DRAINAGE REPORT AND STORMWATER POLLUTION PREVENTION PLAN

2401 INTER

PUYALLUP, WASHINGTON
PARCEL NO. 2105200150

September, 2022

PROJECT ADDRESS:
2401 INTER AVE SE
PUYALLUP, WA 98372

PROPERTY OWNER:
MIKE PHAIR
615 EAST PIONEER #209
PUYALLUP, WA 98372

ENGINEER:
MCINNIS ENGINEERING
535 DOCK ST., SUITE 111
CONTACT: WILL MCINNIS
(253) 414-1992

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Project Engineer's Certification:

"I hereby state that this Storm Drainage Report and Stormwater Pollution Prevention Plan for the 2401 Inter project has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the city of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me."

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Section 1: Proposed Project Description

The project address is 2401 Inter Ave SE Puyallup, WA 98372. Parcel Number 2105200150. See Figure 1 in Appendix A. The project parcel consists of approximately 80,586 square feet (SF). The project proposes the addition of a building. The building will be on the northwest corner of the property and be approximately 4,800 SF. The plan proposes a total hard surface area of 60,250 SF. The proposed landscape is approximately 20,150 SF.

The project proposed projects limits consist of approximately 80,586 SF. This includes the proposed parking, buildings, Contech water quality chamber, ADS detention chamber and landscaped areas. Areas cleared or regraded not proposed for impervious surface shall be restored to meet the soil amendment BMP requirements per the 2021 Pierce County Stormwater Management and Site Development Manual Volume III, Section 3.1 and establish a dense cover of lawn, landscape or groundcover.

The project is accessed from Inter Ave at the south side of the parcel and will utilize the proposed driveway for access. According to the SCS soil mapping, the soils on the site are comprised completely of Briscot loam soils. The site is flat and maintains a 0%-2% slope. The parcel area within the clearing limits is flat with most of the slopes beyond the extents of the proposed site area. See Figure 2 in Appendix A. The parcel area within the Clearing limits is flat with most of the slopes beyond the extents of the proposed site area as shown in Figure 3: Surface Exhibit.

Table 1: Impervious/ Pervious Areas

Project Land Use	Existing Area (SF)	Proposed Area (SF)	Area Change (SF)
Roofs	891	4,800	+3,909
Asphalt Parking	-	55,450	+55,450
Landscape Area	-	20,150	+20,150
Gravel	50,100	-	-50,100
Native Land / Undisturbed	29,595	636	-77,790
Total Impervious	50,991	60,250	+9,259
Total Pervious	29,595	20,150	-9,259
Project Area	**80,586**	**80,586**	-

1.1 Compliance with Minimum Requirement

The proposed project improvements consist of approximately 60,250 SF of new hard surface. The proposed total hard area results in 75% of the site. Per the 2019 Western Washington Stormwater Management Manual this project must comply with all minimum requirements.

Minimum Requirement # 1: Preparation of Stormwater Site Plan

A stormwater site plan has been prepared and will be submitted to the City of Puyallup with this report. Additionally, see Figure 3 in Appendix A attached with this report.

Minimum Requirement # 2: Construction Stormwater Pollution Prevention

A temporary erosion and sediment control plan is part of the construction documents provided with this report (Figure 5, Appendix A). The proposed project has an approximate clearing and grading area of 68,608 SF. Earthwork estimates consist of 0 cubic yards (CY) of cut, 11,124 CY of fill with a net import of 11,124 CY. These estimates do not include stripping. The excess soil will be stockpiled for reuse on the site for amending the soils per soil amendment BMP requirements. See below for how each of the 13 elements of the Stormwater Pollution Prevention Plan (SWPPP) are addressed as follows.

- Element # 1: Preserve vegetation/mark clearing limits
  - Clearing limits are shown on the plan and as noted, shall be marked using high visibility plastic fencing. All vegetated area outside the marked clearing limits shall be preserved in existing conditions.

- Element # 2: Established Construction Entrance
  - As shown on the plans, a construction entrance is provided per City of Puyallup standards.

- Element # 3: Control Flow Rates
  - The proposed silt fence will be placed along all the downgradient boundaries of the proposed project limits as a precautionary measure. Contractor shall adjust silt fencing as necessary to keep sediment laden runoff onsite and are noted in the ESC plan.

- Element # 4: Install Sediment Control
  - Silt fence will be placed along all the downgradient boundaries of the proposed project limits to remove any sediment laden runoff from leaving the site, as shown on plans. Contractor shall adjust silt fencing as necessary to keep sediment laden runoff onsite.

- Element # 5: Stabilize Soils
  - Per the standard erosion control notes provided on the plans, all exposed soils shall be hydroseeded and exposed soils shall be covered if left unworked for longer than 14 days.

- Element # 6: Protect Slopes
  - No slopes over 20% are being disturbed. All exposed soils not covered by the parking surfaces and building foundation will be hydroseeded and there will be no slopes greater than 2:1.

- Element # 7: Protect Drain Inlets.
  - Drain inlets are being protected from sediment and high energy flows through the use of catch basin inserts. Catch basin inserts will be installed in any existing catch basins within 500 feet from the project site.

- Element # 8: Stabilize Channels and Outlets.
  - There are no proposed channels or outlets proposed as part of the SWPPP. There is an existing swale that will need to be maintained according to the checklist in Appendix D.

- Element # 9: Control Pollutants.
  - The only pollutants generated by this project are those that are commonly associated with the construction operations. Contractor is responsible to follow all city of Puyallup pollution prevention measures. Contractor to follow all city of Puyallup pollution control standard, particularly when handling concrete, vehicle activity, and paving operations.

- Element # 10: Control De-watering.
  - Because of high groundwater, dewatering may be required on the site. If dewatering is required, the contractor will use Baker Tanks and every effort will be made to avoid discharge into the storm system

- Element # 11: Maintain BMPs
  - The contractor and property owner will be responsible for checking and maintaining all stormwater BMPs. Contractor to repair as needed or as specified by the inspector.

- Element # 12: Manage the Project.
  - The contractor will be tasked with managing the project and are responsible for ensuring all SWPPP measures are followed per the provided plans and this report.

- Element # 13: Protect Low Impact Development BMPs
  - The proposed project improvements consist of an underground Contech water quality system and an ADS stormtech detention chamber. The TESC plan provided with this document as Figure 4: Temporary Erosion and Sediment Control Plan, in Appendix A, shows silt fence at the top of all native flowpath areas and around all dispersion trenches. Contractor shall inspect LID proposed facility location pre and post construction to ensure no sediment laden water can enter the LID facilities area.

Minimum Requirement # 3: Source Control of Pollution

The plans provided with this report will be followed in the field to reduce the potential of pollution. It is anticipated that the only source of pollution generated on site will be from the grading for drainage and foundation work of the proposed commercial buildings. There is no anticipated pollutant post construction other than pollutants from vehicular traffic typical for a commercial parking lot. The property owners are responsible for the control of pollutants on their property, post construction.

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

The site flows to a swale at the north end of the property. The water then drains from east to west into a control structure. Data for the storm system is not yet available on the Puyallup GIS system but the water likely flows from the control structure, to East Main, and ultimately discharges in the Puyallup River (see the control structure in Appendix E). The grade of the swale at the north end of the property will not be changed. The site drainage plan can be found on Figure 3 in Appendix A.

Minimum Requirement # 5: Onsite Stormwater Management

This project proposes more than 5,000 SF of new plus replaced hard surfaces and is therefore required achieve all minimum requirements per Volume 1, Chapter 2, of the Department of Ecology Stormwater Management Manual for Western Washington. According to the geotechnical report, the soil infiltrates at 0.35 in/hr, however, the groundwater was very high and therefore storm water will not be infiltrated but routed to a Contech water quality chamber, then stored in a Stormtech Chamber, and then routed to the swale (elevation 60) at the north end of the property, making infiltration infeasible.

Roof Area: Stormwater from the proposed roof area of 4,800 SF will flow into the Contech Water quality system and then into the Stormtech Chamber which will ultimately be directed to the swale at the north end of the property.

Asphalt Area: The storm water from the asphalt parking area will flow through a catch basin to a water quality chamber for cleaning which will also flow into the Stormtech Chamber for storage and then will be directed to the swale at the north end of the property.

Minimum Requirement # 6: Runoff Treatment

This project proposes more than 5,000 square feet of new or replaced hard surfaces and therefore will be required to treat all runoff from PGHS. This project proposes Contech water quality system to treat runoff from proposed PGHS. Runoff from PGHS will enter the Contech water quality system before entering the Stormtech Chamber where stormwater will be directed to the swale at the north end of the property. Entry velocity of runoff from the proposed PGHS will remain under a velocity of 1 foot per second as recommended by the Western Washington Stormwater and Site Development Manual, Volume 5, Hydrologic Analysis and Flow Control BMPs (3.7.7.1).

Minimum Requirement # 7: Flow Control

This project is responsible for meeting Minimum Requirement #7 as it creates more than 5,000 square feet of new impervious surface. To satisfy minimum requirement #7, an ADS StormChamber detention system was designed to place beneath the new paved area that will receive stormwater immediately downstream of the water quality chamber.

The project will utilize the StormChamber model 3500 and the outflow will be attenuated with a control manhole with orifices as shown on the project plan. The details for the StormChamber 3500 are also shown on the plans, and the WWHM calculations for the sizing of the StormChamber system is included as an appendix in this report.

Minimum Requirement # 8: Wetland Protection

There is one very small wetland at the North end of the property. This wetland will not be disturbed during or after the construction process per City of Puyallup requirements. It will be protected during construction and identified with an orange fence.

Minimum Requirement # 9: Operation and Maintenance

Conveyance pipes and catch basin shall be checked per maintenance recommendations and after major storm events. A maintenance checklist has been provided in Appendix D. The Stormtech Storm System has a separate O&M manual that has also been submitted with the plans.

Minimum Requirement # 10: Financial Liability

The owner shall bond or provide an assignment of funds as required by the code in order to ensure compliance with the Western Washington Stormwater Manual.

Section 2: Existing Condition Description

The project site is bounded by industrial/commercial parcels. The project site is accessed from Inter Ave. The site is sloping on the order of 0% to 2% trending down to the north. The site contains mostly natural landscaping with a gravel driveway, shed, and house on the southwest side of the lot. There is a small wetland located on the north side of the property. No obvious signs of surface water were observed or reported.

Section 3: Infiltration Rates / Soils Report

The USDA National Resource Conservation Service (NRCS) Web Soil Survey maps the proposed project as consisting of 100% Briscot loam (6A). According to the geotechnical report, the soil infiltrates at 0.35 in/hr, however, the groundwater was very high and therefore storm water will not be infiltrated but stored in a Stormtech Chamber and drain to the swale at the north end of the property. (see Figure 2 in Appendix A)

Section 4: Wells and Septic Systems

There are no existing wells or septic systems identified on the property.

Section 5: Fuel Tanks

There are no identified fuel tanks on the property.

Section 6: Subbasins Description

The proposed project will consider this site as a single drainage basin. The roof area will drain to catch basins, followed by the water quality system followed by the Stormtech Chamber for storage, and ultimately to the outlet on the north end of the property.

Section 7: Floodplain Analysis

The project does not have a stream located within the parcel. A flood area study is not required for the current storm drainage plan application.

Section 8: Aesthetic Consideration for Facilities

The proposed dispersion facilities for stormwater quality and management are based on city standards and contractor shall take aesthetics into consideration when installing stormwater management BMPs.

Section 9: Facility Sizing and Downstream Analysis

Facility Sizing

The proposed stormwater facilities were designed and sized per 2019 Western Washington Stormwater Management Manual. The proposed downspouts flow into the Stormtech Chamber are included in the WWHM calculated sizing parameters. The proposed sheet flow dispersion facilities were sized according to Volume III, Section 3.2.3. See Appendix B for Stormtech Chamber sizing calculations.

Water Quality

The project proses more than 5,000 square feet of new or replaced hard surfaces and is required to apply water quality control. Water quality will be achieved by means of a Contech water quality system.

Flow Control

The project will utilize the StormChamber model 3500 and the outflow will be attenuated with a control manhole with orifices as shown on the project plan. The details for the StormChamber 3500 are also shown on the plans, and the WWHM calculations for the sizing of the StormChamber system is included as an appendix in this report.

Conveyance System

The roof runoff will be collected via PVC storm drainage piping and conveyed directly to the Stormtech Storm Chamber. All proposed pipes are required to be 12" diameter and minimum 0.5% slope. Per the Washington State Department of Ecology Western Washington Hydrology Model Version 2012 (WWHM).

Downstream Analysis

All stormwater will be directed to the swale at the northern end of the property that flows from east to west into a control structure. Though it is not on the Puyallup GIS yet, the water likely flows from the control structure to East Main and ultimately discharges into the Puyallup river. It is anticipated that no adverse impacts will result from the proposed project.

Section 10: Utilities

All utilities will be designed and installed per City of Puyallup standards, storm facilities and conveyance systems will be designed and constructed with appropriate cover. Utility separation from water and sanitary sewer systems will meet minimum requirements of Washington State Department of Ecology Pipeline Separation Design and Installation Reference Guide, Version 9. Pipeline separation details has been included in the stormwater sheet of the plans.

Section 11: Covenants, Dedications, Easements

There are no covenants, dedications or easements proposed for this property at this time.

Section 12: Property Owners' Association Articles of Incorporation

There are no articles on incorporation proposed for this property.

Section 13: Other Permits or Conditions Placed on the Project

There will be building permits required for the construction of the 2 buildings on the site.

Appendix A – Supporting Figures

SITE ADDRESS
2401 INTER AVE SE
PUYALLUP, WA 98372

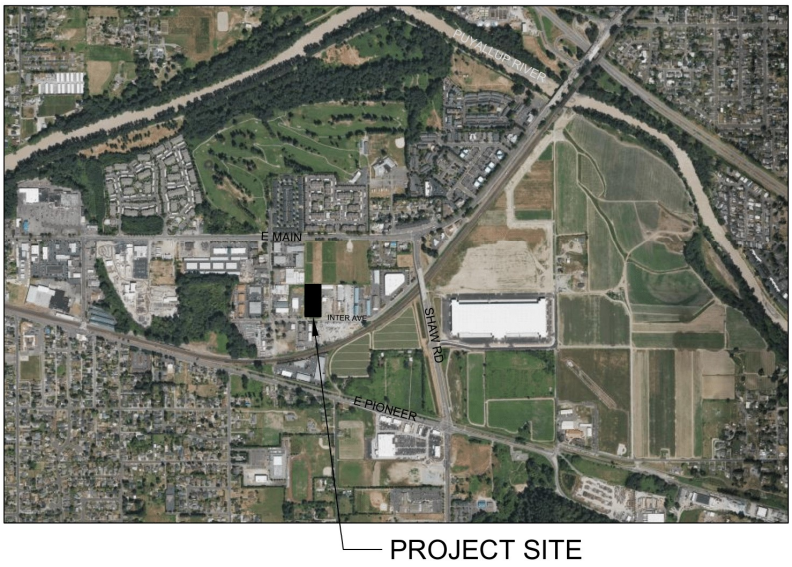

Figure 1: Vicinity Map

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SITE ADDRESS
2401 INTER AVE SE
PUYALLUP, WA 98372

6A = BRISCOT LOAM

Figure 2: Site Soils

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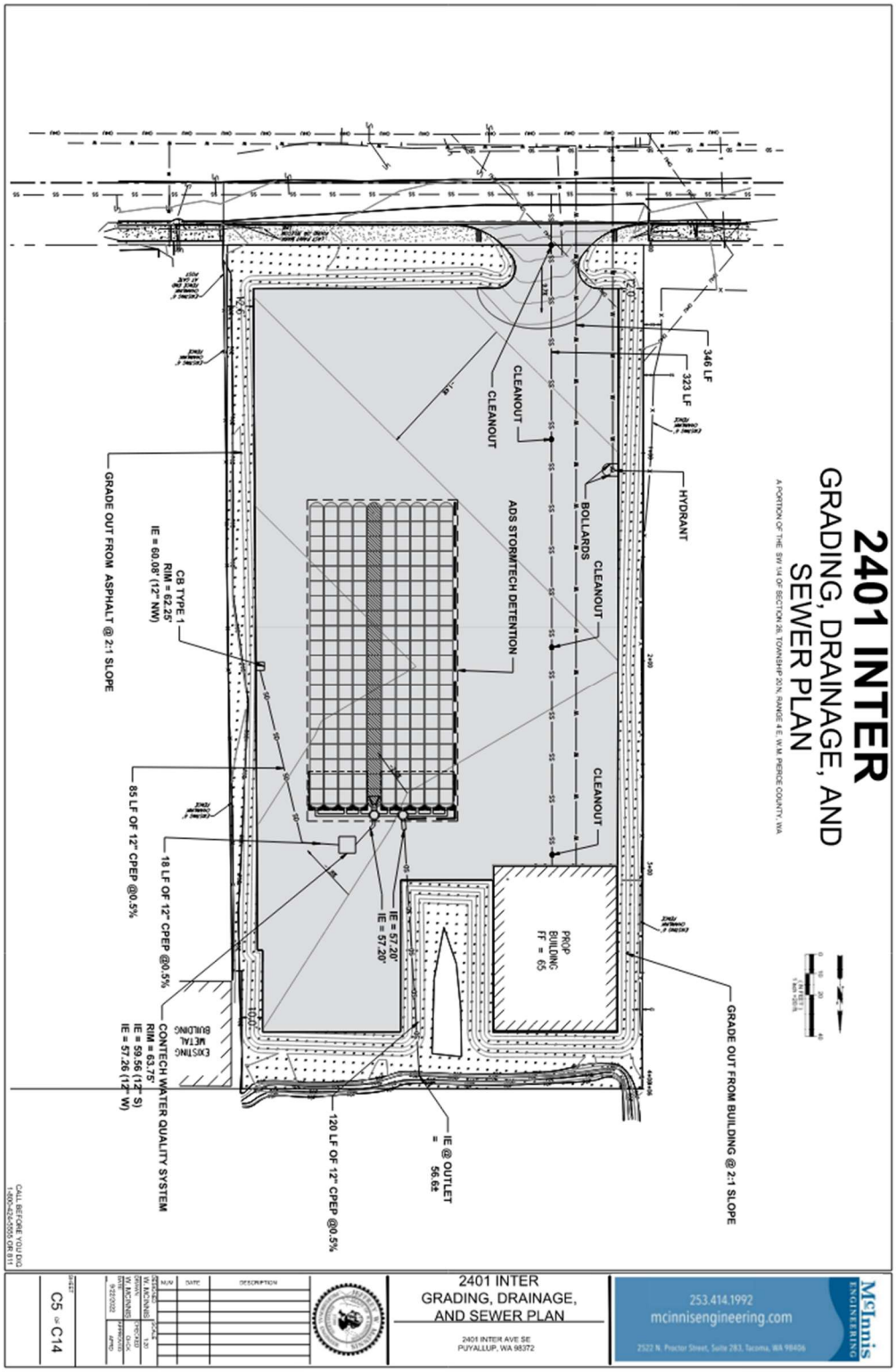

Figure 3: Grading and Drainage Plan Concept

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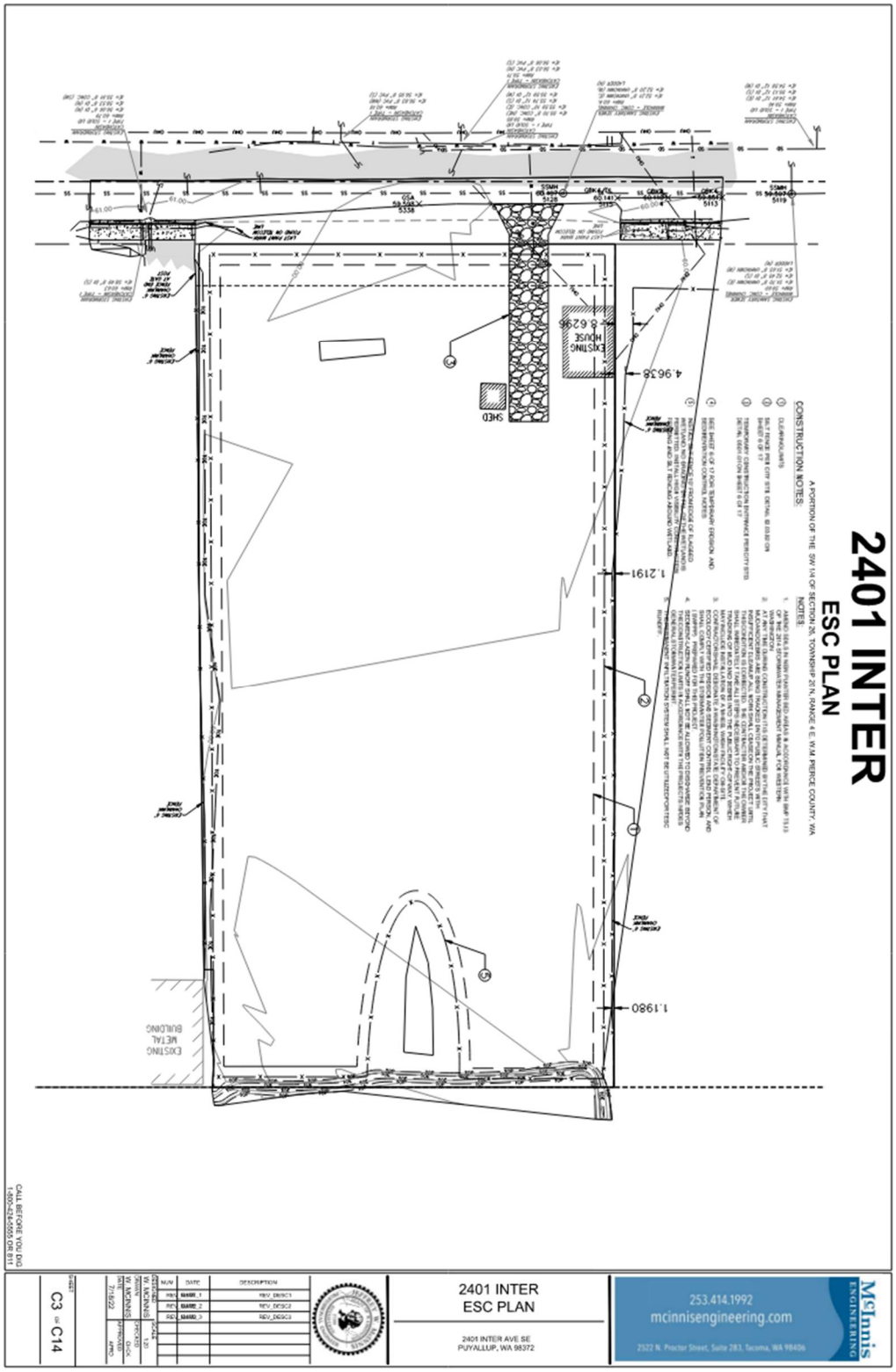


Figure 4: Erosion Control Plan

Appendix B – Hydrologic Calculation & WWHM Report

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	2401 Inter
Site Name:	
Site Address:	
City:	
Report Date:	9/9/2022
Gage:	38 IN CENTRAL
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.85
Pervious Total	1.85
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.85

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.29
Pervious Total	0.29

Impervious Land Use	acre
ROOF TOPS FLAT	0.11
PARKING FLAT	1.45
Impervious Total	1.56
Basin Total	1.85

Element Flows To:

Surface	Interflow	Groundwater
StormTech 2	StormTech 2	

Routing Elements
Predeveloped Routing

Mitigated Routing

StormTech 2

Chamber Model: 740
Dimensions
Max Row Length: 200
Number of Chambers: 460
Number of Endcaps: 36
Top Stone Depth: 6
Bottom Stone Depth: 6
Discharge Structure
Riser Height: 3.5 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.031 ft.
Notch Height: 0.916 ft.
Orifice 1 Diameter: 0.765 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

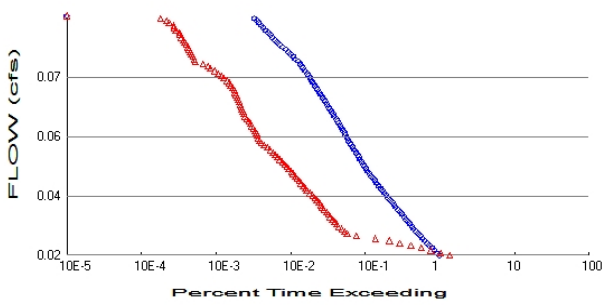
StormTech Hydraulic Table

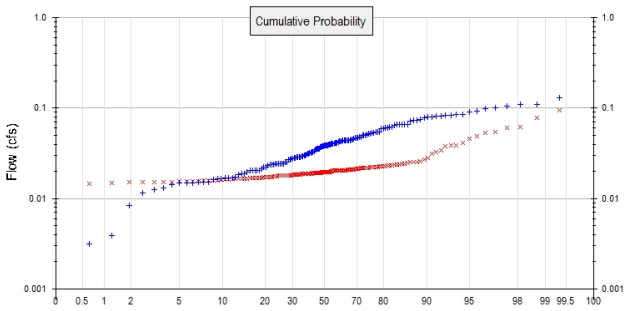
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.357	0.000	0.000	0.000
0.0833	0.357	0.011	0.004	0.000
0.1667	0.357	0.023	0.006	0.000
0.2500	0.357	0.035	0.007	0.000
0.3333	0.357	0.047	0.009	0.000
0.4167	0.357	0.059	0.010	0.000
0.5000	0.357	0.071	0.011	0.000
0.5833	0.357	0.097	0.012	0.000
0.6667	0.357	0.123	0.013	0.000
0.7500	0.357	0.149	0.013	0.000
0.8333	0.357	0.174	0.014	0.000
0.9167	0.357	0.199	0.015	0.000
1.0000	0.357	0.225	0.015	0.000
1.0833	0.357	0.250	0.016	0.000
1.1667	0.357	0.275	0.017	0.000
1.2500	0.357	0.299	0.017	0.000
1.3333	0.357	0.324	0.018	0.000
1.4167	0.357	0.348	0.018	0.000
1.5000	0.357	0.372	0.019	0.000
1.5833	0.357	0.395	0.020	0.000
1.6667	0.357	0.419	0.020	0.000
1.7500	0.357	0.442	0.021	0.000
1.8333	0.357	0.464	0.021	0.000
1.9167	0.357	0.487	0.022	0.000
2.0000	0.357	0.509	0.022	0.000
2.0833	0.357	0.530	0.022	0.000
2.1667	0.357	0.551	0.023	0.000
2.2500	0.357	0.572	0.023	0.000
2.3333	0.357	0.592	0.024	0.000
2.4167	0.357	0.611	0.024	0.000
2.5000	0.357	0.630	0.025	0.000
2.5833	0.357	0.648	0.025	0.000
2.6667	0.357	0.665	0.028	0.000

2.7500	0.357	0.680	0.033	0.000
2.8333	0.357	0.694	0.039	0.000
2.9167	0.357	0.707	0.045	0.000
3.0000	0.357	0.719	0.053	0.000
3.0833	0.357	0.731	0.060	0.000
3.1667	0.357	0.743	0.069	0.000
3.2500	0.357	0.755	0.077	0.000
3.3333	0.357	0.767	0.086	0.000
3.4167	0.357	0.779	0.095	0.000
3.5000	0.357	0.791	0.104	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.85
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.29
Total Impervious Area: 1.56

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.038985
5 year	0.060649
10 year	0.07242
25 year	0.084401
50 year	0.091522
100 year	0.097378

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.019833
5 year	0.0265
10 year	0.031935
25 year	0.040076
50 year	0.047153
100 year	0.05518

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.029	0.020
1903	0.024	0.016
1904	0.039	0.018
1905	0.019	0.022
1906	0.008	0.015
1907	0.060	0.020
1908	0.044	0.017
1909	0.044	0.020
1910	0.060	0.021
1911	0.039	0.019

1912	0.130	0.020
1913	0.062	0.022
1914	0.015	0.015
1915	0.025	0.022
1916	0.039	0.018
1917	0.013	0.018
1918	0.042	0.024
1919	0.031	0.019
1920	0.040	0.019
1921	0.044	0.021
1922	0.044	0.020
1923	0.036	0.022
1924	0.016	0.017
1925	0.020	0.017
1926	0.038	0.017
1927	0.024	0.020
1928	0.030	0.020
1929	0.062	0.022
1930	0.040	0.019
1931	0.037	0.019
1932	0.029	0.021
1933	0.028	0.020
1934	0.082	0.061
1935	0.038	0.025
1936	0.033	0.019
1937	0.053	0.018
1938	0.032	0.019
1939	0.002	0.017
1940	0.036	0.021
1941	0.017	0.015
1942	0.053	0.054
1943	0.028	0.020
1944	0.050	0.024
1945	0.045	0.019
1946	0.024	0.016
1947	0.015	0.018
1948	0.084	0.021
1949	0.072	0.024
1950	0.020	0.018
1951	0.025	0.017
1952	0.109	0.025
1953	0.099	0.028
1954	0.036	0.021
1955	0.029	0.016
1956	0.014	0.016
1957	0.051	0.022
1958	0.106	0.039
1959	0.065	0.038
1960	0.017	0.016
1961	0.066	0.049
1962	0.035	0.020
1963	0.017	0.015
1964	0.019	0.017
1965	0.073	0.062
1966	0.021	0.020
1967	0.032	0.017
1968	0.032	0.021
1969	0.032	0.020

1970	0.050	0.021
1971	0.079	0.026
1972	0.051	0.020
1973	0.065	0.023
1974	0.035	0.020
1975	0.083	0.041
1976	0.044	0.019
1977	0.015	0.014
1978	0.074	0.039
1979	0.020	0.017
1980	0.042	0.018
1981	0.040	0.020
1982	0.016	0.015
1983	0.066	0.023
1984	0.027	0.019
1985	0.043	0.019
1986	0.039	0.021
1987	0.074	0.025
1988	0.047	0.024
1989	0.042	0.018
1990	0.048	0.019
1991	0.038	0.019
1992	0.054	0.027
1993	0.052	0.019
1994	0.078	0.021
1995	0.015	0.019
1996	0.086	0.031
1997	0.033	0.016
1998	0.039	0.019
1999	0.003	0.017
2000	0.030	0.021
2001	0.015	0.015
2002	0.054	0.019
2003	0.047	0.020
2004	0.044	0.020
2005	0.080	0.020
2006	0.024	0.018
2007	0.024	0.019
2008	0.041	0.019
2009	0.028	0.018
2010	0.024	0.023
2011	0.020	0.017
2012	0.028	0.018
2013	0.022	0.015
2014	0.016	0.016
2015	0.032	0.017
2016	0.013	0.018
2017	0.060	0.025
2018	0.109	0.078
2019	0.102	0.034
2020	0.033	0.017
2021	0.054	0.024
2022	0.022	0.017
2023	0.046	0.020
2024	0.086	0.019
2025	0.040	0.019
2026	0.066	0.022
2027	0.024	0.018

2028	0.020	0.016
2029	0.044	0.023
2030	0.082	0.022
2031	0.027	0.017
2032	0.015	0.016
2033	0.024	0.016
2034	0.023	0.018
2035	0.093	0.095
2036	0.048	0.021
2037	0.012	0.017
2038	0.039	0.023
2039	0.004	0.015
2040	0.021	0.018
2041	0.029	0.016
2042	0.090	0.054
2043	0.044	0.023
2044	0.059	0.022
2045	0.040	0.022
2046	0.047	0.046
2047	0.035	0.021
2048	0.045	0.019
2049	0.040	0.020
2050	0.029	0.018
2051	0.042	0.021
2052	0.024	0.019
2053	0.043	0.033
2054	0.055	0.023
2055	0.017	0.015
2056	0.019	0.017
2057	0.029	0.020
2058	0.037	0.021
2059	0.066	0.022

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1298	0.0946
2	0.1094	0.0782
3	0.1092	0.0619
4	0.1055	0.0605
5	0.1019	0.0542
6	0.0986	0.0538
7	0.0930	0.0487
8	0.0905	0.0458
9	0.0857	0.0411
10	0.0856	0.0390
11	0.0839	0.0387
12	0.0831	0.0383
13	0.0824	0.0344
14	0.0816	0.0329
15	0.0801	0.0314
16	0.0792	0.0282
17	0.0782	0.0272
18	0.0744	0.0258
19	0.0740	0.0255
20	0.0734	0.0252
21	0.0719	0.0250
22	0.0660	0.0247

23	0.0656	0.0243
24	0.0656	0.0242
25	0.0656	0.0239
26	0.0654	0.0237
27	0.0652	0.0237
28	0.0622	0.0232
29	0.0619	0.0231
30	0.0604	0.0231
31	0.0601	0.0230
32	0.0598	0.0229
33	0.0590	0.0228
34	0.0546	0.0227
35	0.0544	0.0224
36	0.0541	0.0223
37	0.0538	0.0223
38	0.0535	0.0222
39	0.0526	0.0222
40	0.0521	0.0220
41	0.0513	0.0219
42	0.0505	0.0219
43	0.0504	0.0218
44	0.0503	0.0217
45	0.0483	0.0217
46	0.0480	0.0213
47	0.0473	0.0212
48	0.0472	0.0212
49	0.0470	0.0211
50	0.0455	0.0211
51	0.0448	0.0210
52	0.0446	0.0210
53	0.0445	0.0208
54	0.0444	0.0208
55	0.0443	0.0207
56	0.0443	0.0207
57	0.0440	0.0206
58	0.0438	0.0206
59	0.0437	0.0206
60	0.0435	0.0205
61	0.0435	0.0205
62	0.0430	0.0204
63	0.0424	0.0204
64	0.0419	0.0204
65	0.0417	0.0204
66	0.0417	0.0203
67	0.0414	0.0203
68	0.0402	0.0203
69	0.0401	0.0202
70	0.0401	0.0201
71	0.0400	0.0199
72	0.0398	0.0198
73	0.0396	0.0197
74	0.0393	0.0197
75	0.0391	0.0197
76	0.0390	0.0197
77	0.0389	0.0197
78	0.0389	0.0197
79	0.0385	0.0197
80	0.0379	0.0196

81	0.0378	0.0196
82	0.0376	0.0194
83	0.0373	0.0194
84	0.0368	0.0194
85	0.0357	0.0193
86	0.0356	0.0193
87	0.0355	0.0192
88	0.0354	0.0192
89	0.0352	0.0191
90	0.0346	0.0191
91	0.0332	0.0190
92	0.0329	0.0190
93	0.0329	0.0190
94	0.0322	0.0190
95	0.0321	0.0189
96	0.0320	0.0189
97	0.0316	0.0189
98	0.0315	0.0188
99	0.0308	0.0188
100	0.0302	0.0188
101	0.0297	0.0187
102	0.0295	0.0187
103	0.0291	0.0186
104	0.0289	0.0186
105	0.0288	0.0184
106	0.0287	0.0184
107	0.0286	0.0184
108	0.0284	0.0183
109	0.0283	0.0183
110	0.0278	0.0183
111	0.0275	0.0182
112	0.0272	0.0181
113	0.0267	0.0180
114	0.0251	0.0179
115	0.0251	0.0179
116	0.0245	0.0179
117	0.0243	0.0179
118	0.0242	0.0178
119	0.0242	0.0178
120	0.0241	0.0175
121	0.0240	0.0175
122	0.0238	0.0175
123	0.0238	0.0174
124	0.0236	0.0172
125	0.0235	0.0172
126	0.0224	0.0172
127	0.0221	0.0172
128	0.0214	0.0169
129	0.0206	0.0169
130	0.0204	0.0169
131	0.0204	0.0169
132	0.0203	0.0168
133	0.0203	0.0167
134	0.0195	0.0167
135	0.0190	0.0167
136	0.0187	0.0166
137	0.0186	0.0166
138	0.0174	0.0165

139	0.0169	0.0164
140	0.0169	0.0163
141	0.0169	0.0162
142	0.0165	0.0161
143	0.0164	0.0159
144	0.0163	0.0159
145	0.0152	0.0158
146	0.0152	0.0157
147	0.0152	0.0156
148	0.0150	0.0155
149	0.0148	0.0154
150	0.0148	0.0154
151	0.0143	0.0153
152	0.0130	0.0153
153	0.0126	0.0152
154	0.0115	0.0151
155	0.0084	0.0151
156	0.0039	0.0149
157	0.0031	0.0147
158	0.0020	0.0145

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0195	54293	75123	138	Fail
0.0202	50160	56398	112	Fail
0.0209	46603	42149	90	Pass
0.0217	43329	31196	71	Pass
0.0224	40265	22626	56	Pass
0.0231	37451	16050	42	Pass
0.0239	34936	11690	33	Pass
0.0246	32576	7557	23	Pass
0.0253	30321	4209	13	Pass
0.0260	28265	3156	11	Pass
0.0268	26437	2904	10	Pass
0.0275	24792	2667	10	Pass
0.0282	23290	2425	10	Pass
0.0290	21928	2270	10	Pass
0.0297	20642	2145	10	Pass
0.0304	19423	2001	10	Pass
0.0311	18282	1870	10	Pass
0.0319	17219	1766	10	Pass
0.0326	16166	1669	10	Pass
0.0333	15147	1552	10	Pass
0.0340	14271	1462	10	Pass
0.0348	13446	1394	10	Pass
0.0355	12670	1330	10	Pass
0.0362	11944	1247	10	Pass
0.0370	11246	1170	10	Pass
0.0377	10559	1087	10	Pass
0.0384	9978	991	9	Pass
0.0391	9374	904	9	Pass
0.0399	8847	865	9	Pass
0.0406	8332	815	9	Pass
0.0413	7861	764	9	Pass
0.0420	7462	722	9	Pass
0.0428	7030	670	9	Pass
0.0435	6609	635	9	Pass
0.0442	6277	597	9	Pass
0.0450	5978	567	9	Pass
0.0457	5701	518	9	Pass
0.0464	5437	493	9	Pass
0.0471	5197	459	8	Pass
0.0479	4943	432	8	Pass
0.0486	4704	399	8	Pass
0.0493	4511	367	8	Pass
0.0501	4333	340	7	Pass
0.0508	4159	317	7	Pass
0.0515	3958	293	7	Pass
0.0522	3764	267	7	Pass
0.0530	3577	243	6	Pass
0.0537	3414	224	6	Pass
0.0544	3263	210	6	Pass
0.0551	3134	203	6	Pass
0.0559	3026	197	6	Pass
0.0566	2928	191	6	Pass
0.0573	2814	183	6	Pass
0.0581	2682	175	6	Pass

0.0588	2555	168	6	Pass
0.0595	2451	160	6	Pass
0.0602	2359	152	6	Pass
0.0610	2256	142	6	Pass
0.0617	2140	135	6	Pass
0.0624	2039	130	6	Pass
0.0631	1952	127	6	Pass
0.0639	1860	122	6	Pass
0.0646	1777	120	6	Pass
0.0653	1690	117	6	Pass
0.0661	1619	113	6	Pass
0.0668	1561	109	6	Pass
0.0675	1482	106	7	Pass
0.0682	1407	103	7	Pass
0.0690	1339	99	7	Pass
0.0697	1270	97	7	Pass
0.0704	1217	92	7	Pass
0.0712	1162	87	7	Pass
0.0719	1103	83	7	Pass
0.0726	1055	78	7	Pass
0.0733	1006	70	6	Pass
0.0741	963	65	6	Pass
0.0748	919	59	6	Pass
0.0755	872	53	6	Pass
0.0762	814	46	5	Pass
0.0770	772	43	5	Pass
0.0777	738	37	5	Pass
0.0784	694	29	4	Pass
0.0792	636	28	4	Pass
0.0799	601	27	4	Pass
0.0806	553	26	4	Pass
0.0813	517	25	4	Pass
0.0821	478	24	5	Pass
0.0828	433	23	5	Pass
0.0835	394	22	5	Pass
0.0842	363	21	5	Pass
0.0850	339	20	5	Pass
0.0857	310	19	6	Pass
0.0864	296	18	6	Pass
0.0872	273	18	6	Pass
0.0879	252	16	6	Pass
0.0886	237	15	6	Pass
0.0893	223	15	6	Pass
0.0901	206	13	6	Pass
0.0908	194	12	6	Pass
0.0915	180	10	5	Pass

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
StormTech 2 POC	☐	571.66			☐	0.00			
Total Volume Infiltrated		571.66	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

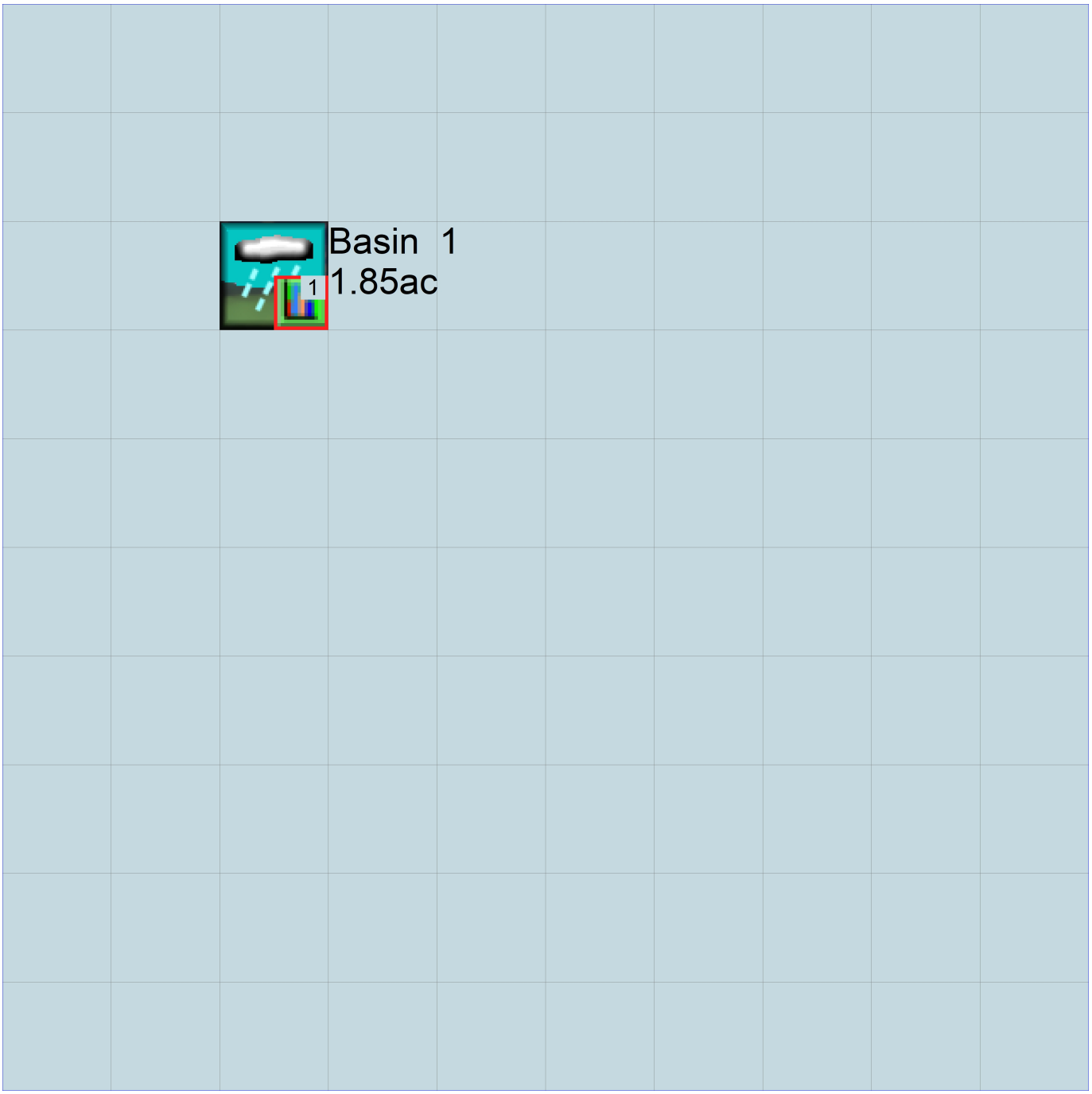
PERLND Changes

No PERLND changes have been made.

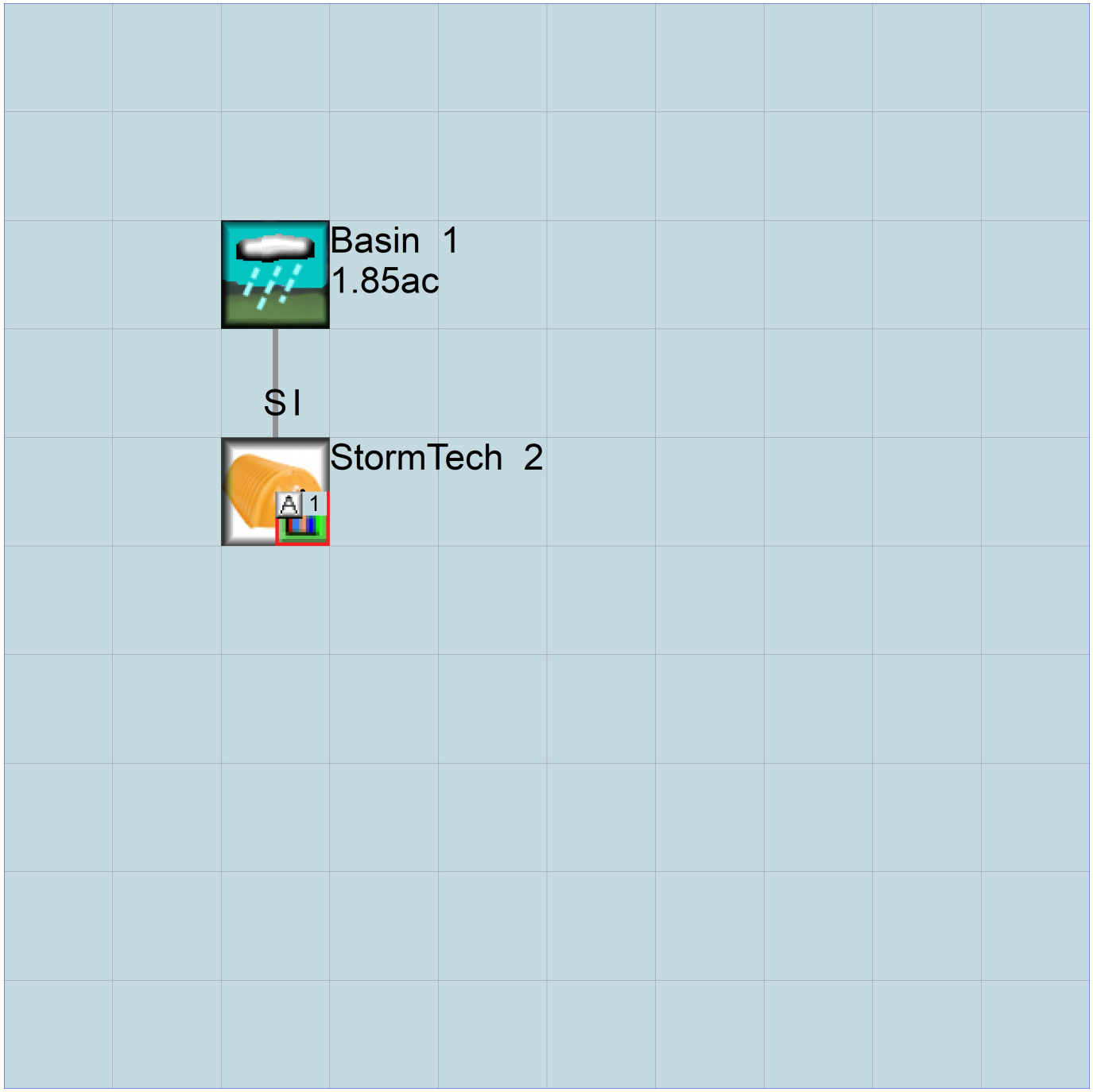
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   2401 Inter.wdm
MESSU       25   Pre2401 Inter.MES
            27   Pre2401 Inter.L61
            28   Pre2401 Inter.L62
            30   POC2401 Inter1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                      in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   10             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

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

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

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

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                        1.85     COPY   501     12
PERLND  10                        1.85     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                           in  out                          ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                     ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

```
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   2401 Inter.wdm
MESSU       25   Mit2401 Inter.MES
            27   Mit2401 Inter.L61
            28   Mit2401 Inter.L62
            30   POC2401 Inter1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND       4
      IMPLND      11
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        StormTech  2               MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7             0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    0    1    9
   11         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
```

```
    4            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
   11              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
   11              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   7                        0.29     RCHRES   1      2
PERLND   7                        0.29     RCHRES   1      3
IMPLND   4                        0.11     RCHRES   1      5
IMPLND  11                        1.45     RCHRES   1      5

******Routing******
PERLND   7                        0.29     COPY     1     12
IMPLND   4                        0.11     COPY     1     15
IMPLND  11                        1.45     COPY     1     15
PERLND   7                        0.29     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
    1     StormTech  2            1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
```

```
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *      *  *  *  *  *         ***
    1       0  1  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.04       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   42    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.356977  0.000000  0.000000
  0.083333  0.356977  0.011914  0.004584
  0.166667  0.356977  0.023828  0.006483
  0.250000  0.356977  0.035788  0.007941
  0.333333  0.356977  0.047698  0.009169
  0.416667  0.356977  0.059631  0.010251
  0.500000  0.356977  0.071564  0.011230
  0.583333  0.356977  0.097462  0.012129
  0.666667  0.356977  0.123277  0.012967
  0.750000  0.356977  0.148971  0.013753
  0.833333  0.356977  0.174517  0.014497
  0.916667  0.356977  0.199923  0.015205
  1.000000  0.356977  0.225159  0.015881
  1.083333  0.356977  0.250206  0.016530
  1.166667  0.356977  0.275063  0.017154
  1.250000  0.356977  0.299696  0.017756
  1.333333  0.356977  0.324110  0.018338
  1.416667  0.356977  0.348263  0.018902
  1.500000  0.356977  0.372157  0.019450
  1.583333  0.356977  0.395809  0.019983
  1.666667  0.356977  0.419131  0.020502
  1.750000  0.356977  0.442137  0.021009
  1.833333  0.356977  0.464805  0.021503
  1.916667  0.356977  0.487110  0.021986
  2.000000  0.356977  0.509035  0.022459
  2.083333  0.356977  0.530595  0.022922
  2.166667  0.356977  0.551707  0.023376
  2.250000  0.356977  0.572192  0.023822
  2.333333  0.356977  0.592111  0.024259
  2.416667  0.356977  0.611490  0.024688
  2.500000  0.356977  0.630197  0.025110
  2.583333  0.356977  0.648120  0.025525
  2.666667  0.356977  0.665099  0.028378
  2.750000  0.356977  0.680825  0.033154
  2.833333  0.356977  0.694510  0.039054
  2.916667  0.356977  0.707442  0.045770
  3.000000  0.356977  0.719690  0.053110
  3.083333  0.356977  0.731604  0.060938
  3.166667  0.356977  0.743518  0.069145
  3.250000  0.356977  0.755478  0.077645
  3.333333  0.356977  0.767388  0.086361
  3.416667  0.356977  0.779321  0.095231
```

```
  END FTABLE  1
END FTABLES

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

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

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

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

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1908/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.169E-02     0.00000  0.0000E+00     0.00000  -2.458E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1923/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-2.908E-02     0.00000  0.0000E+00     0.00000  -1.038E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

DATE/TIME: 1968/ 8/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-4.224E-03	0.00000	0.0000E+00	0.00000	-7.101E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1979/ 8/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-2.865E-03	0.00000	0.0000E+00	0.00000	-1.014E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1983/ 8/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-1.285E-02	0.00000	0.0000E+00	0.00000	-2.317E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.

REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.

Disclaimer

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Appendix C – Geotechnical Analysis

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

May 6, 2020

EJ Poultry
C/O Greg Zetterberg
gregzetterberg@gmail.com

RE: Additional Geotechnical Recommendations
Proposed Commercial Development
2401 Inter Avenue
Puyallup, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter report to discuss groundwater elevations and the use of permeable pavements at the referenced site.

The purpose of our evaluation was to determine the feasibility of utilizing infiltration devices for stormwater runoff management. We previously prepared a Preliminary Geotechnical Investigation dated June 25, 2017 and a stormwater feasibility evaluation dated May 24, 2019.

Previous Test Pits TP-1 through TP-3

We excavated three test pits in June 2017 as part of our preliminary geotechnical investigation. All of the test pits encountered approximately 8 to 18 inches of topsoil and vegetation underlain by about 5 to 5.5 feet of medium stiff to stiff, silt with variable amounts of sand and local woody debris (Alluvium). These materials were underlain by loose to medium dense, very fine to fine grained sand with trace to some silt (Alluvium). These materials locally contained large woody debris and interbeds of silt/clay.

In May 2019, we excavated an area to conduct an in-situ infiltration test along with two hand borings to determine groundwater elevations prior to and following infiltration analysis. These hand borings encountered approximately 9 inches of grass and topsoil underlain by approximately 0.8 feet of fine to medium grained sand with silt (Alluvium?). This layer was underlain by approximately 3.7 feet of loose to medium dense, silty-fine to fine grained sand (Alluvium). This layer was underlain by fine to medium grained sand trace silt (Alluvium), which continued to the termination depths of the hand borings. Groundwater was encountered at 6 feet below grade prior to testing and 5.9 feet below grade following testing.

Based on the previous and recent explorations, the seasonal high regional groundwater elevation is about 5 feet below existing site elevations. We conducted several shallow hand borings in late 2019 and early 2020 to determine the depth to shallow perched groundwater. The results of these explorations can be found below.

Groundwater Elevations

Based on our discussions with Abbey Road Group, we understand that permeable concrete will likely be utilized to manage surface water runoff from new parking areas. Runoff from roof areas and possibly heavy duty pavement sections will likely be routed to a detention system.

We have recently evaluated groundwater elevations using shallow hand boring excavations at numerous locations within the property (Figure 1). The perched groundwater elevations based on elevations (for reference) from the site plan are as follows:

Location	Date	Groundwater Elevation (Feet)	Ground El.
P-1	12/20/19	56.4	~59.5
	1/4/20	56.8	
	1/28/20	56.8	
	2/11/20	57.0	
	3/15/20	56.5	
P-2	12/20/19	56.7	~60.2
	1/4/20	56.8	
	1/28/20	56.9	
	2/11/20	57.5	
	3/15/20	56.7	
P-3	12/20/19	55.7	~59.3
	1/4/20	55.9	
	1/28/20	56.1	
	2/11/20	56.6	
	3/15/20	56.0	
P-4	12/20/19	55.5	~59.1
	1/4/20	55.7	
	1/28/20	56.3	
	2/11/20	56.6	
	3/15/20	55.9	

Perched groundwater due to heavy precipitation is generally 2.5 feet or more below existing site elevations. We anticipate that at least 12 inches of native soils are required to allow clearance between the bottom of angular rock and groundwater.

We should be provided with final plans for review to determine if the intent of our recommendations have been incorporated. We should be on site to confirm soil conditions and provide additional recommendations if necessary. Any system should have adequate overflow to City infrastructure or a detention system.

Permeable Pavements

Typically, pervious pavements are supported by a leveling course and storage reservoir course placed on prepared native soils. These courses typically consist of open graded angular rock, 5/8 to 2 inches in diameter, with a total thickness ranging from 6 to 18 inches.

We understand that the site may be filled to create a finish grade approximately 0.5 to 1.5 feet higher than the existing elevations. While traffic loads and frequency are unknown at this time, we understand that vehicle traffic will include both heavy trucks as well as passenger vehicles. Based on our experience and review of Federal Highway Administration (FHWA) information, pervious pavements are primarily utilized in light duty traffic areas; therefore, the long term performance under heavy truck loads is not well known. Typically, permeable pavements are not recommended for heavy truck loads.

We recommend removal of loose topsoil prior to placement of imported fill materials. The depth to expose inorganic native soils will vary from 6 to 12 inches in most areas. The area around the existing residence may require additional soil removal.

The exposed subgrades should NOT be re-compacted to 95 percent of the modified proctor as is typical for roadway and parking lot subgrade preparation.

We recommend placement of Tensar TX160 geogrid over the resulting subgrade in all areas. The geogrid should be placed on level surfaces. Clean angular rock or imported sand and gravel with less than 5 percent fines should be placed in any low areas. Geogrid should be placed with at least 6 inches of overlap onto adjacent layers and should extend at least 2 feet beyond the edges of pavement areas.

For the heavy-duty pervious pavement section, we recommend placement of 8 inches of 2 inch clean angular rock over the geogrid. Over this layer, we recommend placement of 6 inches of 5/8 inch clean angular rock. The pervious concrete should be at least 8 inches thick. Note that some overexcavation of native soils may be required to achieve the design finish grade elevations. An additional layer of geogrid and/or local overexcavation of native soils may be required if unstable soils are encountered.

For the normal duty pervious pavement section, we recommend placement of 6 inches of 1.25 to 2 inch clean angular rock over the geogrid. Over this layer, we recommend placement of 6 inches of 5/8 inch clean angular rock. The pervious concrete should be at least 6 inches thick.

In either of the above sections, the reservoir course may be increased to allow for additional stormwater storage, if required.

Additional information regarding permeable pavement design, construction, and maintenance can be found in the Pierce County Stormwater and Site Development Manual (2015).

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt

fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.

- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Closure

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above and for the current site conditions and should not be used for any other site. Our recommendations are based on limited knowledge of proposed traffic loading conditions. We are not responsible for long-term performance of permeable concrete or asphalt.

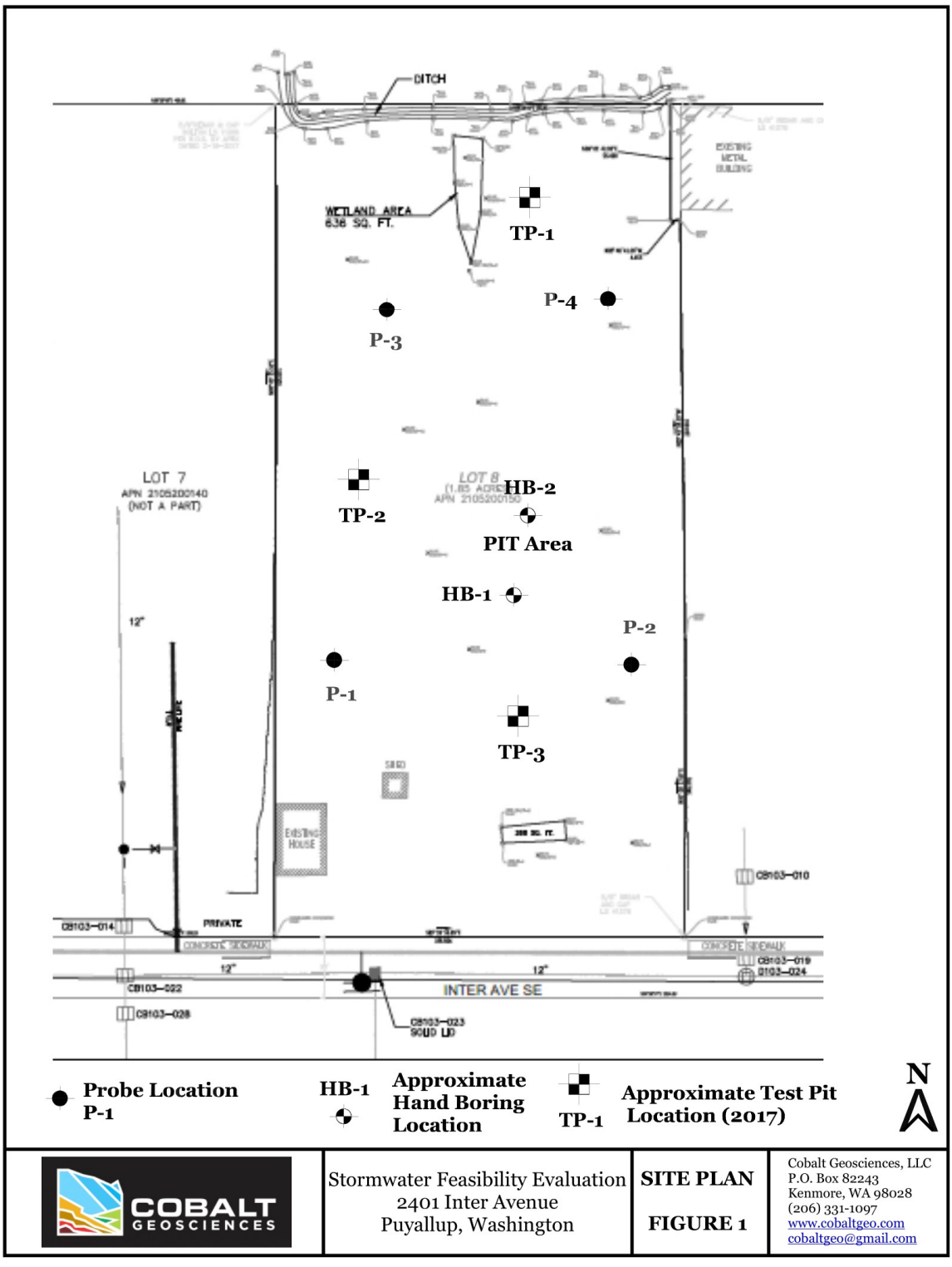
Sincerely,

Cobalt Geosciences, LLC

Exp. 6/26/2020

Phil Haberman, PE, LG, LEG
Principal

PH/sc


DITCH
WETLAND AREA
638 SQ. FT.
TP-1
P-4
P-3
LOT 7
APN 2105200140
(NOT A PART)
LOT 8
(1.85 ACRES)
APN 2105200150
HB-2
TP-2
PIT Area
HB-1
P-2
P-1
TP-3
12"
EXISTING HOUSE
CB103-010
CB103-014
PRIVATE
CONCRETE SIDEWALK
12"
12"
CB103-019
CB103-024
CB103-022
INTER AVE SE
CB103-028
CB103-023
SOLID LID
Probe Location
P-1
HB-1
Approximate Hand Boring Location
TP-1
Approximate Test Pit Location (2017)
N
COBALT GEOSCIENCES
Stormwater Feasibility Evaluation
2401 Inter Avenue
Puyallup, Washington
SITE PLAN
FIGURE 1
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cobaltgeo@gmail.com

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Appendix D – Maintenance and Operations

#3 – Maintenance Checklist for Closed Detention Systems (Tanks/Vaults):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Storage Area	Plugged Air Vents	One-half of the cross-section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning. Remove blockage or replace air vent if damaged.
Storage Area	Debris and Sediment	Accumulated sediment depth exceeds 10 percent of the diameter of the storage area for one-half length of storage vault or any point depth exceeds 15 percent of diameter.	All sediment and debris removed from storage area.
Storage Area	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.
Storage Area	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10 percent of its design shape. (Review required by engineer to determine structural stability.)	Tank/pipe repaired or replaced to design.
Storage Area	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half 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.	Vault replaced or repaired to design specifications and is structurally sound.
Storage Area	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than one-fourth inch wide at the joint of the inlet/outlet pipe. No water or soil entering vault through joints or walls.
Crest Gauge	Crest Gauge Missing/Broken	Crest gauge is not functioning properly, has been vandalized, or is missing.	Crest gauge present and functioning. *Repair/replace crest gauge if missing or broken.*
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole access cover/ lid is in place and secure.
Manhole	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
Manhole	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
Manhole	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

If you are unsure whether a problem exists, contact a professional engineer.

Tanks and vaults are a confined space. Visual inspections should be performed aboveground. If entry is required, it should be performed by qualified personnel.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	"Dump no pollutants" (or similar) stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste-Drains to Stream" or "Only rain down the drain"/ "Puget Sound starts here") painted or embossed on or adjacent to all storm drain inlets.
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inlet capacity by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.
General	Trash and Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
General	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
General	Trash and Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
General	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.
General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch.	No holes and cracks in the top slab allowing material to run into the basin.
General	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
General	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
General	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
General	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
General	Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
General	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. *(Coordinate removal/cleanup with Pierce County Surface Water Management 253-798-2725 and/or Dept. of Ecology Spill Response 800-424-8802.)*
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is in place and secured.
Catch Basin Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.
Catch Basin Cover	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.
Grates	Grate Opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.
Grates	Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.
Grates	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, contact a professional engineer.

#20 – Maintenance Checklist for Grounds (Landscaping):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Weeds (nonpoisonous)	Weeds growing in more than 20 percent of the landscaped area (trees and shrubs only). Any evidence of noxious weeds as defined in the Pierce County Noxious Weeds List.	Weeds present in less than 5 percent of the landscaped area.
General	Insect Hazard	Any presence of poison ivy or other poisonous vegetation or insect nests.	No poisonous vegetation or insect nests present in landscaped area.
General	Trash or Litter	See Detention Ponds (Checklist #1).	See Detention Ponds (Checklist #1).
General	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.
Trees and shrubs	Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25 percent of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.
Trees and shrubs	Damage	Trees or shrubs that have been blown down or knocked over.	Tree replanted, inspected for injury to stem or roots. Replace if severely damaged.
Trees and shrubs	Damage	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Stakes and rubber-coated ties placed around young trees/shrubs for support.

#29 – Maintenance Checklist for Bioretention (Cells, Swales, and Planter Boxes):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash	Trash and debris present.	No trash and debris present.
Concrete Sidewalls	Cracks or Failure in Concrete Planter Reservoir	Cracks wider than 0.5 inch or maintenance/inspection personnel determine that the planter is not structurally sound.	Concrete repaired or replaced.
Rockery Sidewalls	Instable Rockery	Rock walls are insecure.	Rockery sidewalls are stable (may require consultation with professional engineer, particularly for walls 4 feet or greater in height).
Earthen Side Slopes and Berms	Failure in Earthen Reservoir (Embankments, Dikes, Berms, and Side Slopes)	Erosion (gullies/rills) greater than 2 inches around inlets, outlet, and along side slopes.	Source of erosion eliminated and damaged area stabilized (regrade, rock, vegetation, erosion control blanket). For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures are in place until permanent repairs can be made.
Earthen Side Slopes and Berms	Failure in Earthen Reservoir (Embankments, Dikes, Berms, and Side Slopes)	Erosion of sides causes slope to become a hazard.	The hazard is eliminated and slopes are stabilized.
Earthen Side Slopes and Berms	Failure in Earthen Reservoir Embankments, Dikes, Berms, and Side Slopes)	Settlement greater than 3 inches (relative to undisturbed sections of berm).	The design height is restored with additional mulch.
Earthen Side Slopes and Berms	Failure in Earthen Reservoir (Embankments, Dikes, Berms, and Side Slopes)	Downstream face of berm or embankment wet, seeps or leaks evident.	Holes are plugged and berm is compacted. May require consultation with professional engineer, particularly for larger berms.
Earthen Side Slopes and Berms	Failure in Earthen Reservoir (Embankments, Dikes, Berms, and Side Slopes)	Any evidence of rodent holes or water piping around holes if facility acts as dam or berm.	Rodents (see “Pests: Insects/Rodents”) removed or destroyed and berm repaired/ compacted.
Ponding Area	Sediment or Debris Accumulation	Accumulation of sediment or debris to extent that infiltration rate is reduced (see “Ponded water”) or surface storage capacity significantly impacted.	Sediment cleaned out to restore facility shape and depth. Damaged vegetation is replaced and mulched. Source of sediment identified and controlled (if feasible).
Ponding Area	Leaf Accumulation	Accumulated leaves in facility.	No leaves clogging outlet structure or impeding water flow.
Ponding Area	Basin Inlet via Surface Flow	Soil is exposed or signs of erosion are visible.	Erosion sources repaired and controlled.
Curb Cut Inlet	Sediment or Debris Accumulation	Sediment, vegetation, or debris partially or fully blocking inlet structure.	Curb cut is clear of debris. Source of the blockage is identified and action is taken to prevent future blockages.

#29 – Maintenance Checklist for Bioretention (Cells, Swales, and Planter Boxes):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Splash Block Inlet	Water Not Properly Directed to Facility	Water is not being directed properly to the facility and away from the inlet structure.	Blocks are reconfigured to direct water to facility and away from structure.
Splash Block Inlet	Erosion	Water disrupts soil media.	Splash block is reconfigure/repaired.
Inlet/outlet pipe	Damaged Pipe	Pipe is damaged.	Pipe is repaired/replaced. No cracks more than 0.25 inched wide at the joint of inlet/outlet pipes exist.
Inlet/outlet pipe	Clogged Pipe	Pipe is clogged.	Pipe is clear of roots or debris. Source of the blockage is identified and action is taken to prevent future blockages.
Inlets/outlet and access pathways	Blocked Access	Maintain access for inspections.	Vegetation is cleared within 1 foot of inlets and outlets. Access pathways are maintained.
Ponding Area	Erosion	Water disrupts soil media.	No eroded or scoured areas in bioretention area. Cause of erosion or scour addressed. A cover of rock or cobbles or other erosion protection measure maintained (e.g., matting) to protect the ground where concentrated water enters or exits the facility (e.g., a pipe, curb cut or swale).
Trash Rack	Trash or Debris Accumulation	Trash or debris present on trash rack.	No trash or debris on trash rack. Clean and dispose trash.
Trash Rack	Damaged Trash Rack	Bar screen damaged or missing.	Barrier repaired or replaced to design standards.
Check Dams and Weirs	Sediment or Debris Accumulation	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, weir, or orifice.	Blockage is cleared. Identify the source of the blockage and take actions to prevent future blockages.
Check Dams and Weirs	Erosion	Erosion and/or undercutting is present.	No eroded or undercut areas in bioretention area. Cause of erosion or undercutting addressed. Check dam or weir is repaired.
Check Dams and Weirs	Unlevel Top of Weir	Grade board or top of weir damaged or not level.	Weir restored to level position.
Flow Spreader	Sediment Accumulation	Sediment blocks 35 percent or more of ports/notches or, sediment fills 35 percent or more of sediment trap.	Sediment removed and disposed of.
Flow Spreader	Damaged or Unlevel Grade Board/Baffle	Grade board/baffle damaged or not level.	Board/baffle removed and reinstalled to level position.
Overflow/ emergency spillway	Sediment or Debris Accumulation	Overflow spillway is partially or fully plugged with sediment or debris.	No sediment or debris in overflow.
Overflow/ emergency spillway	Erosion	Native soil is exposed or other signs of erosion damage are present.	Erosion repaired and surface of spillway stabilized.

#29 – Maintenance Checklist for Bioretention (Cells, Swales, and Planter Boxes):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Overflow/ emergency spillway	Missing Spillway Armament	Spillway armament is missing.	Armament replaced.
Underdrain	Blocked Underdrain	Plant roots, sediment or debris reducing capacity of underdrain. Prolonged surface ponding (see "Bioretention Soil").	Underdrains and orifice are free of sediment and debris.
Bioretention soil	Ponded Water	Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Cause of ponded water is identified and addressed: 1. Leaf or debris buildup is removed 2. Underdrain is clear 3. Other water inputs (e.g., groundwater, illicit connections) investigated 4. Contributing area verified If steps #1-4 do not solve the problem, imported bioretention soil is replaced and replanted.
Bioretention soil	Protection of Soil	Maintenance requiring entrance into the facility footprint.	Maintenance is performed without compacting bioretention soil media.
Vegetation	Bottom Swale and Upland Slope Vegetation	Less than 75 percent of swale bottom is covered with healthy/ surviving vegetation.	Plants are healthy and pest free. Cause of poor vegetation growth addressed. Bioretention area is replanted as necessary to obtain 75 percent survival rate or greater. Plant selection is appropriate for site growing conditions.
Trees and shrubs	Causing Problems for Operation of Facility	Large trees and shrubs interfere with operation of the basin or access for maintenance.	Trees and shrubs do not hinder facility performance or maintenance activities. Prune or remove large trees and shrubs.
Trees and shrubs	Dead Trees and Shrubs	Standing dead vegetation is present.	Trees and shrubs do not hinder facility performance or maintenance activities. Dead vegetation is removed and cause of dead vegetation is addressed. Specific plants with high mortality rate are replaced with more appropriate species.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	Safety Issues	Vegetation causes some visibility (line of sight) or driver safety issues.	Appropriate height for sight clearance is maintained. Regular pruning maintains visual sight lines for safety or clearance along a walk or drive. Tree or shrub is removed or transplanted if presenting a continual safety hazard.
Emergent Vegetation	Conveyance Blocked	Vegetation compromises conveyance.	Sedges and rushes are clear of dead foliage.
Mulch	Lack of Mulch	Bare spots (without much cover) are present or mulch covers less than 2 inches.	Facility has a maximum 3-inch layer of an appropriate type of mulch and mulch is kept away from woody stems.
Vegetation	Accumulation of Clippings	Grass or other vegetation clippings accumulate to 2 inches or greater in depth.	Clippings removed.

#29 – Maintenance Checklist for Bioretention (Cells, Swales, and Planter Boxes):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Noxious Weeds	Presence of Noxious Weeds	Listed noxious vegetation is present. See Pierce County Noxious Weeds List..	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.
Vegetation	Weeds	Weeds are present (unless on edge and providing erosion control).	Weed material removed and disposed of. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality.
Excessive Vegetation	Adjacent Facilities Compromised	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil.	Vegetation does not impede function of adjacent facilities or pose as safety hazard. Groundcovers and shrubs trimmed at facility edge. Excessive leaf litter is removed.
Excessive Vegetation	Causes Facility to Not Function Properly	Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety.	Pruning and/or thinning vegetation maintains proper plant density and aesthetics. Plants that are weak, broken, or not true to form are removed or replaced in-kind. Appropriate plants are present.
Irrigation (if any)	NA	Irrigation system present.	Manufacturer's instructions for O&M are met.
Plant watering	Plant Establishment	Plant establishment period (1-3 years).	Plants are watered as necessary during periods of no rain to ensure plant establishment.
Summer Watering (after establishment)	Drought Period	Longer term period (3+ years).	Plants are watered as necessary during drought conditions and trees are watered up to five years after planting.
Spill Prevention and Response	Spill Prevention	Storage or use of potential contaminants in the vicinity of facility.	Spill prevention measures are implemented whenever handling or storing potential contaminants.
Spill Prevention and Response	Spill Response	Any evidence of contaminants such as oil, gasoline, concrete slurries, paint, etc.	Spills are cleaned up as soon as possible to prevent contamination of stormwater. No contaminants or pollutants present. *(Coordinate source control, removal, and/or cleanup with Pierce County Surface Water Management 253-798-2725 and/or Dept. of Ecology Spill Response 800-424-8802.)*
Safety	Safety (Slopes)	Erosion of sides causes slope to exceed 1:3 or otherwise becomes a hazard.	Actions taken to eliminate the hazard.
Safety	Safety (Hydraulic Structures)	Hydraulic structures (pipes, culverts, vaults, etc.) become a hazard to children playing in and around the facility.	Actions taken to eliminate the hazard (such as covering and securing any openings).

#29 – Maintenance Checklist for Bioretention (Cells, Swales, and Planter Boxes):

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Aesthetics	Aesthetics	Damage/vandalism/debris accumulation.	Facility restored to original aesthetic conditions.
Aesthetics	Edging	Grass is starting to encroach on swale.	Edging repaired.
Pest Control	Pests: Insects/Rodents	Pest of concern is present and impacting facility function.	Pests removed or destroyed and facility returned to original functionality. Do not use pesticides or *Bacillus thuringiensis israelensis (Bti)*.
Pest Control	Mosquitoes	Standing water remains in the basin for more than three days following storms.	All inlets, overflows and other openings are protected with mosquito screens. No mosquito infestation present.

If you are unsure whether a problem exists, contact a professional engineer.

Appendix E – Swale Control Structure