88

Section 6 - Continuous Simulation Modeling

6.1 Continuous Simulation Background

HSPF based continuous simulation modeling was used to evaluate the hydrologic performances of the pre-developed and developed sub-basins in order to accurately assess flow rates.

The currently adopted continuous simulation models use the HSPF (Hydraulic Simulation Program in FORTRAN) software engine. The HSPF model uses a robust and detail accounting of the 'water budget', including evaporation, evapotranspiration, interception, interflow, and groundwater. The modeling accounts for and assesses land segment areas that include vegetation or impervious cover, soil types, and slopes. The modeling also uses utilized over 50 years of continuous rainfall data (precipitation) and evaporation data for the area. The HSPF continuous modeling is considered the best available science for hydrologic analysis.

6.2 Modeling Methodology

HSPF modeling was managed via the Western Washington Hydrology Model (WWHM) interface program. The current professional version of WWHM by Clearcreek Solutions, Inc., WWHM-2012 was used. The current data precipitation and evaporation set provided by DOE with the WWHM-2012 software interface was used that includes quantized data in 15-minute time steps from October 1948 to October 2009.

The WWHM program comes packaged with generic, well considered HSPF modeling parameters. These settings allow for the modeling of the majority of the topological conditions found in the Puget Sound area. Where conditions fall reasonably outside the range of the default HSPF parameters, adjustments should be made to more accurately reflect those conditions. These is generally limited to the pervious land segments (IMPLNDS) and are mostly limited to slopes (SLSUR), infiltration rates (INFILT), and length of flow path (LSUR). For this project, HSPF parameters were not adjusted to reflect site conditions.

6.2.1 Existing Conditions

The surface vegetative cover is assumed fully forested with an average slope of 5% in the area of development, based on the LIDAR based TIN analysis. The LIDAR model represents the pre-graded conditions and is in accordance with the predeveloped requirements to be represented as native vegetation and soils that existed at a site prior to the influence of Euro-American settlement.

The NRCS soil mapping of Tokul gravelly medial loam within the modeled area is listed as Type C hydrologic soils. Land segments of Forest Flat, Mod are representative of the existing site areas. Wetland buffer is mapped as Forest, Flat. The wetland area itself is modeled in the WWHM as Sat Forest, Flat.

6.2.2 Developed Conditions

Default mapping for flat road was used for the road areas. Roof was for the rooftop areas. Driveway was for the driveway areas and sidewalk for the paths. Pasture was used for the amended soils from DOE recommendations for amended soils modeling. The intent of the modeling of this site was to determine the infiltration and treatment efficiencies of the bio-retention cell. Flow control modeling took place for the bypass area that is unable to be introduced to street system.

It should be noted that when ponds, bio-swales, or other open detention facilities are used, the corresponding WWHM analysis module includes the ponded area. Consequently, this area is not included in the basin land segment mappings so the total area is often different between the developed and pre-developed conditions.

The current DOE specification for amended soils in 2014 is labeled as 'SMMWW' in the Bio-Swale and other WWHM modules that employ amended soils. The parameters for modeling the SMMWW are preset and based on current state-of-the-art modeling using a combination of the Darcy's and Van Genuchten's equations to account for the variability of permeability and water content as the soils transition from dry or partly damp to saturated conditions as the bio-cell cycles through the process of filling, emptying, and drying out. The SMMWW settings based on the WSU amended soils.

Section 7 - Software Output

The following WWHM reports in this section represent individual sub-basin analysis for hydrologic flow evaluations. The following heading is common to all reports.

Western Washington Hydrology Model,

7.1 West Basin

Q

Project Name: West TDA 04-27-1-PASS
Site Name: Gemmer PRD
Site Address: 1125 172nd St NE
City : Marysville, WA
Report Date: 5/4/2022
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	12.271
Pervious Total	12.271

Impervious Land Use	acre
Impervious Total	0
Basin Total	12.271

Element Flows To:

Surface	Interflow	Groundwater

Name : Onsite Wetland
Bypass: No

GroundWater: No

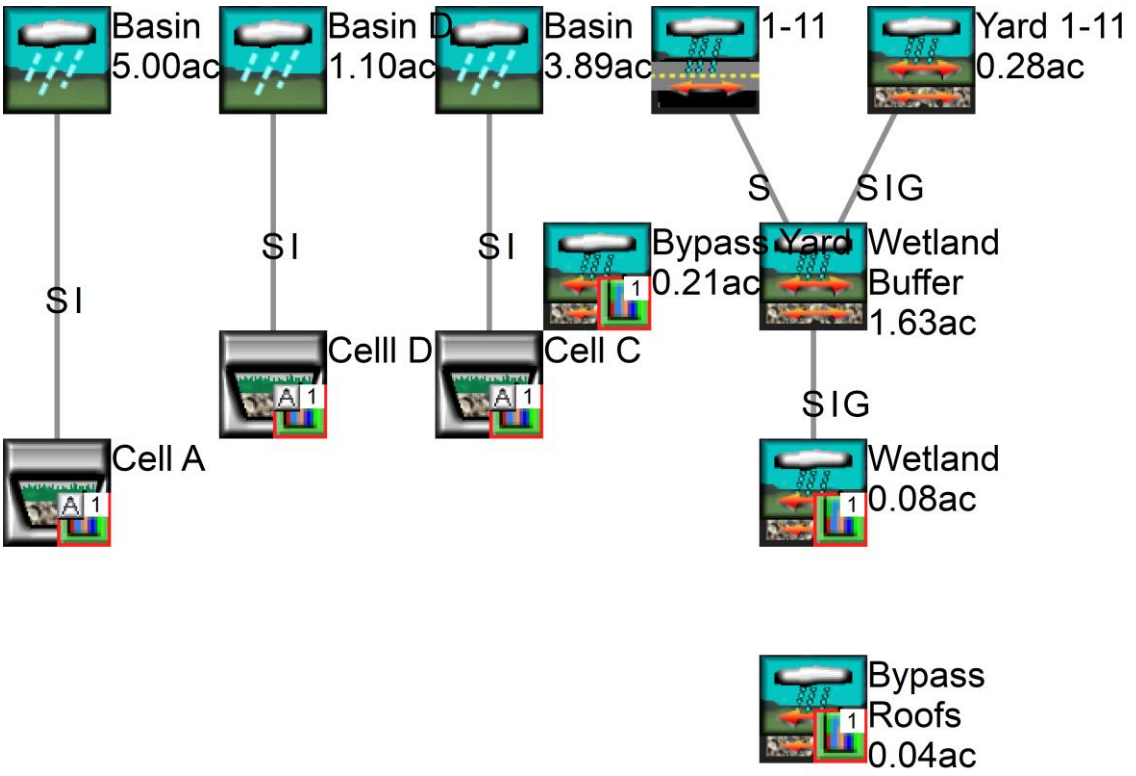
Pervious Land Use	acre
SAT, Forest, Flat	.083
C, Forest, Flat	1.625
Pervious Total	1.708

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.708

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE



Name : Basin A
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.714
Pervious Total	1.714

Impervious Land Use	acre
ROADS FLAT	0.563
ROOF TOPS FLAT	1.723
DRIVEWAYS FLAT	0.689
SIDEWALKS FLAT	0.308
Impervious Total	3.283
Basin Total	4.997

Element Flows To:

Surface	Interflow	Groundwater
Surface Cell A	Surface Cell A	

Name : Cell A
Bottom Length: 315.00 ft.
Bottom Width: 116.00 ft.

Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 0.5
Material type for third layer: GRAVEL
Underdrain used
Underdrain Diameter (feet): 1
Orifice Diameter (in.): 1.2
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 641.626
Total Outflow (ac-ft.): 651.335
Percent Through Underdrain: 98.51
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.6 in. **Elevation:** 0.1 ft.
Orifice 2 Diameter: 1.3 in. **Elevation:** 0.8 ft.

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

Cell A Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.8388	0.0000	0.0000	0.0000
0.0440	0.8388	0.0169	0.0000	0.0000
0.0879	0.8388	0.0337	0.0000	0.0000
0.1319	0.8388	0.0506	0.0000	0.0000
0.1758	0.8388	0.0674	0.0000	0.0000
0.2198	0.8388	0.0843	0.0000	0.0000
0.2637	0.8388	0.1012	0.0007	0.0000
0.3077	0.8388	0.1180	0.0010	0.0000
0.3516	0.8388	0.1349	0.0036	0.0000
0.3956	0.8388	0.1518	0.0049	0.0000
0.4396	0.8388	0.1686	0.0068	0.0000
0.4835	0.8388	0.1855	0.0077	0.0000
0.5275	0.8388	0.2023	0.0091	0.0000
0.5714	0.8388	0.2192	0.0098	0.0000
0.6154	0.8388	0.2361	0.0109	0.0000
0.6593	0.8388	0.2529	0.0115	0.0000
0.7033	0.8388	0.2698	0.0124	0.0000
0.7473	0.8388	0.2866	0.0129	0.0000
0.7912	0.8388	0.3035	0.0138	0.0000
0.8352	0.8388	0.3204	0.0142	0.0000
0.8791	0.8388	0.3372	0.0150	0.0000
0.9231	0.8388	0.3541	0.0154	0.0000
0.9670	0.8388	0.3710	0.0161	0.0000
1.0110	0.8388	0.3878	0.0165	0.0000
1.0549	0.8388	0.4047	0.0172	0.0000
1.0989	0.8388	0.4215	0.0175	0.0000
1.1429	0.8388	0.4384	0.0181	0.0000
1.1868	0.8388	0.4553	0.0185	0.0000
1.2308	0.8388	0.4721	0.0191	0.0000
1.2747	0.8388	0.4890	0.0194	0.0000

1.3187	0.8388	0.5058	0.0199	0.0000
1.3626	0.8388	0.5227	0.0202	0.0000
1.4066	0.8388	0.5396	0.0208	0.0000
1.4505	0.8388	0.5564	0.0211	0.0000
1.4945	0.8388	0.5733	0.0216	0.0000
1.5385	0.8388	0.5880	0.0219	0.0000
1.5824	0.8388	0.6028	0.0224	0.0000
1.6264	0.8388	0.6175	0.0227	0.0000
1.6703	0.8388	0.6323	0.0232	0.0000
1.7143	0.8388	0.6470	0.0234	0.0000
1.7582	0.8388	0.6618	0.0239	0.0000
1.8022	0.8388	0.6765	0.0241	0.0000
1.8462	0.8388	0.6913	0.0246	0.0000
1.8901	0.8388	0.7060	0.0249	0.0000
1.9341	0.8388	0.7208	0.0253	0.0000
1.9780	0.8388	0.7355	0.0256	0.0000
2.0220	0.8388	0.7508	0.0260	0.0000
2.0659	0.8388	0.7661	0.0262	0.0000
2.1099	0.8388	0.7814	0.0562	0.0000
2.1538	0.8388	0.7967	0.0568	0.0000
2.1978	0.8388	0.8120	0.0574	0.0000
2.2418	0.8388	0.8273	0.0581	0.0000
2.2857	0.8388	0.8426	0.0587	0.0000
2.3297	0.8388	0.8580	0.0593	0.0000
2.3736	0.8388	0.8733	0.0600	0.0000
2.4176	0.8388	0.8886	0.0606	0.0000
2.4615	0.8388	0.9039	0.0612	0.0000
2.5000	0.8388	0.9172	0.0618	0.0000

Surface Cell A Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
2.5000	0.8388	0.9172	0.0000	2.5375	0.0000
2.5440	0.8415	0.9542	0.0000	2.5375	0.0000
2.5879	0.8441	0.9912	0.0000	2.6862	0.0000
2.6319	0.8467	1.0284	0.0017	2.7606	0.0000
2.6758	0.8493	1.0657	0.0027	2.8349	0.0000
2.7198	0.8519	1.1030	0.0034	2.9093	0.0000
2.7637	0.8546	1.1405	0.0040	2.9837	0.0000
2.8077	0.8572	1.1782	0.0045	3.0580	0.0000
2.8516	0.8598	1.2159	0.0049	3.1324	0.0000
2.8956	0.8625	1.2538	0.0053	3.2067	0.0000
2.9396	0.8651	1.2917	0.0057	3.2811	0.0000
2.9835	0.8677	1.3298	0.0060	3.3555	0.0000
3.0275	0.8704	1.3680	0.0064	3.4298	0.0000
3.0714	0.8730	1.4063	0.0067	3.5042	0.0000
3.1154	0.8757	1.4448	0.0070	3.5785	0.0000
3.1593	0.8783	1.4833	0.0073	3.6529	0.0000
3.2033	0.8810	1.5220	0.0076	3.7272	0.0000
3.2473	0.8837	1.5608	0.0079	3.8016	0.0000
3.2912	0.8863	1.5997	0.0081	3.8760	0.0000
3.3352	0.8890	1.6387	0.0170	3.9503	0.0000
3.3791	0.8917	1.6778	0.0215	4.0247	0.0000
3.4231	0.8943	1.7171	0.0250	4.0990	0.0000
3.4670	0.8970	1.7564	0.0278	4.1734	0.0000
3.5110	0.8997	1.7959	0.0487	4.2478	0.0000
3.5549	0.9024	1.8355	0.2376	4.3221	0.0000
3.5989	0.9051	1.8753	0.5288	4.3965	0.0000
3.6429	0.9078	1.9151	0.8917	4.4708	0.0000

3.6868	0.9105	1.9551	1.3096	4.5452	0.0000
3.7308	0.9132	1.9951	1.7690	4.6196	0.0000
3.7747	0.9159	2.0353	2.2566	4.6939	0.0000
3.8187	0.9186	2.0757	2.7587	4.7683	0.0000
3.8626	0.9213	2.1161	3.2614	4.8426	0.0000
3.9066	0.9240	2.1567	3.7509	4.9170	0.0000
3.9505	0.9267	2.1973	4.2141	4.9914	0.0000
3.9945	0.9294	2.2381	4.6391	5.0657	0.0000
4.0000	0.9298	2.2432	5.0165	5.0750	0.0000

Name : Surface Cell A

Element Flows To:

Outlet 1	**Outlet 2**
Cell A	

Name : Basin C
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**1.334**
Pervious Total	**1.334**

Impervious Land Use	**acre**
ROADS FLAT	**0.433**
ROOF TOPS FLAT	**1.429**
DRIVEWAYS FLAT	**0.462**
SIDEWALKS FLAT	**0.23**
Impervious Total	**2.554**
Basin Total	**3.888**

Element Flows To:

Surface	**Interflow**	**Groundwater**
Surface Cell C	Surface Cell C	

Name : Basin D
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.723**
Pervious Total	**0.723**

Impervious Land Use	acre
ROOF TOPS FLAT	0.295
DRIVEWAYS FLAT	0.081
Impervious Total	0.376
Basin Total	1.099

Element Flows To:

Surface	Interflow	Groundwater
Surface Celll D	Surface Celll D	

Name : Cell C
Bottom Length: 605.00 ft.
Bottom Width: 16.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 3
Material type for third layer: GRAVEL 0.48
Underdrain used
Underdrain Diameter (feet): 0.5
Orifice Diameter (in.): 0.8
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 433.258
Total Outflow (ac-ft.): 473.513
Percent Through Underdrain: 91.5
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.6 in. **Elevation:** 0.1 ft.
Orifice 2 Diameter: 0.2 in. **Elevation:** -0.5 ft.
Orifice 3 Diameter: 0.1 in. **Elevation:** -1.5 ft.

Element Flows To:

Outlet 1	Outlet 2

Cell C Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.2222	0.0000	0.0000	0.0000
0.0714	0.2222	0.0073	0.0000	0.0000
0.1429	0.2222	0.0145	0.0000	0.0000
0.2143	0.2222	0.0218	0.0000	0.0000
0.2857	0.2222	0.0290	0.0000	0.0000
0.3571	0.2222	0.0363	0.0000	0.0000
0.4286	0.2222	0.0436	0.0000	0.0000
0.5000	0.2222	0.0508	0.0000	0.0000
0.5714	0.2222	0.0581	0.0000	0.0000

0.6429	0.2222	0.0653	0.0000	0.0000
0.7143	0.2222	0.0726	0.0000	0.0000
0.7857	0.2222	0.0798	0.0000	0.0000
0.8571	0.2222	0.0871	0.0000	0.0000
0.9286	0.2222	0.0944	0.0000	0.0000
1.0000	0.2222	0.1016	0.0000	0.0000
1.0714	0.2222	0.1089	0.0000	0.0000
1.1429	0.2222	0.1161	0.0000	0.0000
1.2143	0.2222	0.1234	0.0000	0.0000
1.2857	0.2222	0.1307	0.0000	0.0000
1.3571	0.2222	0.1379	0.0000	0.0000
1.4286	0.2222	0.1452	0.0000	0.0000
1.5000	0.2222	0.1524	0.0000	0.0000
1.5714	0.2222	0.1588	0.0000	0.0000
1.6429	0.2222	0.1651	0.0000	0.0000
1.7143	0.2222	0.1715	0.0000	0.0000
1.7857	0.2222	0.1778	0.0000	0.0000
1.8571	0.2222	0.1842	0.0000	0.0000
1.9286	0.2222	0.1905	0.0000	0.0000
2.0000	0.2222	0.1969	0.0000	0.0000
2.0714	0.2222	0.2044	0.0000	0.0000
2.1429	0.2222	0.2120	0.0000	0.0000
2.2143	0.2222	0.2195	0.0000	0.0000
2.2857	0.2222	0.2270	0.0000	0.0000
2.3571	0.2222	0.2346	0.0000	0.0000
2.4286	0.2222	0.2421	0.0000	0.0000
2.5000	0.2222	0.2497	0.0000	0.0000
2.5714	0.2222	0.2572	0.0000	0.0000
2.6429	0.2222	0.2647	0.0000	0.0000
2.7143	0.2222	0.2723	0.0000	0.0000
2.7857	0.2222	0.2798	0.0000	0.0000
2.8571	0.2222	0.2874	0.0000	0.0000
2.9286	0.2222	0.2949	0.0000	0.0000
3.0000	0.2222	0.3024	0.0000	0.0000
3.0714	0.2222	0.3100	0.0000	0.0000
3.1429	0.2222	0.3175	0.0000	0.0000
3.2143	0.2222	0.3251	0.0000	0.0000
3.2857	0.2222	0.3326	0.0000	0.0000
3.3571	0.2222	0.3401	0.0000	0.0000
3.4286	0.2222	0.3477	0.0000	0.0000
3.5000	0.2222	0.3552	0.0000	0.0000
3.5714	0.2222	0.3628	0.0000	0.0000
3.6429	0.2222	0.3703	0.0000	0.0000
3.7143	0.2222	0.3778	0.0000	0.0000
3.7857	0.2222	0.3854	0.0000	0.0000
3.8571	0.2222	0.3929	0.0000	0.0000
3.9286	0.2222	0.4004	0.0000	0.0000
4.0000	0.2222	0.4080	0.0000	0.0000
4.0714	0.2222	0.4155	0.0000	0.0000
4.1429	0.2222	0.4231	0.0000	0.0000
4.2143	0.2222	0.4306	0.0000	0.0000
4.2857	0.2222	0.4381	0.0000	0.0000
4.3571	0.2222	0.4457	0.0000	0.0000
4.4286	0.2222	0.4532	0.0000	0.0000
4.5000	0.2222	0.4608	0.0000	0.0000
4.5714	0.2222	0.4683	0.0000	0.0000
4.6429	0.2222	0.4758	0.0000	0.0000
4.7143	0.2222	0.4834	0.0000	0.0000

4.7857	0.2222	0.4909	0.0000	0.0000
4.8571	0.2222	0.4985	0.0000	0.0000
4.9286	0.2222	0.5060	0.0000	0.0000
5.0000	0.2222	0.5135	0.0000	0.0000

Surface Cell C Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
5.0000	0.2222	0.5135	0.0000	0.6722	0.0000
5.0714	0.2283	0.5296	0.0000	0.6722	0.0000
5.1429	0.2345	0.5462	0.0000	0.7362	0.0000
5.2143	0.2406	0.5631	0.0000	0.7683	0.0000
5.2857	0.2467	0.5805	0.0000	0.8003	0.0000
5.3571	0.2529	0.5984	0.0013	0.8323	0.0000
5.4286	0.2590	0.6167	0.0019	0.8643	0.0000
5.5000	0.2652	0.6354	0.0037	0.8963	0.0000
5.5714	0.2714	0.6545	0.0045	0.9283	0.0000
5.6429	0.2776	0.6742	0.0054	0.9603	0.0000
5.7143	0.2837	0.6942	0.0059	0.9923	0.0000
5.7857	0.2899	0.7147	0.0065	1.0243	0.0000
5.8571	0.2961	0.7356	0.0069	1.0564	0.0000
5.9286	0.3024	0.7570	0.0074	1.0884	0.0000
6.0000	0.3086	0.7788	0.0076	1.1204	0.0000
6.0714	0.3148	0.8011	0.0081	1.1524	0.0000
6.1429	0.3211	0.8238	0.0083	1.1844	0.0000
6.2143	0.3273	0.8469	0.0088	1.2164	0.0000
6.2857	0.3336	0.8705	0.0090	1.2484	0.0000
6.3571	0.3398	0.8946	0.0094	1.2804	0.0000
6.4286	0.3461	0.9191	0.0096	1.3124	0.0000
6.5000	0.3524	0.9440	0.0099	1.3444	0.0000
6.5000	0.3524	0.9440	0.0101	1.3444	0.0000

Name : Surface Cell C

Element Flows To:

Outlet 1	Outlet 2
Cell C	

Name : Celll D
Bottom Length: 116.00 ft.
Bottom Width: 70.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 2
Material type for third layer: GRAVEL
Underdrain used
Underdrain Diameter (feet): 0.5
Orifice Diameter (in.): 0.5
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 104.73
Total Outflow (ac-ft.): 106.521
Percent Through Underdrain: 98.32
Discharge Structure
Riser Height: 0.75 ft.

Riser Diameter: 12 in.
Orifice 1 Diameter: 1 in. **Elevation:** 0.1 ft.
Orifice 2 Diameter: 0.5 in. **Elevation:** 0.5 ft.

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

Celll D Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1864	0.0000	0.0000	0.0000
0.0577	0.1864	0.0049	0.0000	0.0000
0.1154	0.1864	0.0098	0.0000	0.0000
0.1731	0.1864	0.0148	0.0000	0.0000
0.2308	0.1864	0.0197	0.0000	0.0000
0.2885	0.1864	0.0246	0.0000	0.0000
0.3462	0.1864	0.0295	0.0000	0.0000
0.4038	0.1864	0.0344	0.0000	0.0000
0.4615	0.1864	0.0393	0.0000	0.0000
0.5192	0.1864	0.0443	0.0000	0.0000
0.5769	0.1864	0.0492	0.0000	0.0000
0.6346	0.1864	0.0541	0.0000	0.0000
0.6923	0.1864	0.0590	0.0000	0.0000
0.7500	0.1864	0.0639	0.0000	0.0000
0.8077	0.1864	0.0689	0.0000	0.0000
0.8654	0.1864	0.0738	0.0000	0.0000
0.9231	0.1864	0.0787	0.0000	0.0000
0.9808	0.1864	0.0836	0.0000	0.0000
1.0385	0.1864	0.0885	0.0000	0.0000
1.0962	0.1864	0.0934	0.0000	0.0000
1.1538	0.1864	0.0984	0.0000	0.0000
1.2115	0.1864	0.1033	0.0000	0.0000
1.2692	0.1864	0.1082	0.0000	0.0000
1.3269	0.1864	0.1131	0.0000	0.0000
1.3846	0.1864	0.1180	0.0000	0.0000
1.4423	0.1864	0.1229	0.0000	0.0000
1.5000	0.1864	0.1273	0.0000	0.0000
1.5577	0.1864	0.1316	0.0000	0.0000
1.6154	0.1864	0.1359	0.0000	0.0000
1.6731	0.1864	0.1402	0.0000	0.0000
1.7308	0.1864	0.1445	0.0000	0.0000
1.7885	0.1864	0.1488	0.0000	0.0000
1.8462	0.1864	0.1531	0.0000	0.0000
1.9038	0.1864	0.1574	0.0000	0.0000
1.9615	0.1864	0.1617	0.0000	0.0000
2.0192	0.1864	0.1661	0.0000	0.0000
2.0769	0.1864	0.1706	0.0000	0.0000
2.1346	0.1864	0.1751	0.0000	0.0000
2.1923	0.1864	0.1795	0.0000	0.0000
2.2500	0.1864	0.1840	0.0000	0.0000
2.3077	0.1864	0.1884	0.0000	0.0000
2.3654	0.1864	0.1929	0.0000	0.0000
2.4231	0.1864	0.1974	0.0000	0.0000
2.4808	0.1864	0.2018	0.0000	0.0000
2.5385	0.1864	0.2063	0.0000	0.0000

2.5962	0.1864	0.2108	0.0000	0.0000
2.6538	0.1864	0.2152	0.0000	0.0000
2.7115	0.1864	0.2197	0.0000	0.0000
2.7692	0.1864	0.2241	0.0000	0.0000
2.8269	0.1864	0.2286	0.0000	0.0000
2.8846	0.1864	0.2331	0.0000	0.0000
2.9423	0.1864	0.2375	0.0000	0.0000
3.0000	0.1864	0.2420	0.0000	0.0000
3.0577	0.1864	0.2465	0.0000	0.0000
3.1154	0.1864	0.2509	0.0000	0.0000
3.1731	0.1864	0.2554	0.0000	0.0000
3.2308	0.1864	0.2599	0.0000	0.0000
3.2885	0.1864	0.2643	0.0000	0.0000
3.3462	0.1864	0.2688	0.0000	0.0000
3.4038	0.1864	0.2732	0.0000	0.0000
3.4615	0.1864	0.2777	0.0000	0.0000
3.5192	0.1864	0.2822	0.0000	0.0000
3.5769	0.1864	0.2866	0.0000	0.0000
3.6346	0.1864	0.2911	0.0000	0.0000
3.6923	0.1864	0.2956	0.0000	0.0000
3.7500	0.1864	0.3000	0.0000	0.0000
3.8077	0.1864	0.3045	0.0000	0.0000
3.8654	0.1864	0.3089	0.0000	0.0000
3.9231	0.1864	0.3134	0.0000	0.0000
3.9808	0.1864	0.3179	0.0000	0.0000
4.0000	0.1864	0.3194	0.0000	0.0000

Surface Celll D Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
4.0000	0.1864	0.3194	0.0000	0.5639	0.0000
4.0577	0.1879	0.3302	0.0000	0.5639	0.0000
4.1154	0.1894	0.3410	0.0000	0.6073	0.0000
4.1731	0.1909	0.3520	0.0000	0.6290	0.0000
4.2308	0.1924	0.3631	0.0000	0.6506	0.0000
4.2885	0.1939	0.3742	0.0000	0.6723	0.0000
4.3462	0.1954	0.3854	0.0003	0.6940	0.0000
4.4038	0.1969	0.3967	0.0005	0.7157	0.0000
4.4615	0.1984	0.4082	0.0011	0.7374	0.0000
4.5192	0.1999	0.4196	0.0015	0.7591	0.0000
4.5769	0.2015	0.4312	0.0018	0.7808	0.0000
4.6346	0.2030	0.4429	0.0020	0.8025	0.0000
4.6923	0.2045	0.4546	0.0022	0.8241	0.0000
4.7500	0.2061	0.4665	0.0023	0.8458	0.0000
4.8077	0.2076	0.4784	0.0025	0.8675	0.0000
4.8654	0.2092	0.4904	0.0026	0.8892	0.0000
4.9231	0.2108	0.5026	0.0028	0.9109	0.0000
4.9808	0.2123	0.5148	0.0029	0.9326	0.0000
5.0385	0.2139	0.5271	0.0030	0.9543	0.0000
5.0962	0.2155	0.5394	0.0031	0.9760	0.0000
5.1538	0.2171	0.5519	0.0032	0.9977	0.0000
5.2115	0.2187	0.5645	0.0033	1.0193	0.0000
5.2500	0.2197	0.5729	0.0034	1.0338	0.0000

Name : Surface Celll D

Element Flows To:

Outlet 1 **Outlet 2**

Celll D

Name : 1-11
Bypass: No

Impervious Land Use	acre
ROOF TOPS FLAT LAT	0.516

Element Flows To:

Outlet 1	Outlet 2
Wetland Buffer	

Name : Yard 1-11
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.282

Element Flows To:

Surface	Interflow	Groundwater
Wetland Buffer	Wetland Buffer	Wetland Buffer

Name : Wetland Buffer
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	1.625

Element Flows To:

Surface	Interflow	Groundwater
Wetland	Wetland	Wetland

Name : Wetland
Bypass: No

GroundWater: No

Pervious Land Use	acre
SAT, Forest, Flat	.083

Element Flows To:

Surface	Interflow	Groundwater

Name : Bypass Yard
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.212

Element Flows To:

Surface	Interflow	Groundwater

Name : Bypass Roofs
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.043

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:13.979
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:6.016
Total Impervious Area:6.729

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.299963
5 year	0.444601
10 year	0.543729
25 year	0.671671
50 year	0.768521
100 year	0.866466

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)

2 year	0.246139
5 year	0.498103
10 year	0.748407
25 year	1.190693
50 year	1.634559
100 year	2.198674

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1500	22736	19434	85	Pass
0.1562	20343	12611	61	Pass
0.1625	18463	9702	52	Pass
0.1687	16750	8412	50	Pass
0.1750	15152	7401	48	Pass
0.1812	13548	6468	47	Pass
0.1875	12341	5642	45	Pass
0.1937	11225	4999	44	Pass
0.2000	10213	4447	43	Pass
0.2062	9142	3968	43	Pass
0.2125	8350	3702	44	Pass
0.2187	7599	3461	45	Pass
0.2250	6902	3264	47	Pass
0.2312	6205	2990	48	Pass
0.2375	5685	2757	48	Pass
0.2437	5232	2584	49	Pass
0.2499	4821	2438	50	Pass
0.2562	4363	2286	52	Pass
0.2624	4015	2171	54	Pass
0.2687	3647	2049	56	Pass
0.2749	3335	1912	57	Pass
0.2812	2988	1758	58	Pass
0.2874	2689	1659	61	Pass
0.2937	2468	1567	63	Pass
0.2999	2267	1492	65	Pass
0.3062	2061	1392	67	Pass
0.3124	1914	1330	69	Pass
0.3187	1795	1268	70	Pass
0.3249	1684	1193	70	Pass
0.3312	1550	1127	72	Pass
0.3374	1465	1076	73	Pass
0.3437	1386	1024	73	Pass
0.3499	1319	987	74	Pass
0.3562	1237	948	76	Pass
0.3624	1179	907	76	Pass
0.3687	1126	873	77	Pass
0.3749	1071	843	78	Pass
0.3812	999	803	80	Pass
0.3874	937	774	82	Pass
0.3936	901	754	83	Pass
0.3999	872	728	83	Pass
0.4061	831	699	84	Pass
0.4124	793	679	85	Pass
0.4186	755	666	88	Pass
0.4249	728	645	88	Pass

0.4311	691	623	90	Pass
0.4374	670	606	90	Pass
0.4436	650	586	90	Pass
0.4499	632	565	89	Pass
0.4561	612	539	88	Pass
0.4624	598	515	86	Pass
0.4686	583	504	86	Pass
0.4749	567	488	86	Pass
0.4811	555	463	83	Pass
0.4874	545	450	82	Pass
0.4936	535	437	81	Pass
0.4999	521	422	80	Pass
0.5061	505	411	81	Pass
0.5124	490	404	82	Pass
0.5186	468	390	83	Pass
0.5249	456	379	83	Pass
0.5311	440	370	84	Pass
0.5373	433	363	83	Pass
0.5436	421	354	84	Pass
0.5498	412	345	83	Pass
0.5561	399	340	85	Pass
0.5623	394	336	85	Pass
0.5686	380	325	85	Pass
0.5748	372	319	85	Pass
0.5811	357	312	87	Pass
0.5873	352	295	83	Pass
0.5936	341	292	85	Pass
0.5998	334	289	86	Pass
0.6061	322	282	87	Pass
0.6123	315	273	86	Pass
0.6186	307	268	87	Pass
0.6248	304	261	85	Pass
0.6311	296	256	86	Pass
0.6373	291	252	86	Pass
0.6436	284	246	86	Pass
0.6498	281	242	86	Pass
0.6561	271	237	87	Pass
0.6623	264	233	88	Pass
0.6686	257	226	87	Pass
0.6748	251	222	88	Pass
0.6811	242	215	88	Pass
0.6873	234	215	91	Pass
0.6935	229	211	92	Pass
0.6998	221	209	94	Pass
0.7060	209	204	97	Pass
0.7123	201	201	100	Pass
0.7185	197	197	100	Pass
0.7248	190	190	100	Pass
0.7310	184	185	100	Pass
0.7373	178	181	101	Pass
0.7435	174	177	101	Pass
0.7498	166	171	103	Pass
0.7560	161	165	102	Pass
0.7623	152	165	108	Pass
0.7685	148	163	110	Pass

7.2 East Basin

Project Name: East Basin0710
Site Name: Gemmer PRD
Site Address: 1125 172nd St NE
City : Marysville, WA
Report Date: 7/11/2022
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	8.994
C, Forest, Mod	5.501
Pervious Total	**14.495**

Impervious Land Use	acre
Impervious Total	**0**
Basin Total	**14.495**

Element Flows To:

Surface	Interflow	Groundwater

Name : Wetland Buffer
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.465
Pervious Total	**0.465**

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.465

Element Flows To:

Surface	Interflow	Groundwater

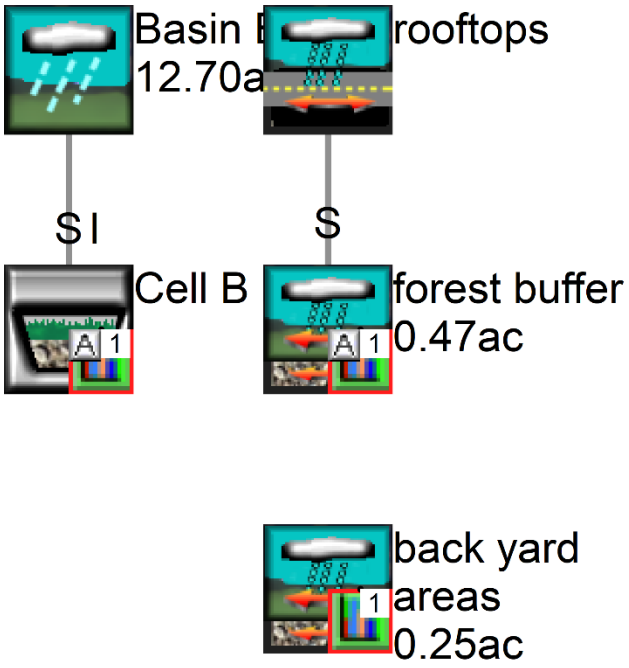
MITIGATED LAND USE

Name : Basin B
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	3.199
Pervious Total	3.199

Impervious Land Use	acre
ROADS FLAT	2.244
ROOF TOPS FLAT	4.364
DRIVEWAYS FLAT	1.839
SIDEWALKS FLAT	1.054
Impervious Total	9.501
Basin Total	12.7



Element Flows To:

Surface	Interflow	Groundwater
Surface Cell B	Surface Cell B	

Name : Cell B
Bottom Length: 1505.00 ft.
Bottom Width: 22.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 8
Material type for third layer: GRAVEL 0.45
Underdrain used
Underdrain Diameter (feet): 1

Orifice Diameter (in.): 1.5
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 1537.056
Total Outflow (ac-ft.): 1667.748
Percent Through Underdrain: 92.16
Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 24 in.
Notch Type: Rectangular
Notch Width: 0.200 ft.
Notch Height: 0.480 ft.
Orifice 1 Diameter: 0.2 in. **Elevation:** -5.2 ft.
Orifice 2 Diameter: 0.4 in. **Elevation:** -1 ft.
Orifice 3 Diameter: 0.2 in. **Elevation:** 0.025 ft.

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

Cell B Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.7601	0.0000	0.0000	0.0000
0.1209	0.7601	0.0420	0.0000	0.0000
0.2418	0.7601	0.0840	0.0000	0.0000
0.3626	0.7601	0.1261	0.0000	0.0000
0.4835	0.7601	0.1681	0.0038	0.0000
0.6044	0.7601	0.2101	0.0181	0.0000
0.7253	0.7601	0.2521	0.0330	0.0000
0.8462	0.7601	0.2941	0.0367	0.0000
0.9670	0.7601	0.3361	0.0386	0.0000
1.0879	0.7601	0.3782	0.0395	0.0000
1.2088	0.7601	0.4202	0.0413	0.0000
1.3297	0.7601	0.4622	0.0423	0.0000
1.4505	0.7601	0.5042	0.0452	0.0000
1.5714	0.7601	0.5410	0.0467	0.0000
1.6923	0.7601	0.5777	0.0497	0.0000
1.8132	0.7601	0.6145	0.0532	0.0000
1.9341	0.7601	0.6512	0.0550	0.0000
2.0549	0.7601	0.6921	0.0569	0.0000
2.1758	0.7601	0.7330	0.0597	0.0000
2.2967	0.7601	0.7739	0.0611	0.0000
2.4176	0.7601	0.8148	0.0618	0.0000
2.5385	0.7601	0.8556	0.0639	0.0000
2.6593	0.7601	0.8965	0.0650	0.0000
2.7802	0.7601	0.9374	0.0672	0.0000
2.9011	0.7601	0.9783	0.0683	0.0000
3.0220	0.7601	1.0192	0.0704	0.0000
3.1429	0.7601	1.0601	0.0715	0.0000
3.2637	0.7601	1.1010	0.0728	0.0000
3.3846	0.7601	1.1419	0.0749	0.0000
3.5055	0.7601	1.1827	0.0760	0.0000
3.6264	0.7601	1.2236	0.0778	0.0000
3.7473	0.7601	1.2645	0.0788	0.0000
3.8681	0.7601	1.3054	0.0807	0.0000
3.9890	0.7601	1.3463	0.0830	0.0000

4.1099	0.7601	1.3872	0.0855	0.0000
4.2308	0.7601	1.4281	0.0879	0.0000
4.3516	0.7601	1.4689	0.0904	0.0000
4.4725	0.7601	1.5098	0.0929	0.0000
4.5934	0.7601	1.5507	0.0953	0.0000
4.7143	0.7601	1.5916	0.0976	0.0000
4.8352	0.7601	1.6325	0.0999	0.0000
4.9560	0.7601	1.6734	0.1021	0.0000
5.0769	0.7601	1.7143	0.1043	0.0000
5.1978	0.7601	1.7552	0.1064	0.0000
5.3187	0.7601	1.7960	0.1085	0.0000
5.4396	0.7601	1.8369	0.1106	0.0000
5.5604	0.7601	1.8778	0.1126	0.0000
5.6813	0.7601	1.9187	0.1146	0.0000
5.8022	0.7601	1.9596	0.1166	0.0000
5.9231	0.7601	2.0005	0.1185	0.0000
6.0440	0.7601	2.0414	0.1204	0.0000
6.1648	0.7601	2.0822	0.1223	0.0000
6.2857	0.7601	2.1231	0.1241	0.0000
6.4066	0.7601	2.1640	0.1259	0.0000
6.5275	0.7601	2.2049	0.1277	0.0000
6.6484	0.7601	2.2458	0.1294	0.0000
6.7692	0.7601	2.2867	0.1312	0.0000
6.8901	0.7601	2.3276	0.1329	0.0000
7.0110	0.7601	2.3685	0.1346	0.0000
7.1319	0.7601	2.4093	0.1362	0.0000
7.2527	0.7601	2.4502	0.1379	0.0000
7.3736	0.7601	2.4911	0.1395	0.0000
7.4945	0.7601	2.5320	0.1411	0.0000
7.6154	0.7601	2.5729	0.1427	0.0000
7.7363	0.7601	2.6138	0.1443	0.0000
7.8571	0.7601	2.6547	0.1458	0.0000
7.9780	0.7601	2.6955	0.1474	0.0000
8.0989	0.7601	2.7364	0.1489	0.0000
8.2198	0.7601	2.7773	0.1504	0.0000
8.3407	0.7601	2.8182	0.1519	0.0000
8.4615	0.7601	2.8591	0.1534	0.0000
8.5824	0.7601	2.9000	0.1548	0.0000
8.7033	0.7601	2.9409	0.1563	0.0000
8.8242	0.7601	2.9818	0.1577	0.0000
8.9451	0.7601	3.0226	0.1592	0.0000
9.0659	0.7601	3.0635	0.1606	0.0000
9.1868	0.7601	3.1044	0.1620	0.0000
9.3077	0.7601	3.1453	0.1634	0.0000
9.4286	0.7601	3.1862	0.1647	0.0000
9.5495	0.7601	3.2271	0.1661	0.0000
9.6703	0.7601	3.2680	0.1675	0.0000
9.7912	0.7601	3.3089	0.1688	0.0000
9.9121	0.7601	3.3497	0.1702	0.0000
10.000	0.7601	3.3795	0.1931	0.0000

Surface Cell B Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
10.000	0.7601	3.3795	0.0068	2.2993	0.0000
10.121	0.7855	3.4729	0.0283	2.2993	0.0000
10.242	0.8110	3.5694	0.0743	2.6699	0.0000
10.363	0.8365	3.6690	0.1327	2.8552	0.0000
10.484	0.8620	3.7716	0.1993	3.0405	0.0000

10.604	0.8875	3.8774	0.9240	3.2258	0.0000
10.725	0.9131	3.9862	2.4596	3.4111	0.0000
10.846	0.9387	4.0981	4.4078	3.5964	0.0000
10.967	0.9643	4.2131	6.5241	3.7816	0.0000
11.000	0.9713	4.2450	8.5603	3.8322	0.0000

Name : Surface Cell B

Element Flows To:

Outlet 1	**Outlet 2**
Cell B	

Name : forest buffer
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Forest, Flat	**.465**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : back yard areas
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.246**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : rooftops
Bypass: No

Impervious Land Use	**acre**
ROOF TOPS FLAT LAT	**0.451**

Element Flows To:

Outlet 1	**Outlet 2**
forest buffer	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:14.96
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:3.91
Total Impervious Area:9.952

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.326144
5 year	0.48784
10 year	0.599402
25 year	0.744082
50 year	0.854039
100 year	0.965566

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.204081
5 year	0.404684
10 year	0.614579
25 year	1.006239
50 year	1.421162
100 year	1.974537

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1631	21774	14322	65	Pass
0.1701	19639	9343	47	Pass
0.1770	17650	5965	33	Pass
0.1840	15853	3846	24	Pass
0.1910	14444	3337	23	Pass
0.1980	13043	3063	23	Pass
0.2049	11779	2817	23	Pass
0.2119	10677	2528	23	Pass
0.2189	9584	2321	24	Pass
0.2259	8675	2147	24	Pass
0.2329	7854	2025	25	Pass
0.2398	7056	1903	26	Pass
0.2468	6382	1689	26	Pass
0.2538	5811	1594	27	Pass
0.2608	5294	1512	28	Pass
0.2678	4845	1433	29	Pass
0.2747	4415	1359	30	Pass

0.2817	4032	1290	31	Pass
0.2887	3636	1180	32	Pass
0.2957	3294	1102	33	Pass
0.3027	2971	1040	35	Pass
0.3096	2654	978	36	Pass
0.3166	2432	916	37	Pass
0.3236	2214	870	39	Pass
0.3306	2029	835	41	Pass
0.3376	1879	789	41	Pass
0.3445	1744	734	42	Pass
0.3515	1630	692	42	Pass
0.3585	1514	652	43	Pass
0.3655	1420	615	43	Pass
0.3725	1346	572	42	Pass
0.3794	1274	511	40	Pass
0.3864	1205	463	38	Pass
0.3934	1142	420	36	Pass
0.4004	1081	381	35	Pass
0.4074	1016	352	34	Pass
0.4143	947	347	36	Pass
0.4213	911	340	37	Pass
0.4283	871	338	38	Pass
0.4353	839	335	39	Pass
0.4423	798	333	41	Pass
0.4492	755	329	43	Pass
0.4562	724	326	45	Pass
0.4632	691	318	46	Pass
0.4702	666	314	47	Pass
0.4771	647	308	47	Pass
0.4841	626	303	48	Pass
0.4911	609	299	49	Pass
0.4981	592	295	49	Pass
0.5051	576	292	50	Pass
0.5120	563	290	51	Pass
0.5190	552	288	52	Pass
0.5260	541	287	53	Pass
0.5330	525	286	54	Pass
0.5400	512	280	54	Pass
0.5469	497	278	55	Pass
0.5539	473	277	58	Pass
0.5609	458	276	60	Pass
0.5679	446	270	60	Pass
0.5749	438	262	59	Pass
0.5818	425	255	60	Pass
0.5888	411	250	60	Pass
0.5958	404	248	61	Pass
0.6028	393	241	61	Pass
0.6098	382	239	62	Pass
0.6167	368	235	63	Pass
0.6237	357	232	64	Pass
0.6307	353	226	64	Pass
0.6377	340	220	64	Pass
0.6447	334	214	64	Pass
0.6516	321	203	63	Pass
0.6586	313	193	61	Pass
0.6656	307	191	62	Pass
0.6726	302	189	62	Pass
0.6796	297	185	62	Pass

0.6865	290	183	63	Pass
0.6935	283	178	62	Pass
0.7005	272	176	64	Pass
0.7075	268	174	64	Pass
0.7144	260	169	65	Pass
0.7214	251	166	66	Pass
0.7284	245	162	66	Pass
0.7354	237	160	67	Pass
0.7424	231	158	68	Pass
0.7493	223	154	69	Pass
0.7563	209	152	72	Pass
0.7633	203	148	72	Pass
0.7703	196	145	73	Pass
0.7773	191	141	73	Pass
0.7842	186	139	74	Pass
0.7912	178	137	76	Pass
0.7982	172	133	77	Pass
0.8052	166	132	79	Pass
0.8122	158	130	82	Pass
0.8191	152	130	85	Pass
0.8261	145	128	88	Pass
0.8331	137	126	91	Pass
0.8401	131	126	96	Pass
0.8471	126	126	100	Pass
0.8540	121	126	104	Pass