Puyallup AOB Preliminary Stormwater Drainage Report

Prepared for

Puyallup Mixed Use, LLC

October 2025

Parametrix

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Acronyms and Abbreviations

BMPs	best management practices
cfs	cubic feet per second
City	City of Puyallup
Ecology	Washington State Department of Ecology
EPSC	erosion prevention and sediment control
hrs	hours
LF	linear feet
LID	low-impact development
Manual	2024 Stormwater Management Manual for Western Washington
MEP	Maximum extent practicable
NPDES	National Pollutant Discharges Elimination System
NPGHS	non-pollution generating hard surface
NRCS	National Resource Conservation Service
PGHS	pollution generating hard surfaces
ROW	right-of-way
SF	square feet
SWMMWW	2024 Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Loads
TSS	total suspended solids
USDA	United States Department of Agriculture
WRIA	Water Resource Inventory Area
WWHM	Western Washington Hydrology Model 2012

1. Introduction

This report is prepared for Puyallup Mixed Use, LLC to meet the requirements of preliminary drainage report as outlined in section 21.10 of the Puyallup Municipal Code (PMC) and the Washington Department of Ecology's 2024 Stormwater Management Manual for Western Washington (SWMMWW).

This report addresses the type of project proposed, applicable minimum requirements, the site's existing and developed hydrology, the analysis of off-site drainage as a result of the project completion, the stormwater facility selection and sizing, and the stormwater conveyance system analysis and design as required by the City of Puyallup.

2. Proposed Project Description

2.1 Overview

The Puyallup AOB (Project) is a mixed-use development project owned by Puyallup Mixed Use, LLC. The project site is located on parcel 5745001371 between W Pioneer Avenue and SW 3rd Street in Puyallup, WA located in Pierce County.

The Project preliminarily proposes developing a 5-story apartment building with 140 residential units, covered parking, and retail space while installing new utility service connections, public frontage improvements, amenities, and open space areas as part of the development. The Project area will be approximately 1.11 acres of development that includes constructing the following:

- 140 residential units
- 2,295 square feet of retail space
- Domestic water and sewer service connections
- Dedicated fire suppression services
- Frontage improvements along SW 3rd Street and Pioneer W Pioneer Avenue

2.2 Minimum Requirements

The Project meets the definition of redevelopment per Figure I-3.2 of the Department of Ecology *2024 Stormwater Management Manual for Western Washington* (SWMMWW) since it proposes to add over 5,000 SF of new plus hard surfaces on a site with more than 35% of hard surface coverage.

See the completed flowchart in Appendix A. As such, it must evaluate meeting all minimum requirements for stormwater runoff generated as a result of the Project.

2.2.1 Minimum Requirement No. 1 – Preparation of Stormwater Site Plan

Preparation of this drainage report in accordance with the SWMMWW outlines and satisfies this criterion. The proposed development activities are indicated in the Preliminary Drainage Composite Plan figure. Stormwater elements are outlined within this report in conjunction with the figure.

2.2.2 Minimum Requirement No. 2 – Construction Stormwater Pollution Prevention Plan (SWPPP)

Minimum Requirement #2 is that all projects shall address erosion and sediment control during site construction activities. There are 13 elements that must be met to cover the general water quality protection strategies of limiting site impacts, preventing erosion and sedimentation, and managing activities and sources during the construction phase of a project.

1. Preserve Vegetation/Mark Clearing Limits
2. Establish Construction Access
3. Control Flow Rates
4. Install Sediment Controls
5. Stabilize Soils
6. Protect Slopes
7. Protect Storm Drain Inlets
8. Stabilize Channels and Outlets
9. Control Pollutants
10. Control Dewatering
11. Maintain Best Management Practices
12. Manage The Project
13. Protect Low Impact Development BMPs

Compliance with the erosion and sediment control requirements shall be demonstrated through implementation of an approved large parcel erosion and sediment control plan. A Construction SWPPP will be completed and submitted with the final stormwater report.

2.2.3 Minimum Requirement No. 3 – Source Control of Pollution

Minimum Requirement #3 is that all known, available, and reasonable source control BMPs shall be applied to all projects to prevent stormwater from coming in contact with pollutants on the developed site. Unlike Core Requirement #1, this core requirement focuses on the post-development condition of the site. Where applicable, source control BMPs will be selected, designed, and maintained according to Volume IV of the SWMMWW.

The site will be a covered multi-family apartment building where pollution concerns are limited. The covered parking garage is the most common area where pollutants may contact stormwater. Any runoff collected in inlets within the garage will be routed through an oil-water separator before discharging through the sanitary sewer connection. Illicit dischargers to storm drains will be prevented. Drains which are found to connect to the stormwater drainage system must either be permanently plugged or disconnected and rerouted as soon as possible. Plug unused drains with concrete or similar permanent materials. Furthermore, any facility material storage or maintenance facilities must implement proper spill control plan procedures including but not limited to storing pollutants in an enclosed structure.

2.2.4 Minimum Requirement No. 4 – Preservation of Natural Drainage Systems and Outfalls

Minimum Requirement #4 is that natural drainage patterns shall be maintained and discharges from the project site shall occur at the natural location to the maximum extent practicable (MEP). Discharges from the Project Site shall occur at the natural location.

For the Project, the site is located in an urbanized, central business district. There are no natural drainage systems within the vicinity of the Project area. However, the City of Puyallup's stormwater collection system is located around the Project site, and there are existing catch basins within the Project area that outfall into the City's system.

The Project will decommission the existing on-site stormwater system as part of the development, but new stormwater connections will be made into the City's system. All runoff from the site will be conveyed into the City's storm system as it currently does. The adjacent roadway will maintain its existing grades as a result of the project. The City's stormwater collection system will be maintained and the ultimate discharge to the Puyallup River will remain as well.

2.2.5 Minimum Requirement No. 5 –On-Site Stormwater Management

The Project's TDAs were evaluated for Flow Control exemption as a result of ultimately discharging into the Puyallup through entirely manmade conveyance structures. During the Project's Pre-Application Engineer Review, the City acknowledged that there is a direct connection to a flow control exempt waterbody, but there are capacity issues within the City's conveyance system to the outfall in the Puyallup River. The City is currently developing a protocol – including but not limited to fee-in-lieu payment – within the downtown business district that permits direct discharge of stormwater runoff without requiring on-site retention/detention.

As such, completion of flow Chart for Determining MR #5 Requirements the List Approach will be implemented for each surface type per List #3. The evaluation of each BMP from List #3 is provided in Table 1 below. The first feasible BMP must be selected, and once a feasible BMP is selected further evaluation may cease.

Table 1 The List Approach for MR5 Compliance

List #3 BMP	Justification for Use
Lawn and Landscaped Areas	
Post Construction Soil Quality and Depth (BMP T5.13)	Feasible: This will be implemented by leaving native vegetation undisturbed to the extent practical, reusing topsoil where practical, and importing topsoil with sufficient organic content and depth to meet requirements.
Roofs	
Downspout Full Infiltration (BMP T5.10A)	Infeasible: Siting and design criteria cannot be achieved on site due to the dense development and the presence of shallow groundwater table. There is not enough separation available from property lines, building foundations, and season groundwater level within the property limits.
Downspout Dispersion Systems (BMP T5.10B)	Infeasible: The urban lot size does not provide a sufficient vegetated flow path length to provide downspout dispersion system. As such, the building's roof drains will be directly connected to the City's stormwater system to convey runoff off-site
Perforated Stub-out Connections (BMP T5.10C)	Infeasible: Siting and design criteria cannot be achieved on site due to the dense development and the presence of shallow groundwater table. There is not enough separation available from property lines, building foundations, and season groundwater level within the property limits.

2.2.6 Minimum Requirement No. 6 – Runoff Treatment

Minimum Requirement #6 is that runoff treatment shall be evaluated for development project sites to reduce the water quality impacts of stormwater runoff from pollution-generating surfaces.

The Project Area is separated between an on-site and off-site Threshold Discharge Areas (TDA). Each TDA's proposed surface types is evaluated if it triggers the threshold that may be subject to runoff treatment requirements. The TDAs are evaluated whether or not a total of 5,000 square feet of pollution generating hard surfaces (PGHS) or more than ¾-acres of pollution generating pervious surfaces (PGPS) are present with the subject area.

2.2.6.1 TDA On-Site Runoff Treatment

The lot's zoning permits up 100% max lot coverage, which results in the building's footprint and rooftop – approximately 43,411 SF – the covering majority of the on-site TDA. The rooftop is a non-pollution-generating hard surface (NPGHS), and it is not subject to runoff treatment thresholds.

A small driveway connection to the covered parking garage is exposed, but the approximately 858 SF of PGHS does not exceed runoff treatment thresholds. Additionally, any rainwater or snowmelt tracked into the covered parking garage will be collected internally through catch basin inlets that convey runoff through an oil-water separator before ultimately discharging through a sanitary sewer line.

As such, runoff treatment is not required for runoff generated from the on-site impervious surfaces.

2.2.6.2 TDA Off-Site Runoff Treatment

Frontage improvements will occur along W Pioneer Avenue and SW 3rd Street as part of the Project. Improvements will include sidewalk widening, a traffic calming intersection bulb out, street tree replacement, minor asphalt roadway patching, and on-street parking channelization.

The roadway resurfacing may include improvements down to the existing subgrade in addition to the asphalt surfacing, which qualifies the improvements as a PGHS. The total estimated roadway resurfacing is 4,407 SF does not exceed runoff treatment thresholds.

As such, runoff treatment is not required for runoff generated from the off-site PGHS. Remaining stormwater catch basins and laterals will be maintained as they currently exist.

2.2.7 Minimum Requirement No. 7 – Flow Control

For projects in which the total of effective impervious surfaces is 10,000 square feet or more in a Threshold Discharge Area (TDA), flow control is typically required. However, flow control is not required for TDAs that discharge directly to a water listed in Appendix I-A of the Manual and qualify for flow control exemption. While the City develops its protocol for permitting flow control exemption in its downtown business district, the Project was requested to evaluate the quantity of stormwater runoff generated as a result of the project.

The Project Area is separated between an on-site and off-site Threshold Discharge Areas (TDA). Each TDA's proposed surface types is evaluated if it triggers the threshold that may be subject to flow control requirements. The TDAs are evaluated whether or not a total of 10,000 square feet of effective impervious surfaces; more than ¾-acres of or more of native vegetation, pasture, scrub/shrub, or unmaintained non-native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture, and from which there is a surface discharge in a natural or man-made conveyance system from the TDA; or TDAs that through a combination of effective hard surfaces and converted vegetation areas cause a 0.15 cubic feet per second (cfs) or greater increase in the 100-year flow frequency as estimated using an approved continuous simulation model and 15-minute time step.

2.2.7.1 TDA On-Site Flow Control

As previously mentioned, the Project's building footprint and rooftop – approximately 43,567 SF – the covering majority of the on-site TDA in an impervious surfaces. Under typical circumstances, flow control is required. However, due to the limited availability of space to provide on-site flow control in combination with the City's goal to address its housing needs and downtown revitalization efforts, a development agreement is being created to permit direct discharge of runoff directly into the City's stormwater system.

In Section 5.2, an analysis of the estimated direct discharge flowrates from the Project is discussed further.

2.2.7.2 TDA Off-Site Flow Control

As previously mentioned, frontage improvements will occur along W Pioneer Avenue and SW 3rd Street. Improvements will include sidewalk widening, a traffic calming intersection bulb out, street tree replacement, minor asphalt roadway patching, and on-street parking channelization.

The total estimated roadway resurfacing is 4,407 SF does not exceed flow control thresholds.

As such, flow control is not required for runoff generated from the on-site PGHS. Remaining stormwater catch basins and laterals in the public ROW will be maintained as they currently exist.

2.2.8 Minimum Requirement No. 8 – Wetland Protection

There are no wetlands in the immediate vicinity or indirectly through a conveyance system from the Project site. This requirement is not applicable.

2.2.9 Minimum Requirement No. 9 – Operations and Maintenance

Operation and maintenance of the on-site conveyance network and stormwater BMPs will be provided by the building's property management group. Any improvements within the public ROW will be maintained by the City. An operation and maintenance manual prepared for the Project with the final drainage report. Common maintenance tasks for the stormwater facilities are listed in Table 2.

Table 2. Operation and Maintenance Plan

Facility	Frequency	Maintenance
Conveyance Systems	Annually and major storm event	▪ Use rodding to clear any root invasion. ▪ Replace damaged pipes with dents or punctures that impact performance. ▪ Remove vegetation that reduces free movement of water through pipes. ▪ Flush pipe networks from cleanouts to clear debris.
Catch Basin	Biannually and major storm event	▪ Dry sweep the parking lots and access drives at least every 6 months to reduce accumulation of sediments and debris. ▪ Clean and dispose of trapped sediments from the sump at least every 6 months and after major storms. ▪ Dispose of any debris or accumulated sediment properly, according to federal, state, and local jurisdictions.
Energy Dissipators	Annually	▪ Replace rock pad or riprap when native soil is visible. ▪ Replace rock pad/riprap and backfill if soil erosion exceeds 6 inches.

3. Existing Site Conditions

The Project site is located on parcel 5745001371 between W Pioneer Avenue and SW 3rd Street in Puyallup, WA located in Pierce County.

The existing site is a surface parking lot that is almost entirely covered in asphalt with a few landscape islands located throughout the center and perimeter of the lot. It is extremely flat with low points and catch basin inlets spaced throughout.

The frontage surrounding the site includes sidewalks, landscape strips with street tress, and a rear alleyway. There are existing catch basin inlets located around frontage that connect to the City's existing conveyance system.

See Appendix A for reference.

3.1 Land Use

The site is in the Central business district core zone (CBD-Core) zone district and the Pedestrian Oriented Commercial (POC) Comprehensive Plan designated area. Nearby land use includes surface parking lots, public parks, churches, schools, single and multi-family housing, shopping, and restaurants.

3.2 Existing Site Hydrology

The 1.11-acre lot is 93% impervious surface with asphalt parking areas and drive aisles covering the site. Runoff is collected in catch basins at low points throughout the property. Due to the flat land surrounding the site, there is no anticipated run-on.

Table 3. Existing Land Surface Characteristics

Threshold Discharge Area	Landscape	Sidewalks (NPGHS)	Roofs (NPGHS)	Pavement (PGHS)
On-Site	3,401 SF	-	-	44,744 SF
Off-Site	860 SF	5,765 SF	-	2,925 SF

NPGHS (non-pollution-generating hard surfaces) – Roofs, sidewalks, or other hard surfaces not subject to a significant source of pollutants.

PGHS (pollution-generating hard surfaces) – Hard surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces are subject to vehicular use, industrial activities, or storage of erodible material. Bike lanes, parking lots, driveways, and unfenced fire lanes are all PGHS.

The pre-development drainage basin map can be found in Appendix A.

3.3 Infiltration Rates/Soils Reports

A draft geotechnical engineering services report was completed by GeoEngineers in March 2022. The report compiled data from previous site investigations and reports prepared by GeoEngineers previously as well as updated data from other consultants.

Test pits and bore holes encountered revealed relatively uniform subsurface conditions that differed from the mapped stratigraphy within the site vicinity. Explorations encountered between 2 and 5 feet of fill consisting of loose, moist, silty sand and sandy silt. The fill was underlain by alluvium consisting of interbedded very soft to medium stiff silt with sand and loose sand with varying amount of silt within the upper 20 feet before becoming predominantly medium dense to dense sand with varying amounts of silt that extended to the maximum depth of the borings (approximately 80 feet below the ground surface). A test pit was excavated on May 11, 2021 and used to determine the percolation rates associated with the underlying soils.

Groundwater was observed and monitored between December 2020 and May 2021. A seasonal maximum groundwater elevation of approximately 3.5 feet below ground surface was observed during these observations. It is expected that groundwater will vary between 3 and 7 feet below ground surface across the site. Geoengineers anticipates fluctuations in the local groundwater levels will occur in response to precipitation, precipitation patterns, off-site construction activities, and site utilization.

Based on their site reconnaissance and subsurface explorations, it is their opinion that the infiltration of stormwater runoff generated onsite by the proposed residential development is not feasible for this project.

Further information regarding the geotechnical investigation can be found in Appendix C.

4. Developed Site Conditions

The Project preliminarily proposes developing a 5-story apartment building with 140 residential units, covered parking, and retail space while installing new utility service connections, public frontage improvements, amenities, and open space areas as part of the development. The Project area will be approximately 1.11 acres of development that includes constructing the following:

- 140 residential units
- 2,295 square feet of retail space
- Domestic water and sewer service connections
- Dedicated fire suppression services
- Frontage improvements along SW 3rd Street and Pioneer W Pioneer Avenue

4.1 Developed Site Hydrology

The 1.11-acre lot will be developed and covered nearly entirely by the proposed building's footprint and rooftop. There are small landscaping areas on the site and the rooftop of building, but nearly 97% of the site will be covered by impervious surfaces. Frontage improvements will include replaced sidewalk, street trees, parking lanes, curb and gutter, and commercial driveway connection. Ultimately, all run-off generated will be collected and conveyed into the City's stormwater conveyance system.

4.1.1 Developed Drainage Patterns

The Project will replace an existing parking lot with a 5-story apartment building covering majority of the property limits. The building's rooftop is impervious, and its gutters will convey runoff through downspouts to the City's stormwater conveyance system through a new connection. Existing grades and drainage patterns will be maintained as a result.

The building's covered parking garage will have inlets installed at low points graded intermittently throughout. Minimal runoff is anticipated to be collected within the covered parking garage resulting from rainwater or snow melt being tracked inside. Whatever runoff is collected will drain through an oil water separator prior to connecting to the building's sanitary sewer service.

Frontage improvements along Pioneer Avenue and 3rd Street will generally match the existing roadway grade. Detailed grading will occur at curb ramps and near building entrances, but generally the existing drainage patterns will remain. Runoff from new hard surfaces within the City's right-of-way will be graded into the roadway, conveyed along the curb line, and collected in public catch basins. The City's existing stormwater conveyance system will remain as is where it will drain stormwater away from the downtown area to its outfall location in the Puyallup River.

For additional detail, see the post-development basin figure in Appendix A.

Table 4. Developed Land Coverage

Threshold Discharge Area	Landscape	Sidewalks (NPGHS)	Roofs (NPGHS)	Pavement (PGHS)
On-Site	1,083 SF	2,793 SF	43,411 SF	858 SF
Off-Site	1,068 SF	4,075 SF	-	4,407 SF

NPGHS (non-pollution-generating hard surfaces) – Roofs, sidewalks, or other hard surfaces not subject to a significant source of pollutants.

PGHS (pollution-generating hard surfaces) – Hard surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces are subject to vehicular use. Bike lanes, parking lots, driveways, and unfenced fire lanes are all PGHS.

5. Permanent Stormwater Control Plan

A permanent storm control plan is required since the Project must meet Minimum Requirements 1-9. Runoff treatment BMPs remove pollutants generated from hard surfaces to prevent downstream pollution. Flow control facilities mitigate potential adverse impacts on downstream properties and waterbodies due to the increase in stormwater runoff caused by increased impervious surfaces.

5.1 Methodology

The SWMMWW was used as a reference to complete hydrologic analysis and design to select appropriate and applicable BMPs for runoff treatment and flow control. On-site stormwater management BMPs from List #3 were evaluated for feasibility and selected as discussed previously in section 2.2.5.

As previously mentioned, the Project's building footprint and rooftop – approximately 43,411 SF – the covering majority of the on-site TDA in an impervious surfaces. Under typical circumstances, flow control is required. However, due to the limited availability of space to provide on-site flow control in combination with the City's goal to address its housing needs and downtown revitalization efforts, a development agreement is being created to permit direct discharge of runoff directly into the City's stormwater system. The City has requested an estimate of the runoff quantity generated a result of these replaced and new hard surfaces.

As such, hydrologic analysis of pre- and post-development conditions are based on hydrographs, water quality flowrates, and discharge flowrate comparisons calculated by the Western Washington Hydrology Model 2012 (WWHM 2012).

Two separate analyses were conducted. The first evaluated the existing land surface coverage of the existing parking lot, and the second evaluated the pre-development forested conditions. The first evaluation was prepared to conduct a comparison of the existing parking lot's runoff generation and off-site runoff discharge rates and the apartment's proposed direct-discharge condition to the City's system. The second evaluation was prepared to consider the typical flow control requirements of reducing post-development discharge rates to that equal to or less than forested site conditions.

Pre-development developed surface conditions were analyzed by using long-term recorded precipitation data for regional specificity, vegetation and land conditions, and continuous simulation hydrology modeling. Pre-development basins were modelled as flat impervious and pervious land use. WWHM models times of concentrations (Tc) and rainfall events from historical data. Land surface characteristics are provided in Table 3.

Post-development surface conditions were analyzed comparing the same precipitation data and continuous simulation hydrology modelling with the new land surface characteristics from developed land coverage. Contributing areas were modeled as impervious land use flat roads; flat roofs, and flat walks. Pervious land use were modelled as pervious Type C lawn. Developed TDAs land coverage details are provided in Table 4.

WWHM 2012 stormwater modelling reports can be found in Appendix E.

5.1 Runoff Treatment BMPs

Within the project limits, there are no TDAs with more than 5,000 square feet of new pollution-generating hard surface (PGHS) being created. Therefore, the project does not require construction of stormwater treatment BMPs for these areas.

5.2 Flow Control Analysis

As previously mentioned, two analyses were prepared to evaluate flow control for the Project.

The first evaluation analyzed the existing parking lot's runoff generation and off-site runoff discharge rates and the apartment's proposed direct-discharge condition to the City's system. The results are summarized below in Table 5.

Table 5 Flow Control Analysis #1

Storm Event	Pre-Development		Post-Development	
	On-Site (cfs)	Off-Site (cfs)	On-Site (cfs)	Off-Site (cfs)
2-Year	0.36	0.05	0.38	0.05
10-Year	0.58	0.08	0.60	0.08
25-Year	0.71	0.10	0.73	0.10
50-Year	0.81	0.11	0.84	0.11

Given the similar, nearly fully impervious conditions of pre- and post-development the amount of runoff generated is nearly identical.

The second evaluation was prepared to consider the flow control requirements of reducing post-development discharge rates to that equal to or less than forested site conditions. An underground vault with a flow control structure was selected to retain runoff before discharging at less than or equal to pre-development conditions. The underground vault would need to be approximately 440'x20'x7' (LxWxH).

Table 6 Flow Control Analysis #2

Storm Event	Pre-Development	Post-Development
	On-Site (cfs)	On-Site (cfs)
2-Year	0.02	0.01

Storm Event	Pre-Development	Post-Development
	On-Site (cfs)	On-Site (cfs)
10-Year	0.04	0.03
25-Year	0.05	0.05
50-Year	0.06	0.06

As noted, a large underground detention facility would be required to reduce runoff flowrates to less than or equal to forested conditions. It is not feasible to install an underground detention vault within the Project's property limits due to existing utility easements and proposed columns and foundation locations. The Project will work with the City to permit direct discharge to its stormwater conveyance system in order to manage the runoff generated from the site.

WWHM 2012 stormwater modelling reports can be found in Appendix E.

6. Off-site Analysis

An analysis was conducted to determine if project construction will create any drainage problems downstream of the project limits. Completion of the project will result in a similar quantity of impervious surfaces and therefore similar amount of runoff generated from the Project site. However, the replacement of the existing, pollution generating parking lot with a non-leaching roof of the proposed building will reduce the amount of contaminated stormwater runoff from the site. As such, the Project will result in similar quantity of runoff but with less pollutants contributing to the watershed.

6.1 Study Area Definition and Maps

The Project area is located within the South Puyallup and Clarks Creek subbasin in the Puyallup/White watershed in the Water Resource Inventory Area (WRIA) 10 per Ecology. The site-specific study area will extend from the Project site to its ultimate outfall in the Puyallup River through the City's existing conveyance system.

6.2 Resource Review

WRIA 10 is defined as the area that drains to the Puyallup, White, and Carbon Rivers, which originate on Mount Rainier. The annual precipitation in the Puyallup-White Watershed ranges from 30 to 40 inches per year in the greater Tacoma area to over 120 inches in the Cascade Mountains. The Puyallup-White Watershed is one of the most heavily populated basins in western Washington.

The western portion of the Puyallup-White Watershed is predominantly urban, characterized by a combination of residential, industrial, commercial, agricultural, transportation, communication, and utility land uses. The most populated cities in the watershed are Tacoma, Auburn, and Federal Way. Approximately 14 percent of the watershed is within a city or designated urban growth area, and approximately 86 percent of the WRIA is outside of the urban growth areas. The confluence of the Puyallup River with Commencement Bay occurs in the urbanized and highly industrialized Port of Tacoma. The eastern or upland portion of the watershed generally consists of commercial forest land, Mount Rainier National Park (19 percent of the WRIA), and the Baker-Snoqualmie and Gifford Pinchot national forests (26 percent of the WRIA). Washington State agencies manage about 3% of the WRIA. Land uses shift to agriculture, suburban developments, and small urban centers in the foothills of the Cascade Mountains. Rural residential development has primarily occurred in the foothills outside of the urban centers.

WRIA 10 is an important watershed for several salmon species – Chinook, Coho, Sockeye, Pink, and Shum – listed under the Endangered Species Act as well as other fish species. Many communities rely on the watershed for their water supply through a mix of groundwater and surface water. Ecology recently published a restoration and enhancement plan for the watershed in 2021 outlining projects and implementation plans to offset the consumptive water use from well connection located throughout the watershed's area.

6.3 Existing Conveyance System Analysis

The City's GIS system was reviewed to trace the downstream route runoff with be conveyed from the Project site to its outfall in the Puyallup River. The analysis is limited to a qualitative review of the City's system.

After entering the City's stormwater system in 3rd Street SW, runoff will travel south approximately 300 feet through a 12-inch diameter concrete pipe and enter into another storm sewer main on 4th Avenue SW. The 4th Avenue SW storm drain is a 24-inch diameter concrete storm sewer. The 4th Avenue SW storm drain will carry the stormwater west for approximately 0.8 miles to Pioneer Street. The water is conveyed approximately 100 feet west along Pioneer Street until it intersects with a weir box at the intersection of 17th Street SW and Pioneer. Low flows are then diverted north along 15th Street SW towards the Puyallup River and high flows are conveyed west along Pioneer towards Clarks Creek.

The Puyallup River is approximately 1.1 miles north of the 15th Street SW/Pioneer Intersection. Clarks Creek is approximately 0.5 miles west of the 15th Street SW/Pioneer Intersection. Low flows for part of the Clarks Creek Drainage basin are diverted north to the Puyallup River in a weir box located at the intersection of Pioneer and 15th Street. SW; however, peak flows are conveyed west to Clarks Creek.

6.4 Downstream Water Quality

A review of Ecology's list of impaired water bodies indicates that Puyallup River is listed as an impaired water body. The impaired water body is categorized as follows:

- Category 5 (303d list) for temperature.
- Category 5 (303d list) for bacteria-fecal coliform.
- Category 5 (303d list) for Mercury.
- Category 2 (water of concern) for Lead.
- Category 2 (water of concern) for Dissolved Oxygen.
- Category 2 (water of concern) for Turbidity.
- Category 1 (meets tested criteria) for arsenic.
- Category 1 (meets tested criteria) for Ammonia-N.
- Category 1 (meets tested criteria) for pH.
- Category 1 (meets tested criteria) for Zinc.
- Category 1 (meets tested criteria) for Copper.

The Puyallup River is an identified water body with both aquatic life and recreation use. Therefore, the Department of Ecology has the following Water Quality Standards for this water body:

- Temperature: 60.8 degrees Fahrenheit.

- DO: 9.5 milligrams per liter (mg/L).
- pH: pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 standard units.
- Turbidity: 5 nephelometric turbidity units (NTUs) over background when the background is 50 NTUs or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTUs.
- Bacteria: Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies per 100 milliliters (mL), with not more than 10 percent of all samples (or any single sample when less than 10 sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies/100 mL.

6.5 Floodplain Analysis

The project site is outside of a floodplain. See Appendix A for the FEMA Firmette Map.

7. Conveyance System

Any conveyance system shall be designed to convey and contain up to the 25-year storm event.

The Project proposes installing a gutter system to collect and convey runoff generated from the building's rooftop through downspouts and a new 8-inch diameter schedule 40 PVC stormwater service connection into the City's conveyance system.

Preliminary design indicates that an 8-inch diameter pipe with a Manning's n roughness value of 0.012 at 2% slope would be 50% full when conveying 0.73 cfs, the 25-year event flowrate.

For the final design, all storm connection(s) shall be designed as 8-inch diameter pipe sloped at a minimum of 2%.

8. Covenants, Dedications, Easements, Agreements

There several existing utility easements recorded on the Project's property that will remain in effect or resolved with the affected party. The site contains an easement granted to the City of Puyallup for public street right-of-way per Ordinance 2486 as a result of a vacated alley. This easement coincides with a 19-foot-wideutility easement (AFN 9609190314). In addition, there is a 10'x25' Utility easement on the southeast side of the property (AFN 201306120788), a 5'x10' utility easement on the east side of the property (AFN 201401150634). There is also a 10'x25' utility easement on the northeast side of the property (AFN 201401150634).

An agreement between the developer and the City of Puyallup to remove the flow control requirement for the Project is under discussion. The agreement has not been executed yet. Once terms have been agreed upon and the agreement is in place, on-site detention will not be provided, and the property will directly discharge stormwater runoff to the City's existing conveyance system.

9. Other Permits

This project will require the following permits from Pierce County Public Works:

- Building Permit
- Right Of Way Use Permit

10. References

Pierce County. Maps/GIS. Available at https://www.Piercecountywa.gov/879/Maps-GIS-Information

Federal Emergency Management Agency. FEMA Flood Map Service Center. Available at https://msc.fema.gov/portal/home.

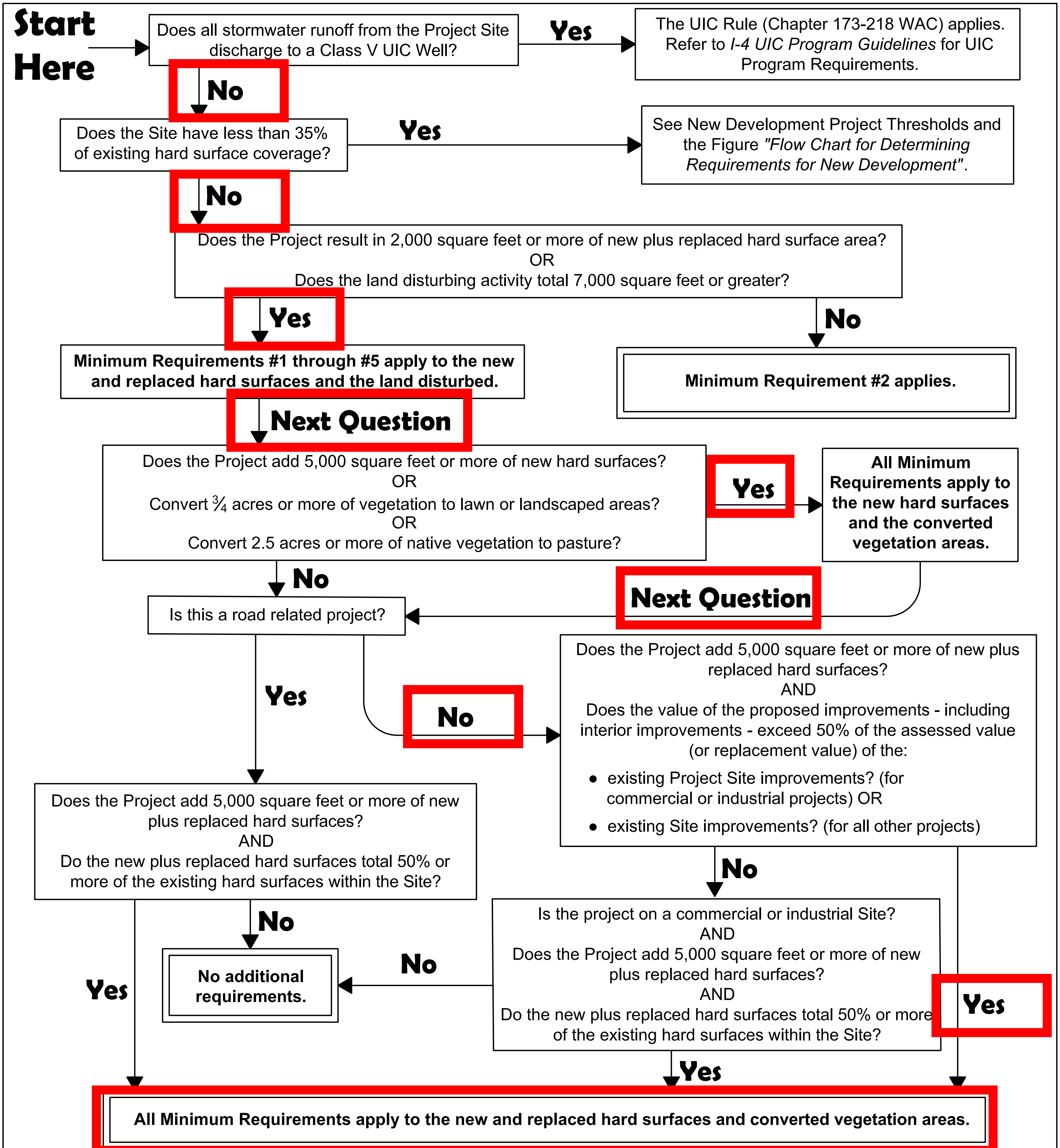
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/. Accessed August 2025.

Washington State Department of Ecology (Ecology). 2024. 2024 Stormwater Management Manual for Western Washington. Publication Number 24-10-013. Available at https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals.

Washington State Department of Ecology (Ecology). 2016. Washington State Water Quality Atlas version 2.0.0.1. Available at https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx.

Appendix A

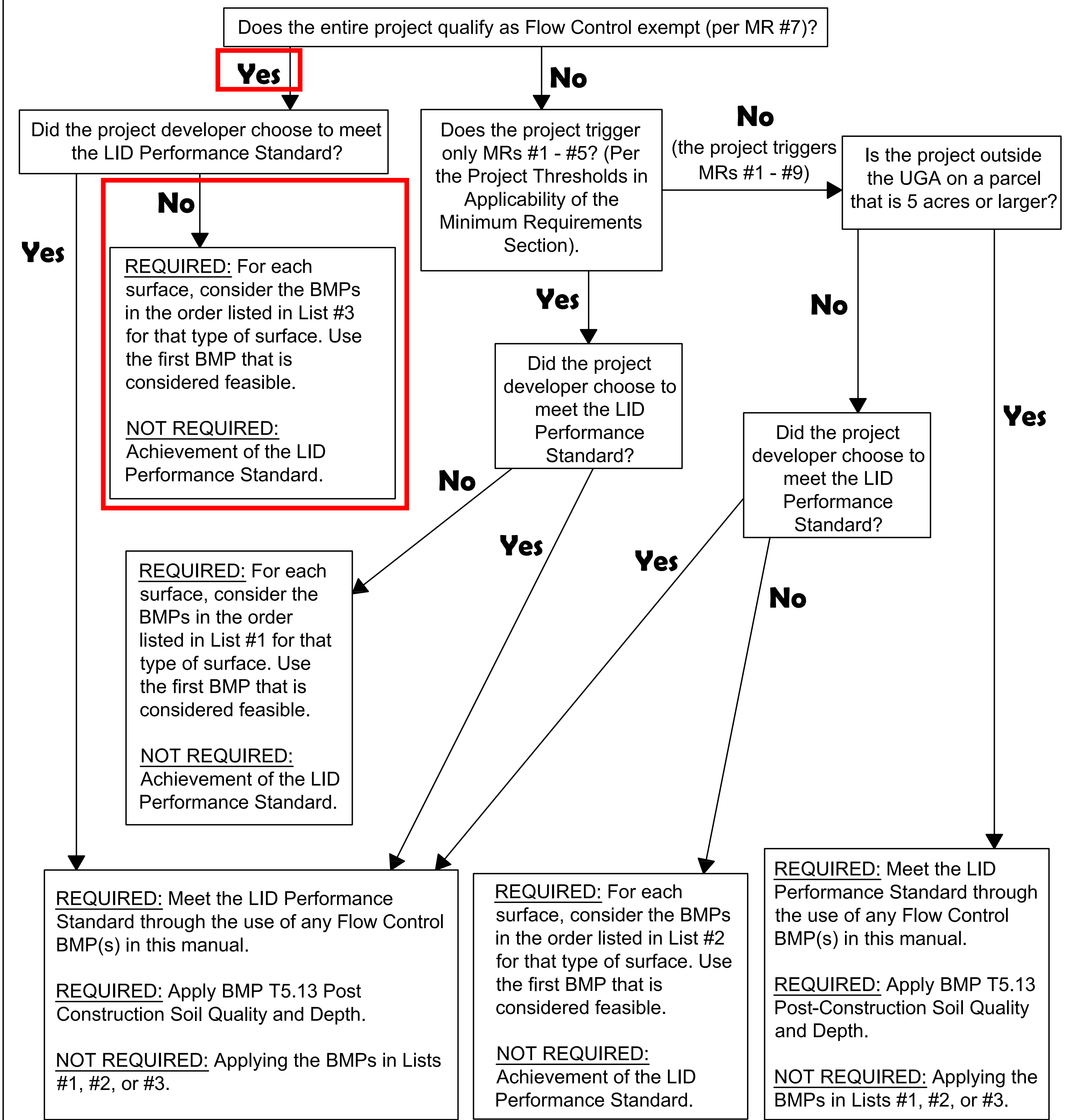
Supplemental Figures



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for Redevelopment

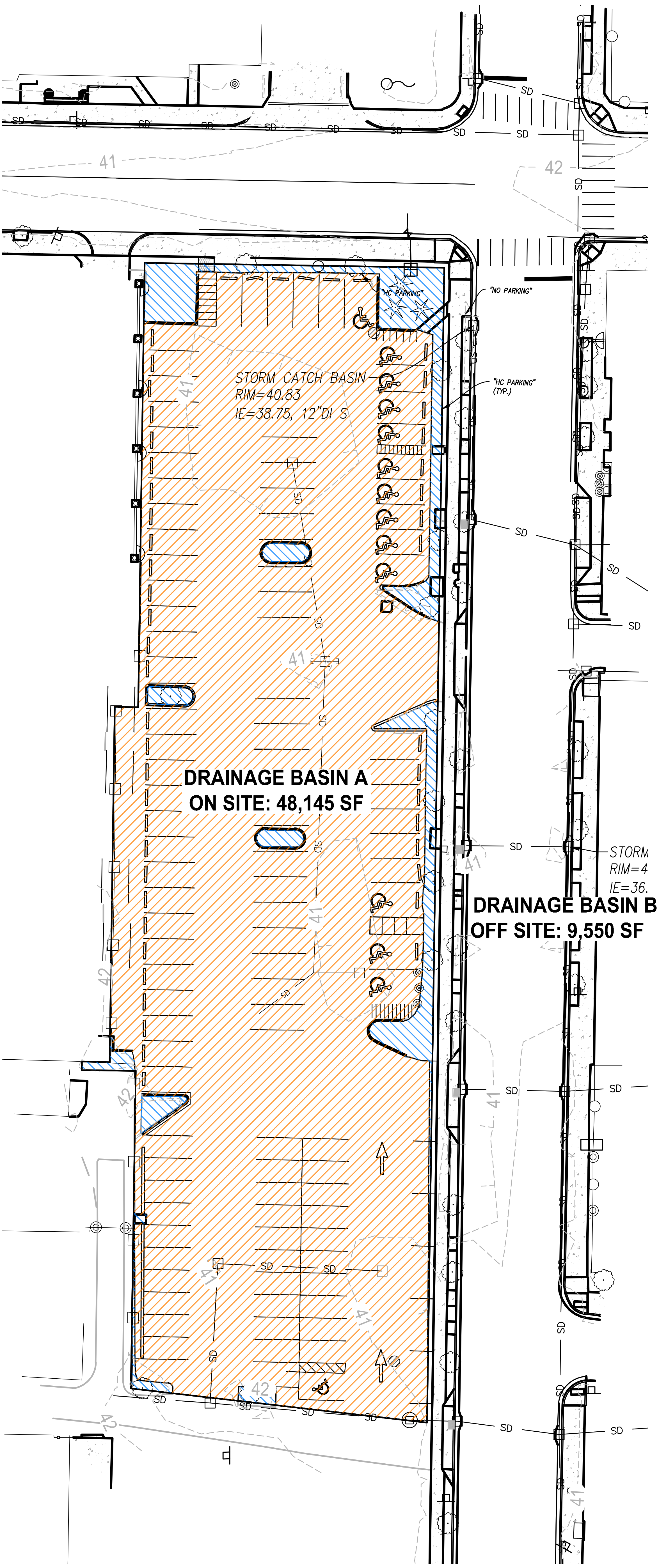
Revised April 2024



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining MR #5 Requirements

Revised March 2019



LEGEND

BASIN A:

- IMPERVIOUS (44,744-SF)
- PERVIOUS (3,401-SF)

BASIN B:

- IMPERVIOUS (8,690-SF)
- PERVIOUS (860-SF)

NOTES

1. EXISTING SITE IS RELATIVELY FLAT.
2. THERE ARE EXISTING DRAINAGE FACILITIES LOCATED - INCLUDING CATCH BASIN INLETS - WITHIN THE PROPERTY LIMITS.
3. STORMWATER RUNOFF IS ASSUMED TO DISCHARGE ENTIRELY OFF-SITE THROUGH EXISTING CONNECTIONS TO THE CITY OF PUYALLUP'S STORMWATER DRAINAGE SYSTEM.
4. THE CITY'S STORMWATER SYSTEM ULTIMATELY OUTFALLS INTO THE PUYALLUP RIVER.

Parametrix DATE: October 17, 2025 FILE: AOB-STORM-V1

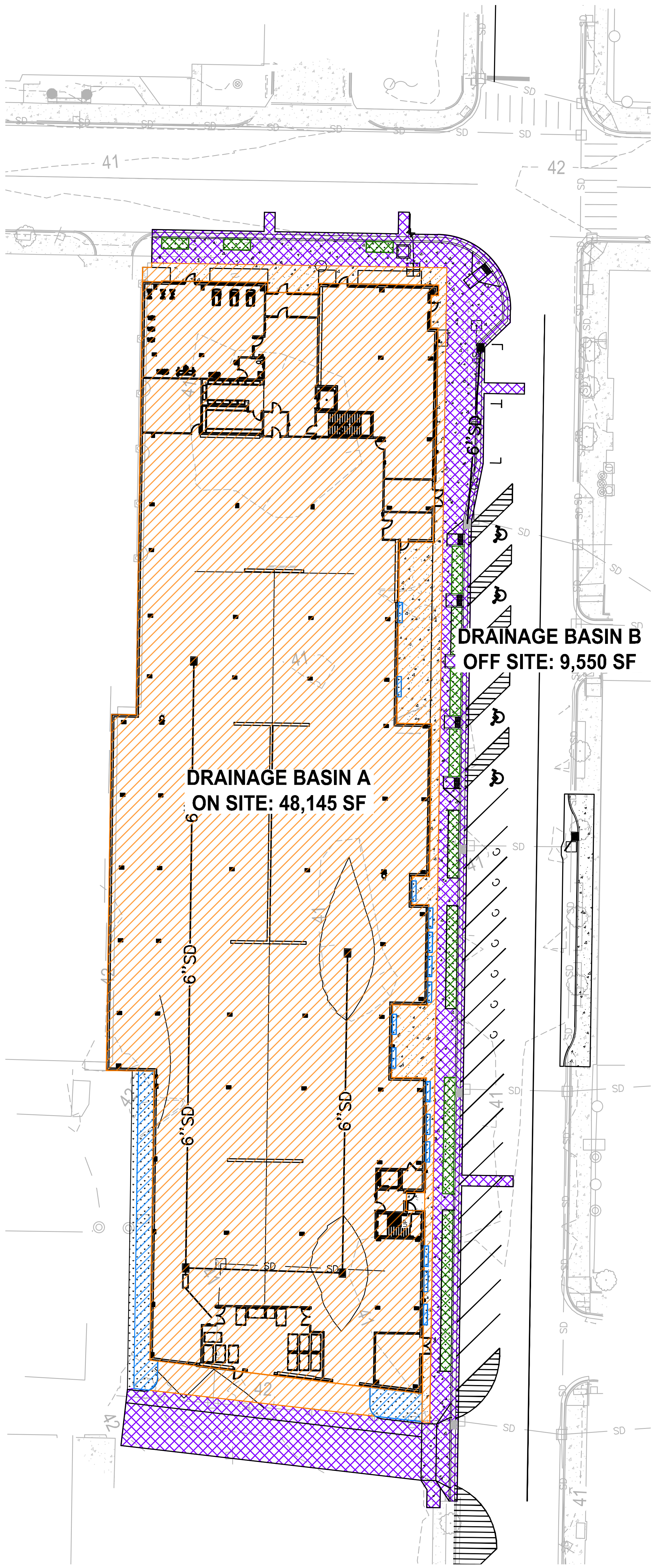
N

0 40

1 INCH = 40 FT.

PRE-DEVELOPMENT DRAINAGE BASINS

PUYALLUP AOB



LEGEND

BASIN A:

IMPERVIOUS (47,062-SF)

PERVIOUS (1,083-SF)

BASIN B:

IMPERVIOUS (8,482-SF)

PERVIOUS (1,068-SF)

NOTES

1. THE GROUND-LEVEL PARKING GARAGE WILL BE COVERED BY RESIDENTIAL UNITS ABOVE AND THE BUILDING'S ROOFTOP.
2. ANY RUNOFF COLLECTED WITHIN THE GARAGE WILL BE ROUTED THROUGH AN OIL-WATER SEPARATOR AND DISCHARGED TO THE SANITARY SEWER SERVICE.
3. STORMWATER RUNOFF FROM THE ROOFTOP WILL BE DISCHARGED OFF-SITE THROUGH NEW CONNECTIONS TO THE CITY OF PUYALLUP'S STORMWATER DRAINAGE SYSTEM.
4. THE CITY'S STORMWATER SYSTEM ULTIMATELY OUTFALLS INTO THE PUYALLUP RIVER.

Parametrix DATE: October 17, 2025 FILE: AOB-STORM-V1

N

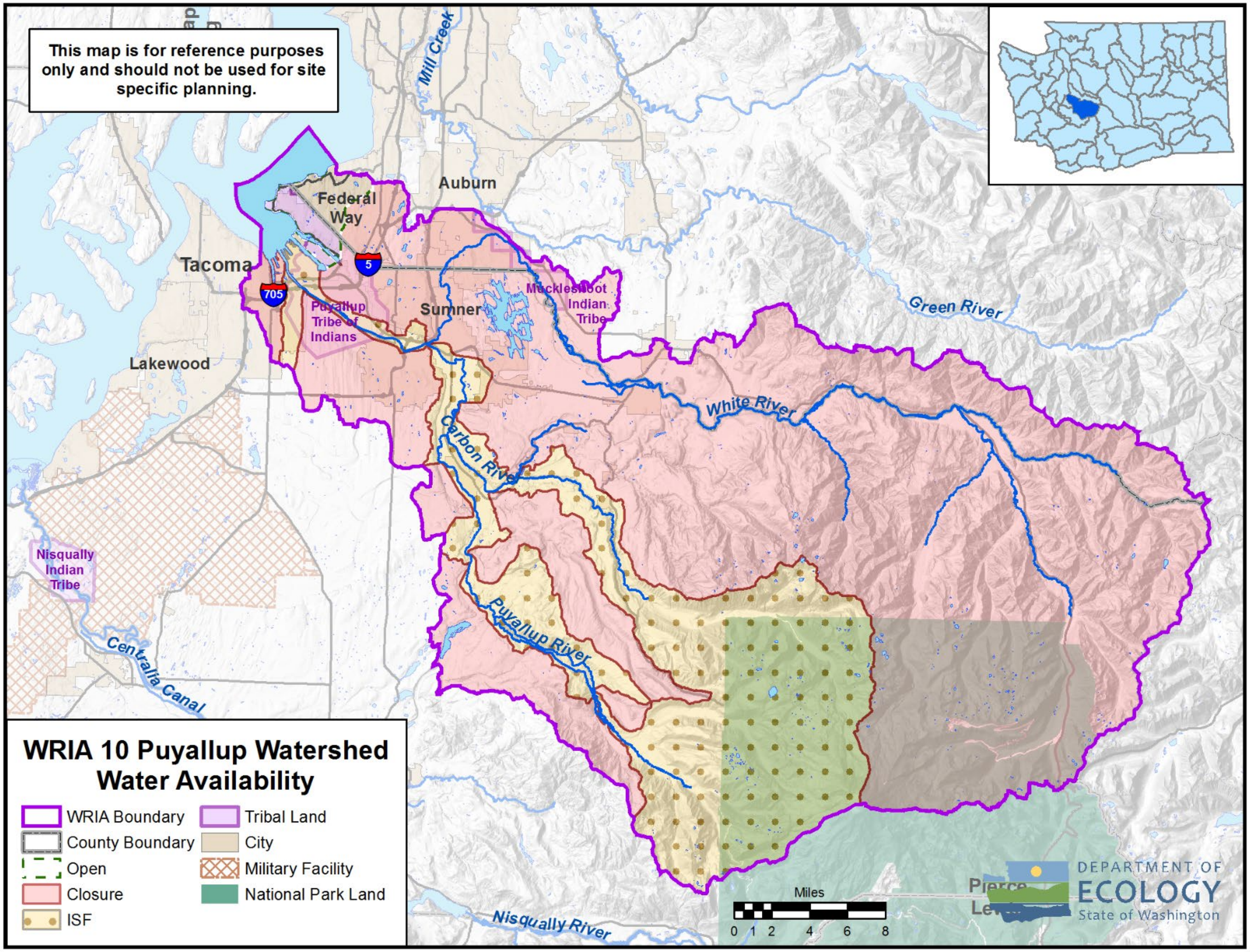
0 40

1 INCH = 40 FT.

POST-DEVELOPMENT DRAINAGE BASINS

PUYALLUP AOB

Map

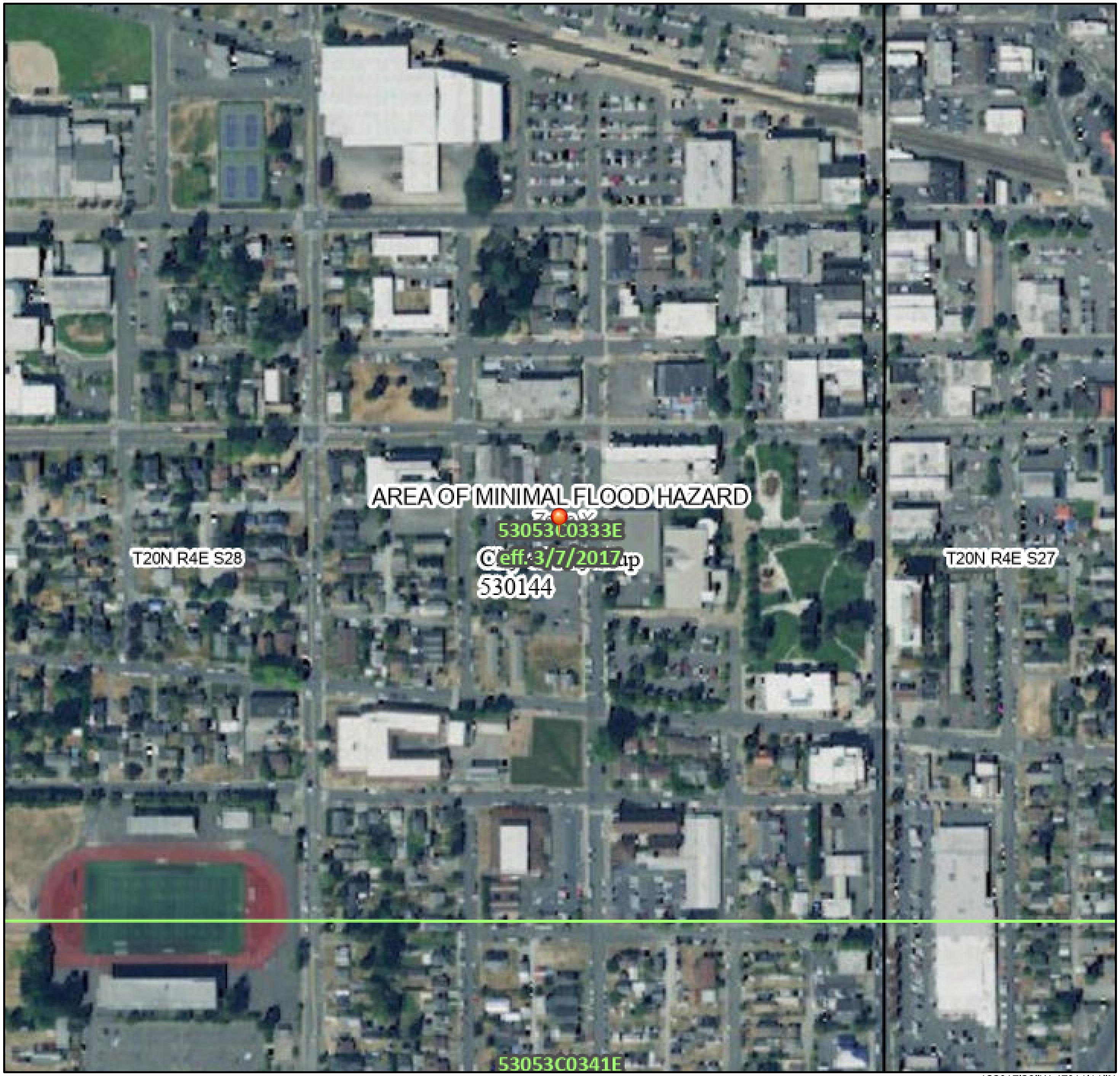


This map is for reference purposes only and should not be used for site specific planning.
Mill Creek
Auburn
Federal Way
Tacoma
5
705
Puyallup Tribe of Indians
Sumner
Muckleshoot Indian Tribe
Green River
Lakewood
White River
Carbon River
Nisqually Indian Tribe
Puyallup River
Centralia Canal
Nisqually River
Miles
0 1 2 4 6 8
WRIA 10 Puyallup Watershed Water Availability
WRIA Boundary
County Boundary
Open
Closure
ISF
Tribal Land
City
Military Facility
National Park Land
DEPARTMENT OF ECOLOGY State of Washington

National Flood Hazard Layer FIRMette

FEMA

122°18'7"W 47°11'35"N



122°17'29"W 47°11'11"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

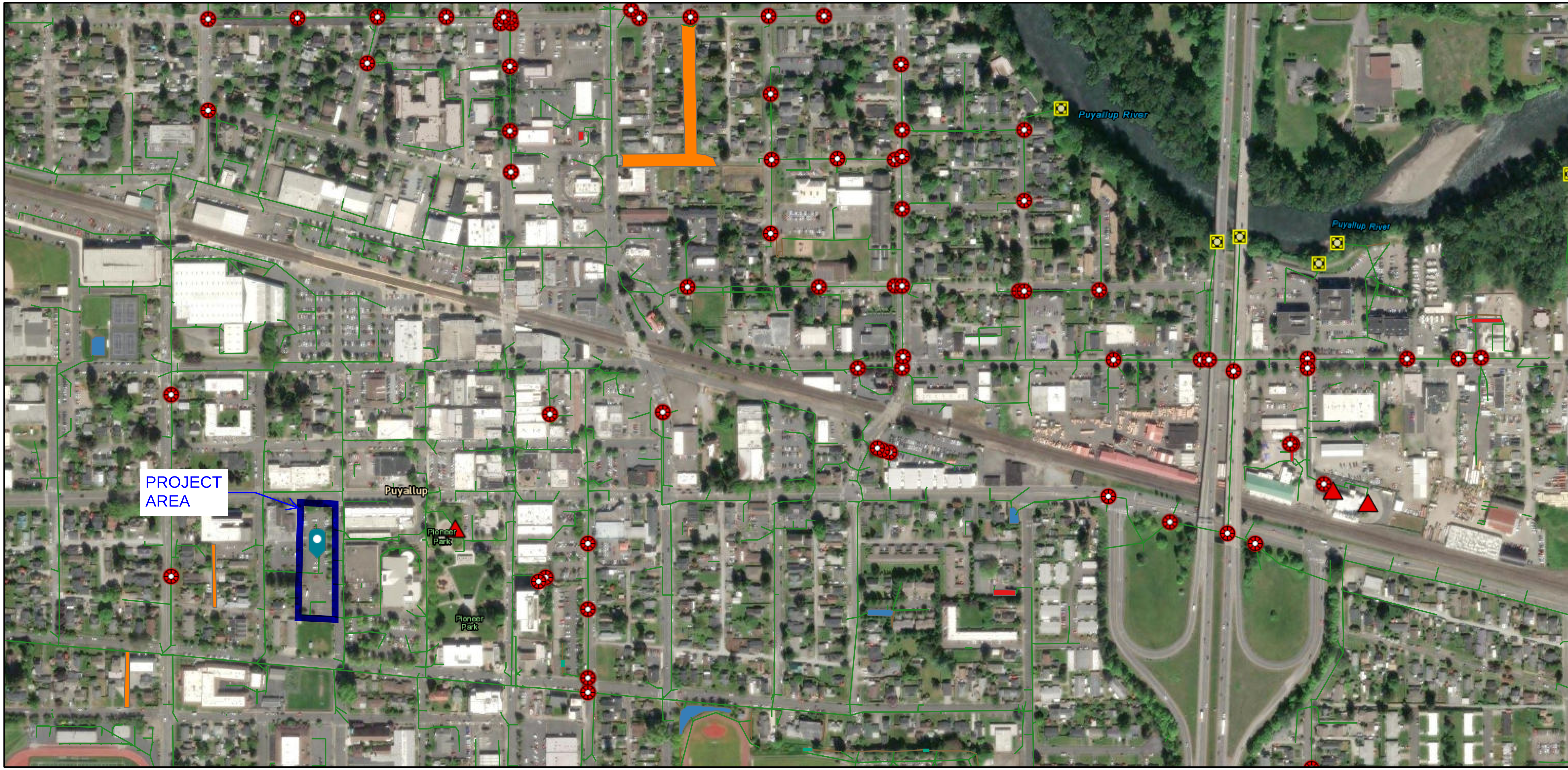
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/17/2025 at 8:54 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix B

Pierce County GIS Maps

Puyallup AOB



9/10/2025, 10:31:41 AM

World_Boundaries_and_Places
Outfalls
Manholes
Control Structures
Pipes
Culverts
Channels
Facilities
System
Pond
Vault
Permeable
World Imagery
Low Resolution 15m Imagery
High Resolution 60cm Imagery
High Resolution 30cm Imagery
Citations
1.2m Resolution Metadata

1:6,660

0 280 560 1,120 ft
0 85 170 340 m

Esri, HERE, Garmin, iPC, Maxar

Appendix C

Geotechnical Engineering Investigation Report

Draft Geotechnical Engineering Services Report

Puyallup AOB Site
Puyallup, Washington

for
MC Construction Consultants

March 28, 2022

GeoEngineers
1101 Fawcett Avenue, Suite 200
Tacoma, Washington
253.383.4940

Draft Geotechnical Engineering Services Report

Puyallup AOB Site
Puyallup, Washington

File No. 8947-005-00

March 28, 2022

Prepared for:

MC Construction Consultants
5219 North Shirley Street No. 100
Ruston, Washington 98407

Attention: Garren Echols Prepared by:

GeoEngineers, Inc.
1101 Fawcett Avenue, Suite 200
Tacoma, Washington
253.383.4940

Brett E. Larabee, PE
Senior Geotechnical Engineer

Dennis, "DJ" Thompson, PE
Associate

BEL:DJT:tjh

GeoEngineers

Table of Contents

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANIDNG

GeoEngineers, Inc. (GeoEngineers) is pleased to submit this geotechnical engineering study and report for the Puyallup AOB Site. The site is located at 330 3rd Street SW in Puyallup, Washington as shown on the Vicinity Map, Figure 1. Prior experience at this site includes subsurface explorations and a preliminary study prepared by GeoEngineers for the City of Puyallup to support potential improvements to the site. GeoEngineers advanced three borings which we reference to support this study. Our previous report is titled “AOB Site Preliminary Geoenvironmental Study” and is dated September 30, 2011 (September 2011 Report).

Our understanding of the proposed improvements is based on conversations with you and review of preliminary site plans. Proposed improvements include a four-story multifamily residential structure with at grade parking and with three stories of residential space above. Below grade parking is not currently envisioned. Based on our discussions with you, we understand that the preferred foundation support method is conventional shallow foundations underlain by ground improvement.

2.0 SCOPE OF SERVICES

The purpose of our services is to review existing geotechnical information at the site as a basis for providing geotechnical design and construction recommendations for the proposed development. In general, our authorized services included: reviewing selected geotechnical information about the site; completing geotechnical analyses; and preparing this geotechnical report with our conclusions, findings and recommendations. Our services are being provided in general accordance with our agreement with MC Construction Consultants authorized February 22, 2022. Our complete scope of services is provided in our proposal dated February 3, 2022.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The site is located southwest of the intersection of Pioneer Way and 3rd Street SW in downtown Puyallup and is bounded to the north and east by city street right-of-way and by commercial lots to the west and south. The site is currently used as an asphalt paved parking area. Landscaping areas that include small trees, grasses, and shrubs are located on the perimeter.

The site is relatively level with small variations in topography between opposite sides. We understand that prior development of the site included a two-story building in the southeast corner and a grocery store in the center of the site, both of which were removed prior to construction of the parking lot.

3.2. Literature Review

3.2.1. Geologic Conditions

Based on our review of the map titled “Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington” (Schuster et. al. 2015) the site is underlain by Holocene Alluvium (map unit Qa). This deposit is described as comprising a mixture of sand, silt, gravel and cobbles. In addition, alluvium deposits in this region can be underlain by lahars and mudflow deposits from Mt. Rainier.

3.2.2. Prior Geotechnical Studies

In addition to the 2011 Report prepared by GeoEngineers for this site, we reviewed two other geotechnical studies that were completed at the site:

- ✓ "Groundwater Level Monitoring and Preliminary Infiltration Feasibility Evaluation" Aspect Consulting, June 2, 2021
- ✓ "Supplemental Geotechnical Report Small Scale Infiltration Test" Leroy Surveyors and Engineers, Inc., January 6, 2022

These reports were prepared primarily to evaluate stormwater infiltration feasibility at the site.

✓ GeoEngineers prior work at the site also includes completing a Phase 1 Environmental Site assessment for the City of Puyallup (report dated September 15, 2011). This report can be provided for review, if requested.

3.3. Subsurface Conditions

3.3.1. Soil Conditions

As part of GeoEngineers 2011 report, three borings were advanced at the site to depths between 21.5 feet and 80 feet below ground surface (bgs). The locations of these borings are shown on the Site Plan, Figure 2 and the summary explorations logs are included in Appendix A. Borings B-1 and B-2 for this study were completed as monitoring wells; details of well construction are also included in Appendix A. Additional borings were not completed as part of the Aspect Consulting and Leroy Surveyors Reports. A shallow excavation for an infiltration test was completed as part of the Leroy Surveyors report. The location of the infiltration test is also shown on the Site Plan.

The borings completed for the 2011 report were advanced in areas surfaced with asphalt concrete. Asphalt thickness was on the order of 2 inches and was underlain by about 2 inches of base course. Below the asphalt, soil conditions described generally consisted of fill underlain by alluvium.

Fill extended approximately 2 to 5 feet below the ground surface. Fill consisted of brown silty sand and sandy silt in a moist condition and was typically in a loose or soft condition.

Alluvium underlying the fill generally consisted of layers of silt, silty sand, and sand with silt. Within about 20 feet of the ground surface, the alluvium was typically very loose to loose (or very soft to medium stiff). Below about 20 feet the relative density of the alluvium generally increased and was typically medium dense to dense, however intermittent layers of loose soil conditions were also noted. B-1 and B-2 were terminated around 21.5 feet bgs. B-3 was terminated around 80 feet bgs.

3.3.2. Groundwater Conditions

Groundwater was reported between 6 and 7 feet at the time of drilling. Groundwater monitoring in the B-1 and B-2 monitoring wells was completed by Aspect Consulting between December 8, 2020 and May 11, 2021. During that timeframe, seasonal high groundwater levels were measured between 3.5 and 4.5 feet bgs. A plot of groundwater levels provided in the Aspect Consulting Report is included as Figure 3 for reference.

We expect that groundwater levels will fluctuate throughout the year but will typically be within 3 to 7 feet of the ground surface. This interpretation is consistent with the groundwater monitoring competed by Aspect Consulting and our experience in the area.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Seismic Design Considerations

4.1.1. Seismic Design Parameters

2021 IBC adoption pending (Nov 1 2023)

We understand that seismic design will be completed using procedures outlined in the 2018 International Building Code (IBC). Per the 2018 IBC, structures shall be designed and constructed to resist the effects of earthquake motions in accordance with American Society of Civil Engineers (ASCE) 7-16.

As discussed below, the alluvial soils at the site are potentially liquefiable during the design seismic event. Due to the presence of potentially liquefiable soils, the site is classified as Site Class F, and a site-specific response analysis could be required.

However, an exception is provided in ASCE 7-16 Section 20.3.1. Site-specific response analysis is not required for liquefiable soils, provided the structure has a fundamental period of vibration equal or less than 0.5 seconds. Provided this exception is true, the site-specific response spectrum for Site Class D may be used as a basis for a simplified design and analysis.

Additionally, in accordance with ASCE 7-16 Section 11.4.8, a ground motion hazard analysis is required for sites classified as Site Class D and because the spectral response acceleration at 1-second periods (S_1) is greater than or equal to 0.2. However, an exception is allowed, provided specific requirements are satisfied, related to the fundamental period of the considered structure.

Table 1 below provides recommended seismic design parameters for Site Class D. These values are only valid if the exceptions provided in ASCE 7-16 Sections 11.4.8 and 20.3.1 described apply to the structures. If these expectations do not apply, we should be consulted further as a site-specific response analysis could be required.

TABLE 1. RECOMMENDED SEISMIC DESIGN PARAMETERS

2018 IBC (ASCE 7-16) Seismic Design Parameters	Recommended Value[1,2,3]
Site Class	D
Mapped Spectral Response Acceleration at Short Period (S_S)	1.273 g
Mapped Spectral Response Acceleration at 1 Second Period (S_1)	0.438 g
Site Amplification Factor at 0.2 second period (F_a)	1.0
Site Amplification Factor at 1.0 second period (F_v)	1.862
Design Spectral Acceleration at 0.2 second period (S_{DS})	0.849 g
Design Spectral Acceleration at 1.0 second period (S_{D1})	0.544 g
Site Modified Peak Ground Acceleration (PGA_M)	0.55 g

Notes:

[1] Parameters developed based on Latitude 47.189333307° and Longitude -122.296787743°.

[2] These values are only valid for structures with fundamental periods less than 0.5 seconds.

[3] A ground motion hazard analysis may be required in accordance with Section 11.4.8 of ASCE 7-16 (Site Class D and $S_1 \geq 0.2$).

4.1.2. Liquefaction

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in saturated soils and a subsequent loss of soil strength. In general, soils that are susceptible to liquefaction include loose to medium dense "clean" to silty sands and non-plastic silts that are below the water table. We evaluated the soil profile for liquefaction potential using methods developed by Idriss and Boulanger (2008). This method compares the predicted cyclic shear stress (CSS) induced by the design earthquake to the cyclic shear resistance (CSR) determined by correlations with standard penetration test (SPT) blow counts. The ratio of the CSR to the CSS is the cyclic shear ratio and is considered the factor of safety against liquefaction.

Based on the results of our liquefaction analysis, the alluvium at the site is, in our opinion, potentially liquefiable. Based on the conditions described on the B-3 boring log, the bottom of the potentially liquefiable soils appears to be around 60 feet bgs.

Our analyses indicates that between about 12 and 18 inches of liquefaction-induced settlement could occur within the upper 60 feet of the soil profile during the design seismic event. Due to the variability of underlying soils and the inherent unpredictability of seismic soil liquefaction, differential settlements could be more than half to equal the total estimated settlement between similarly loaded foundations within a distance greater than about 50 to 100 feet apart.

4.1.3. Lateral Spreading Potential

Lateral spreading related to seismic activity typically involves lateral displacement of large, surficial blocks of non-liquefied soil when a layer of underlying soil loses strength during seismic shaking. Lateral spreading usually develops in areas where sloping ground or large grade changes (including retaining walls) are present. Based on the relatively flat topography of the site, our understanding of the liquefaction risk at the site, and the proposed improvements, it is our opinion that the risk of lateral spreading is low.

4.1.4. Surface Rupture

According to the Washington State Department of Natural Resources Interactive Natural Hazards Map (accessed January 31, 2022), there are no mapped faults or other seismogenic features within about 1 mile of the site. Based on the distance to the nearest mapped fault or seismogenic feature, it is our opinion the risk for surface rupture at this site is low.

4.2. Foundation Support

4.2.1. General

We expect that the estimated liquefaction settlement magnitudes will be excessive from a structural perspective and that liquification mitigation or alternative foundation support methods will be necessary. Based on conversations with you, we understand that your preferred approach to foundation support is conventional shallow foundations underlain by ground improvement. Alternatively, we expect that the proposed structure could be supported on deep foundations (driven piles, augercast piles, drilled shafts, etc.). The sections below provide recommendations for design of ground improvement and shallow foundations located within ground improvement areas and outside of ground improvement areas. We can provide recommendations for design of other foundation support methods, if requested.

4.2.2. Ground Improvement

4.2.2.1. General

We understand that compacted aggregate piers (CAPs), is the current ground improvement method proposed for this site. CAPs, which are often referred to by a trade name, GeoPiers or Rammed Aggregate Piers. CAPs consist of discrete columns of compacted crushed rock that are installed on a regular pattern below the proposed improvements, typically a building footprint. There are several benefits that can be achieved by installing CAPs. CAPs can reduce the magnitude of static settlement, increase the allowable soil bearing resistance and reduce the magnitude of total and differential settlement caused by liquefaction. Other ground improvement types including stone columns, or rigid inclusions which are also be feasible for this site. Because many ground improvement methods are proprietary designs, we recommend that the ground improvement system be designed by the ground improvement contractor selected to perform the work. The design criteria for the ground improvement system are summarized in the section below.

4.2.2.2. Ground Improvement Design Criteria

The primary intent of the ground improvement design should be to mitigate the liquefaction settlement hazard and provide an increased bearing resistance for the proposed structure. The ground improvement should encompass the entire building footprint and extend at least 5 feet beyond the footprint of the structure as well as below any other critical/settlement sensitive infrastructure proposed outside of the main structure. We recommend the design of the ground improvement, including the actual layout, length and minimum diameter of each column or pier based on the final foundation plan. The ground improvement designer may determine the required depth of the ground improvement based on the design criteria provided below. We recommend minimum ground improvement elements be at least 30 feet below primary bearing surfaces such as building slabs and foundations. Some alternative depths could be appropriate depending on type, spacing and diameter.

telcom conduit?

We recommend that the ground improvement be designed to achieve the following minimum performance criteria. It is possible to design ground improvement to achieve higher allowable bearing capacities and less settlement. If a higher level of performance is required for the ground improvement, we should be notified to review the specific application and design prior to preparation of final construction documents. The performance criteria below must be reviewed by the project structural engineer who should confirm that the criteria is appropriate for the proposed building and provide revised performance criteria, if necessary.

- Allowable soil bearing resistance of 3,000 pounds per square foot (psf) with an allowable increase of ⅓ for transient loading conditions.
- Total long-term static settlement of 1 inch and differential static settlement of 0.5 inch over a distance of 40 feet.
- Total liquefaction-induced settlement of 4 inches for the improved area.
- Differential liquefaction-induced settlement of 2 inches over a distance of 40 feet; some variations of this minimum may be accommodated by the structure and with structural design; we suggest we assist with additional review for these cases.

The contractor performing the work should provide adequate verification that the specified design criteria has been achieved after ground improvement installation. This could include modulus tests to verify the specified bearing resistance was achieved and pre-treatment and post-treatment cone penetrometer tests (CPTs) to verify that the specified liquefaction mitigation was achieved. Post treatment performance criteria should be required as part of the project plans and specifications and contractor submittal requirements. We can and recommend we assist with specifications and/or criteria for verification of post treated soil and specific bearing resistance or alternatively, we recommend we review proposed designers' performance verification criteria.

4.2.3. Foundation Support Within Ground Improvement

4.2.3.1. General

The foundation support recommendations provided below assume that ground improvement designed to meet the performance criteria specified above is installed below the proposed structure. We have also developed recommendations for design of foundations outside of the ground improvement area. We recommend a minimum footing width of 1.5 feet for continuous wall footings and 2 feet of isolated column footings. All footing elements should be embedded at least 18 inches below the lowest adjacent external grade.

4.2.3.2. Bearing Surface Preparation

Depending on the ground improvement method selected, shallow foundations will either bear directly on top of the exposed ground improvement elements, or on a load transfer pad that will be specified in the ground improvement design. Load transfer pads typically consist of a few feet of compacted structural fill installed between the top of the ground improvement elements and the design bottom of footing elevation or other structural bearing element. In either case, we recommend that foundation bearing surfaces be proof compacted in place to a uniformly firm and unyielding condition prior to placement of formwork or rebar. Loose or disturbed materials present at the base of footing excavations should be removed or compacted. Prepared foundation bearing surfaces should be observed and evaluated by a member of our firm prior to placement of formwork or steel reinforcement. Our representative will confirm that the bearing surfaces have been prepared in accordance with our recommendations and the project documents.

4.2.3.3. Allowable Soil Bearing Resistance

Provided ground improvement meeting the design criteria described above is installed at the site we recommend that foundations for the proposed structures within the ground improvement be designed assuming an allowable soil bearing resistance of 3,000 psf. The provided bearing pressures apply to the total of dead and long-term live loads and may be increased by one-third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes. The ground improvement designer must confirm that the minimum allowable bearing pressure stated above is achievable with their proposed design. Some designs may yield and attain higher values. This should be reviewed by project geotechnical and structural engineers.

4.2.3.4. Foundation Static Settlement

We estimate that static settlement of footings designed and constructed as recommended will be less than 1 inch, with differential settlements of less than ½ inch between comparably loaded isolated column footings or along 50 feet of continuous footing. These settlement estimates must be confirmed by the ground improvement designer. We estimate that liquefaction induced settlements will be as described previously.

4.2.3.5. Lateral Resistance

The ability of the soil to resist lateral loads is a function of frictional resistance, which can develop on the base of footings and slabs and passive resistance, which can develop on the face of below-grade elements of the structure as these elements tend to move into the soil. The allowable frictional resistance on the base of the footing may be computed using a coefficient of friction of 0.40 applied to the vertical dead-load forces. The allowable passive resistance on the face of the footing or other embedded foundation elements may be computed using an equivalent fluid density of 275 pounds per cubic foot (pcf) for undisturbed site soils or structural fill extending out from the face of the foundation element a distance at least equal to two and one-half times the depth of the element. These values include a factor of safety of about 1.5.

The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The passive earth pressure value is based on the assumptions that the adjacent grade is level and that groundwater remains below the base of the footing throughout the year. The top foot of soil should be neglected when calculating passive lateral earth pressure unless the area adjacent to the foundation is covered with pavement or a slab-on-grade.

4.2.3.6. Footing Drains

We recommend that perimeter foundation drains be installed at the base of exterior footings. The perimeter drains should be provided with cleanouts and at minimum, should consist of a 4-inch-diameter perforated pipe surrounded on all sides by 6 inches of drain material enclosed in a non-woven geotextile fabric for underground drainage to prevent fine soil from migrating into the drain material. We recommend that the drainpipe consist of either heavy-wall solid pipe or rigid corrugated smooth interior polyethylene pipe. We do not recommend using flexible tubing for footing drainpipes. The drain material should consist of pea gravel or material similar to “Gravel Backfill for Drains” per WSDOT Standard Specifications Section 9-03.12(4). The perimeter drains should be sloped to drain by gravity, if practical, to a suitable discharge point. Water collected in roof downspout lines must not be routed to the perimeter footing drains.

4.2.4. Foundations Outside of Ground Improvement Zone

Small, non-critical structures that can tolerate differential settlements during a seismic event without risking life safety or the functionality of the primary structure can be supported on shallow foundations without ground improvement. We recommend that foundations in areas outside of the ground improvement zone be underlain by at least an 18-inch-thick layer of compacted structural fill. Foundation bearing surfaces should be thoroughly compacted to a dense, non-yielding condition. Loose or disturbed materials present at the base of foundation excavations should be removed or compacted. Foundation bearing surfaces should not be exposed to standing water. Should water infiltrate and pool in the excavation, it should be removed and surface repaired before placing structural fill or reinforcing steel.

We recommend that footings in non-ground improvement areas with bearing surfaces prepared as described above be proportioned using an allowable soil bearing pressure of 2,000 psf. This is a net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. We estimate that settlements of footings due to static column loads less than about 30 kips will be less than 1 inch. We estimate that differential settlements across the base of foundations will be less than ½ inch. These estimates are exclusive of settlement resulting from fill placed to raise site grades. The lateral resistance parameters provided previously can also be used for design of footings located outside of ground improvement areas.

4.2.5. Slab on Grade Floors

We understand that the ground level of the structure will be used for vehicle parking and large at grade building slabs are not envisioned. We expect that relatively small slab on grade floors will be included at ground level for entrances and lobby areas. It is also possible that the ground level parking area pavements will be designed as a slab on grade or mat foundation for structural reasons. We recommend that ground improvement be included below parking areas that are within the building footprint and below ground level slab on grade floors.

We recommend that the slab subgrades be prepared in accordance with Section 4.6.6 "Subgrade Preparation" of this report and that the slab be underlain by at least 8 inches of capillary break material consisting of crushed surfacing base course (CSBC) conforming 9-03.9(3) of the Washington State Department of Transportation (WSDOT) Standard Specifications with the exception that the percent of material passing the No.200 sieve should be less than 5 percent.

Provided that loose soil is removed and the subgrade is prepared as recommended, we recommend slabs-on-grade be designed using a modulus of subgrade reaction of 300 pounds per cubic inch (pci). We estimate that settlement for slabs-on-grade with improved ground constructed as recommended will be less than ¾ inch for a floor load of 500 psf.

4.3. Retaining Walls and Below-Grade Structures

4.3.1. Design Parameters

We recommend the following lateral earth pressures be used for design of conventional retaining walls and below-grade structures up to about 10 feet in height. Our design pressures assume that the ground surface around the structures will be level or near level. If drained design parameters are used, drainage systems must be included in the design in accordance with the recommendations presented in the "Drainage" section below.

- Active soil pressure may be estimated using an equivalent fluid density of 35 pcf for the drained condition.
- Active soil pressure may be estimated using an equivalent fluid density of 80 pcf for the undrained condition; this value includes hydrostatic pressures.
- At-rest soil pressure may be estimated using an equivalent fluid density of 55 pcf for the drained condition.
- At-rest soil pressure may be estimated using an equivalent fluid density of 90 pcf for the undrained condition; this value includes hydrostatic pressures.
- For seismic considerations, a uniform lateral pressure of 11H psf (where H is the height of the retaining structure or the depth of a structure below ground surface) should be added to the lateral earth pressure.

- Active soil pressure condition assumes the wall is free to move laterally 0.001 H, where H is the wall height). The at-rest condition is applicable where walls are restrained from movement.
- For backfill sloping conditions up to 2H:1V, the soil pressures presented above should be increased by 15 percent.
- A typical traffic surcharge representing an additional 2 feet of fill equal to 250 psf should be included if vehicles are allowed to operate within ½ the height of the retaining walls.
- Other surcharge and backfill conditions can increase the magnitude of the loads upon the wall requiring alternative design considerations. We should be consulted if other surcharge or backfill conditions will be considered above retaining walls. Examples of other loading conditions may include nearby structures, construction equipment and stockpiled soil or materials.

Over-compaction of fill placed directly behind retaining walls or below-grade structures must be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet of retaining walls and below-grade structures.

Retaining wall foundation bearing surfaces should be prepared following Section "4.2 Foundation Support" of this report. Provided bearing surfaces are prepared as recommended retaining wall foundations may be designed using the allowable soil bearing values and lateral resistance values presented above. In general, we estimate settlement of retaining structures will be similar to the values previously presented for spread foundations.

In applications where retaining walls are designed as a fill wall and fill soil is added behind the wall to generate new grade and the new grade, or height of the wall exceeds about 4 to 5 feet, there is a potential for additional static settlement if subsurface soil below the retaining wall if unimproved. We recommend we provide further review of this specific situation where the wall becomes greater than about 4 feet, will retain new fill, and be on unimproved ground. A specific overexcavation depth and possibly a pre-load could be required for this specific situation and will be based, in part on the new fill and depths placed.

4.3.2. Drainage

If retaining walls or below-grade structures are designed using drained parameters, a drainage system behind the structure must be constructed to collect water and prevent the buildup of hydrostatic pressure against the structure. We recommend the drainage system include a zone of free-draining backfill a minimum of 18 inches in width against the back of the wall. The drainage material should consist of coarse sand and gravel containing less that 5 percent fines based on the fraction of material passing the ¾-inch sieve. Other systems, such as waffle drain boards may also be considered. Drainage products should be reviewed to determine adequate coverage, drainage flow and proper connection to outlets.

A perforated, rigid, smooth-walled drainpipe with a minimum diameter of 4 inches should be placed along the base of the structure within the free-draining backfill and extend for the entire wall length. The drainpipe should be metal or rigid PVC pipe and be sloped to drain by gravity. Discharge should be routed properly to reduce erosion potential.

Cleanouts should be provided to allow routine maintenance. We recommend roof downspouts or other types of drainage systems not be connected to retaining wall drain systems

4.4. Pavement Design

4.4.1. General

Paved areas are expected to include parking areas, driveways and sidewalk areas. Based on our experience, we provide recommended conventional asphalt concrete pavement (ACP) and Portland cement concrete (PCC) sections below. These pavement sections may not be adequate for heavy construction traffic loads such as those imposed by concrete transit mixers, dump trucks or cranes. Additional pavement thickness may be necessary to prevent pavement damage during construction if other loading types are planned. The recommended sections assume that final improvements surrounding the pavements will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not accumulate below the pavement section or pond on pavement surfaces.

Existing pavements, hardscaping or other structural elements should be removed prior to placement of new pavement sections. Pavement subgrade should be prepared as recommended in Section "4.4.6 Subgrade Preparation" of this report. Crushed surfacing base course and subbase should be moisture conditioned to near optimum moisture content and compacted to at least 95 percent of the theoretical MDD per ASTM D 1557.

CSBC and crushed surfacing top course (CSTC) should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications. The top approximate 2 inches of the CSBC sections provided may consist of CSTC as a leveling layer and for more precise grade development.

Hot mix asphalt should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications.

PCC mix design should conform with Section 5-05.3(1) of the WSDOT Standard Specifications. Aggregates for PCC should conform to applicable sections of 9-03.1 of the WSDOT Standard Specifications.

Some areas of pavement may exhibit settlement and subsequent cracking over time. Cracks in the pavement will allow water to infiltrate to the underlying base course, which could increase the amount of pavement damage caused by traffic loads. To prolong the effective life of the pavement, cracks should be sealed as soon as possible.

4.4.2. Asphalt Concrete Pavement Sections

Recommended minimum ACP sections are provided below.

4.4.2.1. Standard-Duty ACP – Automobile Driveways and Parking Areas

- 2 inches of hot mix asphalt, class ½ inch, PG 58-22
- 4 inches of compacted CSBC
- 6 inches of subbase consisting of imported granular structural fill to provide uniform grading and pavement support, to maintain drainage, and to provide separation from fine-grained subgrade soil
- Native soil, existing fill or structural fill prepared as recommended in Section "4.5.6 Subgrade Preparation" of this report

4.4.2.2. Heavy-Duty ACP – Areas Subject to Heavy-Duty Traffic

- 3 inches of hot mix asphalt, class ½ inch, PG 58-22
- 6 inches of compacted CSBC
- 6 inches of subbase consisting of imported granular structural fill to provide uniform grading and pavement support, to maintain drainage, and to provide separation from fine-grained subgrade soil
- Native soil, existing fill or structural fill prepared as recommended in Section "4.5.6 Subgrade Preparation" of this report

4.4.3. Portland Cement Concrete Pavement Design

Recommended minimum PCC pavement sections are provided below. In our opinion steel reinforcement does not need to be included in PCC pavements that will be primarily used in landscaping and pedestrian areas (areas not subjected to heavy vehicle traffic). Reinforcement could be considered to reduce the potential for cracking in areas where the concrete slabs have irregular shapes or where new slabs abut existing concrete slabs, and the joint layout between the slabs cannot be matched. If reinforcement is considered, we are available to discuss typical steel reinforcement volumes with the project structural engineer, who ultimately designs the location, size and layout of reinforcement.

4.4.3.1. Sidewalk PCC Pavement – Pedestrian Areas Not Subjected to Vehicle Loading

- 4 inches of PCC with a minimum 14-day flexural strength of 650 pounds per square inch (psi)
- 2 inches of compacted CSBC
- Native subgrade or structural fill prepared in accordance with Section "4.5.6 Subgrade Preparation" of this report

4.4.3.2. Standard PCC Pavement – Automobile Driveways and Parking Areas

- 6 inches of PCC with a minimum 14-day flexural strength of 650 psi
- 4 inches of compacted CSBC
- Native subgrade, existing fill or structural fill prepared in accordance with Section "4.5.6 Subgrade Preparation" of this report

4.4.3.3. Heavy Duty PCC Pavement – Areas Subject to Heavy Truck Traffic

- 9 inches (minimum) of PCC with a minimum 14-day flexural strength of 650 psi
- 4 inches of compacted CSBC
- Native subgrade, existing fill or structural fill prepared in accordance with Section "4.5.6 Subgrade Preparation" of this report.

4.5. Earthwork

4.5.1. General

We anticipate that site development and earthwork will include demolition of existing features, excavating for shallow foundations, utilities, and other improvements, establishing subgrades for structures and hardscaping, and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. We strongly recommend that site development and earthwork activities be scheduled during dry weather months when groundwater levels will be at their lowest. The following sections provide our recommendations for earthwork activities at the site.

4.5.2. Clearing, Stripping and Demolition

We recommend that existing pavements and hardscaping be completely removed from areas that will be developed. During removal and/or demolition, excessive disturbance of surficial soils may occur, especially if left exposed to wet conditions. Disturbed and demolition areas may require additional remediation during construction and grading.

Within landscaped areas, stripping depths on the order of 3 to 6 inches should be expected. The primary root system of trees and shrubs should be removed during stripping activities. Stripped material should

If existing utilities exist beneath new structures, they should be removed and the area backfilled, if practical, or abandoned in place. Abandonment can include filling or pumping using a controlled density fill or other approved flowable fill material that will fill the utility cavity completely and offer support similar to backfill soil. Utility use, ownership and rights of way should also be considered.

4.5.3. Erosion and Sedimentation Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce the project impact on erosion-prone areas. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;
- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;
- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

Some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan.

4.5.4. Temporary Excavations and Dewatering

Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA).

In general, temporary cut slopes at this site should be inclined no steeper than about 1½H to 1V (horizontal to vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. We expect that flatter slopes or shoring will be necessary when excavating below the water table which is expected to be present between 3 to 5 feet below ground surface.

We anticipate that dewatering will typically be required to complete excavations extending deeper than 5 feet below existing site grade. If the planned excavation is completed during dry weather months, is only extended a few feet below the groundwater table and will remain open for a short period of time, managing groundwater inflow using sump pumps could be feasible. We expect that dewatering will be necessary to complete deeper excavations at the site or excavations that will remain open for an extended period of time.

Excavation, shoring, and dewatering are interrelated; the design and implementation of these elements must be coordinated and must consider the over-all construction staging to ensure a consistent and compatible approach. We recommend that the contractor performing the work be made responsible for designing and installing construction shoring and for controlling and collecting groundwater encountered. The contract documents must specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety, and providing shoring, as required, to protect personnel and structures.

4.5.5. Surface Drainage

Surface water from roofs, pavements and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not be connected to wall or foundation drains.

4.5.6. Subgrade Preparation

Subgrades that will support slab-on-grade floors and pavements should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping/excavation and before placing structural fill. We recommend that subgrades for structures and pavements be evaluated, as appropriate, to identify areas of yielding or soft soil. Probing with a steel probe rod or proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

4.5.7. Subgrade Protection and Wet Weather Considerations

The wet weather season generally begins in October and continues through May in Western Washington; however, periods of wet weather can occur during any month of the year. The soils encountered in our explorations contain a significant amount of fines. Soil with high fines content is very sensitive to small changes in moisture and is susceptible to disturbance from construction traffic when wet or if earthwork is performed during wet weather. If wet weather earthwork is unavoidable, we recommend that the following steps be taken.

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting and controlling surface water with sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- During periods of wet weather, concrete should be placed as soon as practical after preparation of the footing excavations. Foundation bearing surfaces should not be exposed to standing water. If water pools in the base of the excavation, it should be removed before placing structural fill or reinforcing steel. If footing excavations are exposed to extended wet weather conditions, a lean concrete mat or a layer of clean crushed rock can be considered for foundation bearing surface protection.

4.6. Fill Materials

4.6.1. Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. We recommend that washed crushed rock or select granular fill, as described below, be used for structural fill during the rainy season. If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable. Weather, material use, schedule, duration exposed, and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill.

Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, we recommend that structural fill material consist of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the Washington State Department of Transportation (WSDOT) Standard Specifications.

4.6.2. Select Granular Fill/Wet Weather Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), “Gravel Backfill for Walls” as described in Section 9-03.12(2) of the WSDOT Standard Specifications, or Section 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

4.6.3. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to “gravel backfill for pipe zone bedding” described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

4.6.4. Fill Material Below Groundwater Level

If fill or trench backfill will be placed below or near the groundwater level, we recommend imported material consisting of either permeable ballast or quarry spalls be used.

Permeable ballast should consist of material with gradation characteristics similar to WSDOT Standard Specification 9-03.9 (2). We recommend that quarry spalls consist of 2- to 4-inch washed, crushed stone similar to that described in Section 9-13 of the WSDOT Standard Specifications. Alternative stone size ranges may be considered, depending on the application and availability.

4.6.5. Drainage Zone Material

Free-draining backfill should comprise material similar to WSDOT Standard Specification 9-03.12(2) “Gravel Backfill for Walls.”

4.6.6. On-Site Soil

Existing site soils must not be used as base course, top course or as drainage material. Due to moisture content and fines content of existing site soil, in general, we recommend against use of on-site material as a structural fill. If still necessary, we recommend contingencies in the project budget be included for handling, drying, and/or amending site materials as well as importing granular structural fill. We recommend that a representative from GeoEngineers be on site during earthwork activities to evaluate if the existing soil generated during excavation is suitable for reuse and to provide alternative recommendations, if necessary.

The soils at the site contain a significant amount of fines and are extremely moisture sensitive and will be very difficult or impossible to properly compact when wet. Soils generated from below the water table will likely be saturated or at a moisture content above what is optimum for compaction. In this case, the soils would need to be moisture conditioned prior to re-use. Space for drying out material during dryer weather or covering on-site materials generated during wet weather will be necessary. During wetter or even slightly colder times of year, such as when temperatures reach below about 60 degrees, drying becomes more difficult and accommodations to cover and protect stockpiled material generated on-site for re-use should be planned. In many cases, covering of stockpiled material will not be sufficient to allow for the material to dry when near or below this temperature.

4.7. Fill Placement and Compaction

4.7.1. General

To obtain proper compaction, fill soil should be compacted near optimum moisture content and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 8- to 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Thinner lifts are appropriate for smaller compaction equipment. Compaction should be achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

4.7.2. Area Fills and Pavement Bases

Fill placed to raise site grades and materials under pavements and structural areas should be placed on subgrades prepared as previously recommended. Fill material placed below structures and footings should be compacted to at least 95 percent of the theoretical MDD per ASTM D 1557. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the MDD. Fill placed deeper than 2 feet below pavement sections should be compacted to at least 90 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically at least 85 to 90 percent of the MDD.

4.7.3. Backfill Behind Retaining Walls and Below-Grade Structures

Backfill behind retaining walls or below-grade structures should be compacted to between 90 and 92 percent of the MDD. Overcompaction of fill placed directly behind below-grade structures should be avoided. We recommend use of hand-operated compaction equipment and maximum 6-inch loose lift thickness when compacting fill within about 5 feet behind below-grade structures.

4.7.4. Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

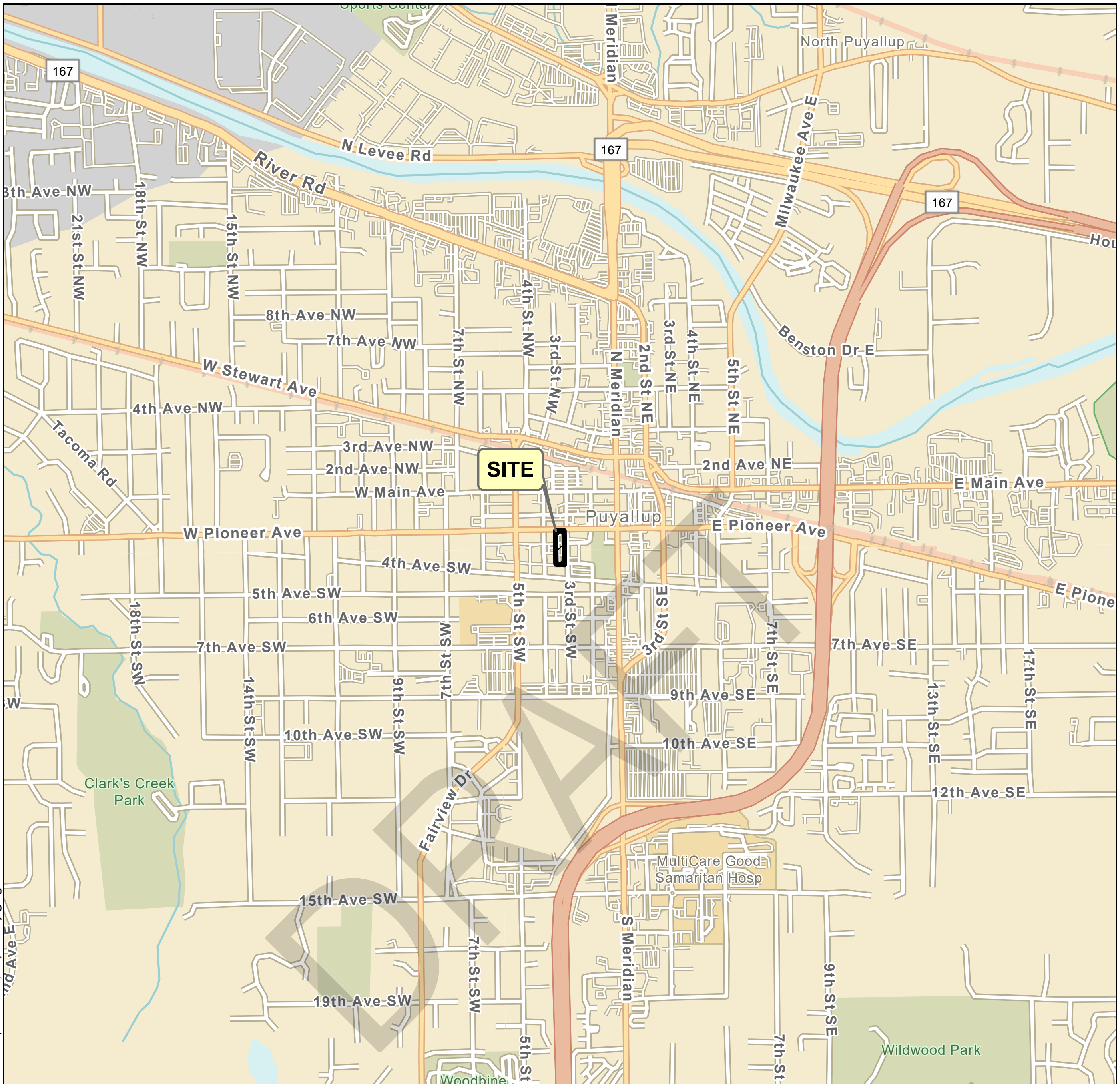
Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 90 percent of the MDD. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment as necessary.

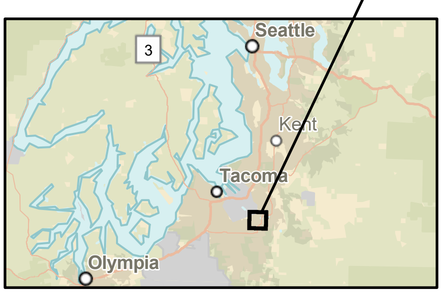
5.0 LIMITATIONS

We have prepared this report for MC Construction Consultants, for the Puyallup AOB Site project in Puyallup, Washington. MC Construction Consultants may distribute copies of this report to owner and owner's authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.





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Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

Vicinity Map	
Puyallup AOB Site Puyallup, WA	
GEOENGINEERS	**Figure 1**

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Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial from Microsoft Bing Images.

Projection: Wahshington State Plane, South Zone, NAD83, US Foot

Legend

- Property Boundary
- Footprint of Former Building
- TP-1 Test Pit by LS&E, 2022
- B-1 Boring by GeoEngineers, Inc.

W S N E

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Feet

Site Plan

Puyallup AOB Site
Puyallup, WA

GeoEngineers

Figure 2

P:\8\8947005\CAD\00\Geotech Report\894700500_F02_Site Plan.dwg TAB:F02 Date Exported: 03/24/22 - 13:29 by gregister

8947-005-00 Date Exported: 03/23/2022

Legend

Precipitation

B-1

B-2

Note:
bgs = feet below ground surface. Ground surface taken at top of existing monument cover.

Precipitation Date Source:
National Oceanic and Atmospheric Administration (NOAA)

Recorded Groundwater Levels

Groundwater Level Monitoring and
Preliminary Infiltration Feasibility Study
City of Puyallup AOB Parking Lot
330 3rd St NW, Puyallup, Washington

Aspect CONSULTING | May-2021 | PROJECT NO. 200589 | BY ECS/CMV | REVISED BY - | FIGURE NO. 1

CAD Path: Q:\City of Puyallup\200589\200589-01 May 2021.dwg Fig 1 || Data Saved: May 19, 2021 2:09pm || User: cvanslyke

B-1 and B-1 Groundwater Plot

Puyallup AOB Site
Puyallup, Washington

GEOENGINEERS

Figure 3

Data Source: "Groundwater Level Monitoring and Preliminary Infiltration Feasibility Evaluation" Aspect Consulting, June 2, 2021

APPENDIX A
Boring Logs from 2011 GeoEngineers Report

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	CC	Cement Concrete
	AC	Asphalt Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Sonic Core

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled	Start: 8/15/2011	End: 8/15/2011	Total Depth (ft)	21.5	Logged By: MJH / Checked By: MJH	Driller: Holocene	Drilling Method: HSA

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	BK-81
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)	
Easting (X) Northing (Y)		Horizontal Datum	

Licensing agency well number: **940**
A 2 (in) well was installed on to a depth of (ft).

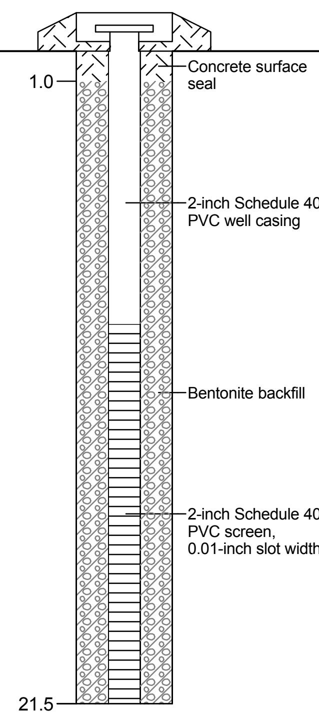
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
9/15/2011	7.6	

Notes: Well No. 940

FIELD DATA

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)
	0	16	12	1 / SA	AC	2 inches asphalt concrete with 2 inches base course	6	
					SM	%F=16 Brown fine to medium silty sand (medium dense, moist) (fill)		
	5	18	2	2 & 3	ML	Brown silt with sand (soft, moist)		
					SP	Black fine to medium sand, trace silt (very loose, moist)		
					MH	Gray silt, trace sand and organics (soft, moist)		
	10	15	7	4	SP	Black fine to medium sand, trace silt (loose, wet)		
					ML	Green silt, trace sand (medium stiff, wet)		
					ML	Gray sandy silt (medium stiff, wet)		
	15	18	7	5 / MC	ML	Gray sandy silt interbedded with green silt, trace sand (loose to medium stiff, wet) %F=50	37	
	20	17	8	6 & 7	SP-SM	Gray fine to medium sand with silt (loose, wet)		

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring B-1

GeoEngineers

Project: City of Puyallup - AOB Site
Project Location: Puyallup, Washington
Project Number: 0402-030-00

Figure A-2
Sheet 1 of 1

Tacoma: Date:9/13/11 Path:P:\0\0402030\GINT\0402030.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_WELL

Drilled	Start 8/15/2011	End 8/15/2011	Total Depth (ft)	21.5	Logged By MJH / Checked By MJH	Driller	Holocene	Drilling Method	HSA

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	BK-81
Surface Elevation (ft) Vertical Datum	Undetermined	Top of Casing Elevation (ft)	
Easting (X) Northing (Y)		Horizontal Datum	

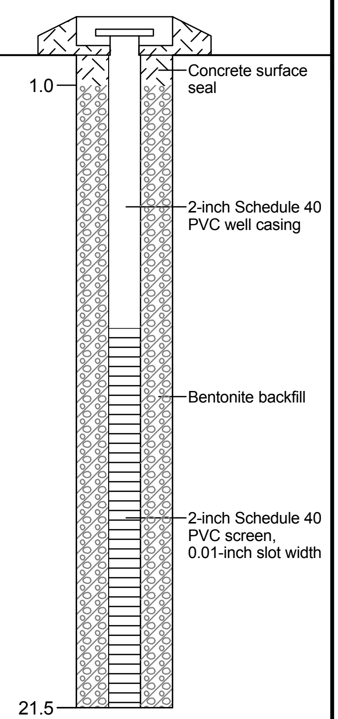
Licensing agency well number: **941**
A 2 (in) well was installed on to a depth of (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
8/15/2011	6.4	

Notes: Well No. 941

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)
	0	12	10	1	AC	2 inches asphalt concrete with 2 inches base course		
					SM	Brown silty fine to medium sand (medium dense, moist) (fill)		
		18	6	2 & 3 / SA	ML	Gray mottled silt with sand (loose, moist) %F=83	32	
					SP-SM	Brown mottled fine to medium sand with silt (loose, moist)		
	5	18	1	4 / MC	ML	Gray silt with sand and trace organics (very soft, moist) %F=78	64	
	10	15	3	5		Grades to soft and wet		
					SP-SM	Gray fine to medium sand with silt (loose, wet)		
	15	18	6	6 &7	ML	Gray silt with sand (medium stiff, wet)		
	20	18	7	8				

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring B-2

GEOENGINEERS

Project: City of Puyallup - AOB Site
Project Location: Puyallup, Washington
Project Number: 0402-030-00

Figure A-3
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/15/2011	8/15/2011	80	MJH	MJH	Holocene	HSA

Surface Elevation (ft) Vertical Datum	Undetermined
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop
Drilling Equipment	BK-81
Easting (X) Northing (Y)	
System Datum	
Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	
Notes:	

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0								ML	Brown sandy silt (loose, moist) (fill)			
			12	4		1 / SA					29		%F=57
	5												
									ML/SP	Gray silt with sand interbedded with black sand, trace silt (loose to medium stiff, moist)			
			13	4		2							
	10												
									ML	Gray silt with sand and organics (1 inch thick wood) (soft, wet)			
			18	3		3 / MC					42		%F=93
	15												
									ML/SP	Gray silt, trace sand interbedded with black sand, trace silt (soft to very loose, wet)			
			14	3		4							
	20												
									ML	Gray silt with sand (medium stiff, wet)			
			14	6		5 & 6 / MC					33		%F=80
									SP-SM	Black fine to medium sand with silt (loose, wet)			
	25												
			14	12		7				Grades to medium dense			
	30												
			15	28		8 / MC				Grades to with occasional fine gravel, dense	23		%F=6
	35												
			15	32		9							
	40												

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-3

GeoEngineers

Project: City of Puyallup - AOB Site

Project Location: Puyallup, Washington

Project Number: 0402-030-00

Figure A-4

Sheet 1 of 2

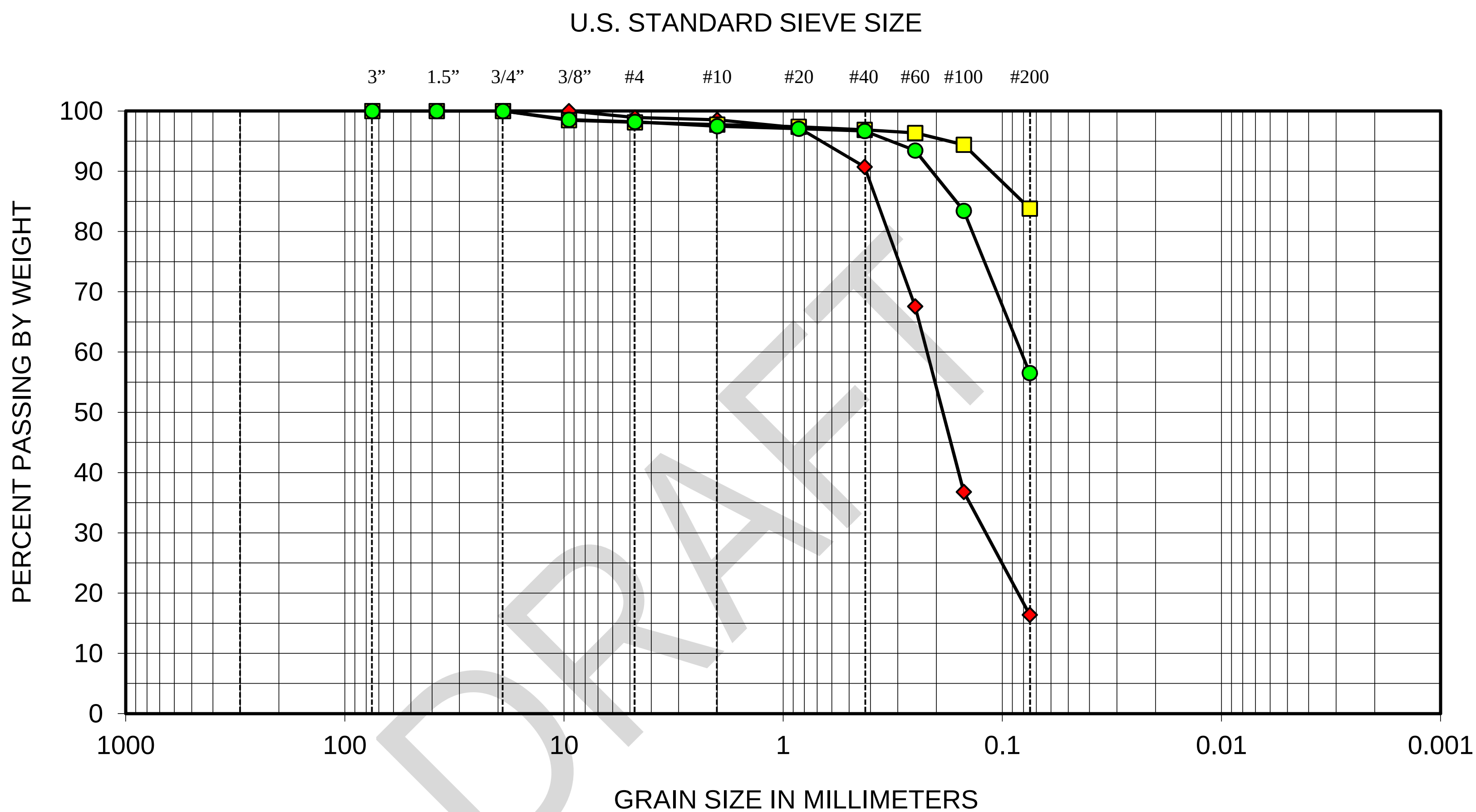
Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Water Level	Group Classification	Material Description	Moisture Content, %	Dry Density, (pcf)	Remarks
	40									
		10	35	10			Grades to with gravel			
	45									Driller indicates intermittent hard drilling from 45 to 50 feet
						SM	Gray silty fine to coarse sand with gravel (very loose, wet)			
		6	3	11						Rock in shoe tip
	50									
						GP-GM	Gray fine to coarse gravel with silt and sand (medium dense, wet)			
		2	16	12						
	55									
						SM	Gray silty fine to coarse sand, occasional gravel (loose wet)			
		15	6	13 / MC				19		%F=27
	60									
						SP	Black fine to medium sand, trace silt, occasional gravel (dense, wet)			
		10	35	14						
	65									
						SM	Gray silty fine to medium sand with gravel (dense, wet)			
		10	42	15 / MC				19		%F=33
	70									
						ML	Gray silt with sand (very stiff, wet)			
		16	16	16 / MC				37		%F=64
	75									
		15	42	17 & 18						
						SP	Gray fine sand, trace silt (dense, wet)			
	80									

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-3 (continued)

GeoEngineers

Project: City of Puyallup - AOB Site
Project Location: Puyallup, Washington
Project Number: 0402-030-00



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE (%)	SOIL CLASSIFICATION
◆	B-1	0	6	Silty sand (SM)
■	B-2	2.5	32	Silt with sand (ML)
●	B-3	2.5	29	Sandy silt (ML)

Sieve Analysis Results

City of Puyallup – AOB Site
Puyallup, Washington

Figure A-5

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for MC Construction Consultants and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with generally accepted geotechnical practices in this area at the time this report was prepared, and our Agreement with MC Construction Consultants dated February 22, 2022. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the Puyallup AOB Site project located in Puyallup, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

1 Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Appendix D

Construction Stormwater Pollution Prevention Plan (SWPPP)

Appendix E

Western Washington Hydrology Model 2012 Reports

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Puyallup AOB_v1
Site Name:	Puyallup AOB
Site Address:	
City:	
Report Date:	9/16/2025
Gage:	
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
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year

Landuse Basin Data
Predeveloped Land Use

AOB-ON

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.08
Pervious Total	0.08
Impervious Land Use	acre
PARKING FLAT	1.03
Impervious Total	1.03
Basin Total	1.11

Element Flows To:

Surface	Interflow	Groundwater

AOB-OFF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.02
Pervious Total	0.02
Impervious Land Use	acre
ROADS FLAT	0.01
SIDEWALKS FLAT	0.13
Impervious Total	0.14
Basin Total	0.16

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

AOB-ON

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.03
Pervious Total	0.03
Impervious Land Use	acre
ROADS FLAT	0.02
ROOF TOPS FLAT	1
SIDEWALKS FLAT	0.06
Impervious Total	1.08
Basin Total	1.11

Element Flows To:

Surface	Interflow	Groundwater

AOB-OFF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.02
Pervious Total	0.02
Impervious Land Use	acre
ROADS FLAT	0.05
SIDEWALKS FLAT	0.09
Impervious Total	0.14
Basin Total	0.16

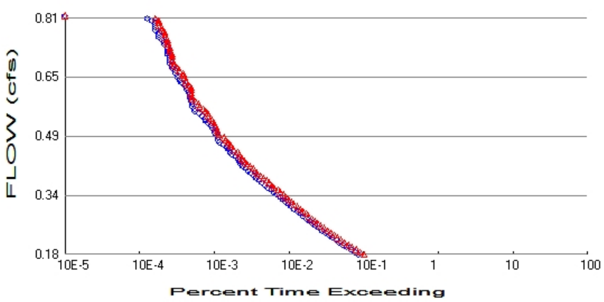
Element Flows To:

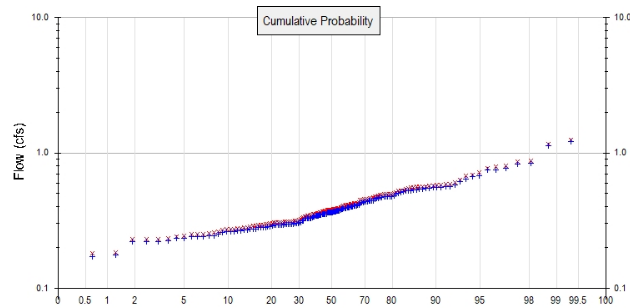
Surface	Interflow	Groundwater

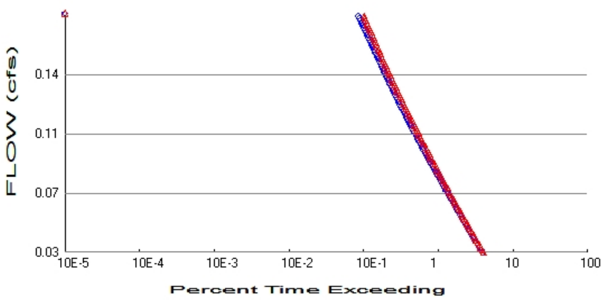
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1







+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.08
Total Impervious Area: 1.03

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.03
Total Impervious Area: 1.08

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.364144
5 year	0.489909
10 year	0.581477
25 year	0.706976
50 year	0.807822
100 year	0.91518

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.379664
5 year	0.510041
10 year	0.604858
25 year	0.734692
50 year	0.838939
100 year	0.949845

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.427	0.448
1903	0.473	0.496
1904	0.549	0.567
1905	0.241	0.252
1906	0.269	0.282
1907	0.366	0.379
1908	0.298	0.311
1909	0.364	0.382
1910	0.351	0.366
1911	0.396	0.412
1912	0.671	0.688
1913	0.282	0.296
1914	1.204	1.249
1915	0.245	0.255
1916	0.455	0.477
1917	0.172	0.180
1918	0.364	0.382
1919	0.225	0.234
1920	0.301	0.312
1921	0.258	0.268
1922	0.408	0.421
1923	0.282	0.293
1924	0.526	0.551
1925	0.221	0.231
1926	0.428	0.449
1927	0.349	0.366
1928	0.261	0.272
1929	0.523	0.544
1930	0.541	0.567
1931	0.263	0.274
1932	0.284	0.296
1933	0.280	0.293
1934	0.464	0.479
1935	0.240	0.252
1936	0.339	0.353
1937	0.500	0.524
1938	0.245	0.256
1939	0.308	0.322
1940	0.542	0.568
1941	0.536	0.562
1942	0.410	0.425
1943	0.402	0.419
1944	0.583	0.605
1945	0.436	0.456
1946	0.343	0.356
1947	0.264	0.276
1948	0.364	0.380
1949	0.559	0.586
1950	0.316	0.331
1951	0.478	0.502
1952	0.556	0.569
1953	0.513	0.526
1954	0.296	0.309
1955	0.273	0.286
1956	0.269	0.282
1957	0.293	0.306

1958	0.369	0.382
1959	0.371	0.383
1960	0.288	0.302
1961	0.831	0.864
1962	0.355	0.371
1963	0.262	0.275
1964	0.774	0.802
1965	0.345	0.359
1966	0.287	0.300
1967	0.407	0.422
1968	0.339	0.354
1969	0.307	0.319
1970	0.351	0.364
1971	0.342	0.353
1972	1.129	1.168
1973	0.642	0.673
1974	0.469	0.489
1975	0.497	0.509
1976	0.523	0.541
1977	0.221	0.231
1978	0.381	0.392
1979	0.393	0.410
1980	0.386	0.403
1981	0.363	0.380
1982	0.296	0.309
1983	0.405	0.421
1984	0.403	0.418
1985	0.462	0.478
1986	0.232	0.242
1987	0.403	0.422
1988	0.242	0.252
1989	0.221	0.231
1990	0.294	0.306
1991	0.440	0.457
1992	0.412	0.432
1993	0.472	0.494
1994	0.327	0.338
1995	0.252	0.263
1996	0.341	0.354
1997	0.304	0.317
1998	0.364	0.377
1999	0.389	0.408
2000	0.345	0.360
2001	0.274	0.287
2002	0.514	0.528
2003	0.293	0.306
2004	0.438	0.458
2005	0.836	0.874
2006	0.391	0.410
2007	0.441	0.460
2008	0.362	0.378
2009	0.275	0.288
2010	0.355	0.371
2011	0.371	0.389
2012	0.347	0.362
2013	0.330	0.342
2014	0.314	0.329
2015	0.544	0.560

2016	0.330	0.346
2017	0.532	0.556
2018	0.327	0.336
2019	0.484	0.498
2020	0.391	0.406
2021	0.328	0.341
2022	0.554	0.579
2023	0.681	0.714
2024	0.748	0.771
2025	0.354	0.372
2026	0.390	0.408
2027	0.434	0.455
2028	0.170	0.178
2029	0.282	0.294
2030	0.560	0.586
2031	0.177	0.185
2032	0.298	0.312
2033	0.374	0.392
2034	0.293	0.307
2035	0.369	0.381
2036	0.292	0.307
2037	0.393	0.412
2038	0.381	0.394
2039	0.750	0.786
2040	0.296	0.308
2041	0.375	0.392
2042	0.430	0.451
2043	0.475	0.498
2044	0.329	0.343
2045	0.267	0.278
2046	0.295	0.308
2047	0.362	0.379
2048	0.298	0.313
2049	0.443	0.464
2050	0.334	0.347
2051	0.475	0.491
2052	0.355	0.372
2053	0.302	0.316
2054	0.617	0.634
2055	0.366	0.384
2056	0.473	0.496
2057	0.232	0.244
2058	0.445	0.467
2059	0.555	0.582

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.2036	1.2491
2	1.1286	1.1679
3	0.8359	0.8741
4	0.8308	0.8639
5	0.7739	0.8017
6	0.7503	0.7864
7	0.7484	0.7710
8	0.6810	0.7140
9	0.6713	0.6879
10	0.6424	0.6734

11	0.6167	0.6343
12	0.5827	0.6047
13	0.5596	0.5865
14	0.5593	0.5861
15	0.5565	0.5818
16	0.5550	0.5789
17	0.5540	0.5689
18	0.5494	0.5684
19	0.5442	0.5670
20	0.5425	0.5667
21	0.5413	0.5615
22	0.5357	0.5597
23	0.5320	0.5562
24	0.5261	0.5512
25	0.5234	0.5437
26	0.5226	0.5408
27	0.5140	0.5279
28	0.5126	0.5264
29	0.4997	0.5239
30	0.4970	0.5094
31	0.4841	0.5015
32	0.4783	0.4983
33	0.4754	0.4978
34	0.4746	0.4962
35	0.4735	0.4959
36	0.4734	0.4942
37	0.4715	0.4908
38	0.4692	0.4890
39	0.4643	0.4791
40	0.4624	0.4775
41	0.4548	0.4766
42	0.4450	0.4666
43	0.4428	0.4640
44	0.4411	0.4597
45	0.4397	0.4576
46	0.4378	0.4570
47	0.4365	0.4564
48	0.4344	0.4553
49	0.4298	0.4506
50	0.4282	0.4489
51	0.4270	0.4476
52	0.4124	0.4325
53	0.4101	0.4251
54	0.4076	0.4223
55	0.4074	0.4218
56	0.4051	0.4213
57	0.4028	0.4208
58	0.4028	0.4195
59	0.4023	0.4184
60	0.3957	0.4123
61	0.3933	0.4116
62	0.3932	0.4097
63	0.3910	0.4096
64	0.3910	0.4083
65	0.3898	0.4077
66	0.3889	0.4055
67	0.3856	0.4027
68	0.3813	0.3943

69	0.3812	0.3925
70	0.3754	0.3921
71	0.3739	0.3916
72	0.3711	0.3891
73	0.3707	0.3842
74	0.3690	0.3829
75	0.3687	0.3821
76	0.3664	0.3817
77	0.3661	0.3816
78	0.3644	0.3809
79	0.3643	0.3803
80	0.3639	0.3796
81	0.3639	0.3793
82	0.3632	0.3792
83	0.3619	0.3782
84	0.3617	0.3774
85	0.3548	0.3720
86	0.3548	0.3716
87	0.3547	0.3706
88	0.3544	0.3705
89	0.3514	0.3660
90	0.3507	0.3658
91	0.3491	0.3642
92	0.3473	0.3622
93	0.3454	0.3596
94	0.3450	0.3590
95	0.3429	0.3557
96	0.3416	0.3542
97	0.3413	0.3539
98	0.3392	0.3534
99	0.3390	0.3533
100	0.3335	0.3471
101	0.3300	0.3460
102	0.3299	0.3432
103	0.3289	0.3425
104	0.3282	0.3414
105	0.3266	0.3380
106	0.3266	0.3362
107	0.3161	0.3315
108	0.3142	0.3294
109	0.3078	0.3223
110	0.3065	0.3194
111	0.3037	0.3167
112	0.3017	0.3162
113	0.3011	0.3127
114	0.2983	0.3124
115	0.2980	0.3121
116	0.2978	0.3107
117	0.2965	0.3094
118	0.2962	0.3091
119	0.2956	0.3085
120	0.2952	0.3078
121	0.2938	0.3070
122	0.2932	0.3065
123	0.2930	0.3060
124	0.2928	0.3057
125	0.2924	0.3056
126	0.2883	0.3017

127	0.2870	0.2996
128	0.2837	0.2960
129	0.2825	0.2958
130	0.2824	0.2938
131	0.2817	0.2929
132	0.2804	0.2927
133	0.2747	0.2881
134	0.2741	0.2874
135	0.2733	0.2865
136	0.2694	0.2825
137	0.2688	0.2816
138	0.2666	0.2779
139	0.2639	0.2761
140	0.2626	0.2747
141	0.2620	0.2739
142	0.2612	0.2722
143	0.2577	0.2677
144	0.2524	0.2634
145	0.2451	0.2564
146	0.2449	0.2554
147	0.2420	0.2525
148	0.2415	0.2523
149	0.2401	0.2517
150	0.2324	0.2437
151	0.2322	0.2415
152	0.2248	0.2342
153	0.2212	0.2309
154	0.2210	0.2307
155	0.2206	0.2307
156	0.1767	0.1846
157	0.1716	0.1800
158	0.1700	0.1782

LID Duration Flows

The Development Failed :duration increase
for more than 0% of the flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0291	217060	224262	103	Fail
0.0307	207198	214345	103	Fail
0.0322	197946	205038	103	Fail
0.0338	189027	196284	103	Fail
0.0353	180717	187864	103	Fail
0.0369	172850	179941	104	Fail
0.0384	165260	172351	104	Fail
0.0399	158113	165205	104	Fail
0.0415	151299	158335	104	Fail
0.0430	144817	151853	104	Fail
0.0446	138502	145593	105	Fail
0.0461	132629	139554	105	Fail
0.0477	127034	133903	105	Fail
0.0492	121494	128419	105	Fail
0.0508	116341	123156	105	Fail
0.0523	111466	118059	105	Fail
0.0538	106923	113294	105	Fail
0.0554	102491	108807	106	Fail
0.0569	98115	104486	106	Fail
0.0585	94015	100275	106	Fail
0.0600	90192	96286	106	Fail
0.0616	86480	92464	106	Fail
0.0631	82935	88863	107	Fail
0.0647	79500	85262	107	Fail
0.0662	76176	82048	107	Fail
0.0678	73073	78780	107	Fail
0.0693	70137	75566	107	Fail
0.0708	67312	72686	107	Fail
0.0724	64597	69805	108	Fail
0.0739	62049	67146	108	Fail
0.0755	59611	64597	108	Fail
0.0770	57229	62160	108	Fail
0.0786	54919	59777	108	Fail
0.0801	52708	57506	109	Fail
0.0817	50581	55290	109	Fail
0.0832	48476	53151	109	Fail
0.0847	46487	51085	109	Fail
0.0863	44586	49107	110	Fail
0.0878	42808	47140	110	Fail
0.0894	41179	45246	109	Fail
0.0909	39539	43600	110	Fail
0.0925	37922	41905	110	Fail
0.0940	36448	40393	110	Fail
0.0956	34947	38825	111	Fail
0.0971	33667	37312	110	Fail
0.0986	32343	35922	111	Fail
0.1002	31179	34659	111	Fail
0.1017	29922	33335	111	Fail
0.1033	28803	32110	111	Fail
0.1048	27722	30891	111	Fail
0.1064	26620	29828	112	Fail
0.1079	25562	28664	112	Fail
0.1095	24603	27678	112	Fail

0.1110	23651	26587	112	Fail
0.1126	22775	25623	112	Fail
0.1141	21928	24698	112	Fail
0.1156	21113	23772	112	Fail
0.1172	20399	22952	112	Fail
0.1187	19634	22055	112	Fail
0.1203	18930	21329	112	Fail
0.1218	18205	20592	113	Fail
0.1234	17573	19883	113	Fail
0.1249	16919	19185	113	Fail
0.1265	16238	18565	114	Fail
0.1280	15656	17839	113	Fail
0.1295	15163	17246	113	Fail
0.1311	14615	16676	114	Fail
0.1326	14061	15989	113	Fail
0.1342	13573	15490	114	Fail
0.1357	13108	14980	114	Fail
0.1373	12642	14465	114	Fail
0.1388	12183	13944	114	Fail
0.1404	11778	13473	114	Fail
0.1419	11307	13030	115	Fail
0.1435	10936	12598	115	Fail
0.1450	10598	12188	115	Fail
0.1465	10194	11773	115	Fail
0.1481	9883	11352	114	Fail
0.1496	9546	10964	114	Fail
0.1512	9252	10615	114	Fail
0.1527	8953	10260	114	Fail
0.1543	8648	9944	114	Fail
0.1558	8354	9606	114	Fail
0.1574	8077	9329	115	Fail
0.1589	7778	9058	116	Fail
0.1604	7568	8759	115	Fail
0.1620	7318	8476	115	Fail
0.1635	7058	8205	116	Fail
0.1651	6809	7922	116	Fail
0.1666	6571	7673	116	Fail
0.1682	6366	7451	117	Fail
0.1697	6149	7208	117	Fail
0.1713	5978	6986	116	Fail
0.1728	5773	6731	116	Fail
0.1743	5601	6515	116	Fail
0.1759	5442	6316	116	Fail
0.1774	5253	6138	116	Fail
0.1790	5069	5956	117	Fail
0.1805	4897	5767	117	Fail
0.1821	4735	5590	118	Fail

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

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1821	4735	5590	118	Fail
0.1884	4228	4940	116	Fail
0.1947	3731	4416	118	Fail
0.2010	3249	3852	118	Fail
0.2074	2917	3437	117	Fail
0.2137	2627	3070	116	Fail
0.2200	2383	2775	116	Fail
0.2263	2108	2469	117	Fail
0.2326	1921	2236	116	Fail
0.2390	1724	2039	118	Fail
0.2453	1527	1829	119	Fail
0.2516	1397	1651	118	Fail
0.2579	1272	1490	117	Fail
0.2642	1134	1343	118	Fail
0.2706	1042	1231	118	Fail
0.2769	959	1121	116	Fail
0.2832	853	1020	119	Fail
0.2895	790	937	118	Fail
0.2958	728	855	117	Fail
0.3022	646	780	120	Fail
0.3085	594	719	121	Fail
0.3148	547	652	119	Fail
0.3211	498	595	119	Fail
0.3274	456	546	119	Fail
0.3338	425	504	118	Fail
0.3401	380	465	122	Fail
0.3464	346	425	122	Fail
0.3527	322	398	123	Fail
0.3591	289	351	121	Fail
0.3654	268	326	121	Fail
0.3717	241	301	124	Fail
0.3780	221	277	125	Fail
0.3843	199	251	126	Fail
0.3907	189	230	121	Fail
0.3970	172	209	121	Fail
0.4033	157	195	124	Fail
0.4096	146	183	125	Fail
0.4159	132	165	125	Fail
0.4223	126	150	119	Fail
0.4286	120	140	116	Fail
0.4349	115	132	114	Fail
0.4412	107	124	115	Fail
0.4475	94	120	127	Fail
0.4539	90	114	126	Fail
0.4602	86	101	117	Fail
0.4665	81	93	114	Fail
0.4728	73	90	123	Fail
0.4791	64	84	131	Fail
0.4855	62	78	125	Fail
0.4918	62	75	120	Fail
0.4981	58	64	110	Pass
0.5044	57	62	108	Pass
0.5107	56	61	108	Pass
0.5171	52	58	111	Fail

0.5234	50	58	116	Fail
0.5297	46	55	119	Fail
0.5360	42	52	123	Fail
0.5424	41	50	121	Fail
0.5487	38	46	121	Fail
0.5550	35	45	128	Fail
0.5613	30	42	140	Fail
0.5676	30	39	130	Fail
0.5740	28	35	125	Fail
0.5803	28	34	121	Fail
0.5866	27	31	114	Fail
0.5929	27	28	103	Pass
0.5992	26	28	107	Pass
0.6056	26	27	103	Pass
0.6119	25	27	108	Pass
0.6182	24	27	112	Fail
0.6245	24	27	112	Fail
0.6308	22	25	113	Fail
0.6372	20	23	115	Fail
0.6435	19	23	121	Fail
0.6498	18	22	122	Fail
0.6561	18	21	116	Fail
0.6624	17	21	123	Fail
0.6688	17	19	111	Fail
0.6751	15	18	120	Fail
0.6814	15	16	106	Pass
0.6877	14	16	114	Fail
0.6940	14	15	107	Pass
0.7004	14	15	107	Pass
0.7067	14	15	107	Pass
0.7130	13	15	115	Fail
0.7193	13	14	107	Pass
0.7257	13	14	107	Pass
0.7320	13	14	107	Pass
0.7383	12	13	108	Pass
0.7446	12	13	108	Pass
0.7509	11	13	118	Fail
0.7573	10	12	120	Fail
0.7636	10	12	120	Fail
0.7699	10	12	120	Fail
0.7762	9	11	122	Fail
0.7825	9	11	122	Fail
0.7889	9	10	111	Fail
0.7952	9	10	111	Fail
0.8015	8	10	125	Fail
0.8078	7	9	128	Fail

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

Water Quality

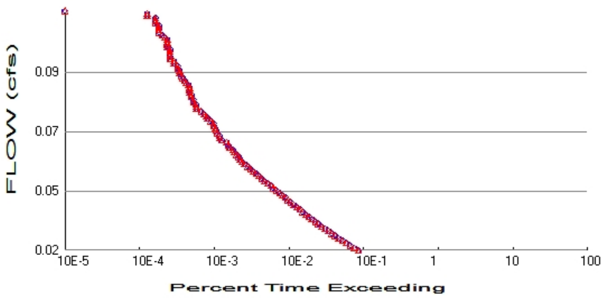
Water Quality BMP Flow and Volume for POC #1

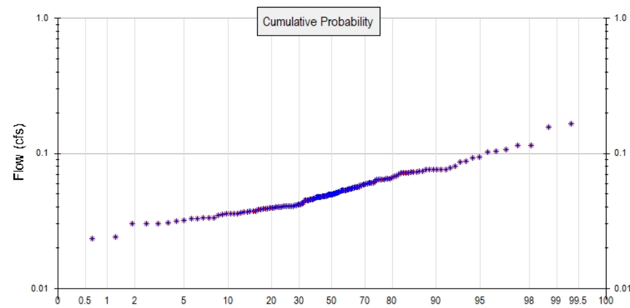
On-line facility volume:	0.0156 acre-feet
On-line facility target flow:	0.0206 cfs.
Adjusted for 15 min:	0.0206 cfs.
Off-line facility target flow:	0.0874 cfs.
Adjusted for 15 min:	0.0874 cfs.

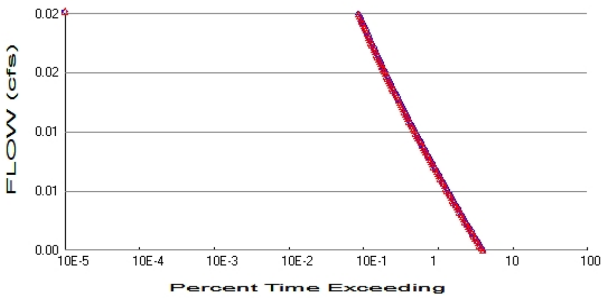
LID Report

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

POC 2







+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.02
Total Impervious Area: 0.14

Mitigated Landuse Totals for POC #2
Total Pervious Area: 0.02
Total Impervious Area: 0.14

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.049862
5 year	0.067219
10 year	0.079876
25 year	0.097246
50 year	0.111219
100 year	0.126107

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	0.049862
5 year	0.067219
10 year	0.079876
25 year	0.097246
50 year	0.111219
100 year	0.126107

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**

1902	0.058	0.058
1903	0.064	0.064
1904	0.076	0.076
1905	0.033	0.033
1906	0.037	0.037
1907	0.051	0.051
1908	0.041	0.041
1909	0.050	0.050
1910	0.048	0.048
1911	0.054	0.054
1912	0.094	0.094
1913	0.038	0.038
1914	0.166	0.166
1915	0.034	0.034
1916	0.062	0.062
1917	0.023	0.023
1918	0.049	0.049
1919	0.031	0.031
1920	0.041	0.041
1921	0.035	0.035
1922	0.056	0.056
1923	0.039	0.039
1924	0.072	0.072
1925	0.030	0.030
1926	0.058	0.058
1927	0.047	0.047
1928	0.036	0.036
1929	0.072	0.072
1930	0.074	0.074
1931	0.036	0.036
1932	0.039	0.039
1933	0.038	0.038
1934	0.064	0.064
1935	0.033	0.033
1936	0.046	0.046
1937	0.068	0.068
1938	0.033	0.033
1939	0.042	0.042
1940	0.074	0.074
1941	0.073	0.073
1942	0.057	0.057
1943	0.055	0.055
1944	0.080	0.080
1945	0.060	0.060
1946	0.047	0.047
1947	0.036	0.036
1948	0.050	0.050
1949	0.076	0.076
1950	0.043	0.043
1951	0.065	0.065
1952	0.078	0.078
1953	0.072	0.072
1954	0.041	0.041
1955	0.037	0.037
1956	0.037	0.037
1957	0.040	0.040
1958	0.051	0.051
1959	0.051	0.051

1960	0.039	0.039
1961	0.114	0.114
1962	0.048	0.048
1963	0.036	0.036
1964	0.107	0.107
1965	0.047	0.047
1966	0.039	0.039
1967	0.056	0.056
1968	0.046	0.046
1969	0.042	0.042
1970	0.048	0.048
1971	0.047	0.047
1972	0.156	0.156
1973	0.087	0.087
1974	0.064	0.064
1975	0.070	0.070
1976	0.072	0.072
1977	0.030	0.030
1978	0.053	0.053
1979	0.054	0.054
1980	0.053	0.053
1981	0.050	0.050
1982	0.040	0.040
1983	0.056	0.056
1984	0.055	0.055
1985	0.064	0.064
1986	0.032	0.032
1987	0.055	0.055
1988	0.033	0.033
1989	0.030	0.030
1990	0.040	0.040
1991	0.060	0.060
1992	0.056	0.056
1993	0.064	0.064
1994	0.045	0.045
1995	0.035	0.035
1996	0.047	0.047
1997	0.042	0.042
1998	0.050	0.050
1999	0.053	0.053
2000	0.047	0.047
2001	0.037	0.037
2002	0.072	0.072
2003	0.040	0.040
2004	0.060	0.060
2005	0.114	0.114
2006	0.053	0.053
2007	0.060	0.060
2008	0.049	0.049
2009	0.037	0.037
2010	0.048	0.048
2011	0.050	0.050
2012	0.048	0.048
2013	0.045	0.045
2014	0.043	0.043
2015	0.076	0.076
2016	0.045	0.045
2017	0.073	0.073

2018	0.045	0.045
2019	0.067	0.067
2020	0.054	0.054
2021	0.045	0.045
2022	0.076	0.076
2023	0.093	0.093
2024	0.104	0.104
2025	0.048	0.048
2026	0.053	0.053
2027	0.059	0.059
2028	0.023	0.023
2029	0.039	0.039
2030	0.076	0.076
2031	0.024	0.024
2032	0.040	0.040
2033	0.051	0.051
2034	0.040	0.040
2035	0.051	0.051
2036	0.040	0.040
2037	0.053	0.053
2038	0.053	0.053
2039	0.102	0.102
2040	0.040	0.040
2041	0.051	0.051
2042	0.058	0.058
2043	0.065	0.065
2044	0.045	0.045
2045	0.037	0.037
2046	0.040	0.040
2047	0.049	0.049
2048	0.041	0.041
2049	0.060	0.060
2050	0.046	0.046
2051	0.066	0.066
2052	0.048	0.048
2053	0.041	0.041
2054	0.086	0.086
2055	0.050	0.050
2056	0.064	0.064
2057	0.032	0.032
2058	0.060	0.060
2059	0.075	0.075

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	0.1658	0.1658
2	0.1560	0.1560
3	0.1141	0.1141
4	0.1140	0.1140
5	0.1069	0.1069
6	0.1041	0.1041
7	0.1020	0.1020
8	0.0942	0.0942
9	0.0926	0.0926
10	0.0873	0.0873
11	0.0859	0.0859
12	0.0803	0.0803

13	0.0781	0.0781
14	0.0763	0.0763
15	0.0761	0.0761
16	0.0761	0.0761
17	0.0758	0.0758
18	0.0756	0.0756
19	0.0754	0.0754
20	0.0738	0.0738
21	0.0737	0.0737
22	0.0728	0.0728
23	0.0726	0.0726
24	0.0725	0.0725
25	0.0718	0.0718
26	0.0717	0.0717
27	0.0716	0.0716
28	0.0715	0.0715
29	0.0695	0.0695
30	0.0679	0.0679
31	0.0675	0.0675
32	0.0657	0.0657
33	0.0650	0.0650
34	0.0646	0.0646
35	0.0644	0.0644
36	0.0644	0.0644
37	0.0644	0.0644
38	0.0643	0.0643
39	0.0641	0.0641
40	0.0641	0.0641
41	0.0619	0.0619
42	0.0605	0.0605
43	0.0604	0.0604
44	0.0604	0.0604
45	0.0602	0.0602
46	0.0598	0.0598
47	0.0595	0.0595
48	0.0591	0.0591
49	0.0584	0.0584
50	0.0582	0.0582
51	0.0581	0.0581
52	0.0566	0.0566
53	0.0564	0.0564
54	0.0563	0.0563
55	0.0561	0.0561
56	0.0557	0.0557
57	0.0554	0.0554
58	0.0551	0.0551
59	0.0548	0.0548
60	0.0544	0.0544
61	0.0539	0.0539
62	0.0539	0.0539
63	0.0535	0.0535
64	0.0533	0.0533
65	0.0532	0.0532
66	0.0530	0.0530
67	0.0530	0.0530
68	0.0529	0.0529
69	0.0528	0.0528
70	0.0514	0.0514

71	0.0514	0.0514
72	0.0511	0.0511
73	0.0510	0.0510
74	0.0508	0.0508
75	0.0506	0.0506
76	0.0504	0.0504
77	0.0502	0.0502
78	0.0498	0.0498
79	0.0498	0.0498
80	0.0496	0.0496
81	0.0495	0.0495
82	0.0495	0.0495
83	0.0494	0.0494
84	0.0492	0.0492
85	0.0485	0.0485
86	0.0485	0.0485
87	0.0484	0.0484
88	0.0482	0.0482
89	0.0482	0.0482
90	0.0479	0.0479
91	0.0475	0.0475
92	0.0475	0.0475
93	0.0475	0.0475
94	0.0473	0.0473
95	0.0473	0.0473
96	0.0473	0.0473
97	0.0470	0.0470
98	0.0464	0.0464
99	0.0464	0.0464
100	0.0458	0.0458
101	0.0455	0.0455
102	0.0454	0.0454
103	0.0451	0.0451
104	0.0451	0.0451
105	0.0450	0.0450
106	0.0449	0.0449
107	0.0430	0.0430
108	0.0427	0.0427
109	0.0420	0.0420
110	0.0419	0.0419
111	0.0416	0.0416
112	0.0415	0.0415
113	0.0410	0.0410
114	0.0408	0.0408
115	0.0406	0.0406
116	0.0406	0.0406
117	0.0405	0.0405
118	0.0405	0.0405
119	0.0404	0.0404
120	0.0404	0.0404
121	0.0403	0.0403
122	0.0402	0.0402
123	0.0400	0.0400
124	0.0398	0.0398
125	0.0398	0.0398
126	0.0393	0.0393
127	0.0392	0.0392
128	0.0389	0.0389

129	0.0388	0.0388
130	0.0387	0.0387
131	0.0384	0.0384
132	0.0383	0.0383
133	0.0373	0.0373
134	0.0373	0.0373
135	0.0372	0.0372
136	0.0366	0.0366
137	0.0366	0.0366
138	0.0365	0.0365
139	0.0360	0.0360
140	0.0359	0.0359
141	0.0358	0.0358
142	0.0356	0.0356
143	0.0354	0.0354
144	0.0345	0.0345
145	0.0335	0.0335
146	0.0334	0.0334
147	0.0331	0.0331
148	0.0330	0.0330
149	0.0326	0.0326
150	0.0319	0.0319
151	0.0316	0.0316
152	0.0308	0.0308
153	0.0303	0.0303
154	0.0302	0.0302
155	0.0301	0.0301
156	0.0241	0.0241
157	0.0233	0.0233
158	0.0231	0.0231

LID Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0040	218334	218334	100	Pass
0.0042	208196	208196	100	Pass
0.0044	198888	198888	100	Pass
0.0046	189913	189913	100	Pass
0.0048	181437	181437	100	Pass
0.0050	173515	173515	100	Pass
0.0053	165870	165870	100	Pass
0.0055	158667	158667	100	Pass
0.0057	151798	151798	100	Pass
0.0059	145260	145260	100	Pass
0.0061	138945	138945	100	Pass
0.0063	133017	133017	100	Pass
0.0065	127366	127366	100	Pass
0.0067	121881	121881	100	Pass
0.0070	116618	116618	100	Pass
0.0072	111798	111798	100	Pass
0.0074	107089	107089	100	Pass
0.0076	102657	102657	100	Pass
0.0078	98336	98336	100	Pass
0.0080	94181	94181	100	Pass
0.0082	90303	90303	100	Pass
0.0084	86536	86536	100	Pass
0.0086	82990	82990	100	Pass
0.0089	79555	79555	100	Pass
0.0091	76231	76231	100	Pass
0.0093	73129	73129	100	Pass
0.0095	70193	70193	100	Pass
0.0097	67312	67312	100	Pass
0.0099	64653	64653	100	Pass
0.0101	62049	62049	100	Pass
0.0103	59666	59666	100	Pass
0.0105	57229	57229	100	Pass
0.0108	55002	55002	100	Pass
0.0110	52797	52797	100	Pass
0.0112	50559	50559	100	Pass
0.0114	48476	48476	100	Pass
0.0116	46442	46442	100	Pass
0.0118	44581	44581	100	Pass
0.0120	42814	42814	100	Pass
0.0122	41196	41196	100	Pass
0.0125	39517	39517	100	Pass
0.0127	37861	37861	100	Pass
0.0129	36404	36404	100	Pass
0.0131	34963	34963	100	Pass
0.0133	33628	33628	100	Pass
0.0135	32321	32321	100	Pass
0.0137	31113	31113	100	Pass
0.0139	29822	29822	100	Pass
0.0141	28670	28670	100	Pass
0.0144	27617	27617	100	Pass
0.0146	26526	26526	100	Pass
0.0148	25501	25501	100	Pass
0.0150	24548	24548	100	Pass

0.0152	23595	23595	100	Pass
0.0154	22670	22670	100	Pass
0.0156	21844	21844	100	Pass
0.0158	21008	21008	100	Pass
0.0160	20249	20249	100	Pass
0.0163	19556	19556	100	Pass
0.0165	18853	18853	100	Pass
0.0167	18122	18122	100	Pass
0.0169	17451	17451	100	Pass
0.0171	16831	16831	100	Pass
0.0173	16177	16177	100	Pass
0.0175	15634	15634	100	Pass
0.0177	15097	15097	100	Pass
0.0180	14504	14504	100	Pass
0.0182	13978	13978	100	Pass
0.0184	13512	13512	100	Pass
0.0186	13036	13036	100	Pass
0.0188	12576	12576	100	Pass
0.0190	12160	12160	100	Pass
0.0192	11701	11701	100	Pass
0.0194	11257	11257	100	Pass
0.0196	10881	10881	100	Pass
0.0199	10526	10526	100	Pass
0.0201	10133	10133	100	Pass
0.0203	9817	9817	100	Pass
0.0205	9496	9496	100	Pass
0.0207	9208	9208	100	Pass
0.0209	8908	8908	100	Pass
0.0211	8593	8593	100	Pass
0.0213	8305	8305	100	Pass
0.0215	8022	8022	100	Pass
0.0218	7745	7745	100	Pass
0.0220	7523	7523	100	Pass
0.0222	7246	7246	100	Pass
0.0224	7008	7008	100	Pass
0.0226	6764	6764	100	Pass
0.0228	6532	6532	100	Pass
0.0230	6327	6327	100	Pass
0.0232	6116	6116	100	Pass
0.0235	5911	5911	100	Pass
0.0237	5740	5740	100	Pass
0.0239	5573	5573	100	Pass
0.0241	5411	5411	100	Pass
0.0243	5224	5224	100	Pass
0.0245	5028	5028	100	Pass
0.0247	4862	4862	100	Pass
0.0249	4706	4706	100	Pass

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0249	4706	4706	100	Pass
0.0258	4145	4145	100	Pass
0.0267	3640	3640	100	Pass
0.0275	3220	3220	100	Pass
0.0284	2878	2878	100	Pass
0.0293	2574	2574	100	Pass
0.0302	2311	2311	100	Pass
0.0310	2075	2075	100	Pass
0.0319	1888	1888	100	Pass
0.0328	1692	1692	100	Pass
0.0336	1508	1508	100	Pass
0.0345	1368	1368	100	Pass
0.0354	1248	1248	100	Pass
0.0363	1120	1120	100	Pass
0.0371	1023	1023	100	Pass
0.0380	933	933	100	Pass
0.0389	844	844	100	Pass
0.0397	776	776	100	Pass
0.0406	708	708	100	Pass
0.0415	640	640	100	Pass
0.0424	588	588	100	Pass
0.0432	538	538	100	Pass
0.0441	493	493	100	Pass
0.0450	450	450	100	Pass
0.0458	415	415	100	Pass
0.0467	376	376	100	Pass
0.0476	343	343	100	Pass
0.0485	320	320	100	Pass
0.0493	288	288	100	Pass
0.0502	260	260	100	Pass
0.0511	238	238	100	Pass
0.0520	219	219	100	Pass
0.0528	200	200	100	Pass
0.0537	184	184	100	Pass
0.0546	169	169	100	Pass
0.0554	157	157	100	Pass
0.0563	140	140	100	Pass
0.0572	130	130	100	Pass
0.0581	123	123	100	Pass
0.0589	118	118	100	Pass
0.0598	110	110	100	Pass
0.0607	102	102	100	Pass
0.0615	99	99	100	Pass
0.0624	88	88	100	Pass
0.0633	86	86	100	Pass
0.0642	81	81	100	Pass
0.0650	69	69	100	Pass
0.0659	66	66	100	Pass
0.0668	64	64	100	Pass
0.0676	61	61	100	Pass
0.0685	58	58	100	Pass
0.0694	57	57	100	Pass
0.0703	54	54	100	Pass

0.0711	54	54	100	Pass
0.0720	50	50	100	Pass
0.0729	45	45	100	Pass
0.0737	43	43	100	Pass
0.0746	40	40	100	Pass
0.0755	37	37	100	Pass
0.0764	32	32	100	Pass
0.0772	32	32	100	Pass
0.0781	31	31	100	Pass
0.0790	29	29	100	Pass
0.0798	29	29	100	Pass
0.0807	27	27	100	Pass
0.0816	27	27	100	Pass
0.0825	26	26	100	Pass
0.0833	26	26	100	Pass
0.0842	26	26	100	Pass
0.0851	25	25	100	Pass
0.0859	23	23	100	Pass
0.0868	22	22	100	Pass
0.0877	21	21	100	Pass
0.0886	20	20	100	Pass
0.0894	19	19	100	Pass
0.0903	19	19	100	Pass
0.0912	18	18	100	Pass
0.0920	18	18	100	Pass
0.0929	16	16	100	Pass
0.0938	16	16	100	Pass
0.0947	14	14	100	Pass
0.0955	14	14	100	Pass
0.0964	14	14	100	Pass
0.0973	14	14	100	Pass
0.0981	14	14	100	Pass
0.0990	13	13	100	Pass
0.0999	13	13	100	Pass
0.1008	13	13	100	Pass
0.1016	13	13	100	Pass
0.1025	12	12	100	Pass
0.1034	11	11	100	Pass
0.1042	10	10	100	Pass
0.1051	10	10	100	Pass
0.1060	10	10	100	Pass
0.1069	10	10	100	Pass
0.1077	9	9	100	Pass
0.1086	9	9	100	Pass
0.1095	9	9	100	Pass
0.1103	7	7	100	Pass
0.1112	7	7	100	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #2

On-line facility volume:	0.0156 acre-feet
On-line facility target flow:	0.0206 cfs.
Adjusted for 15 min:	0.0206 cfs.
Off-line facility target flow:	0.0118 cfs.
Adjusted for 15 min:	0.0118 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% 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   Puyallup AOB_v1.wdm
MESSU      25   PrePuyallup AOB_v1.MES
           27   PrePuyallup AOB_v1.L61
           28   PrePuyallup AOB_v1.L62
           30   POCPuyallup AOB_v11.dat
           31   POCPuyallup AOB_v12.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND      11
      IMPLND       1
      IMPLND       8
      COPY       501
      COPY       502
      DISPLY       1
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1         AOB-ON                    MAX                     1    2   30    9
    2         AOB-OFF                   MAX                     1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         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           ***
   16      C, 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 ***
   16         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  *********
   16         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 ***
   16         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
   16              0       4.5      0.03       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
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                    ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      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
   16              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           ***
   11       PARKING/FLAT          1    1    1   27    0
    1       ROADS/FLAT            1    1    1   27    0
    8       SIDEWALKS/FLAT        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         0    0    4    0    0    0    1    9
    1         0    0    4    0    0    0    1    9
    8         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    ***
```

```
   11         0    0    0    0    0
    1         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -   # ***  LSUR      SLSUR      NSUR     RETSC
   11            400       0.01        0.1       0.1
    1            400       0.01        0.1       0.1
    8            400       0.01        0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN
   11              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -   # ***  RETS      SURS
   11              0         0
    1              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
AOB-ON***
PERLND  16                        0.08     COPY   501      12
PERLND  16                        0.08     COPY   501      13
IMPLND  11                        1.03     COPY   501      15
AOB-OFF***
PERLND  16                        0.02     COPY   502      12
PERLND  16                        0.02     COPY   502      13
IMPLND   1                        0.01     COPY   502      15
IMPLND   8                        0.13     COPY   502      15

******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
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     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
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    502 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  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   Puyallup AOB_v1.wdm
MESSU      25   MitPuyallup AOB_v1.MES
           27   MitPuyallup AOB_v1.L61
           28   MitPuyallup AOB_v1.L62
           30   POCPuyallup AOB_v11.dat
           31   POCPuyallup AOB_v12.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      COPY       501
      COPY       502
      DISPLY       1
      DISPLY       2
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        AOB-ON                      MAX                   1    2   30    9
    2        AOB-OFF                     MAX                   1    2   31    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1        1    1
  501        1    1
  502        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           ***
   16     C, 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 ***
   16         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  *********
   16         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 ***
   16         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
   16              0       4.5      0.03       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
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      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
   16              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          ***
    1      ROADS/FLAT              1    1    1   27    0
    4      ROOF TOPS/FLAT          1    1    1   27    0
    8      SIDEWALKS/FLAT          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         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    ***
```

```
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1             0         0
    4             0         0
    8             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
    4             0         0
    8             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
AOB-ON***
PERLND  16                        0.03     COPY   501     12
PERLND  16                        0.03     COPY   501     13
IMPLND   1                        0.02     COPY   501     15
IMPLND   4                           1     COPY   501     15
IMPLND   8                        0.06     COPY   501     15
AOB-OFF***
PERLND  16                        0.02     COPY   502     12
PERLND  16                        0.02     COPY   502     13
IMPLND   1                        0.05     COPY   502     15
IMPLND   8                        0.09     COPY   502     15

******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
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     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     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL       REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL       REPL
COPY     2 OUTPUT MEAN   1 1     48.4      WDM    702 FLOW     ENGL       REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    802 FLOW     ENGL       REPL
END EXT TARGETS

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

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

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


END MASS-LINK
```

```
END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

General Model Information

Project Name: Puyallup AOB_v1

Site Name: Puyallup AOB

Site Address:

City:

Report Date: 9/16/2025

Gage:

Data Start: 10/01/1901

Data End: 09/30/2059

Timestep: Hourly

Precip Scale: 1.000

Version Date: 2021/08/18

Version: 4.2.18

POC Thresholds

Low Flow Threshold for POC3:	50 Percent of the 2 Year
High Flow Threshold for POC3:	50 Year

Landuse Basin Data
Predeveloped Land Use

AOB-ON

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.08
Pervious Total	0.08
Impervious Land Use	acre
PARKING FLAT	1.03
Impervious Total	1.03
Basin Total	1.11

Element Flows To:

Surface	Interflow	Groundwater

AOB-OFF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.02
Pervious Total	0.02
Impervious Land Use	acre
ROADS FLAT	0.01
SIDEWALKS FLAT	0.13
Impervious Total	0.14
Basin Total	0.16

Element Flows To:

Surface	Interflow	Groundwater

AOB-ON-TEST

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.11
Pervious Total	1.11
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.11

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

AOB-ON

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.03
Pervious Total	0.03
Impervious Land Use	acre
ROADS FLAT	0.02
ROOF TOPS FLAT	1
SIDEWALKS FLAT	0.06
Impervious Total	1.08
Basin Total	1.11

Element Flows To:

Surface	Interflow	Groundwater
Vault TEST	Vault TEST	

AOB-OFF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.02
Pervious Total	0.02
Impervious Land Use	acre
ROADS FLAT	0.05
SIDEWALKS FLAT	0.09
Impervious Total	0.14
Basin Total	0.16

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault TEST

Width:	20 ft.	
Length:	438.156153358206 ft.	
Depth:	7 ft.	
Discharge Structure		
Riser Height:	6 ft.	
Riser Diameter:	18 in.	
Orifice 1 Diameter:	0.33 in.	Elevation:0 ft.
Orifice 2 Diameter:	0.66 in.	Elevation:4.862 ft.
Orifice 3 Diameter:	1.25 in.	Elevation:5.40541666666669 ft.
Element Flows To:		
Outlet 1	Outlet 2	

Vault Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.201	0.000	0.000	0.000
0.0778	0.201	0.015	0.000	0.000
0.1556	0.201	0.031	0.001	0.000
0.2333	0.201	0.046	0.001	0.000
0.3111	0.201	0.062	0.001	0.000
0.3889	0.201	0.078	0.001	0.000
0.4667	0.201	0.093	0.002	0.000
0.5444	0.201	0.109	0.002	0.000
0.6222	0.201	0.125	0.002	0.000
0.7000	0.201	0.140	0.002	0.000
0.7778	0.201	0.156	0.002	0.000
0.8556	0.201	0.172	0.002	0.000
0.9333	0.201	0.187	0.002	0.000
1.0111	0.201	0.203	0.003	0.000
1.0889	0.201	0.219	0.003	0.000
1.1667	0.201	0.234	0.003	0.000
1.2444	0.201	0.250	0.003	0.000
1.3222	0.201	0.266	0.003	0.000
1.4000	0.201	0.281	0.003	0.000
1.4778	0.201	0.297	0.003	0.000
1.5556	0.201	0.312	0.003	0.000
1.6333	0.201	0.328	0.003	0.000
1.7111	0.201	0.344	0.003	0.000
1.7889	0.201	0.359	0.004	0.000
1.8667	0.201	0.375	0.004	0.000
1.9444	0.201	0.391	0.004	0.000
2.0222	0.201	0.406	0.004	0.000
2.1000	0.201	0.422	0.004	0.000
2.1778	0.201	0.438	0.004	0.000
2.2556	0.201	0.453	0.004	0.000
2.3333	0.201	0.469	0.004	0.000
2.4111	0.201	0.485	0.004	0.000
2.4889	0.201	0.500	0.004	0.000
2.5667	0.201	0.516	0.004	0.000
2.6444	0.201	0.532	0.004	0.000
2.7222	0.201	0.547	0.004	0.000
2.8000	0.201	0.563	0.004	0.000
2.8778	0.201	0.578	0.005	0.000

2.9556	0.201	0.594	0.005	0.000
3.0333	0.201	0.610	0.005	0.000
3.1111	0.201	0.625	0.005	0.000
3.1889	0.201	0.641	0.005	0.000
3.2667	0.201	0.657	0.005	0.000
3.3444	0.201	0.672	0.005	0.000
3.4222	0.201	0.688	0.005	0.000
3.5000	0.201	0.704	0.005	0.000
3.5778	0.201	0.719	0.005	0.000
3.6556	0.201	0.735	0.005	0.000
3.7333	0.201	0.751	0.005	0.000
3.8111	0.201	0.766	0.005	0.000
3.8889	0.201	0.782	0.005	0.000
3.9667	0.201	0.798	0.005	0.000
4.0444	0.201	0.813	0.005	0.000
4.1222	0.201	0.829	0.006	0.000
4.2000	0.201	0.844	0.006	0.000
4.2778	0.201	0.860	0.006	0.000
4.3556	0.201	0.876	0.006	0.000
4.4333	0.201	0.891	0.006	0.000
4.5111	0.201	0.907	0.006	0.000
4.5889	0.201	0.923	0.006	0.000
4.6667	0.201	0.938	0.006	0.000
4.7444	0.201	0.954	0.006	0.000
4.8222	0.201	0.970	0.006	0.000
4.9000	0.201	0.985	0.008	0.000
4.9778	0.201	1.001	0.010	0.000
5.0556	0.201	1.017	0.011	0.000
5.1333	0.201	1.032	0.012	0.000
5.2111	0.201	1.048	0.013	0.000
5.2889	0.201	1.064	0.014	0.000
5.3667	0.201	1.079	0.015	0.000
5.4444	0.201	1.095	0.024	0.000
5.5222	0.201	1.110	0.031	0.000
5.6000	0.201	1.126	0.035	0.000
5.6778	0.201	1.142	0.039	0.000
5.7556	0.201	1.157	0.043	0.000
5.8333	0.201	1.173	0.046	0.000
5.9111	0.201	1.189	0.049	0.000
5.9889	0.201	1.204	0.052	0.000
6.0667	0.201	1.220	0.328	0.000
6.1444	0.201	1.236	0.926	0.000
6.2222	0.201	1.251	1.696	0.000
6.3000	0.201	1.267	2.563	0.000
6.3778	0.201	1.283	3.450	0.000
6.4556	0.201	1.298	4.282	0.000
6.5333	0.201	1.314	4.992	0.000
6.6111	0.201	1.330	5.538	0.000
6.6889	0.201	1.345	5.920	0.000
6.7667	0.201	1.361	6.278	0.000
6.8444	0.201	1.376	6.587	0.000
6.9222	0.201	1.392	6.882	0.000
7.0000	0.201	1.408	7.165	0.000
7.0778	0.201	1.423	7.437	0.000
7.1556	0.000	0.000	7.699	0.000

Analysis Results

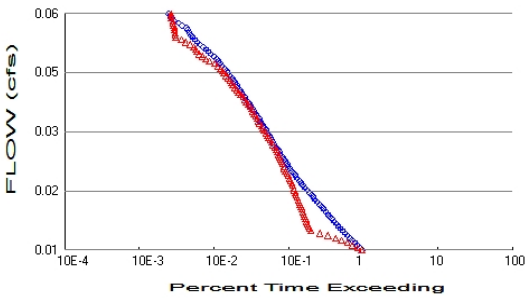
POC 1

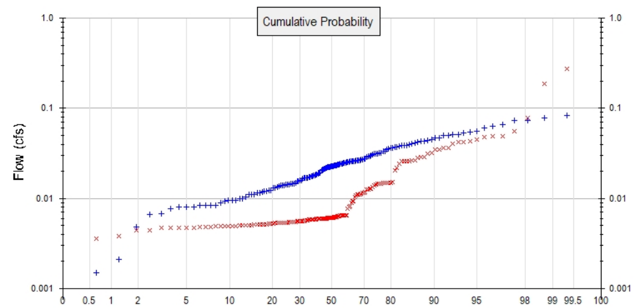
POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 2

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 3





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #3
Total Pervious Area: 1.11
Total Impervious Area: 0

Mitigated Landuse Totals for POC #3
Total Pervious Area: 0.03
Total Impervious Area: 1.08

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	**Flow(cfs)**
2 year	0.023118
5 year	0.03682
10 year	0.044383
25 year	0.052148
50 year	0.056791
100 year	0.060624

Flow Frequency Return Periods for Mitigated. POC #3

Return Period	**Flow(cfs)**
2 year	0.008214
5 year	0.017215
10 year	0.027265
25 year	0.047177
50 year	0.06947
100 year	0.100627

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #3

Year	**Predeveloped**	**Mitigated**
1902	0.017	0.006
1903	0.014	0.005
1904	0.023	0.006
1905	0.011	0.006
1906	0.005	0.004
1907	0.036	0.005
1908	0.026	0.006
1909	0.026	0.006
1910	0.037	0.006
1911	0.024	0.006
1912	0.084	0.035

1913	0.036	0.049
1914	0.008	0.005
1915	0.015	0.009
1916	0.023	0.011
1917	0.008	0.005
1918	0.025	0.040
1919	0.018	0.005
1920	0.023	0.006
1921	0.026	0.014
1922	0.026	0.006
1923	0.021	0.015
1924	0.010	0.005
1925	0.012	0.005
1926	0.022	0.006
1927	0.014	0.006
1928	0.018	0.006
1929	0.040	0.032
1930	0.023	0.006
1931	0.021	0.011
1932	0.017	0.006
1933	0.016	0.011
1934	0.050	0.056
1935	0.022	0.006
1936	0.019	0.015
1937	0.033	0.006
1938	0.019	0.011
1939	0.001	0.004
1940	0.021	0.006
1941	0.010	0.005
1942	0.032	0.015
1943	0.015	0.006
1944	0.034	0.026
1945	0.026	0.012
1946	0.014	0.005
1947	0.008	0.005
1948	0.050	0.006
1949	0.043	0.006
1950	0.011	0.005
1951	0.015	0.006
1952	0.074	0.013
1953	0.060	0.043
1954	0.022	0.006
1955	0.016	0.005
1956	0.008	0.005
1957	0.029	0.009
1958	0.064	0.188
1959	0.038	0.045
1960	0.010	0.005
1961	0.038	0.036
1962	0.021	0.006
1963	0.010	0.005
1964	0.010	0.005
1965	0.044	0.043
1966	0.012	0.005
1967	0.018	0.005
1968	0.018	0.008
1969	0.019	0.006
1970	0.029	0.006

1971	0.047	0.015
1972	0.030	0.012
1973	0.040	0.022
1974	0.024	0.006
1975	0.054	0.026
1976	0.026	0.012
1977	0.008	0.005
1978	0.043	0.048
1979	0.012	0.005
1980	0.024	0.012
1981	0.024	0.006
1982	0.009	0.005
1983	0.039	0.013
1984	0.015	0.005
1985	0.025	0.005
1986	0.023	0.006
1987	0.045	0.026
1988	0.027	0.006
1989	0.025	0.006
1990	0.029	0.006
1991	0.022	0.021
1992	0.031	0.036
1993	0.031	0.014
1994	0.047	0.008
1995	0.008	0.005
1996	0.051	0.078
1997	0.019	0.006
1998	0.023	0.006
1999	0.002	0.004
2000	0.017	0.006
2001	0.008	0.005
2002	0.042	0.006
2003	0.027	0.006
2004	0.028	0.009
2005	0.037	0.014
2006	0.014	0.006
2007	0.014	0.006
2008	0.024	0.006
2009	0.017	0.006
2010	0.014	0.006
2011	0.011	0.005
2012	0.016	0.006
2013	0.013	0.005
2014	0.010	0.005
2015	0.019	0.005
2016	0.007	0.004
2017	0.037	0.011
2018	0.073	0.272
2019	0.065	0.049
2020	0.022	0.006
2021	0.032	0.028
2022	0.012	0.005
2023	0.027	0.026
2024	0.078	0.006
2025	0.023	0.006
2026	0.039	0.032
2027	0.013	0.006
2028	0.012	0.005

2029	0.026	0.024
2030	0.051	0.014
2031	0.015	0.006
2032	0.008	0.005
2033	0.014	0.005
2034	0.013	0.006
2035	0.055	0.006
2036	0.030	0.008
2037	0.007	0.005
2038	0.025	0.015
2039	0.002	0.004
2040	0.012	0.005
2041	0.017	0.005
2042	0.055	0.006
2043	0.026	0.029
2044	0.035	0.035
2045	0.023	0.026
2046	0.027	0.015
2047	0.020	0.006
2048	0.026	0.005
2049	0.024	0.006
2050	0.017	0.005
2051	0.025	0.015
2052	0.014	0.010
2053	0.025	0.026
2054	0.032	0.013
2055	0.009	0.005
2056	0.011	0.005
2057	0.018	0.011
2058	0.022	0.029
2059	0.041	0.042

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #3

Rank	Predeveloped	Mitigated
1	0.0842	0.2719
2	0.0780	0.1885
3	0.0735	0.0785
4	0.0732	0.0556
5	0.0654	0.0489
6	0.0637	0.0486
7	0.0601	0.0481
8	0.0555	0.0449
9	0.0549	0.0431
10	0.0537	0.0426
11	0.0512	0.0419
12	0.0508	0.0401
13	0.0503	0.0364
14	0.0499	0.0361
15	0.0471	0.0351
16	0.0470	0.0349
17	0.0454	0.0320
18	0.0438	0.0315
19	0.0434	0.0289
20	0.0428	0.0289
21	0.0420	0.0283
22	0.0414	0.0263
23	0.0402	0.0261

24	0.0396	0.0260
25	0.0392	0.0260
26	0.0387	0.0257
27	0.0385	0.0256
28	0.0383	0.0244
29	0.0374	0.0219
30	0.0373	0.0206
31	0.0367	0.0151
32	0.0364	0.0149
33	0.0356	0.0148
34	0.0350	0.0148
35	0.0336	0.0148
36	0.0334	0.0147
37	0.0319	0.0145
38	0.0317	0.0145
39	0.0316	0.0144
40	0.0312	0.0142
41	0.0311	0.0139
42	0.0305	0.0133
43	0.0300	0.0129
44	0.0295	0.0127
45	0.0293	0.0125
46	0.0285	0.0125
47	0.0276	0.0119
48	0.0274	0.0116
49	0.0273	0.0114
50	0.0272	0.0112
51	0.0266	0.0111
52	0.0264	0.0110
53	0.0264	0.0109
54	0.0264	0.0108
55	0.0260	0.0103
56	0.0259	0.0094
57	0.0259	0.0094
58	0.0258	0.0088
59	0.0256	0.0082
60	0.0255	0.0079
61	0.0253	0.0077
62	0.0252	0.0065
63	0.0249	0.0065
64	0.0249	0.0065
65	0.0248	0.0065
66	0.0245	0.0064
67	0.0244	0.0064
68	0.0242	0.0064
69	0.0241	0.0064
70	0.0239	0.0063
71	0.0237	0.0063
72	0.0235	0.0063
73	0.0234	0.0063
74	0.0233	0.0062
75	0.0232	0.0062
76	0.0230	0.0062
77	0.0230	0.0061
78	0.0229	0.0061
79	0.0228	0.0061
80	0.0226	0.0061
81	0.0224	0.0060

82	0.0222	0.0060
83	0.0222	0.0060
84	0.0220	0.0060
85	0.0217	0.0060
86	0.0217	0.0060
87	0.0214	0.0060
88	0.0213	0.0060
89	0.0209	0.0060
90	0.0208	0.0059
91	0.0205	0.0059
92	0.0192	0.0059
93	0.0192	0.0059
94	0.0191	0.0059
95	0.0189	0.0059
96	0.0185	0.0059
97	0.0185	0.0059
98	0.0181	0.0059
99	0.0181	0.0058
100	0.0176	0.0058
101	0.0176	0.0058
102	0.0173	0.0058
103	0.0171	0.0058
104	0.0170	0.0058
105	0.0170	0.0057
106	0.0170	0.0057
107	0.0168	0.0056
108	0.0165	0.0056
109	0.0160	0.0056
110	0.0158	0.0056
111	0.0155	0.0056
112	0.0154	0.0055
113	0.0148	0.0055
114	0.0146	0.0055
115	0.0146	0.0055
116	0.0145	0.0054
117	0.0143	0.0054
118	0.0142	0.0054
119	0.0142	0.0054
120	0.0140	0.0054
121	0.0140	0.0054
122	0.0140	0.0053
123	0.0137	0.0053
124	0.0135	0.0053
125	0.0131	0.0053
126	0.0129	0.0053
127	0.0124	0.0053
128	0.0122	0.0052
129	0.0121	0.0052
130	0.0121	0.0052
131	0.0117	0.0051
132	0.0116	0.0051
133	0.0115	0.0051
134	0.0111	0.0051
135	0.0111	0.0051
136	0.0109	0.0051
137	0.0105	0.0050
138	0.0099	0.0050
139	0.0099	0.0050

140	0.0096	0.0050
141	0.0096	0.0049
142	0.0096	0.0049
143	0.0093	0.0049
144	0.0090	0.0049
145	0.0084	0.0049
146	0.0084	0.0049
147	0.0083	0.0048
148	0.0083	0.0048
149	0.0081	0.0048
150	0.0080	0.0047
151	0.0080	0.0047
152	0.0077	0.0047
153	0.0067	0.0047
154	0.0066	0.0044
155	0.0048	0.0044
156	0.0021	0.0038
157	0.0015	0.0036
158	0.0011	0.0035

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0116	13593	13271	97	Pass
0.0120	12515	11588	92	Pass
0.0125	11573	9939	85	Pass
0.0129	10719	8559	79	Pass
0.0134	9954	7109	71	Pass
0.0138	9190	5882	64	Pass
0.0143	8554	4686	54	Pass
0.0148	7944	3644	45	Pass
0.0152	7388	2749	37	Pass
0.0157	6857	2630	38	Pass
0.0161	6428	2554	39	Pass
0.0166	6023	2487	41	Pass
0.0170	5661	2413	42	Pass
0.0175	5314	2355	44	Pass
0.0180	4989	2284	45	Pass
0.0184	4686	2226	47	Pass
0.0189	4384	2169	49	Pass
0.0193	4102	2097	51	Pass
0.0198	3841	2046	53	Pass
0.0202	3619	1983	54	Pass
0.0207	3378	1925	56	Pass
0.0212	3188	1866	58	Pass
0.0216	3004	1806	60	Pass
0.0221	2813	1742	61	Pass
0.0225	2634	1706	64	Pass
0.0230	2469	1659	67	Pass
0.0234	2317	1623	70	Pass
0.0239	2180	1571	72	Pass
0.0244	2054	1532	74	Pass
0.0248	1933	1470	76	Pass
0.0253	1828	1428	78	Pass
0.0257	1717	1371	79	Pass
0.0262	1622	1321	81	Pass
0.0266	1535	1268	82	Pass
0.0271	1457	1227	84	Pass
0.0276	1391	1191	85	Pass
0.0280	1326	1156	87	Pass
0.0285	1261	1111	88	Pass
0.0289	1202	1079	89	Pass
0.0294	1149	1052	91	Pass
0.0298	1091	1020	93	Pass
0.0303	1052	980	93	Pass
0.0307	1001	957	95	Pass
0.0312	947	907	95	Pass
0.0317	897	866	96	Pass
0.0321	854	828	96	Pass
0.0326	818	788	96	Pass
0.0330	791	754	95	Pass
0.0335	758	718	94	Pass
0.0339	731	684	93	Pass
0.0344	699	656	93	Pass
0.0349	661	624	94	Pass
0.0353	630	602	95	Pass

0.0358	604	572	94	Pass
0.0362	579	548	94	Pass
0.0367	555	526	94	Pass
0.0371	524	502	95	Pass
0.0376	505	478	94	Pass
0.0381	478	461	96	Pass
0.0385	460	443	96	Pass
0.0390	435	421	96	Pass
0.0394	417	399	95	Pass
0.0399	399	379	94	Pass
0.0403	372	356	95	Pass
0.0408	359	342	95	Pass
0.0413	338	319	94	Pass
0.0417	324	296	91	Pass
0.0422	311	281	90	Pass
0.0426	291	264	90	Pass
0.0431	278	249	89	Pass
0.0435	267	237	88	Pass
0.0440	252	228	90	Pass
0.0445	244	216	88	Pass
0.0449	229	201	87	Pass
0.0454	215	189	87	Pass
0.0458	206	181	87	Pass
0.0463	191	169	88	Pass
0.0467	181	155	85	Pass
0.0472	169	141	83	Pass
0.0477	159	121	76	Pass
0.0481	150	107	71	Pass
0.0486	139	97	69	Pass
0.0490	128	88	68	Pass
0.0495	116	82	70	Pass
0.0499	109	79	72	Pass
0.0504	99	74	74	Pass
0.0509	89	67	75	Pass
0.0513	84	58	69	Pass
0.0518	77	51	66	Pass
0.0522	72	43	59	Pass
0.0527	69	42	60	Pass
0.0531	65	42	64	Pass
0.0536	62	41	66	Pass
0.0540	59	41	69	Pass
0.0545	52	40	76	Pass
0.0550	47	39	82	Pass
0.0554	41	39	95	Pass
0.0559	38	37	97	Pass
0.0563	36	37	102	Pass
0.0568	34	37	108	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #3
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

Model Default Modifications

Total of 0 changes have been made.

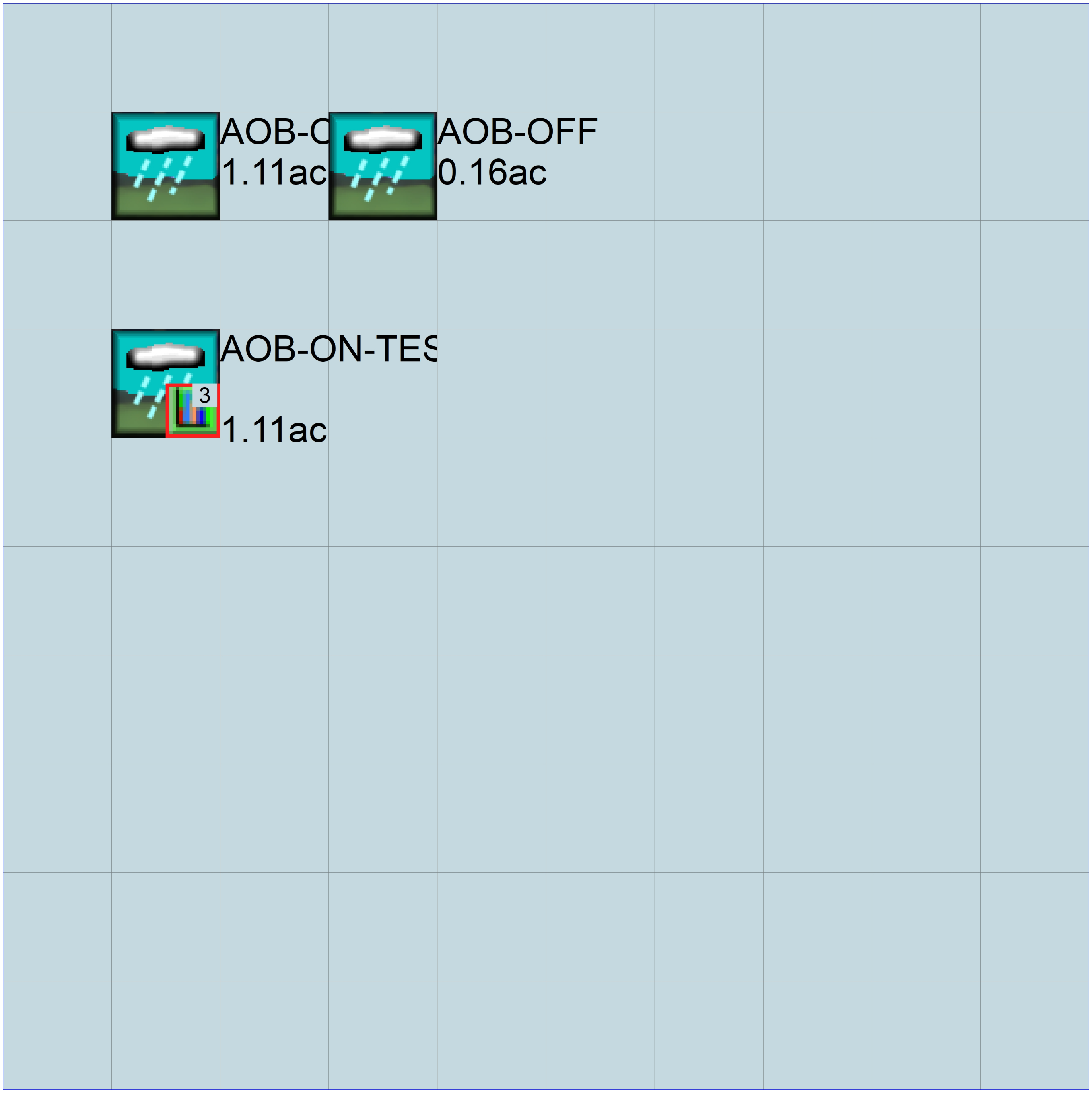
PERLND Changes

No PERLND changes have been made.

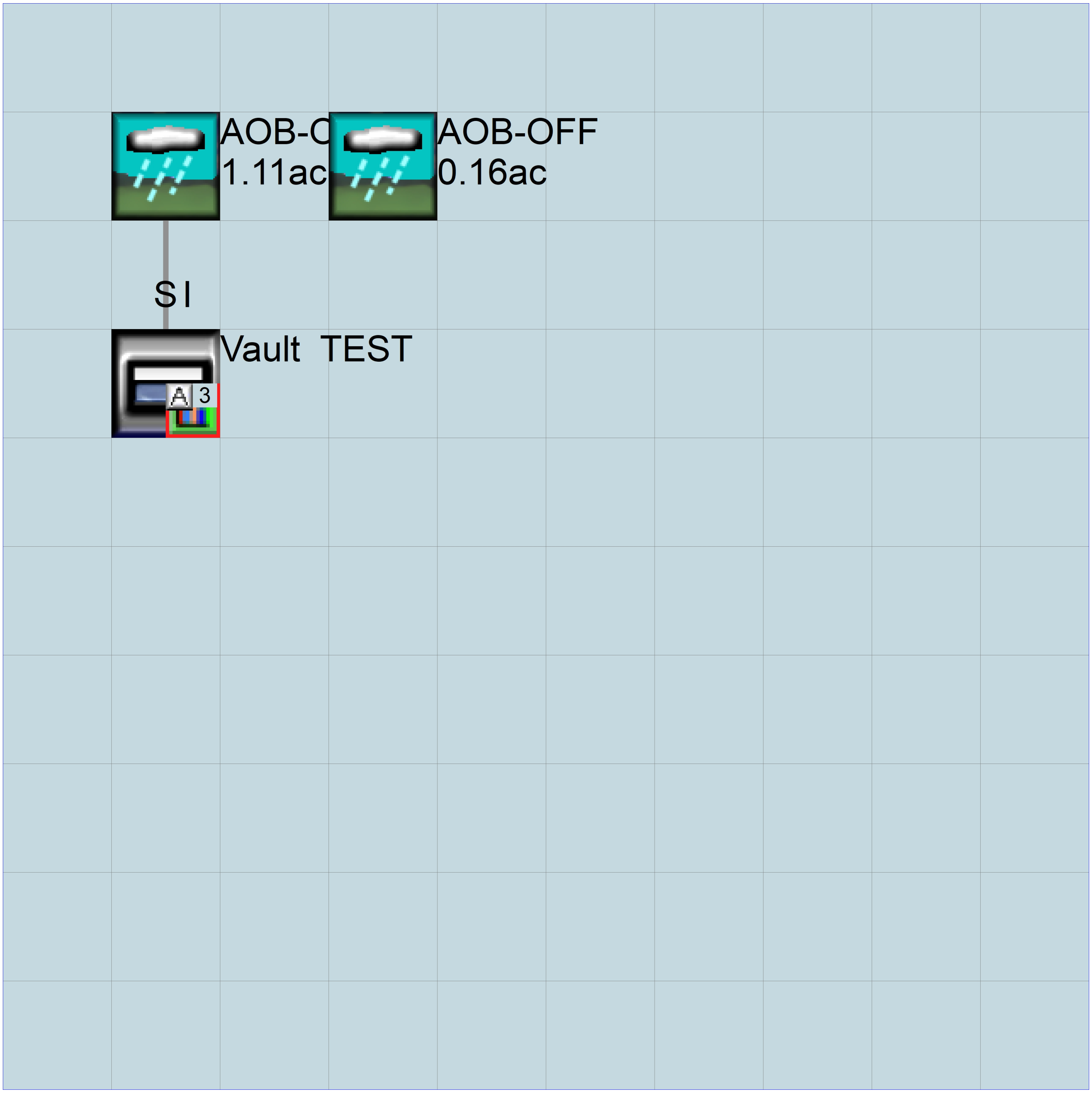
IMPLND Changes

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   Puyallup AOB_v1.wdm
MESSU      25   PrePuyallup AOB_v1.MES
           27   PrePuyallup AOB_v1.L61
           28   PrePuyallup AOB_v1.L62
           32   POCPuyallup AOB_v13.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      16
      IMPLND      11
      IMPLND       1
      IMPLND       8
      PERLND      10
      COPY       503
      DISPLY       3
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    3        AOB-ON-TEST                 MAX                      1    2   32    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  503         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           ***
   16      C, Lawn, Flat           1    1    1    1   27    0
   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 ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
   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  *********
   16        0    0    4    0    0    0    0    0    0    0    0    0    1    9
   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 ***
   16        0    0    0    0    0    0    0    0    0    0    0
   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
   16              0       4.5      0.03       400      0.05       0.5     0.996
   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
   16              0         0         2         2         0         0         0
   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 ***
   16            0.1      0.25      0.25         6       0.5      0.25
   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
   16              0         0         0         0       2.5         1         0
   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           ***
   11      PARKING/FLAT            1    1    1   27    0
    1      ROADS/FLAT              1    1    1   27    0
    8      SIDEWALKS/FLAT          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # - # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11        0    0    1    0    0    0
    1        0    0    1    0    0    0
    8        0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # - # ATMP SNOW IWAT  SLD  IWG IQAL   *********
   11        0    0    4    0    0    0    1    9
    1        0    0    4    0    0    0    1    9
    8        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     ***
   11         0    0    0    0    0
    1         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR      SLSUR      NSUR     RETSC
   11            400      0.01        0.1       0.1
    1            400      0.01        0.1       0.1
    8            400      0.01        0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11              0         0
    1              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                <--Area-->     <-Target->   MBLK   ***
<Name>   #                <-factor->     <Name>   #   Tbl#   ***
AOB-ON-TEST***
PERLND  10                      1.11     COPY   503     12
PERLND  10                      1.11     COPY   503     13

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   503 OUTPUT MEAN   1 1   12.1        DISPLY   3     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         SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC      ENGL    1         SUM  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   503 OUTPUT MEAN   1 1     12.1      WDM    503 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   Puyallup AOB_v1.wdm
MESSU      25   MitPuyallup AOB_v1.MES
           27   MitPuyallup AOB_v1.L61
           28   MitPuyallup AOB_v1.L62
           32   POCPuyallup AOB_v13.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      RCHRES       1
      COPY         3
      COPY       503
      DISPLY       3
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    3        Vault  TEST                 MAX                     1    2   32    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
    3         1    1
  503         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           ***
   16      C, 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 ***
   16         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  *********
   16         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 ***
   16         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
   16              0       4.5      0.03       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
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      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
   16              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           ***
    1      ROADS/FLAT              1    1    1   27    0
    4      ROOF TOPS/FLAT          1    1    1   27    0
    8      SIDEWALKS/FLAT          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         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    ***
    1         0    0    0    0    0
    4         0    0    0    0    0
```

```
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1           400      0.01       0.1       0.1
    4           400      0.01       0.1       0.1
    8           400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
AOB-ON***
PERLND  16                        0.03     RCHRES   1      2
PERLND  16                        0.03     RCHRES   1      3
IMPLND   1                        0.02     RCHRES   1      5
IMPLND   4                           1     RCHRES   1      5
IMPLND   8                        0.06     RCHRES   1      5

******Routing******
PERLND  16                        0.03     COPY     3     12
IMPLND   1                        0.02     COPY     3     15
IMPLND   4                           1     COPY     3     15
IMPLND   8                        0.06     COPY     3     15
PERLND  16                        0.03     COPY     3     13
RCHRES   1                           1     COPY   503     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   503 OUTPUT MEAN   1 1   12.1        DISPLY   3     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     Vault  TEST              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      0.08       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
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)  (ft/sec)    (Minutes)***
  0.000000  0.201174  0.000000  0.000000
  0.077778  0.201174  0.015647  0.000824
  0.155556  0.201174  0.031294  0.001166
  0.233333  0.201174  0.046941  0.001427
  0.311111  0.201174  0.062587  0.001648
  0.388889  0.201174  0.078234  0.001843
  0.466667  0.201174  0.093881  0.002019
  0.544444  0.201174  0.109528  0.002181
  0.622222  0.201174  0.125175  0.002331
  0.700000  0.201174  0.140822  0.002472
  0.777778  0.201174  0.156468  0.002606
  0.855556  0.201174  0.172115  0.002733
  0.933333  0.201174  0.187762  0.002855
  1.011111  0.201174  0.203409  0.002972
  1.088889  0.201174  0.219056  0.003084
  1.166667  0.201174  0.234703  0.003192
  1.244444  0.201174  0.250349  0.003297
  1.322222  0.201174  0.265996  0.003398
  1.400000  0.201174  0.281643  0.003497
  1.477778  0.201174  0.297290  0.003592
  1.555556  0.201174  0.312937  0.003686
  1.633333  0.201174  0.328584  0.003777
  1.711111  0.201174  0.344230  0.003866
  1.788889  0.201174  0.359877  0.003953
  1.866667  0.201174  0.375524  0.004038
  1.944444  0.201174  0.391171  0.004121
  2.022222  0.201174  0.406818  0.004202
  2.100000  0.201174  0.422465  0.004282
  2.177778  0.201174  0.438111  0.004361
  2.255556  0.201174  0.453758  0.004438
  2.333333  0.201174  0.469405  0.004514
```

```
  2.411111  0.201174  0.485052  0.004589
  2.488889  0.201174  0.500699  0.004662
  2.566667  0.201174  0.516346  0.004734
  2.644444  0.201174  0.531992  0.004806
  2.722222  0.201174  0.547639  0.004876
  2.800000  0.201174  0.563286  0.004945
  2.877778  0.201174  0.578933  0.005013
  2.955556  0.201174  0.594580  0.005080
  3.033333  0.201174  0.610227  0.005147
  3.111111  0.201174  0.625873  0.005212
  3.188889  0.201174  0.641520  0.005277
  3.266667  0.201174  0.657167  0.005341
  3.344444  0.201174  0.672814  0.005404
  3.422222  0.201174  0.688461  0.005467
  3.500000  0.201174  0.704108  0.005529
  3.577778  0.201174  0.719755  0.005590
  3.655556  0.201174  0.735401  0.005650
  3.733333  0.201174  0.751048  0.005710
  3.811111  0.201174  0.766695  0.005769
  3.888889  0.201174  0.782342  0.005828
  3.966667  0.201174  0.797989  0.005886
  4.044444  0.201174  0.813636  0.005943
  4.122222  0.201174  0.829282  0.006000
  4.200000  0.201174  0.844929  0.006056
  4.277778  0.201174  0.860576  0.006112
  4.355556  0.201174  0.876223  0.006167
  4.433333  0.201174  0.891870  0.006222
  4.511111  0.201174  0.907517  0.006277
  4.588889  0.201174  0.923163  0.006331
  4.666667  0.201174  0.938810  0.006384
  4.744444  0.201174  0.954457  0.006437
  4.822222  0.201174  0.970104  0.006489
  4.900000  0.201174  0.985751  0.008846
  4.977778  0.201174  1.001398  0.010615
  5.055556  0.201174  1.017044  0.011845
  5.133333  0.201174  1.032691  0.012853
  5.211111  0.201174  1.048338  0.013730
  5.288889  0.201174  1.063985  0.014520
  5.366667  0.201174  1.079632  0.015244
  5.444444  0.201174  1.095279  0.024293
  5.522222  0.201174  1.110925  0.031041
  5.600000  0.201174  1.126572  0.035852
  5.677778  0.201174  1.142219  0.039847
  5.755556  0.201174  1.157866  0.043354
  5.833333  0.201174  1.173513  0.046525
  5.911111  0.201174  1.189160  0.049445
  5.988889  0.201174  1.204806  0.052169
  6.066667  0.201174  1.220453  0.328428
  6.144444  0.201174  1.236100  0.926154
  6.222222  0.201174  1.251747  1.696424
  6.300000  0.201174  1.267394  2.562958
  6.377778  0.201174  1.283041  3.450111
  6.455556  0.201174  1.298688  4.281973
  6.533333  0.201174  1.314334  4.992064
  6.611111  0.201174  1.329981  5.538132
  6.688889  0.201174  1.345628  5.920451
  6.766667  0.201174  1.361275  6.278523
  6.844444  0.201174  1.376922  6.587437
  6.922222  0.201174  1.392569  6.882460
  7.000000  0.201174  1.408215  7.165314
  7.077778  0.201174  1.423862  7.437391
  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          SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1          SUM  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   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     3 OUTPUT MEAN   1 1     12.1      WDM    703 FLOW     ENGL      REPL
COPY   503 OUTPUT MEAN   1 1     12.1      WDM    803 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

Mitigated HSPF Message File

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