STORM DRAINAGE REPORT

For:

<u>Headrick Residence</u>

8822 SE 62nd Street

Mercer Island, WA 98040

Owner:

Greg Headrick

8822 SE 62nd Street

Mercer Island, WA 98040

Engineer:

Bush, Roed and Hitchings

Ted Dimof, PE

Bush, Roed and Hitchings

2009 Minor Avenue E

Seattle, WA 98102

(206) 323-4144

BRH Project: 2019094

Date: August 16, 2023

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1.0 - PROJECT OVERVIEW

The site is located at 8822 SE 62nd Street and consists of one garage and a one-story building on parcel, #8650500040, with an area of 27,481 square feet (0.631 acres).

The Headrick Residence project proposes to demolish the existing residence and swimming pool and some pavement onsite to add a new garage and residential structure, extend the driveway, and build a new swimming pool with a pervious wood deck.

The existing site is partially developed with roof, and asphalt parking area. The undeveloped portion of the site is made up of trees and dense brush. The site generally has flat to moderate slopes. The existing driveway slopes moderately towards the existing garage. Around the building, the site is fairly flat with slopes ranging from 1-3%. The landscape on the east side of the property slopes east towards the east at an approximate slope of 25%. A steep slope is located at the edge of the site and a small drainage course drains at the base of the slope. See **Appendix D** for **the Reconnaissance Report**.

The sites' existing contours were preserved wherever possible. New catch basins were proposed to capture runoff from the pavement and the roof. These onsite new structures will tie back into the existing system, preserving the overall function of the existing system.

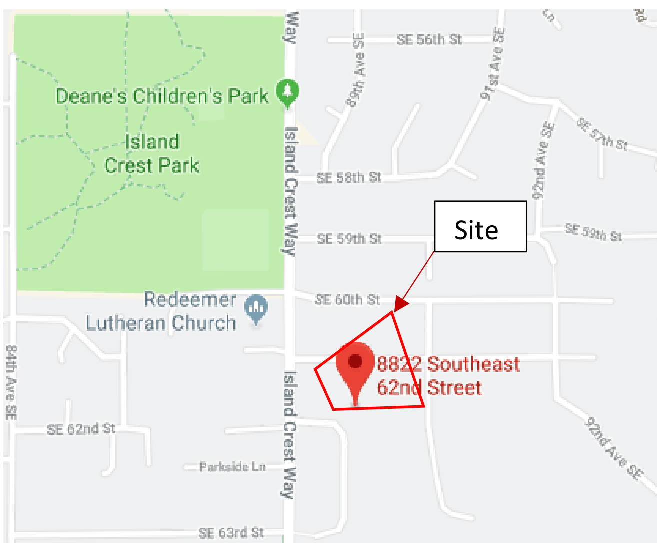


Figure 1 – Vicinity Map

2.0 – MINIMUM REQUIREMENTS

The design of the facilities on site conforms to the "2014 Stormwater Management Manual for Western Washington'" and "City Of Mercer Island On-Site Detention Design Requirements".

Minimum Requirements Analysis
In order to establish the minimum requirements for this project, the "City Of Mercer Island Stormwater Management Standards" guidance sheet was used. The site installs more than 5,000 square feet of new plus replaced impervious surface (10,781 sf). Minimum #1 through #9 apply to this project.

1. **Preparation of Stormwater Site Plans:**

   A storm water site plan has been prepared and has been submitted for review and acceptance.

2. **Construction Stormwater Pollution Prevention Plan:**

   A CSWPP Plan has been prepared and is included as section 7 of this report in accordance with the ECY Manual.

3. **Source Control of Pollution:**

   There will be no outdoor storage of fertilizers, pesticides, equipment or materials that will allow pollutants to enter the stormwater system.

4. **Preservation of Natural Drainage Systems and Outfalls:**

   The site does not have existing drainage structures. Stormwater sheet flows to the east and goes to a ditch. The ditch carries the flow south for 115 ft where water flows south to an 18 inch storm main for 586 feet and discharges to a creek before reaching Lake Washington.

   The proposed drainage will implement catch basins and roof leaders to drain runoffs to the proposed bioretention planters. The bioretention planters will be piped to a flow spreader that eventually discharges to the existing water course.

   The proposed drainage eventually meets the existing drainage thus preserving drainage patterns.

5. **On-Site Stormwater Management:**

   The 2,000 SF impervious surface threshold has been exceeded, and On-Site Stormwater Management will be required. List #2 was applied to all replaced and new hard surfaces on-site. All impervious surfaces were mitigated by bioretention planters. See **Section 4.2** – **Low Impact Development design**.

6. Runoff Treatment:

The site will install less than 5,000 *sf* of PGHS (3,457 *sf*); therefore, water quality is not required.

7. Flow Control:

The 2014 DOE Stormwater Management Manual states that projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area must provide flow control mitigation. The 2014 Manual defines effective impervious surfacing as those impervious surfaces that are connected via sheet flow or discrete conveyance to a drainage system. The pool surface drains to the sanitary sewer and a portion of the existing driveway that was going to be repaved is now being replaced with landscaping. This reduces the new plus replaced impervious surfacing to be 9,970 sf which does not trigger flow control.

8. Wetlands Protection:

There are no wetlands on the subject property or in the immediate vicinity of the site; therefore no protection measures are necessary.

9. Basin/Watershed Planning:

No basin or watershed planning requirements apply to this site.

3.0 – SITE ANALYSIS

3.1 - Offsite Analysis

Volume 1, Section 3.1.3 of the ECY Manual recommends that projects adding 5,000 sf of *new* hard surface should conduct an Off-Site Analysis (downstream analysis). The project does meet that threshold.

3.2 - Downstream Analysis

A downstream analysis was conducted. See **Figure 2** below for the downstream flow path.

The entire site is within Lake Washington drainage basin. Onsite stormwater drains to a watercourse that drains into an existing 18in storm main.

The site does not have existing drainage structures; therefore, runoffs sheet flow to the east where a slope is located at the edge of the site and a small drainage course drains at the base of the slope.

Per records, the small water course carries the flow south for 115 ft where water enters an 18 inch storm main for 586 feet and discharges to a creek that carries the flows for 0.6 miles before discharging Lake Washington.

The proposed drainage will implement catch basins and roof leaders to drain runoffs to the proposed bioretention planters. The bioretention planters will be piped to the inlet of the 18 inch main and a new manhole will be placed at the entry of that inlet to convey flow from the site and the existing drainage.

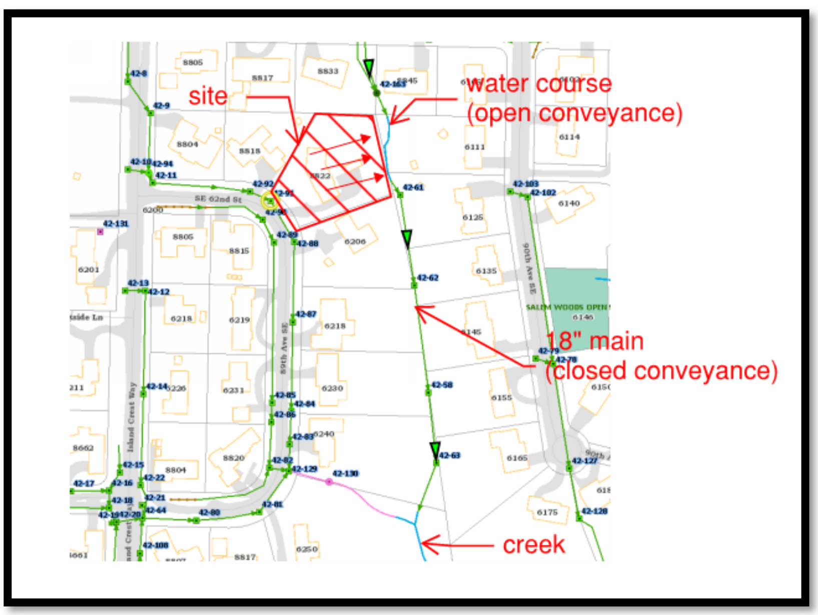


Figure 2 – Downstream flow path

3.3 - Soils/Infiltration Rates

During the geotechnical investigation, three test pits and two test holes were performed. The results of those borings revealed 2 - 4 inches of topsoil loose fill encountered. Underlying topsoil, native soils were encountered consisting primarily of gravelly silty sand but became dense of about 5 feet deep in two of the test pits. Perched groundwater was encountered at depths of 4 feet in one of the five explorations. See the **Geotechnical Report** in **Appendix C** for more detail.

3.4 - Critical Areas and Flood Plain

There is a seasonal water course at the edge of the property. Water course and Buffer zones were delineated and are shown on the topographic survey and the critical area report. See **Appendix D** for **Reconnaissance Report**.

4.0 – PERMANENT STORMWATER CONTROL

4.1 - Low Impact Development and Flow Control

The 2014 DOE Stormwater Management Manual states that projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area must provide flow control mitigation. The 2014 Manual defines effective impervious surfacing as those impervious surfaces that are connected via sheet flow or discrete conveyance to a drainage system. The pool surface drains to the sanitary sewer and a portion of the existing driveway that was going to be repaved is now being replaced with landscaping. This reduces the new plus replaced impervious surfacing to be 9,970 sf which does not trigger flow control. See **Section 2.0** for a description of the minimum requirements, **Section 4.2** for Low Impact Development Design and **Appendix A – Onsite Basin Map** for hard surface summary and sub-basins location.

Low Impact Development (Stormwater BMPs) are required per MR-5. The purpose of MR-5 is to design the site to retain as much stormwater on site as possible through the use of the various BMPs described in the Chapter 5 of Volume V of the DOE Manual. **City of Mercer Island Infeasibility List Handout** has been used to determine BMP feasibility for each new and replaced hard surface.

List #2: On-Site SW BMPs for project triggering MR 1-9:

Landscaped Areas:

All landscaping is proposed to have amended soils per BMP T5.13: Post Construction Soil Quality and Depth.

Roofs:

Sub-basin I Roof:

1. Full Dispersion is infeasible due to the lack of vegetated flow path from the surface. The eastern portion of the site provides about 52 lf of native vegetated flow path; however, the required flow path length is 100 lf. Thus, full dispersion for the sub-basin I roof is infeasible.
   See **Appendix A – Basin Map** for flow path exhibit and hard surface summary.

2. Downspout Full Infiltration is infeasible because there is no out-wash or loam soils present onsite. Per the Geotechnical Report, Glacial Till soil were encountered during boring exploration in all the borings. Thus limiting full infiltration onsite. See **Appendix C - Geotechnical Report** page 3 for more details.

3. A Bioretention planter with a closed bottom is feasible and proposed onsite.
   The site does not contain critical areas, drinking water wells or any sewage disposal system. In addition, the slopes around the building vary from 2 – 10% and the proposed bioretention planter will be placed on flat grades. Thus, satisfying site suitability criteria.
   The impervious area draining to bioretention planter A is 6,288 sf (Sub-basins I &V and the patio pavers) which does not exceed 5,000 sf of PGHS, 10,000 sf of impervious area, and 0.75 acres of

lawn. Thus, making bioretention feasible. See **Appendix A** – **Basin Map** for hard surface summary.

Sub-basin II Roof:

1. Full Dispersion is infeasible due to the lack of vegetated flow path from the surface. The northern portion of the site provides about 78 lf of native vegetated flow path; however, the required flow path length is 100 lf. Thus, full dispersion for the sub-basin II roof is infeasible.
   See **Appendix A – Basin Map** for flow path exhibit and hard surface summary.

2. Downspout Full Infiltration is infeasible because there is no out-wash or loam soils present onsite. Per the Geotechnical Report, Glacial Till soil were encountered during boring exploration in all the borings. Thus limiting full infiltration onsite. See **Appendix C - Geotechnical Report** page 3 for more details.

3. A Bioretention planter with a closed bottom is feasible and proposed onsite.
   The site does not contain critical areas, drinking water wells or any sewage disposal system. In addition, the slopes around the building vary from 2 – 10% and the proposed bioretention planter will be placed on flat grades. Thus, satisfying site suitability criteria.
   The impervious areas draining to bioretention planter B is 1,829 sf which does not exceed 5,000 sf of PGHS, 10,000 sf of impervious area, and 0.75 acres of lawn. Thus, making bioretention feasible. See **Appendix A** – **Basin Map** for hard surface summary.

Sub-basin III Roof:

1. Full Dispersion is infeasible due to the lack of vegetated flow path from the surface. The northern portion of the site provides about 78 lf of native vegetated flow path; however, the required flow path length is 100 lf. Thus, full dispersion for the sub-basin II roof is infeasible.
   See **Appendix A – Basin Map** for flow path exhibit and hard surface summary.

2. Downspout Full Infiltration is infeasible because there is no out-wash or loam soils present onsite. Per the Geotechnical Report, Glacial Till soil were encountered during boring exploration in all the borings. Thus limiting full infiltration onsite. See **Appendix C - Geotechnical Report** page 3 for more details.

3. A Bioretention planter with a closed bottom is feasible and proposed onsite.
   The site does not contain critical areas, drinking water wells or any sewage disposal system. In addition, the slopes around the building vary from 2 – 10% and the proposed bioretention planter will be placed on flat grades. Thus, satisfying site suitability criteria.
   The impervious areas draining to bioretention planter C is 451 sf which does not exceed 5,000 sf of PGHS, 10,000 sf of impervious area, and 0.75 acres of lawn. Thus, making bioretention feasible. See **Appendix A** – **Basin Map** for hard surface summary.

Sub-basin IV Roof:

1. Full Dispersion is infeasible due to the lack of vegetated flow path from the surface. The topography from the area of the surface does not positively drain away from the building. Thus, full

dispersion for the sub-basin II roof is infeasible. See **Appendix A – Basin Map** for flow path exhibit and hard surface summary.

2. Downspout Full Infiltration is infeasible because there is no out-wash or loam soils present onsite. Per the Geotechnical Report, Glacial Till soil were encountered during boring exploration in all the borings. Thus limiting full infiltration onsite. See **Appendix C - Geotechnical Report** page 3 for more details.

3. A Bioretention planter with a closed bottom is feasible and proposed onsite.
   The site does not contain critical areas, drinking water wells or any sewage disposal system. In addition, the slopes around the building vary from 2 – 10% and the proposed bioretention planter will be placed on flat grades. Thus, satisfying site suitability criteria.
   The impervious areas draining to bioretention planter D is 1,529 sf which does not exceed 5,000 sf of PGHS, 10,000 sf of impervious area, and 0.75 acres of lawn. Thus, making bioretention feasible. See **Appendix A** – **Basin Map** for hard surface summary.

<u>Other Hard Surfaces:</u>

Sub-Basin I Driveway Pavement (PGIS) and Concrete Sidewalk/Patio:

1. Full Dispersion is infeasible due to the lack of vegetated flow path from the surface. The eastern portion of the site provides about 46 lf of native vegetated flow path; however, the required native vegetated flow path length is 100 lf. Thus, full dispersion for the roof in Sub-basin I is infeasible. See **Appendix A - figure 2** for flow path exhibit.

2. Permeable Pavement is infeasible. The eastern portion of the site contains slopes greater than 20 percent. The Driveway and the sidewalk are located within 50 feet from the top of slopes exceeding 20 percent. Thus, permeable pavement is infeasible.

3. Bioretention planters with closed bottoms are feasible and proposed onsite.
   The site does not contain critical areas, drinking water wells or any sewage disposal system. Although the slopes on the eastern portion of the site varies from 2 – 40% the vertical relief from the top of the slope does not exceed 10 feet (8 feet to 9 feet). In addition, the proposed bioretention planters will be placed on flat grades. Thus, satisfying site suitability criteria. The impervious area draining to bioretention planter A is 6,288 sf (Sub-basins I &V and the patio pavers) which does not exceed 5,000 sf of PGHS, 10,000 sf of impervious area, and 0.75 acres of lawn. Thus, making bioretention feasible. See **Appendix A** – **Onsite Basin Map** for hard surface summary.

4.2 - Low Impact Development Design

Non-infiltrating bioretention planters were used where feasible to mitigate as much of the site as possible. There are three non-infiltrating bio-retention planters receiving all new and replaced hard surface of the total impervious surfaces. See **Appendix A** for onsite basin map and **Appendix B** for Onsite Plans.

Sub-Basin I represents the part of the roof draining to **Bioretention planter A** (2,657 sf).
Sub-Basin II represents part of the roof draining to **Bioretention planter B** (1,829 sf).
Sub-Basin III represents part of the roof draining to **Bioretention planter C** (451 sf).

Sub-Basin IV represents part of the roof draining to **Bioretention planter D** (1,529 sf).
Sub-Basin V represents the impervious pavement surface to **Bioretention planter A** (3,457sf).
The patio pavers represents a portion of impervious pavement surface to **Bioretention planter A** (174 sf).

Design Criteria for Bioretention:

1. *Flow Entrance and Presettling:*
   Riprap rocks will be placed at the entrance of the pipes to minimize erosion potential. This will apply for all the proposed bioretention planters.

2. *Bottom Area*
   The bottom width of the bioretention planters should not be less than two feet.
   The width of Bioretention planter A varies from approximately 5 feet to approximately 10 feet.
   The width of Bioretention planter B is 7 feet.
   The width of Bioretention planter C is a minimum of 2 feet.
   The width of Bioretention planter D is approximately 6 feet.

3. *Ponding Area*
   The minimum required surface area corresponds to 5% of the total impervious surface and 2% of lawn draining to it.

   Bioretention Planter A receives 2,657 sf of impervious surface from Basin I, 3,457 sf from Basin IV and 278 sf from the patio pavers. Therefore, the minimum surface area of **Bioretention Planter A** is:
   ((2,657sf + 3,457sf + 174sf) x 5)/100 = 314.4sf.
   The project proposes a 326 sf bioretention planter which satisfies the surface minimum requirement with additional capacity.

   Bioretention Planter B receives 1,829 sf of impervious surface from Basin II. Therefore, the minimum surface area of **Bioretention Planter B** is:
   (1,829 sf x 5)/100 = 91.5 sf.
   The project proposes a 140 sf bioretention planter which satisfies the surface minimum requirement with additional capacity.

   Bioretention Planter C receives 451 sf of impervious surface from Basin III. Therefore, the minimum surface area of **Bioretention Planter C** is:
   (451sf x 5)/100 = 22.6 sf.
   The project proposes a 39.75 sf bioretention planter which satisfies the surface minimum requirement with additional capacity.

   Bioretention Planter D receives 1,529 sf of impervious surface from Basin IV. Therefore, the minimum surface area of **Bioretention Planter D** is:
   (1,529 sf x 5)/100 = 76.5 sf.

The project proposes a 79.15 sf bioretention planter which satisfies the surface minimum requirement with additional capacity.

4. *Ponding Depth*
   The ponding depth recommendation for each bioretention planter is 6 in. WWHM was used to make sure all the draining water is getting filtered through the bioretention planter without overflowing. See **Appendix E** WWHM Calculations for Bioretention Planters.

5. *Surface Overflow*
   Vertical stand pipes that are connected to underdrains represent the overflow for each bioretention planter. See **Appendix B** – **Onsite Plans** for the location of the overflows.

6. *Default Bioretention Soil Media (BSM)*
   The proposed bioretention planters will use the BSM; therefore, testing the media for it saturated hydraulic conductivity is not required. Mineral Aggregate Gradation is found in **Table V-7.4.1** of "2019 Stormwater Management Manual for Western Washington". Compost standards to ensure heathy growth support is also found in **Chapter V-7 – Infiltration and Bioretention Treatment Facilities** of "2012 Stormwater Management Manual for Western Washington".

7. *Soil Depth and Mulch Layer*
   The soil depth of all bioretention planter is 18 in. The mulch layer is a 3 in coarse compost in the bottom of the facilities. See **Appendix B** for **Bioretention Planter Typical Cross Section**.

8. *Underdrain*
   There will be a 4 in slotted underdrain PVC pipe per ASTM D1785 SCH 40. The slotted Underdrain is surrounded of underdrain aggregate material. See **Appendix B** for **a typical bioretention planter cross section**. The guidance for the aggregate underdrain filter and bedding layer is found in **Chapter V-7 – Infiltration and Bioretention Treatment Facilities** of "2019 Stormwater Management Manual for Western Washington".

9. *Plant Material*
   Plant material utilized in bioretention areas are facultative species adapted to stresses associated with wet and dry conditions. Red alder or Clustered wild rose can be used as plant materials. See **the LID Technical Guidance Manual for Puget Sound (2012)** for additional guidance and other recommended plant species.

4.3 - Water Quality
N/A – See Section 2.0 for minimum requirements overview.

4.4 - Source Control
N/A

4.5 - Conveyance System Analysis and Design
A Conveyance System Analysis and Design can be provided upon request.

5.0 – SPECIAL REPORTS AND STUDIES

The Geotechnical Engineering Report is **Appendix C** for this report. The Geotechnical Engineering Study was prepared by:

Engineer:	Geotech Consultants, INC
Date:	March 20, 2019

The Critical Areas Reconnaissance Report is **Appendix D** for this report. The Critical Areas Reconnaissance Study was prepared by:

Engineer:	Wetland Resources, INC
Date:	September, 2018

6.0 – OTHER PERMITS

N/A

7.0 – CONSTRUCTION STORMWATER POLLUTION PREVENTION (MR-2)

The CSWPPP was developed per the requirements in Chapter 24 of the Engineering Development Standards and Volume II of the 2014 Stormwater Management Manual for Western Washington.

13 Elements:

1. **Preserve Vegetation/Mark Clearing Limits**
   Construction Limits will be marked by chain link fencing and/or high visibility fence where necessary (BMP C103), which will be moved as necessary for construction phasing of the various project elements.

2. **Establish Construction Access**
   Entrance to the site will be off of the existing driveway as shown in the TESC plan. Trucks will be positioned to avoid exposed soil and excavation equipment will be washed on-site prior to transfer off-site, per BMP C106.

3. **Control Flow Rates**
   Exposed soils are mostly limited to the area within the new foundation, which will contain sediment and runoff.

   Wattles (BMP C235) and filter socks will be used as necessary to contain runoff to the construction area.

4. **Install Sediment Controls**
   Perimeter protection will be provided in the form of silt fence (BMP C233), straw wattles (BMP C235) and/or compost socks.

5. **Stabilize Soils**
   Exposed soils will be limited to the building foundation, utility trenching and pavement restoration. Landscaped surfaces will be given topsoil per BMP C125, and other exposed soils will be mitigated with plastic covering per BMP C123 as necessary. The entire site will apply dust control per BMP C140 during dry weather periods.

6. **Protect Slopes**
   N/A – All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion.

7. **Protect Drain Inlets**
   All catch basins on site and in the right-of-way within 500 ft downstream of the construction site will be protected with Storm Drain Inlet Protection per BMP C220 for the duration of the project.

8. **Stabilize Channels and Outlets**
   N/A – No channels to protect.

9. Control Pollutants

Silt Fence as well as straw wattles and/or compost socks will be used to capture laden runoff. In addition, the equipment used will be in good working order.

10. Control Dewatering

Construction is relatively shallow and groundwater is not anticipated during construction. All trench and building excavation will be self-contained to prevent runoff. If groundwater is encountered, sump pumps will pump to either the sediment trap or sediment tanks prior to discharge.

11. Maintain BMPs

All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMPs specifications.

Visual monitoring of the BMPs will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive, and is temporarily stabilized, the inspection frequency will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

12. Manage the Project

Erosion and sediment control BMPs for this project have been designed based on the following principles:

- Design the project to fit the existing topography, soils, and drainage patterns.
- Emphasize erosion control rather than sediment control.
- Minimize the extent and duration of the area exposed.
- Keep runoff velocities low.
- Retain sediment on site.
- Thoroughly monitor site and maintain all ESC measures.
- Schedule major earthwork during the dry season.

The project will be managed according to the following key project components:

Phasing of Construction

The project is proposed to be completed in one phase.

Seasonal Work Limitations

From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

- Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and
- Limitations on activities and the extent of disturbed areas; and
- Proposed erosion and sediment control measures.

Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance.

The following activities are exempt from the seasonal clearing and grading limitations:

- Routine maintenance and necessary repair of erosion and sediment control BMPs;
- Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
- Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

Coordination with Utilities and Other Jurisdictions

Care has been taken to coordinate with utilities, other construction projects, and the local jurisdiction in preparing this SWPPP and scheduling the construction work.

Inspection and Monitoring

All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. This person has the necessary skills to:

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

A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.

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

Maintaining an Updated Construction SWPPP

This SWPPP shall be retained on-site or within reasonable access to the site.

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

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

13. Protect Low Impact Development BMPs

The existing soil beneath the proposed non-infiltrating bioretention planters in the eastern and western portion of the site will be flagged to avoid over-compaction.

See Appendix B – Onsite Plans for TESC Plans and additional details.

9.0 – APPENDICES

Appendix A – Onsite Basin Map

ROOF AREAS:

BUILDING ROOF TO BIOPLANTERS = 6,466 SF (0.15 AC)

SUB BASIN I (BP A) = 2,657SF

SUB BASIN II (BP B) = 1,829SF

SUB BASIN IIII (BP C) = 451SF

SUB BASIN IV (BP D) = 1,529SF

BIORETENTION PLANTERS

(BP A) = 6,288 SF CONTRIBUTING AREA

(BP B) = 1,829 SF CONTRIBUTING AREA

(BP C) = 451 SF CONTRIBUTING AREA

(BP D) = 1,529 SF CONTRIBUTING AREA

NEW AND REPLACED EFFECTIVE SURFACES:

IMPERVIOUS PAVEMENT (PGHS) (SUB BASIN V) – (BP A) = 3,457 SF (0.08 AC)

PATIO PAVERS (BP A) =174 SF (0.004 AC)

NON–EFFECTIVE IMPERVIOUS SURFACE:

NEW POOL WATER SURFACE (DRAINS TO SEWER) = 684 SF (0.01 AC)

NEW PERVIOUS AREAS

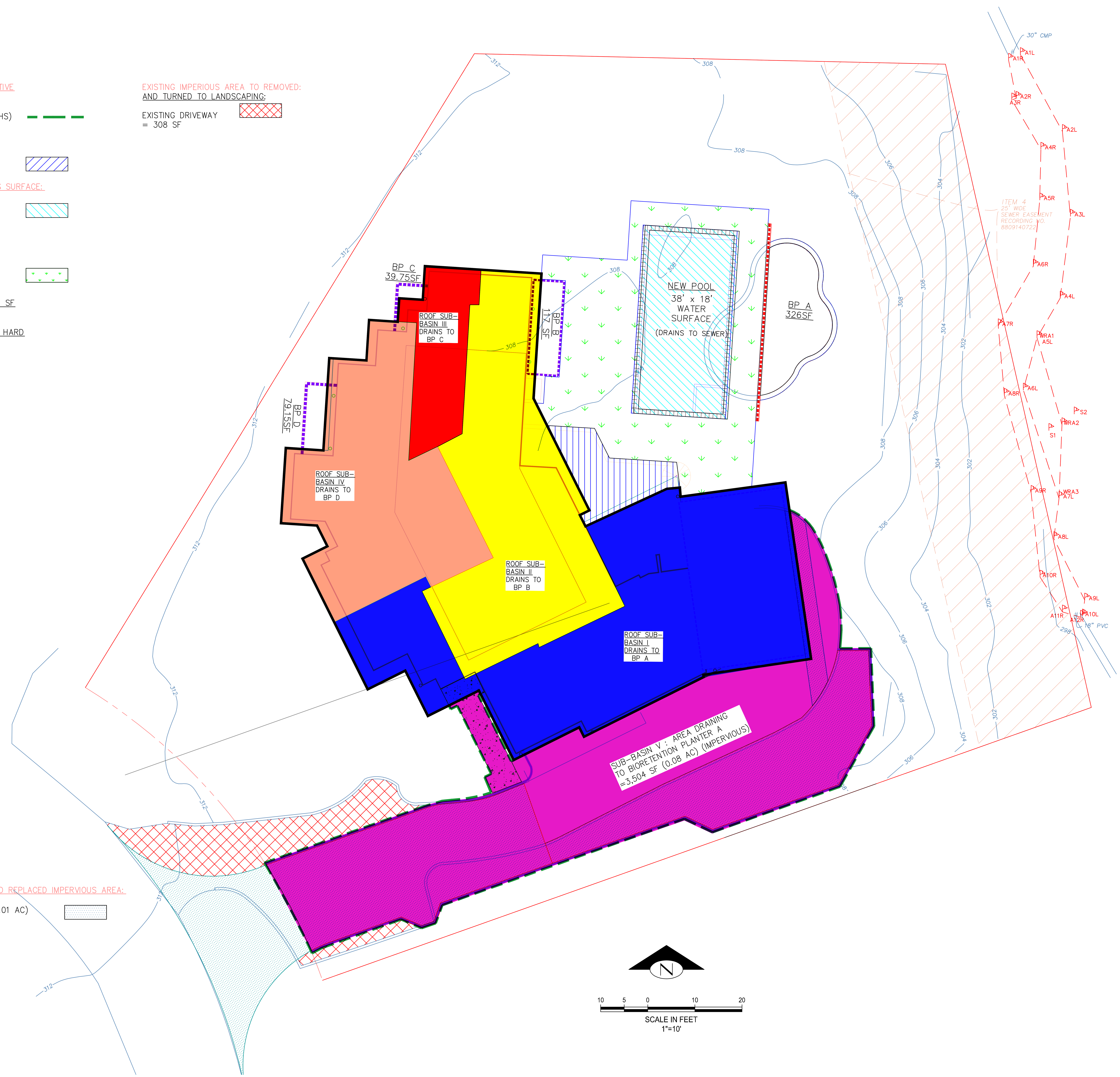
NEW LANDSCAPING (GRASS) = 1,452 SF

TOTAL SITE AREA = 27,481 SF (0.63 AC)

TOTAL NEW AND REPLACED HARD SURFACE = 9,970 SF (0.23 AC)

EXISTING IMPERIOUS AREA TO REMOVED: AND TURNED TO LANDSCAPING:

EXISTING DRIVEWAY = 308 SF



ROW NEW AND REPLACED IMPERVIOUS AREA:

= 645 SF (0.01 AC)

SCALE IN FEET
1"=10'

BUSH, ROED & HITCHINGS, INC.
LAND SURVEYORS & CIVIL ENGINEERS

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SEATTLE, Washington
98102-3513
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FAX# (206) 323-7135

ONSITE BASIN MAP

8822 S.E. 62ND STREET

HEADRICK RESIDECE

MERCER ISLAND KING COUNTY WASHINGTON

drawn by	checked by
MFM	TFD
scale NO SCALE	date 08/14/23
job no. 2019094.00	
sheet 1	of 1

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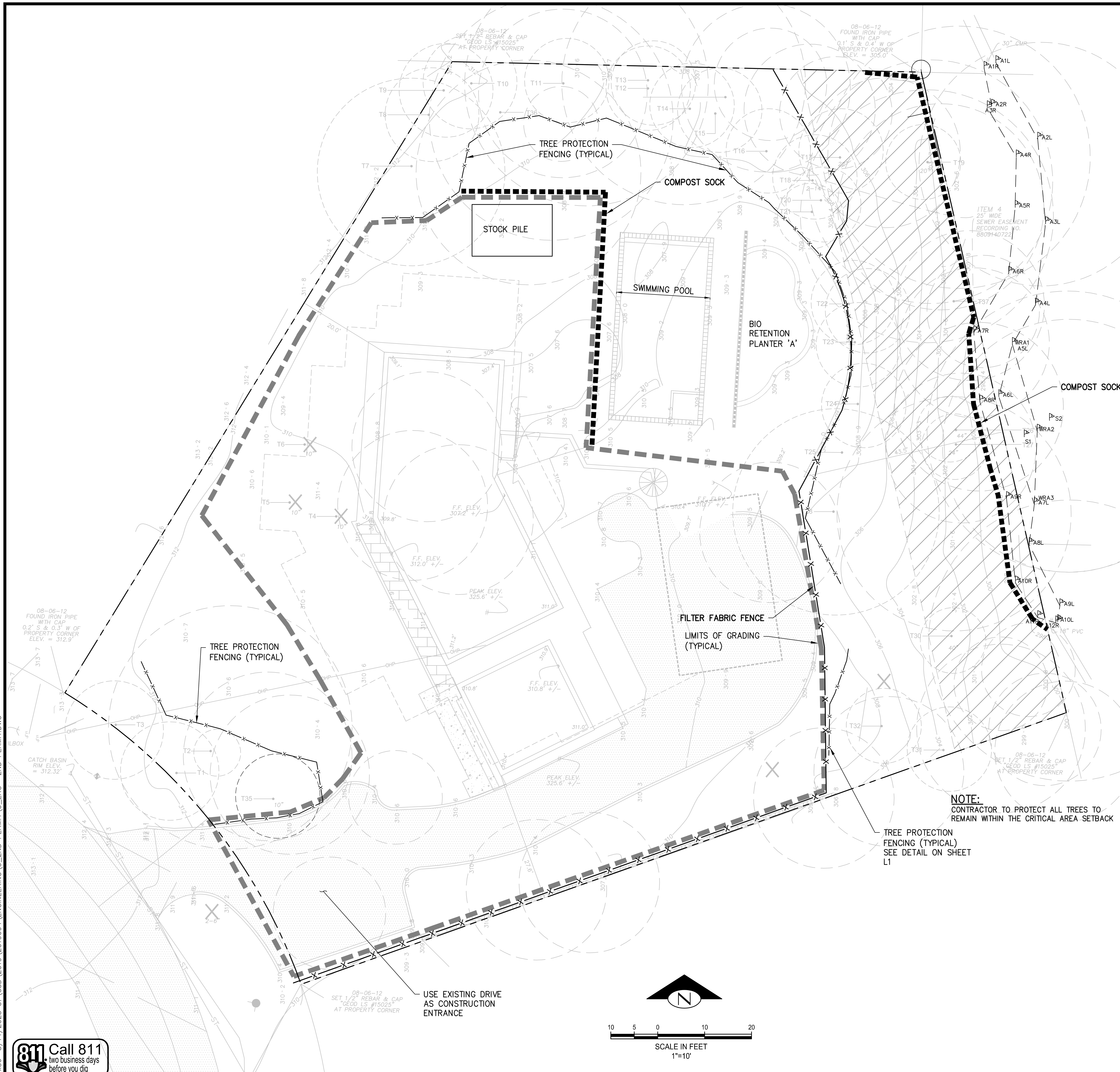
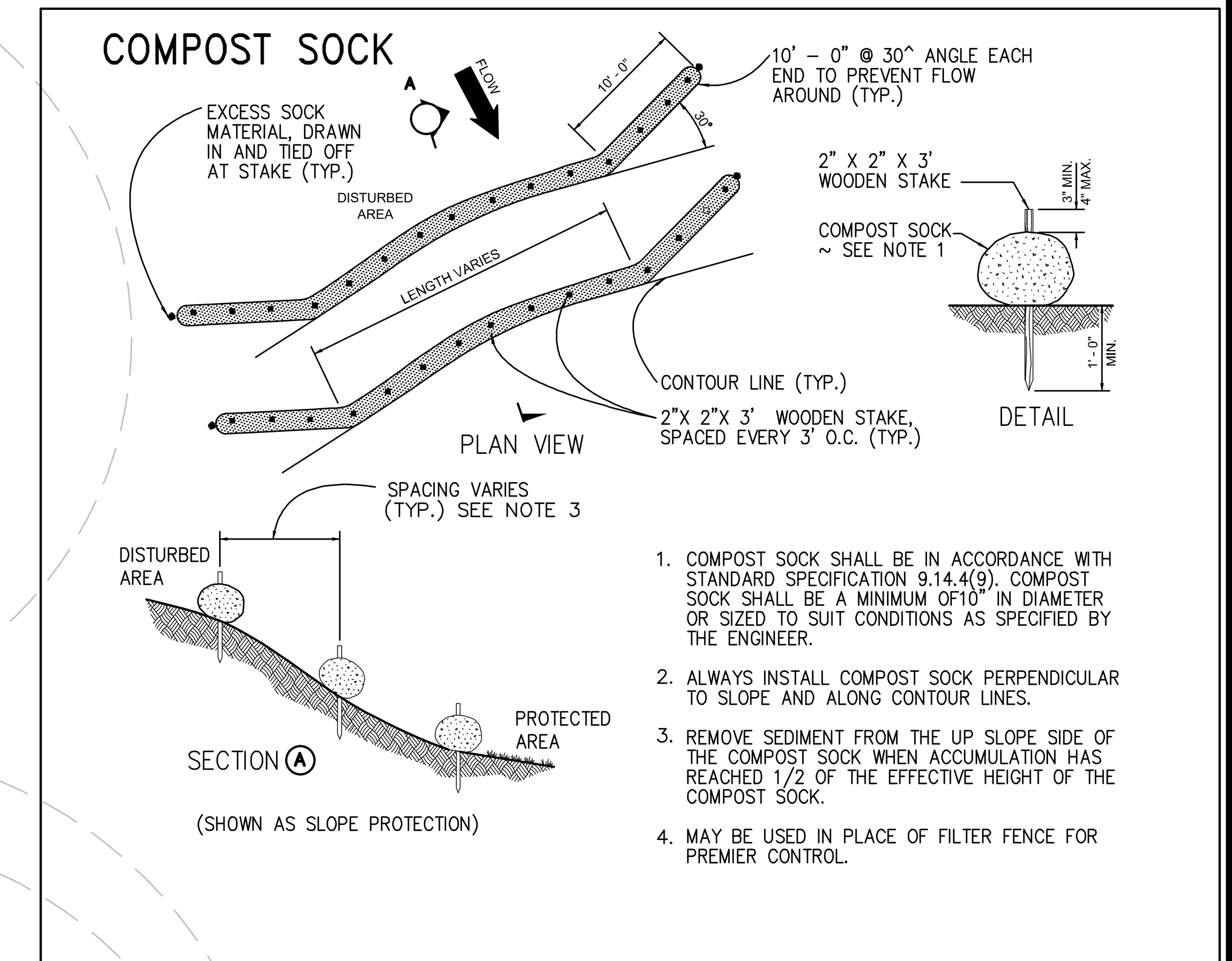
Appendix B – Onsite Plans





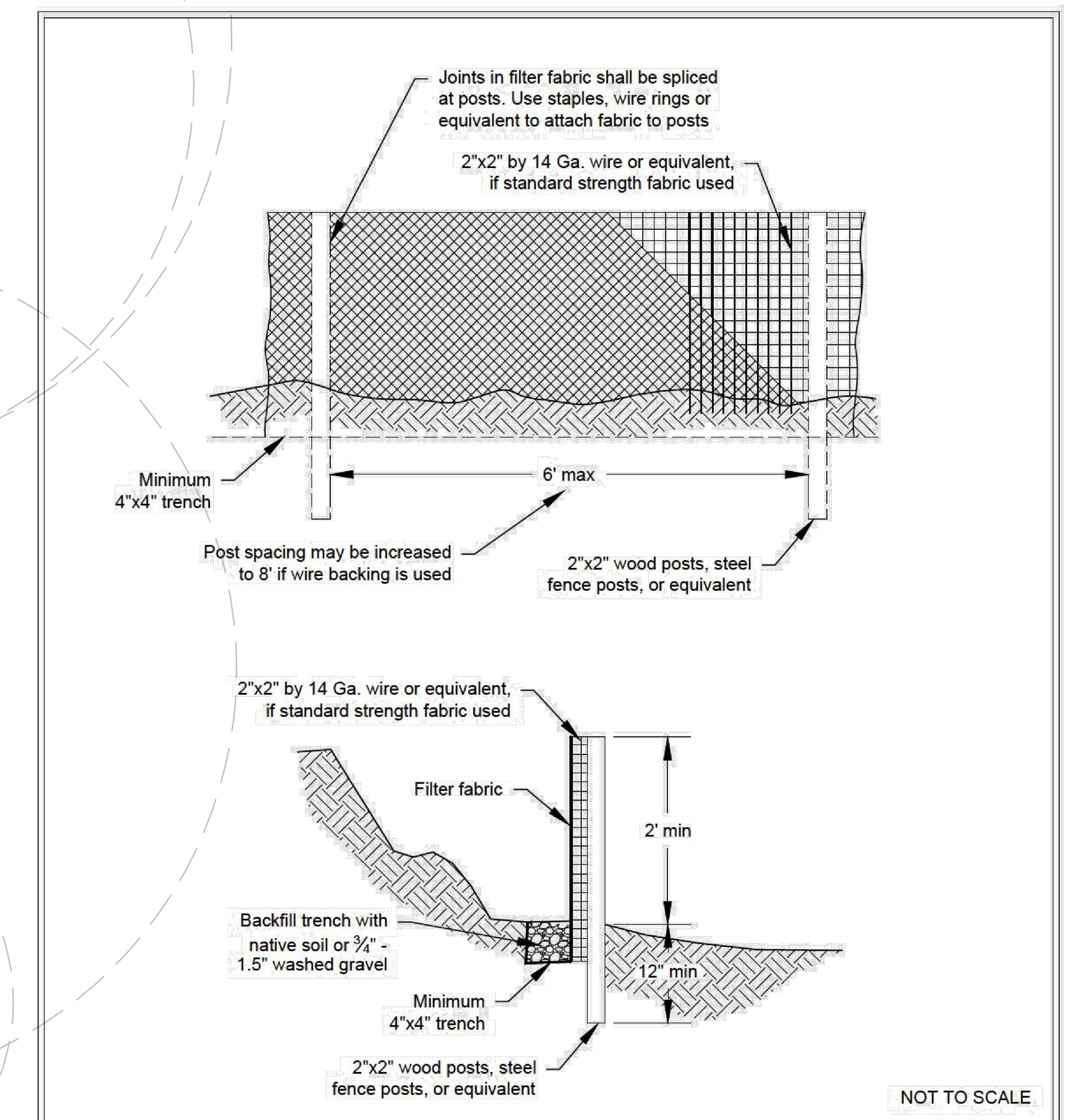


Figure II-4.2.12
Silt Fence

Revised October 2014

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SEATTLE, Washington
98102-3513
(206) 323-4144
1-800-935-0508
FAX# (206) 323-7135

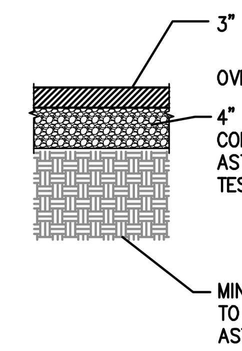
EROSION CONTROL PLAN
8822 S.E. 62ND STREET
HEADRICK RESIDECE
MERCER ISLAND KING COUNTY WASHINGTON

drawn by	checked by
WPG	TFD
scale: AS SHOWN	date: 08/14/23
job no.: 2019094.00	
sheet: C1	of

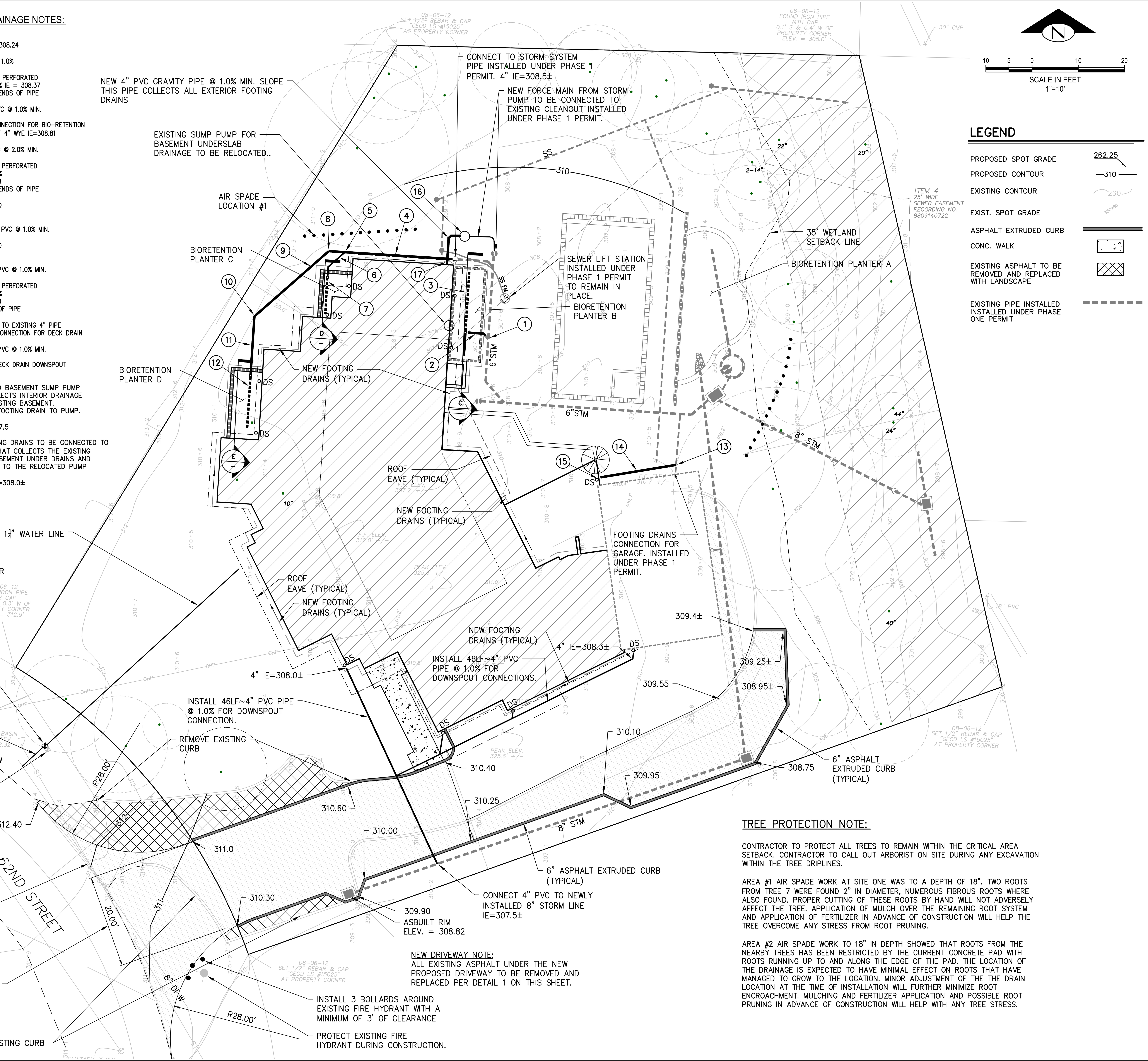
24"x36" 8/14/2023 U:\C3D\2019\2019094\ENGINEERING\0_2ND PERMIT\0_ERO- 2ND PERMIT.DWG

STORM DRAINAGE NOTES:

1. EXISTING 4" WYE IE=308.24
2. 4.7LF 4" @ 1.0%
3. 18LF ~ 4"ø PERFORATED PIPE @ 0.0% IE = 308.37 CAP BOTH ENDS OF PIPE
4. 27LF~4" PVC @ 1.0% MIN.
5. OUTLET CONNECTION FOR BIO-RETENTION PLANTER 'C' 4" WYE IE=308.81
6. 4LF~4" PVC @ 2.0% MIN.
7. 11LF ~ 4"ø PERFORATED PIPE @ 0.0% IE = 308.88 CAP BOTH ENDS OF PIPE
8. 4" 45° BEND IE=308.84
9. 21.45LF~4" PVC @ 1.0% MIN.
10. 4" 45° BEND IE=309.05
11. 16.5LF~4" PVC @ 1.0% MIN.
12. 11LF ~ 4"ø PERFORATED PIPE @ 0.0% IE = 309.20 CAP END OF PIPE
13. CUT IN TEE TO EXISTING 4" PIPE IE=307.9. CONNECTION FOR DECK DRAIN
14. 16.5LF~4" PVC @ 1.0% MIN.
15. CONNECT DECK DRAIN DOWNSPOUT IE=308.0
16. RELOCATED BASEMENT SUMP PUMP THAT COLLECTS INTERIOR DRAINAGE INSIDE EXISTING BASEMENT. ALL NEW FOOTING DRAIN TO PUMP. RIM=310.2 4" IE= 307.5
17. ALL FOOTING DRAINS TO BE CONNECTED TO 4" PIPE THAT COLLECTS THE EXISTING HOUSE BASEMENT UNDER DRAINS AND ROUTES IT TO THE RELOCATED PUMP CHAMBER. 4" F.D. IE=308.0±



1 — ASPHALT PAVEMENT
NOT TO SCALE



LEGEND

PROPOSED SPOT GRADE	262.25
PROPOSED CONTOUR	—310—
EXISTING CONTOUR	260
EXIST. SPOT GRADE	
ASPHALT EXTRUDED CURB	
CONC. WALK	
EXISTING ASPHALT TO BE REMOVED AND REPLACED WITH LANDSCAPE	
EXISTING PIPE INSTALLED UNDER PHASE ONE PERMIT	

TREE PROTECTION NOTE:

CONTRACTOR TO PROTECT ALL TREES TO REMAIN WITHIN THE CRITICAL AREA SETBACK. CONTRACTOR TO CALL OUT ARBORIST ON SITE DURING ANY EXCAVATION WITHIN THE TREE DRIPLINES.

AREA #1 AIR SPADE WORK AT SITE ONE WAS TO A DEPTH OF 18". TWO ROOTS FROM TREE 7 WERE FOUND 2" IN DIAMETER, NUMEROUS FIBROUS ROOTS WHERE ALSO FOUND. PROPER CUTTING OF THESE ROOTS BY HAND WILL NOT ADVERSELY AFFECT THE TREE. APPLICATION OF MULCH OVER THE REMAINING ROOT SYSTEM AND APPLICATION OF FERTILIZER IN ADVANCE OF CONSTRUCTION WILL HELP THE TREE OVERCOME ANY STRESS FROM ROOT PRUNING.

AREA #2 AIR SPADE WORK TO 18" IN DEPTH SHOWED THAT ROOTS FROM THE NEARBY TREES HAS BEEN RESTRICTED BY THE CURRENT CONCRETE PAD WITH ROOTS RUNNING UP TO AND ALONG THE EDGE OF THE PAD. THE LOCATION OF THE DRAINAGE IS EXPECTED TO HAVE MINIMAL EFFECT ON ROOTS THAT HAVE MANAGED TO GROW TO THE LOCATION. MINOR ADJUSTMENT OF THE THE DRAIN LOCATION AT THE TIME OF INSTALLATION WILL FURTHER MINIMIZE ROOT ENCROACHMENT. MULCHING AND FERTILIZER APPLICATION AND POSSIBLE ROOT PRUNING IN ADVANCE OF CONSTRUCTION WILL HELP WITH ANY TREE STRESS.

Call 811 two business days before you dig

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LAND SURVEYORS & CIVIL ENGINEERS
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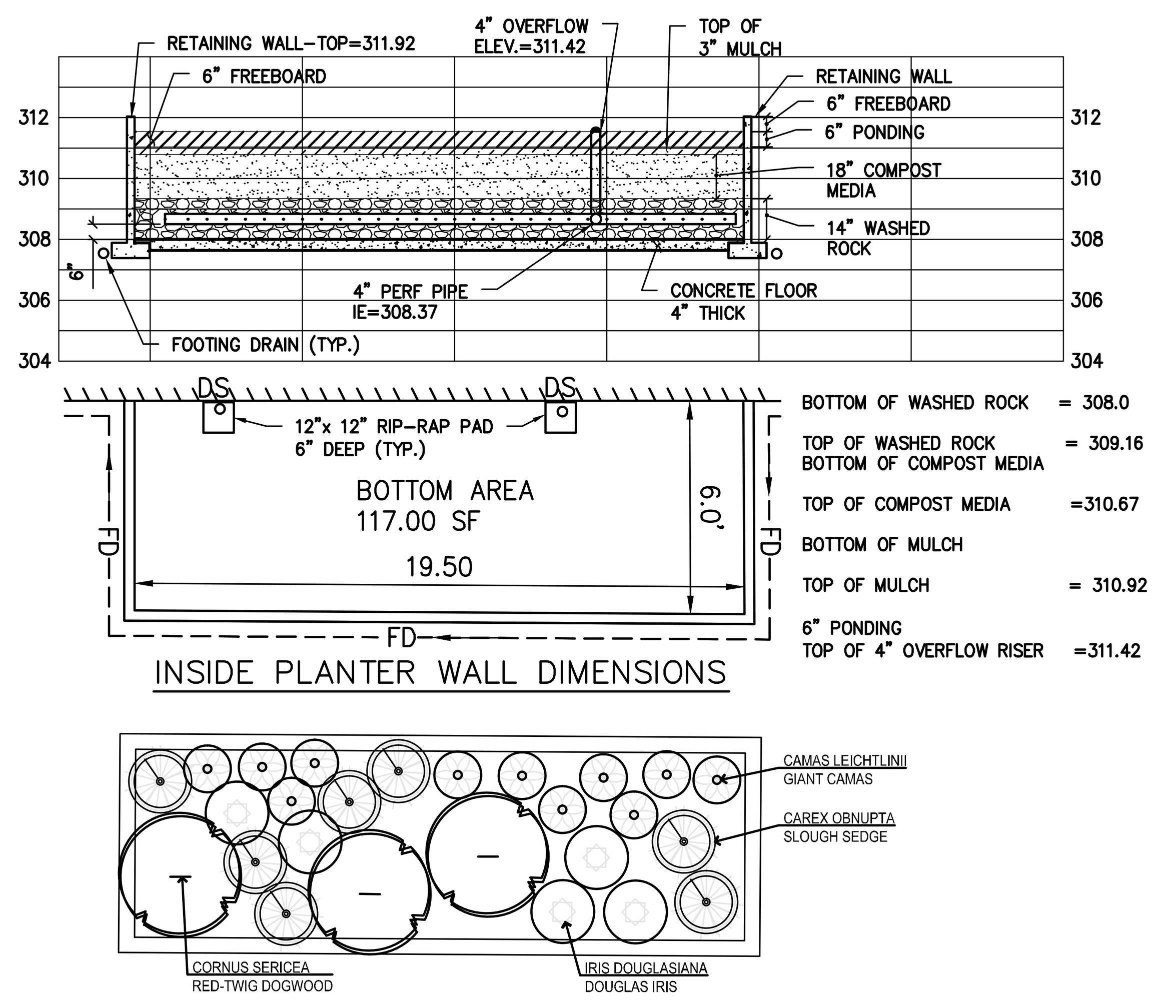
STORM DRAINAGE PLAN
8822 S.E. 62ND STREET
HEADRICK RESIDECE
MERCER ISLAND KING COUNTY WASHINGTON

drawn by	checked by
WPG	TFD
scale AS SHOWN	date 08/14/23
job no. 2019094.00	
sheet C2	of

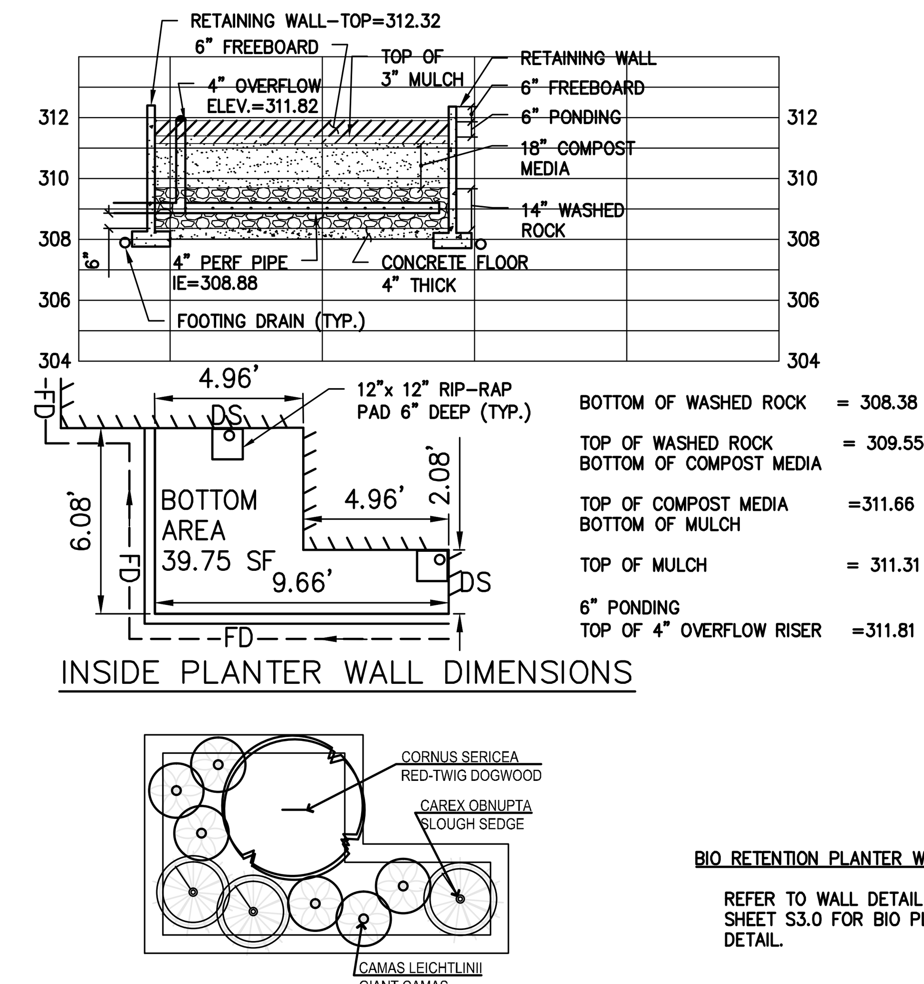
24"x36" 8/14/2023 U:\C3D\2019\2019094\ENGINEERING\0_2ND PERMIT\0_GRD - 2ND PERMIT.DWG



PLANTING DIAGRAM INSIDE PLANTER

NO SCALE

C SECTION C BIO RETENTION PLANTER 'B'



PLANTING DIAGRAM INSIDE PLANTER

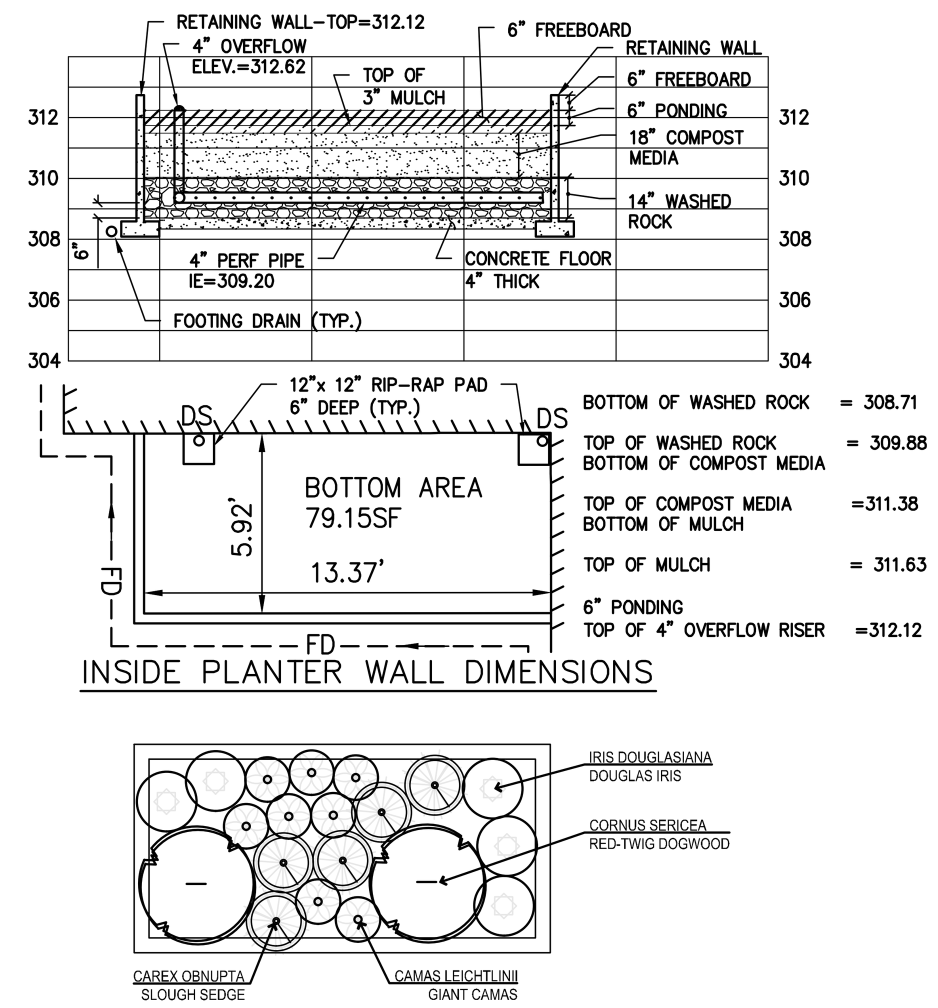
NO SCALE

D SECTION D BIO RETENTION PLANTER 'C'

1"=5' H & 1"=5' V

BIO RETENTION PLANTER WALL DETAIL:

REFER TO WALL DETAIL 9 ON SHEET S3.0 FOR BIO PLANTER WALL DETAIL.



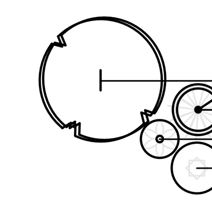
PLANTING DIAGRAM INSIDE PLANTER

NO SCALE

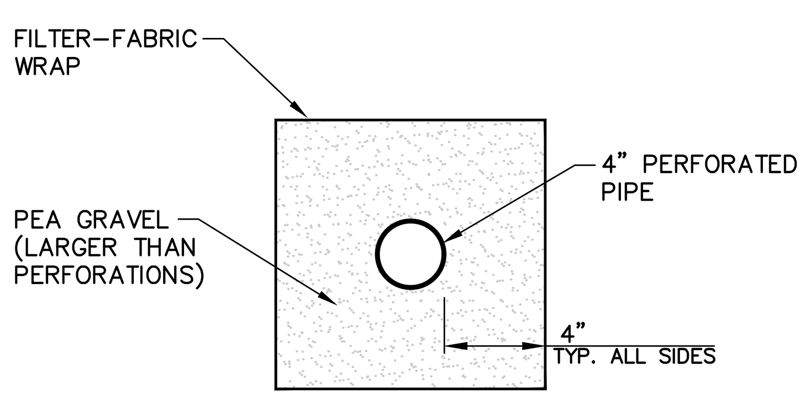
E SECTION E BIO RETENTION PLANTER 'D'

1"=5' H & 1"=5' V

BIO RETENTION PLANT LIST 08.07.2023



QTY	BOTANICAL NAME	COMMON NAME	SIZE / SPACING	NOTES
	SHRUBS & PERENNIALS			
6	CORNUS SERICEA	RED TWIGGED DOGWOOD	5 GAL / 5' OC	FULL, WELL-ROOTED
15	CAREX OBNUPTA	SLOUGH SEDGE	1 GAL /2' OC	FULL, WELL-ROOTED
25	CAMAS LEICHTLINII	GIANT CAMAS	1 GAL /18" OC	FULL, WELL-ROOTED
11	IRIS DOUGLASIANA	DOUGLAS IRIS	1 GAL /2' OC	FULL, WELL-ROOTED



FOOTING DRAIN

NO SCALE

24"x36" 8/17/2023 U: \C3D\2019\2019094\ENGINEERING\0_2ND PERMIT\0_GRD – 2ND PERMIT.DWG

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THEODOR F DIMOF STATE OF WASHINGTON 38024 REGISTERED PROFESSIONAL ENGINEER 08/14/23

BUSH, ROED & HITCHINGS, INC. CORPORATE SEAL 1969 WASHINGTON

BUSH, ROED & HITCHINGS, INC.
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NO	REVISION	DATE

STORM DRAINAGE DETAILS
8822 S.E. 62ND STREET
HEADRICK RESIDECE
MERCER ISLAND KING COUNTY WASHINGTON

drawn by WPG	checked by TFD
scale AS SHOWN	date 08/14/23
job no. 2019094.00	
sheet C3	of

Appendix C – Geotechnical Report

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

March 20, 2019

JN 19086

Jennifer Headrick
8822 Southeast 62nd Street
Mercer Island, Washington 98040
via email: jenheadrick@hotmail.com

Subject: **Geotechnical Engineering Study**
Proposed Detached Garage and Pool Project
8822 Southeast 62nd Street
Mercer Island, Washington

Dear Ms. Headrick:

We are pleased to submit this geotechnical engineering report for the proposed detached garage and pool project to be constructed in Mercer Island, Washington. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design considerations for foundations, retaining walls, subsurface drainage, and temporary excavations. This work was authorized by your acceptance of our proposal, P-10315, dated March 6, 2019.

We were provided with a site plan and a topographic map. Based on this information, we understand that the development will consist of constructing a detached garage and storage building on the southeastern portion of the site (this assumes that the street is located on the western side of the site), as well as a new, 5-foot-deep pool on the northeastern portion of the site. These will be located about 40 to 45 feet west of the eastern property line. In addition, some additional driveway will be added at the southern edge of a portion of the site. The ground in the area of these proposed structures is relatively flat, and we expect the slab grade of the proposed garage and the pool deck level will be near the grade of the existing ground.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The site is located on near the middle of Mercer Island, just east of Island Crest Way. The site is located near the corner of Southeast 62nd Street and 89th Avenue Southeast. The site is somewhat northeast of this corner, but for ease of description, this report assumes that street is on the western side of the site.

The site is nearly flat with just a very gentle slope down to the east. However, a steep slope that is about 8 feet tall is located at the eastern edge of the site. Apparently, there is a small, seasonal drainage course located at the base of the slope. A residence, garage, shed, pool, and patio are located on the central portion of the site. An asphalt driveway is located along much of the southern side of the site that is nearly flat. Some lawn areas are located on the northern and northwestern portions of the site. There are some scattered, large evergreen trees in the area of the steep eastern slope.

SUBSURFACE

The subsurface conditions were explored by excavating three test pits and two test holes at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The test pits and test holes were excavated on March 12, 2019. The test pits were excavated with a small tracked excavator, while the test holes were excavated with hand equipment. A geotechnical engineer from our staff observed the excavation process of the test pits, logged the explorations, and obtained representative samples of the soil encountered. "Grab" samples of selected subsurface soil were collected from the backhoe bucket and/or hand equipment. The Test Pit Logs are attached to this report as Plates 3 and 4, while the Test Hole Logs are attached as Plate 5.

Soil Conditions

The test pits were excavated on the southern portion of the site, nearer the proposed location of the detached garage. These test pits encountered about 2 to 4 feet of loose fill soil and/or topsoil at the ground surface. Native, gravelly silty sand was revealed below these soils. This soil was initially loose, but became dense at depths of about 5 feet in two of the test pits. The loose soil was still encountered to the maximum explored depth of 6 feet in one test pit, but we would expect the soil to become dense within a maximum of a few feet below the maximum explored depth. The dense soil is geologically known as Glacial Till; this soil is typical in upland areas of the Puget Sound region. This dense Glacial Till was revealed at depths of approximately 1.5 to 3.5 feet in the test holes that were excavated closer to the proposed pool area.

Groundwater Conditions

Some perched groundwater seepage was observed at a depth of 4 feet in one of the five explorations. However, the explorations were left open for only a short time period; therefore, the seepage levels on the logs represent the location of transient water seepage and may not indicate the static groundwater level. It should be noted that groundwater levels vary seasonally with rainfall and other factors, with levels and amounts being higher in the winter and early spring months. Thus, it is possible that groundwater will be revealed perched on the dense glacial till soil during these months.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the test pit logs are interpretive descriptions based on the conditions observed during excavation.

The compaction of test pit backfill was not in the scope of our services. The test pits were backfilled with excavated soil that was lightly tamped into place. Loose soil will therefore be found in the area of the test pits. If this presents a problem, the backfill will need to be removed and replaced with structural fill during construction.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test pits and test holes conducted for this study encountered dense Glacial Till soil at depths ranging from about 1.5 to greater than 6 feet. Loose soil was revealed above the Glacial Till. The more shallow depths of the Glacial Till were revealed in the area of the proposed pool, but depths of about 5 feet or more were revealed in the area of the proposed garage. The proposed garage and pool should bear on the Glacial Till or structural fill that is placed over the Glacial Till. It appears that the proposed excavations for the pool will likely reach to or into the Glacial Till, although some structural fill may be needed if the base of the old pool is deeper than the new pool. The depth to the Glacial Till is at least 5 feet deep in the area of the proposed garage based on the test pits. Because of this depth, it is likely more economically feasible to place the garage on driven pipe piles that embed into the Glacial Till in lieu of making the over-excavations necessary to reach the Glacial Till. We have provided information regarding driven pipe piles, as well as footing foundation, in this report.

In order to satisfy the City of Mercer Island's requirements for Geologic Hazard Areas, a "statement of risk" for the project is required. As such, we make the following statement:

> *Provided the recommendations in this report are followed, it is our professional opinion that the development can be constructed so that the risk to the lot and adjacent property is mitigated such that the site is determined to be safe.*

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, the access roads should follow the alignment of planned pavements. Trucks should not be allowed to drive off of the rock-covered areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type C (Very Dense Soil). As noted in the USGS website, the mapped spectral acceleration value for a 0.2 second (S_s) and 1.0 second period (S_1) equals 1.45g and 0.56g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.60g. The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature and/or the absence of near-surface groundwater.

Sections 1803.5 of the IBC and 11.8 of ASCE 7 require that other seismic-related geotechnical design parameters (seismic surcharge for retaining wall design and slope stability) include the potential effects of the Design Earthquake. The peak ground acceleration for the Design Earthquake is defined in Section 11.2 of ASCE 7 as two-thirds (2/3) of the MCE peak ground acceleration, or 0.40g.

PIPE PILES

Three- or 4-inch-diameter pipe piles driven with a 850- or 1,100- or 2,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE **(850-pound hammer)**	FINAL DRIVING RATE **(1,100-pound hammer)**	FINAL DRIVING RATE **(2,000-pound hammer)**	**ALLOWABLE COMPRESSIVE CAPACITY**
3 inches	10 sec/inch	6 sec/inch	2 sec/inch	6 tons
4 inches	16 sec/inch	10 sec/inch	4 sec/inch	10 tons

Note: The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on the top of the pile during driving. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard-mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

As a minimum, Schedule 40 pipe should be used. The site soils are not highly organic, and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard "black" pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles.

We recommend a minimum pile length of 5 feet below the existing ground. However, based on the test pits, the piles are likely to extend to an average depth of 10 feet.

Pile caps and grade beams should be used to transmit loads to the piles. Isolated pile caps should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. Subsequent sections of pipe can be connected with slip or threaded couplers, or they can be welded together. If slip couplers are used, they should fit snugly into the pipe sections. This may require that shims be used or that beads of welding flux be applied to the outside of the coupler.

Lateral loads due to wind or seismic forces may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level compacted fill. We recommend using a passive earth pressure of 300 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. We recommend a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate passive value.

If lateral resistance from fill placed against the foundations is required for this project, the structural engineer should indicate this requirement on the plans for the general and earthwork contractor's information. Compacted fill placed against the foundations can consist of on-site or imported soil. that is tamped into place using the backhoe or is compacted using a jumping jack compactor. It is necessary for the fill to be compacted to a firm condition, but it does not need to reach even 90 percent relative compaction to develop the passive resistance recommended above.

CONVENTIONAL FOUNDATIONS

Structures can be supported on conventional continuous and spread footings bearing on undisturbed, dense, native Glacial Till soil, or on structural fill placed above this competent native soil. See the section entitled ***General Earthwork and Structural Fill*** for recommendations regarding the placement and compaction of structural fill beneath structures. Adequate compaction of structural fill should be verified with frequent density testing during fill placement. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer to document that adequate bearing soils have been exposed.

We recommend that continuous and individual spread footings have minimum widths of 12 and 16 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

Depending on the final site grades, overexcavation may be required below the footings to expose competent native soil. Unless lean concrete is used to fill an overexcavated hole, the overexcavation must be at least as wide at the bottom as the sum of the depth of the overexcavation and the footing width. For example, an overexcavation extending 2 feet below the bottom of a 2-foot-wide footing must be at least 4 feet wide at the base of the excavation. If lean concrete is used, the overexcavation need only extend 6 inches beyond the edges of the footing.

An allowable bearing pressure of 3,000 pounds per square foot (psf) is appropriate for footings supported on soils as noted above native soil. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, or on structural fill up to 5 feet in thickness, will be about one inch, with differential settlements on the order of one-half inch in a distance of 40 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.50
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	35 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.50
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Active and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure. This applies only to walls with level backfill.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired.

The passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 7**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The later section entitled ***Drainage Considerations*** should also be reviewed for recommendations related to subsurface drainage behind foundation and retaining walls.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The recommended wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

The ***General***, ***Slabs-On-Grade***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop non-organic, firm existing soil or on structural fill. The subgrade soil must be in a firm, non-yielding condition at the time of slab construction or underslab fill placement. Any soft areas encountered should be excavated and replaced with select, imported structural fill.

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI recommends a minimum 10-mil thickness vapor retarder for better durability and long term performance than is provided by 6-mil plastic sheeting that has historically been used. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection.

If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material.

The ***General***, ***Permanent Foundation and Retaining Walls***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

EXCAVATIONS AND SLOPES

Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Temporary cuts to a maximum overall depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. Based upon Washington Administrative Code (WAC) 296, Part N, the upper soil at the subject site would generally be classified as Type B. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 1:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that sand or loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

DRAINAGE CONSIDERATIONS

Footing drains should be used where: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or, (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the ***Slabs-On-Grade*** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Providing a few inches of free draining gravel underneath the vapor retarder is also prudent to limit the potential for seepage to build up on top of the vapor retarder.

Groundwater was observed during our field work. If seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to buildings should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the ***Foundation and Retaining Walls*** section.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. It is important that existing foundations be removed before site development. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches, but should be thinner if small, hand-operated compactors are used. We recommend testing structural fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended levels of relative compaction for compacted fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath footings, slabs or walkways	95%
Filled slopes and behind retaining walls	90%

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the explorations are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking samples in explorations. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of the Headrick Family and their representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 4	Test Pit Logs
Plate 5	Test Hole Logs

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

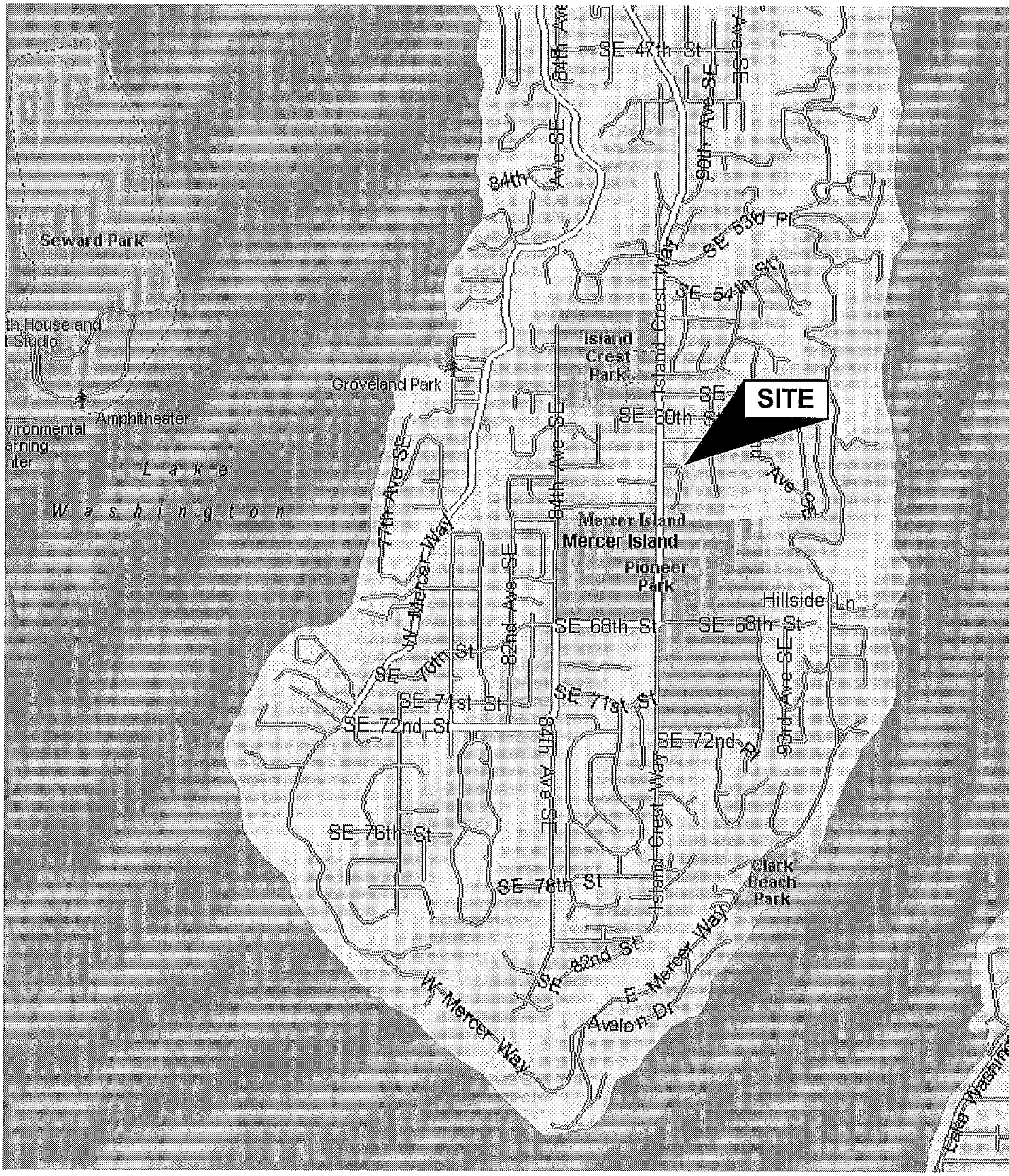
GEOTECH CONSULTANTS, INC.

03/20/19

D. Robert Ward, P.E.
Principal

DRW:kg

NORTH



(Source: Microsoft MapPoint, 2013)

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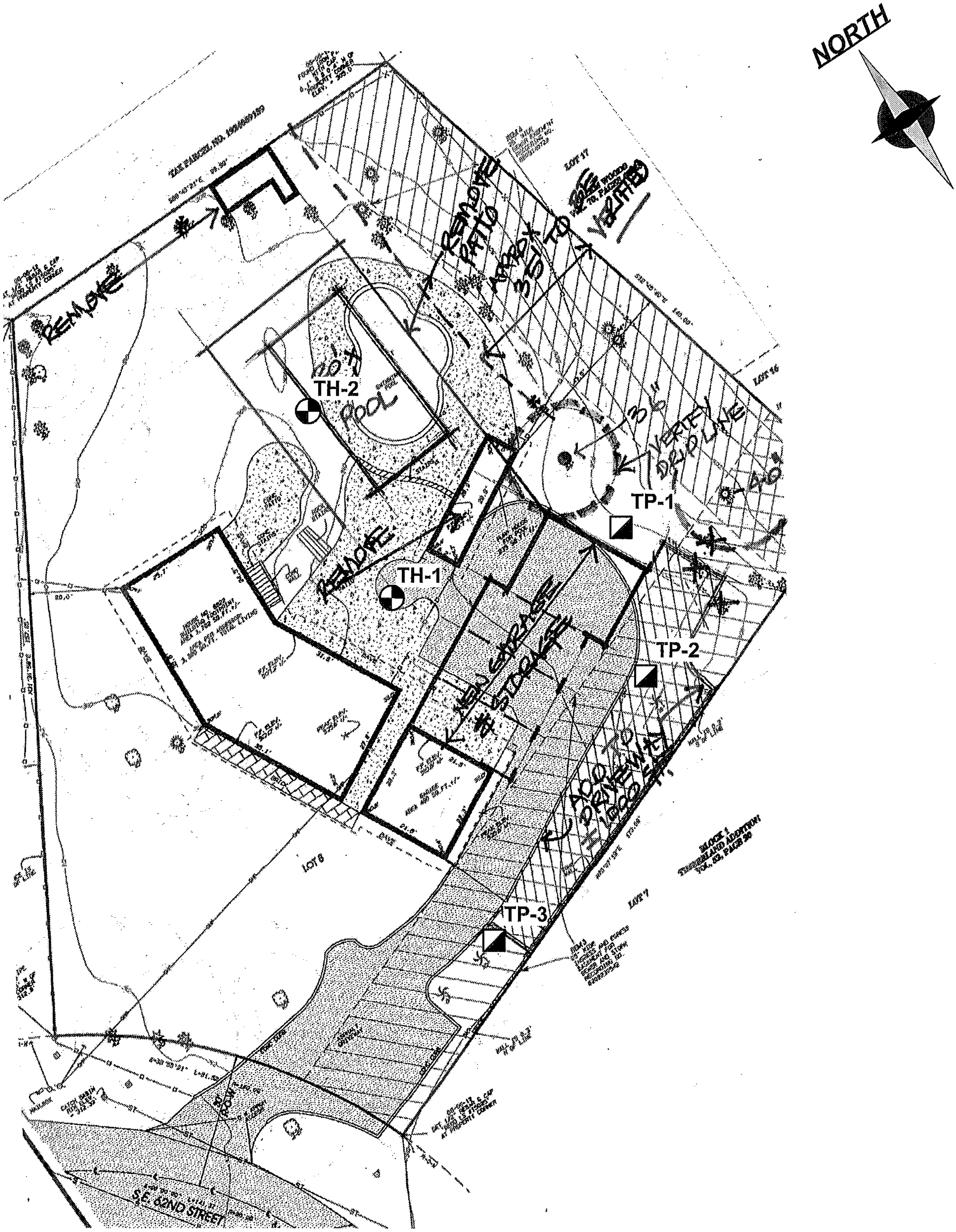
CONSULTANTS, INC.

VICINITY MAP

8822 Southeast 62nd Street
Mercer Island, Washington

Job No:	Date:		Plate:
19086	Mar. 2019		1



Legend:

- Test Pit Location
- Test Hole Location

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SITE EXPLORATION PLAN

8822 Southeast 62nd Street
Mercer Island, Washington

Job No:	Date:		Plate:
19086	Mar. 2019	No Scale	2

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				TOPSOIL
			FILL	Gray silty SAND with gravel, fine to medium-grained, moist, loose **(FILL)** -with brick debris
			SM	Rust-brown silty SAND with organics, very fine-grained, moist, loose
5				-becomes gray, cemented, fine to mediu-grained, dense, reduced organics content **(Glacial Till)**
10				

*** Test Pit terminated at 6.0 feet on March 12, 2019.**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

TEST PIT 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				TOPSOIL
			FILL	Gray and rust-brown silty SAND with gravel, fine to medium-grained, moist, loose **(FILL)** -concrete slab next to test pit
				TOPSOIL
			SM	Rust-brown silty SAND with gravel and organics, fine-grained, moist, loose
5				-becomes brown, reduced organics content, loose to medium-dense
10				

*** Test Pit terminated at 6.0 feet on March 12, 2019.**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

GEOTECH
CONSULTANTS, INC.

TEST PIT LOG

8822 Southeast 62nd Street
Mercer Island, Washington

Job	Date:	Logged by:	Plate:
19086	Mar. 2019	ASM	3

TEST PIT 3

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Dark-brown silty SAND with abundant organics, fine to medium-grained, moist, loose **(FILL)**
				TOPSOIL
5			SM	Rust-brown silty SAND with gravel, fine-grained, moist, loose -becomes gray, cemented, dense **(Glacial Till)**
10				

*** Test Pit terminated at 5.8 feet on March 12, 2019.**

*** Perched groundwater seepage was observed from 3.5 to 4 feet during excavation.**

*** No caving observed during excavation.**

GEOTECH
CONSULTANTS, INC.

TEST PIT LOG

8822 Southeast 62nd Street
Mercer Island, Washington

Job	Date:	Logged by:	Plate:
19086	Mar. 2019	ASM	4

TEST HOLE 1

Depth (feet)	Soil Description
0.0 – 0.5	Topsoil
0.5 – 4.0	Rust-brown silty SAND with gravel and organics, fine to medium-grained, moist, loose **[SM]** - at 3.5 feet; becomes gray-brown, cemented, dense, reduced organics content **(Glacial Till)**

Test Hole was terminated at 4.0 feet on March 12, 2018.
No groundwater seepage was encountered in the test hole.

TEST HOLE 2

Depth (feet)	Soil Description
0.0 – 0.5	Topsoil
0.5 – 4.0	Rust-brown silty SAND with gravel, fine to medium-grained, moist, loose **[SM]** - at 1.5 feet; becomes gray-brown, cemented, dense **(Glacial Till)**

Test Hole was terminated at 2.0 feet on March 12, 2018.
No groundwater seepage was encountered in the test hole.

***NOTE** – Letters in brackets **[ ]** denote the USCS soil classification.

GEOTECH
CONSULTANTS, INC.

TEST HOLE LOGS

8822 Southeast 62nd Street
Mercer Island, Washington

Job No:	Date:		Plate:
19086	Mar. 2019		5

Appendix D – Reconnaissance Report

Wetland Resources, Inc.
Delineation / Mitigation / Restoration / Habitat Creation / Permit Assistance

9505 19th Avenue S.E.
Suite 106
Everett, Washington 98208
(425) 337-3174
Fax (425) 337-3045

September 21, 2018

Greg and Jennifer Headrick
8822 SE 62nd St
Mercer Island, WA 98040

RE: Reconnaissance Report for King County Parcel No. 8650500040, Located at 8822 SE 62nd Street, in the City of Mercer Island

Introduction

Wetland Resources, Inc. (WRI) performed a critical areas reconnaissance on September 20, 2018, to identify regulated wetlands and watercourses on and in the vicinity of the 0.63-acre parcel located at 8822 SE 62nd Street. Access is from the west via SE 62nd Street. The subject property is located within the Cedar/Sammamish Watershed, in the Mercer Island subbasin.

The subject property is a relatively level lot that slopes to a shallow ravine in the eastern portion of the property. The level portion of the site is developed with a single-family residence and appurtenant structures/uses, including access/parking, storage sheds, ornamental landscaping, lawngrass, and a pool. A seasonal stream channel was identified along the eastern property line, as depicted in Figure 1 below. No other critical areas were observed on or in the vicinity of the subject property.

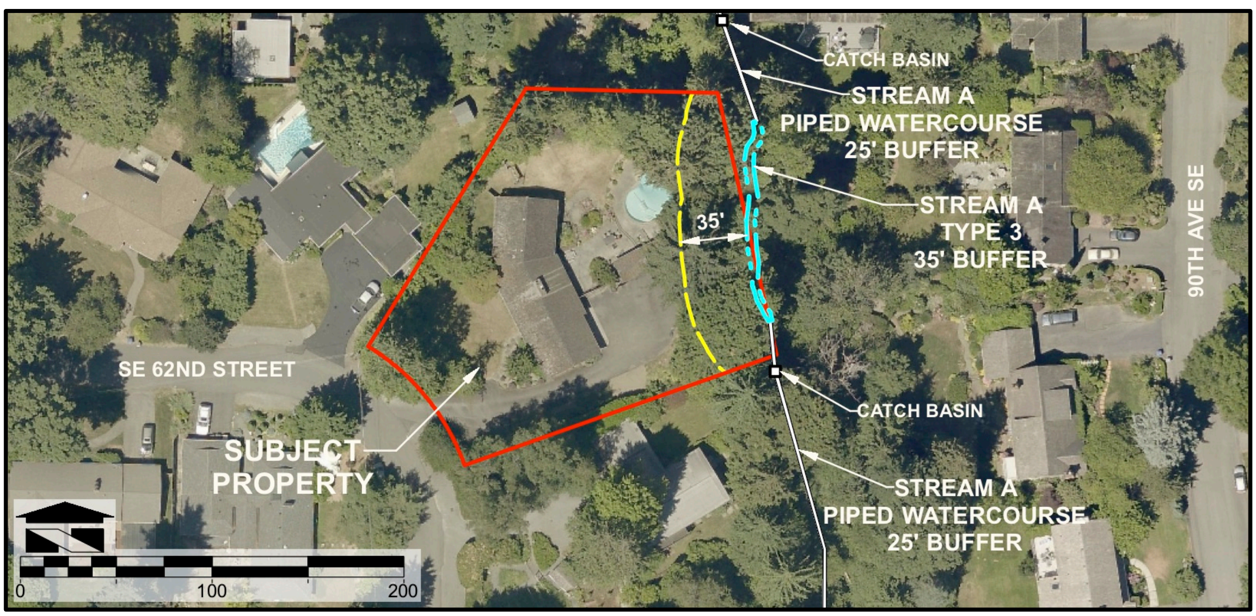

Figure 1: Aerial Overview of Subject Property

Critical Areas Findings

The City of Mercer Island Development Services Group relies on data compiled in the City of Mercer Island GIS Portal to approximate critical areas presence and locate stormwater features (among many other things). This resource was used by WRI staff prior to the site investigation, to determine potential critical areas on and in the vicinity of the subject property. This resource depicts two Type 3 watercourses within the boundaries of the subject property; Stream A, which flows through the aforementioned ravine along the east property line, and a tributary to Stream A, which is shown passing through maintained lawn, the primary residence, and impervious surfaces in the northern portion of the site. Based on the developed condition of the site, it is highly unlikely that a Type 3 watercourse flows through the property. Special care was taken during the site inspection to confirm or deny the presence of the mapped tributary.

Stream A is the only critical area feature that was observed within the subject property. The mapped tributary to Stream A was not observed. No evidence of a surface channel is present in or around the mapped location of the tributary to Stream A. The mapped tributary to Stream A is a map error that should be corrected by City staff based on WRI findings.

Critical Area Name	Critical Area Type	Standard Buffer Width
Stream A	Piped or Restored	25 feet
Stream A	Type 3	35 feet

Table 1: Critical Areas Summary

The on-site boundaries of Stream A were estimated in the field, and refined in the office using fine-scale elevation contours derived from the King County 3x3 Digital Elevation Model (DEM). The stream enters the site near the northeast property corner, where flows discharge from a large-diameter culvert. The stream flows south along the east property line within an approximately three-foot-wide surface channel. The surface channel then flows into another culvert, located in approximately the southeast corner of the property. Bed material within the open channel consists of small to medium cobble, and indicates that stream velocity is relatively high during large rain events. The channel was dry during the September site visit, which supports the Type 3 classification made by the City. Type 3 watercourses require 35-foot protective buffers in the city of Mercer Island. Piped watercourses require 25-foot protective buffers.

The protective buffer associated with Stream A appears to terminate in the vicinity of existing development (in the level portion of the site). It is possible that existing development encroaches slightly into the buffer associated with Stream A. Previously developed areas within 35 feet of Stream A are considered a legally existing non-conforming use, because they were constructed prior to the adoption of 35-foot protective buffers. Generally, nonconforming uses can be maintained and repaired. Changes in use may also be allowed by the DSG, provided that they do not increase the nonconformance.

Use of This Report

This report is supplied to Greg and Jennifer Headrick as a means of determining the presence of on-site and adjacent critical areas as required by the City of Mercer Island. This report is based largely on readily observable conditions and, to a lesser extent, on readily ascertainable conditions. No attempt has been made to determine hidden or concealed conditions.

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

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

Wetland Resources, Inc.

Niels Pedersen
Senior Ecologist

Enclosures:
Critical Areas Reconnaissance Map (Sheet 1/1)

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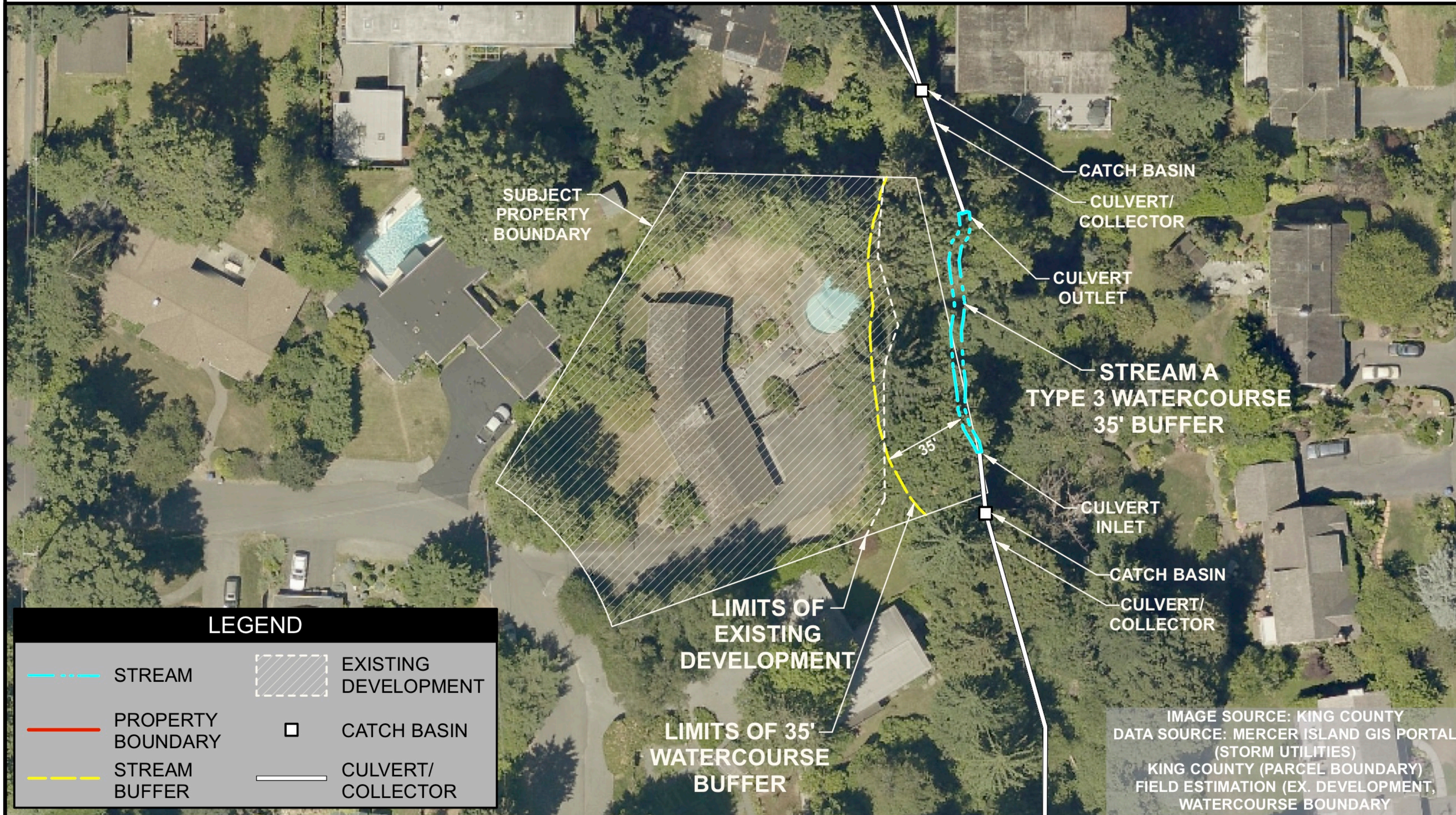
CRITICAL AREAS RECONNAISSANCE MAP

HEADRICK - 8822 SE 62ND ST



PLEASE NOTE: THIS MAP IS ***APPROXIMATE*** FOR PLANNING AND DISCUSSION PURPOSES ONLY. THIS DOES NOT REPRESENT A DELINEATION OR SURVEY. ALL WATERCOURSES, BUFFERS, AND PROPERTY LINE LOCATIONS ARE ***APPROXIMATE***. THE LOCATIONS SHOWN ON THIS MAP SHOULD ***NOT*** BE USED TO CREATE A FORMAL SITE LAYOUT.

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

Critical Areas Reconnaissance Map
Headrick - 8822 SE 62nd St
City of Mercer Island

Greg & Jennifer Headrick
8822 SE 62nd St
Mercer Island, WA 98040

Sheet 1/1
Project Number: 18303
Drawn by: NP
09/21/2018

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September 21, 2018

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The subject property is a relatively level lot that slopes to a shallow ravine in the eastern portion of the property. The level portion of the site is developed with a single-family residence and appurtenant structures/uses, including access/parking, storage sheds, ornamental landscaping, lawngrass, and a pool. A seasonal stream channel was identified along the eastern property line, as depicted in Figure 1 below. No other critical areas were observed on or in the vicinity of the subject property.

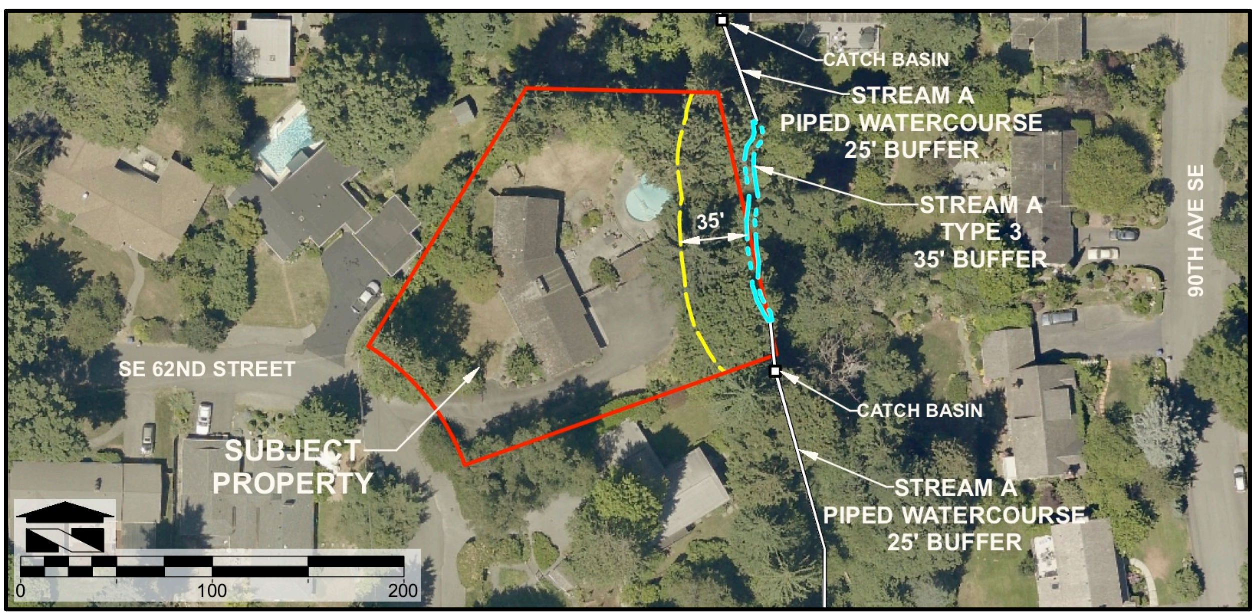

Figure 1: Aerial Overview of Subject Property

Critical Areas Findings

The City of Mercer Island Development Services Group relies on data compiled in the City of Mercer Island GIS Portal to approximate critical areas presence and locate stormwater features (among many other things). This resource was used by WRI staff prior to the site investigation, to determine potential critical areas on and in the vicinity of the subject property. This resource depicts two Type 3 watercourses within the boundaries of the subject property; Stream A, which flows through the aforementioned ravine along the east property line, and a tributary to Stream A, which is shown passing through maintained lawn, the primary residence, and impervious surfaces in the northern portion of the site. Based on the developed condition of the site, it is highly unlikely that a Type 3 watercourse flows through the property. Special care was taken during the site inspection to confirm or deny the presence of the mapped tributary.

Stream A is the only critical area feature that was observed within the subject property. The mapped tributary to Stream A was not observed. No evidence of a surface channel is present in or around the mapped location of the tributary to Stream A. The mapped tributary to Stream A is a map error that should be corrected by City staff based on WRI findings.

Critical Area Name	Critical Area Type	Standard Buffer Width
Stream A	Piped or Restored	25 feet
Stream A	Type 3	35 feet

Table 1: Critical Areas Summary

The on-site boundaries of Stream A were estimated in the field, and refined in the office using fine-scale elevation contours derived from the King County 3x3 Digital Elevation Model (DEM). The stream enters the site near the northeast property corner, where flows discharge from a large-diameter culvert. The stream flows south along the east property line within an approximately three-foot-wide surface channel. The surface channel then flows into another culvert, located in approximately the southeast corner of the property. Bed material within the open channel consists of small to medium cobble, and indicates that stream velocity is relatively high during large rain events. The channel was dry during the September site visit, which supports the Type 3 classification made by the City. Type 3 watercourses require 35-foot protective buffers in the city of Mercer Island. Piped watercourses require 25-foot protective buffers.

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Wetland Resources, Inc.

Niels Pedersen
Senior Ecologist

Enclosures:
Critical Areas Reconnaissance Map (Sheet 1/1)

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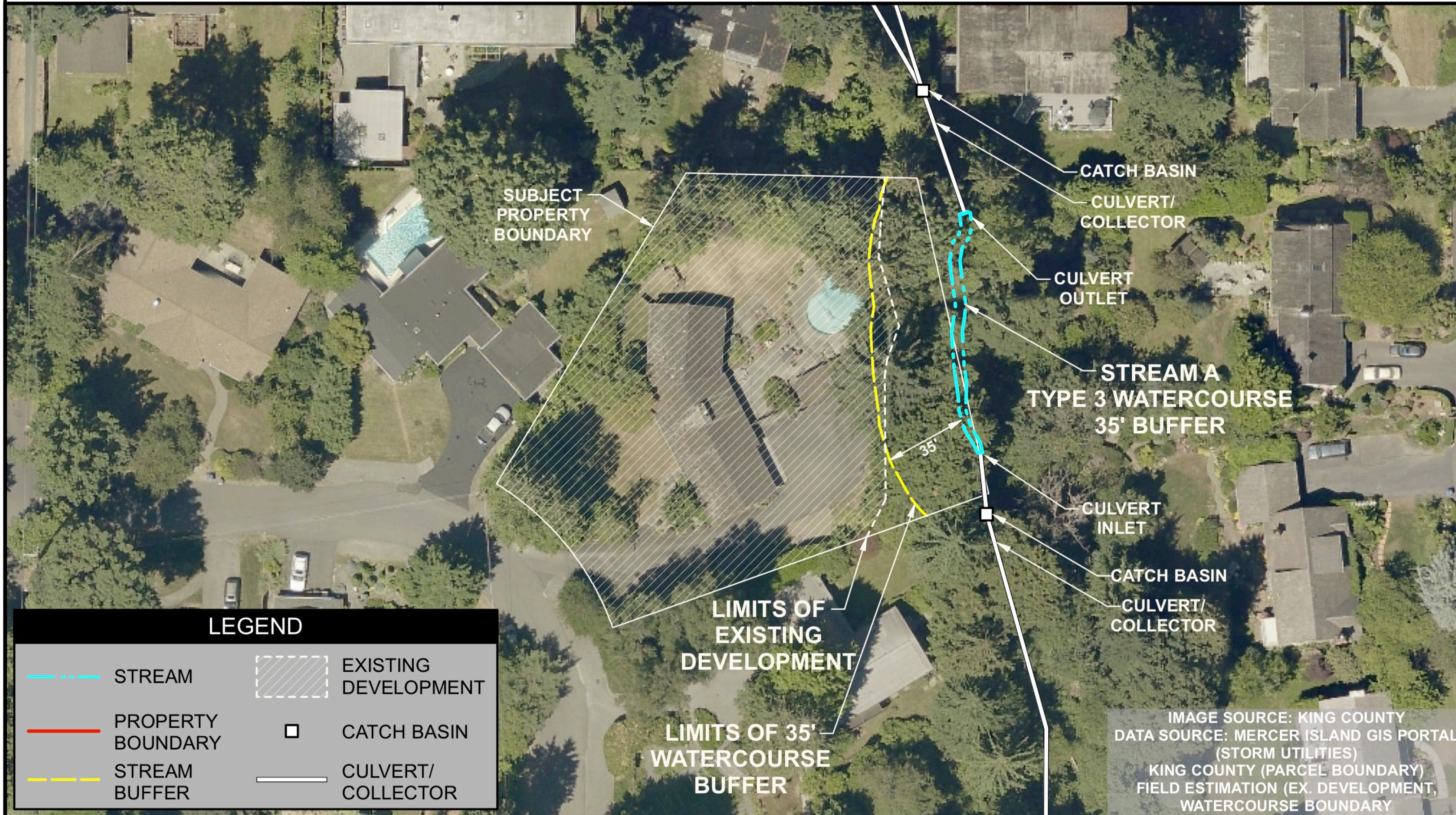
CRITICAL AREAS RECONNAISSANCE MAP

HEADRICK - 8822 SE 62ND ST



Scale 1" = 60'

0 30 60 90 120

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Critical Areas Reconnaissance Map
Headrick - 8822 SE 62nd St
City of Mercer Island

Sheet 1/1
Greg & Jennifer Headrick
8822 SE 62nd St
Mercer Island, WA 98040
Project Number: 18303
Drawn by: NP
09/21/2018

Appendix E – WWHM Calculations for Bioretention Planters

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: BIORETENTION A

Site Name:	
Site Address:	
City:	
Report Date:	8/17/2023
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

BP A Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.06
ROADS FLAT	0.08
SIDEWALKS FLAT	0.004
Impervious Total	0.144
Basin Total	0.144

Mitigated Land Use

BP A Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.06
ROADS FLAT	0.08
SIDEWALKS FLAT	0.004
Impervious Total	0.144
Basin Total	0.144

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention A

Bottom Length:	32.60 ft.
Bottom Width:	10.00 ft.
Material thickness of first layer:	0.25
Material type for first layer:	Sand
Material thickness of second layer:	1.5
Material type for second layer:	SMMWW
Material thickness of third layer:	1.08
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.33
Orifice Diameter (in.):	3.9
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	23.149
Total Outflow (ac-ft.):	23.149
Percent Through Underdrain:	100

Discharge Structure

Riser Height:	0.5 ft.
Riser Diameter:	6 in.

Element Flows To:

Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.0075	0.0000	0.0000	0.0000
0.0421	0.0075	0.0001	0.0000	0.0000
0.0842	0.0075	0.0003	0.0000	0.0000
0.1263	0.0075	0.0004	0.0000	0.0000
0.1684	0.0075	0.0005	0.0000	0.0000
0.2104	0.0075	0.0006	0.0000	0.0000
0.2525	0.0075	0.0008	0.0000	0.0000
0.2946	0.0075	0.0009	0.0002	0.0000
0.3367	0.0075	0.0010	0.0003	0.0000
0.3788	0.0075	0.0011	0.0005	0.0000
0.4209	0.0075	0.0013	0.0007	0.0000
0.4630	0.0075	0.0014	0.0010	0.0000
0.5051	0.0075	0.0015	0.0013	0.0000
0.5471	0.0075	0.0016	0.0017	0.0000
0.5892	0.0075	0.0018	0.0022	0.0000
0.6313	0.0075	0.0019	0.0027	0.0000
0.6734	0.0075	0.0020	0.0033	0.0000
0.7155	0.0075	0.0021	0.0040	0.0000
0.7576	0.0075	0.0023	0.0047	0.0000
0.7997	0.0075	0.0024	0.0056	0.0000
0.8418	0.0075	0.0025	0.0065	0.0000
0.8838	0.0075	0.0027	0.0075	0.0000
0.9259	0.0075	0.0028	0.0075	0.0000
0.9680	0.0075	0.0029	0.0086	0.0000
1.0101	0.0075	0.0030	0.0096	0.0000
1.0522	0.0075	0.0032	0.0098	0.0000
1.0943	0.0075	0.0033	0.0111	0.0000
1.1364	0.0075	0.0034	0.0125	0.0000
1.1785	0.0075	0.0035	0.0140	0.0000

1.2205	0.0075	0.0037	0.0156	0.0000
1.2626	0.0075	0.0038	0.0167	0.0000
1.3047	0.0075	0.0039	0.0174	0.0000
1.3468	0.0075	0.0040	0.0192	0.0000
1.3889	0.0075	0.0042	0.0211	0.0000
1.4310	0.0075	0.0043	0.0231	0.0000
1.4731	0.0075	0.0044	0.0232	0.0000
1.5152	0.0075	0.0046	0.0253	0.0000
1.5573	0.0075	0.0047	0.0276	0.0000
1.5993	0.0075	0.0048	0.0299	0.0000
1.6414	0.0075	0.0049	0.0308	0.0000
1.6835	0.0075	0.0051	0.0324	0.0000
1.7256	0.0075	0.0052	0.0351	0.0000
1.7677	0.0075	0.0053	0.0378	0.0000
1.8098	0.0075	0.0054	0.0406	0.0000
1.8519	0.0075	0.0056	0.0436	0.0000
1.8940	0.0075	0.0057	0.0453	0.0000
1.9360	0.0075	0.0058	0.0679	0.0000
1.9781	0.0075	0.0060	0.0679	0.0000
2.0202	0.0075	0.0061	0.0679	0.0000
2.0623	0.0075	0.0062	0.0679	0.0000
2.1044	0.0075	0.0064	0.0679	0.0000
2.1465	0.0075	0.0065	0.0679	0.0000
2.1886	0.0075	0.0066	0.0679	0.0000
2.2307	0.0075	0.0068	0.0679	0.0000
2.2727	0.0075	0.0069	0.0679	0.0000
2.3148	0.0075	0.0070	0.0679	0.0000
2.3569	0.0075	0.0071	0.0679	0.0000
2.3990	0.0075	0.0073	0.0679	0.0000
2.4411	0.0075	0.0074	0.0679	0.0000
2.4832	0.0075	0.0075	0.0679	0.0000
2.5253	0.0075	0.0077	0.0679	0.0000
2.5674	0.0075	0.0078	0.0679	0.0000
2.6095	0.0075	0.0079	0.0679	0.0000
2.6515	0.0075	0.0081	0.0679	0.0000
2.6936	0.0075	0.0082	0.0679	0.0000
2.7357	0.0075	0.0083	0.0679	0.0000
2.7778	0.0075	0.0085	0.0679	0.0000
2.8199	0.0075	0.0086	0.0679	0.0000
2.8300	0.0075	0.0086	0.0679	0.0000

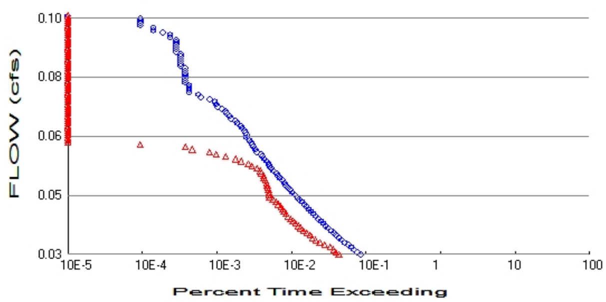
Bioretention Hydraulic Table

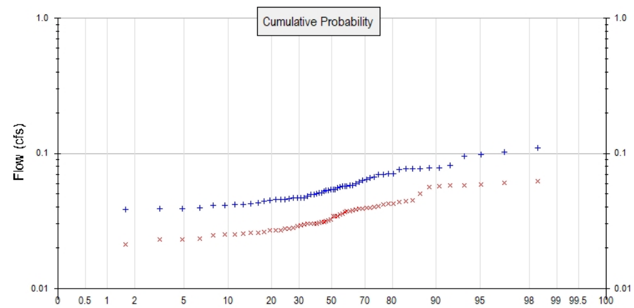
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.8300	0.0075	0.0086	0.0000	0.0541	0.0000
2.8721	0.0075	0.0089	0.0000	0.0541	0.0000
2.9142	0.0075	0.0092	0.0000	0.0554	0.0000
2.9563	0.0075	0.0096	0.0000	0.0566	0.0000
2.9984	0.0075	0.0099	0.0000	0.0579	0.0000
3.0404	0.0075	0.0102	0.0000	0.0592	0.0000
3.0825	0.0075	0.0105	0.0000	0.0604	0.0000
3.1246	0.0075	0.0108	0.0000	0.0617	0.0000
3.1667	0.0075	0.0111	0.0000	0.0630	0.0000
3.2088	0.0075	0.0114	0.0000	0.0643	0.0000
3.2509	0.0075	0.0118	0.0000	0.0655	0.0000
3.2930	0.0075	0.0121	0.0000	0.0668	0.0000
3.3351	0.0075	0.0124	0.0019	0.0681	0.0000
3.3771	0.0075	0.0127	0.0540	0.0693	0.0000
3.4192	0.0075	0.0130	0.1370	0.0706	0.0000

3.4613	0.0075	0.0133	0.2288	0.0719	0.0000
3.5034	0.0075	0.0137	0.3089	0.0732	0.0000
3.5455	0.0075	0.0140	0.3631	0.0744	0.0000
3.5876	0.0075	0.0143	0.3996	0.0757	0.0000
3.6297	0.0075	0.0146	0.4310	0.0770	0.0000
3.6718	0.0075	0.0149	0.4603	0.0782	0.0000
3.7138	0.0075	0.0152	0.4878	0.0795	0.0000
3.7559	0.0075	0.0155	0.5139	0.0808	0.0000
3.7980	0.0075	0.0159	0.5387	0.0820	0.0000
3.8300	0.0075	0.0161	0.5624	0.0830	0.0000

Surface retention A

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.144

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.144

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.054902
5 year	0.069348
10 year	0.079163
25 year	0.091894
50 year	0.101638
100 year	0.111619

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.033699
5 year	0.043101
10 year	0.049417
25 year	0.057536
50 year	0.063699
100 year	0.06997

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.071	0.037
1950	0.077	0.044
1951	0.044	0.036
1952	0.040	0.028
1953	0.043	0.030
1954	0.045	0.029
1955	0.051	0.034
1956	0.050	0.032
1957	0.057	0.041
1958	0.046	0.026

1959	0.047	0.025
1960	0.046	0.034
1961	0.048	0.031
1962	0.042	0.024
1963	0.047	0.025
1964	0.046	0.032
1965	0.058	0.030
1966	0.039	0.029
1967	0.067	0.039
1968	0.076	0.042
1969	0.053	0.031
1970	0.051	0.030
1971	0.061	0.032
1972	0.063	0.042
1973	0.038	0.026
1974	0.056	0.028
1975	0.064	0.037
1976	0.043	0.028
1977	0.047	0.027
1978	0.057	0.044
1979	0.078	0.026
1980	0.070	0.038
1981	0.057	0.039
1982	0.081	0.058
1983	0.066	0.050
1984	0.042	0.023
1985	0.057	0.037
1986	0.050	0.038
1987	0.077	0.040
1988	0.046	0.027
1989	0.058	0.021
1990	0.098	0.060
1991	0.078	0.057
1992	0.041	0.031
1993	0.036	0.020
1994	0.039	0.023
1995	0.051	0.030
1996	0.054	0.039
1997	0.053	0.034
1998	0.053	0.026
1999	0.109	0.058
2000	0.054	0.040
2001	0.060	0.030
2002	0.070	0.045
2003	0.054	0.025
2004	0.102	0.063
2005	0.047	0.036
2006	0.041	0.027
2007	0.095	0.057
2008	0.077	0.059
2009	0.071	0.043

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1090	0.0625
2	0.1020	0.0600
3	0.0978	0.0590

4	0.0953	0.0583
5	0.0809	0.0577
6	0.0782	0.0569
7	0.0782	0.0565
8	0.0768	0.0504
9	0.0768	0.0448
10	0.0765	0.0445
11	0.0763	0.0439
12	0.0711	0.0426
13	0.0710	0.0422
14	0.0701	0.0421
15	0.0696	0.0406
16	0.0671	0.0402
17	0.0658	0.0395
18	0.0641	0.0394
19	0.0630	0.0390
20	0.0610	0.0390
21	0.0596	0.0383
22	0.0582	0.0376
23	0.0581	0.0374
24	0.0574	0.0373
25	0.0572	0.0367
26	0.0571	0.0358
27	0.0565	0.0355
28	0.0556	0.0344
29	0.0543	0.0341
30	0.0541	0.0341
31	0.0540	0.0323
32	0.0533	0.0318
33	0.0530	0.0316
34	0.0526	0.0311
35	0.0511	0.0309
36	0.0509	0.0307
37	0.0506	0.0303
38	0.0498	0.0301
39	0.0496	0.0301
40	0.0483	0.0300
41	0.0467	0.0299
42	0.0467	0.0293
43	0.0466	0.0290
44	0.0465	0.0280
45	0.0464	0.0279
46	0.0458	0.0277
47	0.0456	0.0270
48	0.0456	0.0269
49	0.0446	0.0269
50	0.0444	0.0262
51	0.0431	0.0258
52	0.0427	0.0257
53	0.0421	0.0256
54	0.0415	0.0249
55	0.0412	0.0249
56	0.0411	0.0247
57	0.0395	0.0235
58	0.0389	0.0232
59	0.0388	0.0230
60	0.0381	0.0213
61	0.0356	0.0203

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0275	1801	918	50	Pass
0.0282	1636	837	51	Pass
0.0289	1475	785	53	Pass
0.0297	1344	711	52	Pass
0.0304	1227	593	48	Pass
0.0312	1102	513	46	Pass
0.0319	1003	452	45	Pass
0.0327	920	406	44	Pass
0.0334	853	379	44	Pass
0.0342	790	344	43	Pass
0.0349	726	309	42	Pass
0.0357	665	284	42	Pass
0.0364	610	262	42	Pass
0.0372	571	242	42	Pass
0.0379	532	225	42	Pass
0.0387	488	207	42	Pass
0.0394	450	191	42	Pass
0.0402	419	181	43	Pass
0.0409	389	170	43	Pass
0.0417	364	162	44	Pass
0.0424	339	155	45	Pass
0.0432	316	143	45	Pass
0.0439	295	132	44	Pass
0.0447	271	120	44	Pass
0.0454	256	108	42	Pass
0.0462	238	108	45	Pass
0.0469	221	107	48	Pass
0.0477	206	105	50	Pass
0.0484	193	102	52	Pass
0.0492	181	101	55	Pass
0.0499	171	99	57	Pass
0.0507	161	95	59	Pass
0.0514	148	91	61	Pass
0.0522	139	90	64	Pass
0.0529	135	85	62	Pass
0.0537	122	82	67	Pass
0.0544	113	73	64	Pass
0.0552	108	63	58	Pass
0.0559	105	56	53	Pass
0.0567	100	45	45	Pass
0.0574	92	38	41	Pass
0.0582	87	28	32	Pass
0.0589	84	21	25	Pass
0.0597	73	17	23	Pass
0.0604	71	10	14	Pass
0.0612	65	8	12	Pass
0.0619	63	2	3	Pass
0.0627	62	0	0	Pass
0.0634	58	0	0	Pass
0.0642	54	0	0	Pass
0.0649	54	0	0	Pass
0.0657	52	0	0	Pass
0.0664	50	0	0	Pass

0.0672	46	0	0	Pass
0.0679	45	0	0	Pass
0.0687	40	0	0	Pass
0.0694	38	0	0	Pass
0.0702	33	0	0	Pass
0.0709	32	0	0	Pass
0.0717	29	0	0	Pass
0.0724	28	0	0	Pass
0.0732	25	0	0	Pass
0.0739	22	0	0	Pass
0.0747	21	0	0	Pass
0.0754	20	0	0	Pass
0.0762	17	0	0	Pass
0.0769	13	0	0	Pass
0.0777	12	0	0	Pass
0.0784	9	0	0	Pass
0.0792	9	0	0	Pass
0.0799	9	0	0	Pass
0.0807	9	0	0	Pass
0.0814	8	0	0	Pass
0.0822	8	0	0	Pass
0.0829	8	0	0	Pass
0.0837	8	0	0	Pass
0.0844	8	0	0	Pass
0.0852	8	0	0	Pass
0.0859	8	0	0	Pass
0.0867	7	0	0	Pass
0.0874	7	0	0	Pass
0.0881	7	0	0	Pass
0.0889	7	0	0	Pass
0.0896	7	0	0	Pass
0.0904	7	0	0	Pass
0.0911	6	0	0	Pass
0.0919	6	0	0	Pass
0.0926	6	0	0	Pass
0.0934	6	0	0	Pass
0.0941	6	0	0	Pass
0.0949	6	0	0	Pass
0.0956	5	0	0	Pass
0.0964	5	0	0	Pass
0.0971	4	0	0	Pass
0.0979	3	0	0	Pass
0.0986	3	0	0	Pass
0.0994	2	0	0	Pass
0.1001	2	0	0	Pass
0.1009	2	0	0	Pass
0.1016	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
retention APOC	☐	21.07			☐	0.00			
Total Volume Infiltrated		21.07	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 = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

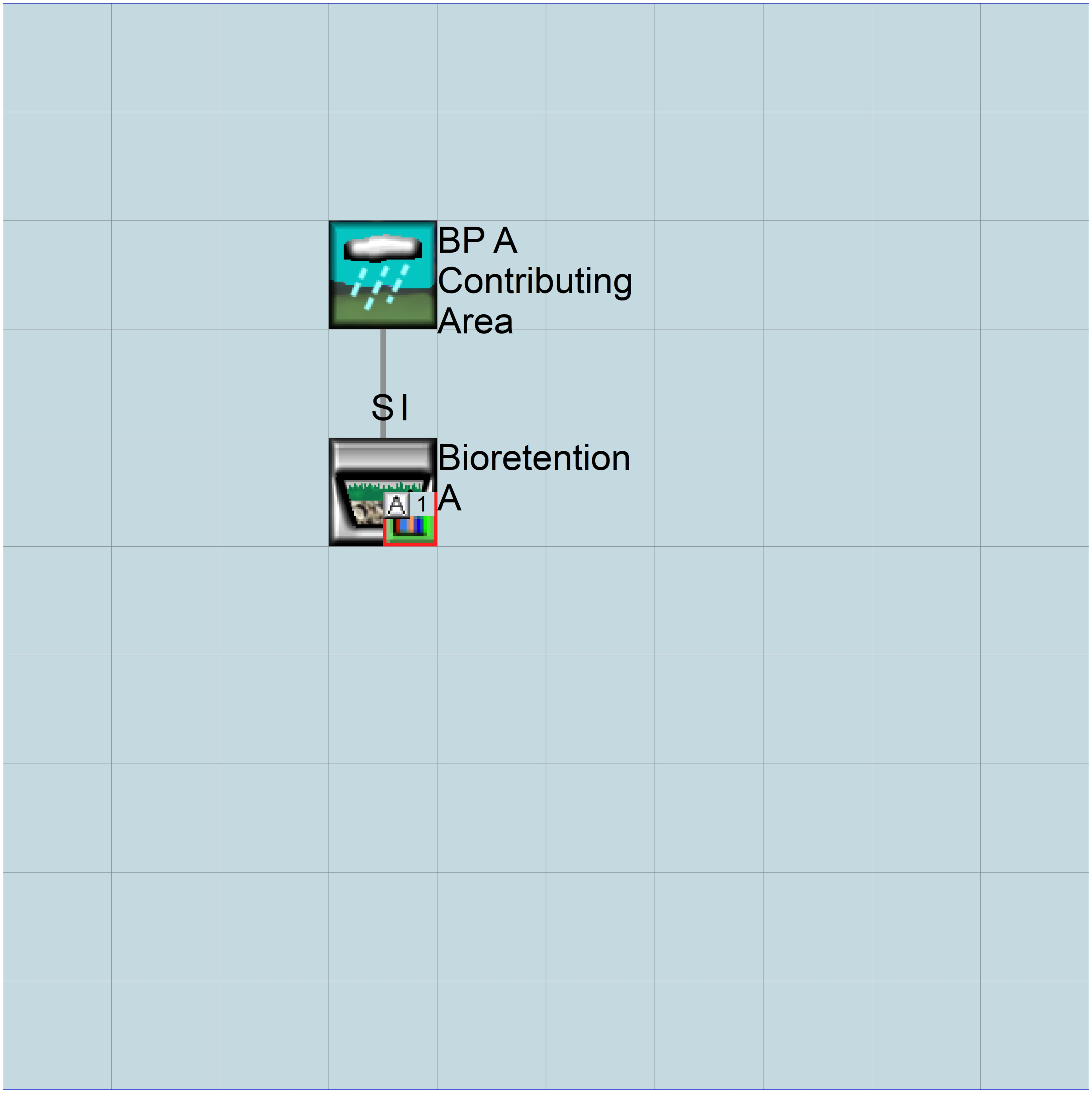
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION A.wdm
MESSU      25   PreBIORETENTION A.MES
           27   PreBIORETENTION A.L61
           28   PreBIORETENTION A.L62
           30   POCBIORETENTION A1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      IMPLND       1
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        BP A Contributing Area      MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
  END GEN-INFO
  *** Section PWATER***

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

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

  PWAT-PARM1
```

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
    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   ***
    4         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    *********
    4         0    0    4    0    0    4    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     ***
    4         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
    4            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
    4             0         0
    1             0         0
    8             0         0
  END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP A Contributing Area***
IMPLND   4                        0.06     COPY   501     15
IMPLND   1                        0.08     COPY   501     15
IMPLND   8                       0.004     COPY   501     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



<-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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

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

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       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       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION A.wdm
MESSU      25   MitBIORETENTION A.MES
           27   MitBIORETENTION A.L61
           28   MitBIORETENTION A.L62
           30   POCBIORETENTION A1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      IMPLND       1
      IMPLND       8
      GENER        2
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1         Surface retention  A        MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
  END GEN-INFO
  *** Section PWATER***

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

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

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

```
    4            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
    4              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP A Contributing Area***
IMPLND   4                        0.06     RCHRES   1      5
IMPLND   1                        0.08     RCHRES   1      5
IMPLND   8                       0.004     RCHRES   1      5

******Routing******
IMPLND   4                        0.06     COPY     1     15
IMPLND   1                        0.08     COPY     1     15
IMPLND   8                       0.004     COPY     1     15
RCHRES   1                           1     RCHRES   2      8
RCHRES   2                           1     COPY   501     16
RCHRES   1                           1     COPY   501     17
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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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     Surface retentio-011    2    1    1    1   28    0    1
    2     Bioretention  A         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
    2         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
    2        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  5  0  0  0       0  1  0  0  0       2  1  2  2  2
    2        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      0.01       0.0       0.0       0.0       0.0
    2             2      0.01       0.0       0.0       0.0       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  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2          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
*** User-Defined Variable Quantity Lines
***                          addr
***                        <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                 addr or                        addr or
***                <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                              v2m2            =  436.3
*** Compute remaining available pore space
  GENER   2                              vpo2            =  v2m2
  GENER   2                              vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                              vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                              v2d2            =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   69    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.007484  0.000000  0.000000
  0.042088  0.007484  0.000126  0.000000
  0.084176  0.007484  0.000252  0.000000
```

0.126264	0.007484	0.000378	0.000000
0.168352	0.007484	0.000504	0.000000
0.210440	0.007484	0.000630	0.000000
0.252527	0.007484	0.000756	0.000000
0.294615	0.007484	0.000883	0.000176
0.336703	0.007484	0.001009	0.000301
0.378791	0.007484	0.001136	0.000470
0.420879	0.007484	0.001262	0.000689
0.462967	0.007484	0.001389	0.000963
0.505055	0.007484	0.001515	0.001295
0.547143	0.007484	0.001642	0.001690
0.589231	0.007484	0.001768	0.002152
0.631319	0.007484	0.001895	0.002683
0.673407	0.007484	0.002021	0.003289
0.715495	0.007484	0.002148	0.003971
0.757582	0.007484	0.002274	0.004733
0.799670	0.007484	0.002400	0.005578
0.841758	0.007484	0.002527	0.006509
0.883846	0.007484	0.002653	0.007481
0.925934	0.007484	0.002780	0.007528
0.968022	0.007484	0.002906	0.008639
1.010110	0.007484	0.003033	0.009614
1.052198	0.007484	0.003159	0.009844
1.094286	0.007484	0.003286	0.011145
1.136374	0.007484	0.003412	0.012544
1.178462	0.007484	0.003539	0.014045
1.220549	0.007484	0.003665	0.015649
1.262637	0.007484	0.003792	0.016689
1.304725	0.007484	0.003918	0.017359
1.346813	0.007484	0.004045	0.019177
1.388901	0.007484	0.004171	0.021104
1.430989	0.007484	0.004297	0.023142
1.473077	0.007484	0.004424	0.023209
1.515165	0.007484	0.004550	0.025294
1.557253	0.007484	0.004677	0.027561
1.599341	0.007484	0.004803	0.029943
1.641429	0.007484	0.004930	0.030779
1.683516	0.007484	0.005056	0.032443
1.725604	0.007484	0.005183	0.035060
1.767692	0.007484	0.005313	0.037792
1.809780	0.007484	0.005444	0.040634
1.851868	0.007484	0.005575	0.043564
1.893956	0.007484	0.005706	0.045278
1.936044	0.007484	0.005836	0.067917
1.978132	0.007484	0.005967	0.067917
2.020220	0.007484	0.006098	0.067917
2.062308	0.007484	0.006228	0.067917
2.104396	0.007484	0.006359	0.067917
2.146484	0.007484	0.006490	0.067917
2.188571	0.007484	0.006621	0.067917
2.230659	0.007484	0.006751	0.067917
2.272747	0.007484	0.006882	0.067917
2.314835	0.007484	0.007013	0.067917
2.356923	0.007484	0.007143	0.067917
2.399011	0.007484	0.007274	0.067917
2.441099	0.007484	0.007405	0.067917
2.483187	0.007484	0.007536	0.067917
2.525275	0.007484	0.007666	0.067917
2.567363	0.007484	0.007797	0.067917
2.609451	0.007484	0.007928	0.067917
2.651538	0.007484	0.008059	0.067917
2.693626	0.007484	0.008189	0.067917
2.735714	0.007484	0.008320	0.067917
2.777802	0.007484	0.008451	0.067917
2.819890	0.007484	0.008581	0.067917
2.830000	0.007484	0.010016	0.067917

END FTABLE 2
FTABLE 1
25 5

Depth	Area	Volume	Outflow1	Outflow2	Velocity	Travel Time***

```
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.007484  0.000000  0.000000  0.000000
  0.042088  0.007484  0.000315  0.000000  0.054095
  0.084176  0.007484  0.000630  0.000000  0.055365
  0.126264  0.007484  0.000945  0.000000  0.056635
  0.168352  0.007484  0.001260  0.000000  0.057906
  0.210440  0.007484  0.001575  0.000000  0.059176
  0.252527  0.007484  0.001890  0.000000  0.060447
  0.294615  0.007484  0.002205  0.000000  0.061717
  0.336703  0.007484  0.002520  0.000000  0.062988
  0.378791  0.007484  0.002835  0.000000  0.064258
  0.420879  0.007484  0.003150  0.000000  0.065528
  0.462967  0.007484  0.003465  0.000000  0.066799
  0.505055  0.007484  0.003780  0.001908  0.068069
  0.547143  0.007484  0.004095  0.054025  0.069340
  0.589231  0.007484  0.004410  0.136981  0.070610
  0.631319  0.007484  0.004725  0.228750  0.071881
  0.673407  0.007484  0.005040  0.308919  0.073151
  0.715495  0.007484  0.005355  0.363061  0.074421
  0.757582  0.007484  0.005670  0.399630  0.075692
  0.799670  0.007484  0.005985  0.431044  0.076962
  0.841758  0.007484  0.006300  0.460319  0.078233
  0.883846  0.007484  0.006615  0.487841  0.079503
  0.925934  0.007484  0.006930  0.513891  0.080774
  0.968022  0.007484  0.007245  0.538682  0.082044
  1.000000  0.007484  0.007484  0.562382  0.083009
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   2     EXTNL  POTEV

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   2 HYDR   RO     1 1       1       WDM   1000 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1       1       WDM   1001 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1       1       WDM   1002 STAG     ENGL      REPL
RCHRES   1 HYDR   O      1 1       1       WDM   1003 FLOW     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1    48.4       WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1    48.4       WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

  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

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                  COPY           INPUT  MEAN
  END MASS-LINK   17

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: BIORETENTION B

Site Name:	
Site Address:	
City:	
Report Date:	8/17/2023
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

BP B Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.04
Impervious Total	0.04
Basin Total	0.04

Mitigated Land Use

BP B Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.04
Impervious Total	0.04
Basin Total	0.04

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention B

Bottom Length:	19.50 ft.
Bottom Width:	6.00 ft.
Material thickness of first layer:	0.25
Material type for first layer:	Sand
Material thickness of second layer:	1.5
Material type for second layer:	SMMWW
Material thickness of third layer:	1.08
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.33
Orifice Diameter (in.):	3.9
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	6.43
Total Outflow (ac-ft.):	6.43
Percent Through Underdrain:	100

Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 4 in.
Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.0027	0.0000	0.0000	0.0000
0.0421	0.0027	0.0000	0.0000	0.0000
0.0842	0.0027	0.0001	0.0000	0.0000
0.1263	0.0027	0.0001	0.0000	0.0000
0.1684	0.0027	0.0002	0.0000	0.0000
0.2104	0.0027	0.0002	0.0000	0.0000
0.2525	0.0027	0.0003	0.0000	0.0000
0.2946	0.0027	0.0003	0.0001	0.0000
0.3367	0.0027	0.0004	0.0001	0.0000
0.3788	0.0027	0.0004	0.0002	0.0000
0.4209	0.0027	0.0005	0.0002	0.0000
0.4630	0.0027	0.0005	0.0003	0.0000
0.5051	0.0027	0.0005	0.0005	0.0000
0.5471	0.0027	0.0006	0.0006	0.0000
0.5892	0.0027	0.0006	0.0008	0.0000
0.6313	0.0027	0.0007	0.0010	0.0000
0.6734	0.0027	0.0007	0.0012	0.0000
0.7155	0.0027	0.0008	0.0014	0.0000
0.7576	0.0027	0.0008	0.0017	0.0000
0.7997	0.0027	0.0009	0.0020	0.0000
0.8418	0.0027	0.0009	0.0023	0.0000
0.8838	0.0027	0.0010	0.0027	0.0000
0.9259	0.0027	0.0010	0.0027	0.0000
0.9680	0.0027	0.0010	0.0031	0.0000
1.0101	0.0027	0.0011	0.0035	0.0000
1.0522	0.0027	0.0011	0.0035	0.0000
1.0943	0.0027	0.0012	0.0040	0.0000
1.1364	0.0027	0.0012	0.0045	0.0000
1.1785	0.0027	0.0013	0.0050	0.0000

1.2205	0.0027	0.0013	0.0056	0.0000
1.2626	0.0027	0.0014	0.0060	0.0000
1.3047	0.0027	0.0014	0.0062	0.0000
1.3468	0.0027	0.0015	0.0069	0.0000
1.3889	0.0027	0.0015	0.0076	0.0000
1.4310	0.0027	0.0015	0.0083	0.0000
1.4731	0.0027	0.0016	0.0083	0.0000
1.5152	0.0027	0.0016	0.0091	0.0000
1.5573	0.0027	0.0017	0.0099	0.0000
1.5993	0.0027	0.0017	0.0107	0.0000
1.6414	0.0027	0.0018	0.0110	0.0000
1.6835	0.0027	0.0018	0.0116	0.0000
1.7256	0.0027	0.0019	0.0126	0.0000
1.7677	0.0027	0.0019	0.0136	0.0000
1.8098	0.0027	0.0020	0.0146	0.0000
1.8519	0.0027	0.0020	0.0156	0.0000
1.8940	0.0027	0.0020	0.0163	0.0000
1.9360	0.0027	0.0021	0.0244	0.0000
1.9781	0.0027	0.0021	0.0244	0.0000
2.0202	0.0027	0.0022	0.0244	0.0000
2.0623	0.0027	0.0022	0.0244	0.0000
2.1044	0.0027	0.0023	0.0244	0.0000
2.1465	0.0027	0.0023	0.0244	0.0000
2.1886	0.0027	0.0024	0.0244	0.0000
2.2307	0.0027	0.0024	0.0244	0.0000
2.2727	0.0027	0.0025	0.0244	0.0000
2.3148	0.0027	0.0025	0.0244	0.0000
2.3569	0.0027	0.0026	0.0244	0.0000
2.3990	0.0027	0.0026	0.0244	0.0000
2.4411	0.0027	0.0027	0.0244	0.0000
2.4832	0.0027	0.0027	0.0244	0.0000
2.5253	0.0027	0.0028	0.0244	0.0000
2.5674	0.0027	0.0028	0.0244	0.0000
2.6095	0.0027	0.0028	0.0244	0.0000
2.6515	0.0027	0.0029	0.0244	0.0000
2.6936	0.0027	0.0029	0.0244	0.0000
2.7357	0.0027	0.0030	0.0244	0.0000
2.7778	0.0027	0.0030	0.0244	0.0000
2.8199	0.0027	0.0031	0.0244	0.0000
2.8300	0.0027	0.0031	0.0244	0.0000

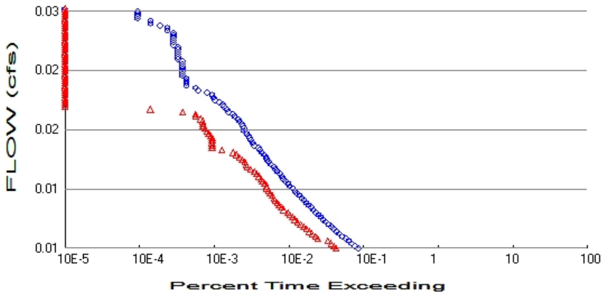
Bioretention Hydraulic Table

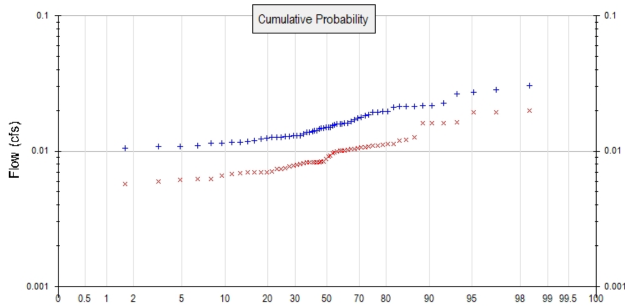
Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**To Amended(cfs)**	**Infilt(cfs)**
2.8300	0.0027	0.0031	0.0000	0.0194	0.0000
2.8721	0.0027	0.0032	0.0000	0.0194	0.0000
2.9142	0.0027	0.0033	0.0000	0.0199	0.0000
2.9563	0.0027	0.0034	0.0000	0.0203	0.0000
2.9984	0.0027	0.0035	0.0000	0.0208	0.0000
3.0404	0.0027	0.0037	0.0000	0.0212	0.0000
3.0825	0.0027	0.0038	0.0000	0.0217	0.0000
3.1246	0.0027	0.0039	0.0000	0.0222	0.0000
3.1667	0.0027	0.0040	0.0000	0.0226	0.0000
3.2088	0.0027	0.0041	0.0000	0.0231	0.0000
3.2509	0.0027	0.0042	0.0000	0.0235	0.0000
3.2930	0.0027	0.0043	0.0000	0.0240	0.0000
3.3351	0.0027	0.0044	0.0013	0.0244	0.0000
3.3771	0.0027	0.0046	0.0356	0.0249	0.0000
3.4192	0.0027	0.0047	0.0849	0.0253	0.0000

3.4613	0.0027	0.0048	0.1244	0.0258	0.0000
3.5034	0.0027	0.0049	0.1457	0.0263	0.0000
3.5455	0.0027	0.0050	0.1625	0.0267	0.0000
3.5876	0.0027	0.0051	0.1776	0.0272	0.0000
3.6297	0.0027	0.0052	0.1916	0.0276	0.0000
3.6718	0.0027	0.0054	0.2046	0.0281	0.0000
3.7138	0.0027	0.0055	0.2168	0.0285	0.0000
3.7559	0.0027	0.0056	0.2284	0.0290	0.0000
3.7980	0.0027	0.0057	0.2394	0.0294	0.0000
3.8300	0.0027	0.0058	0.2499	0.0298	0.0000

Surface retention B

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.04

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.04

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.015251
5 year	0.019263
10 year	0.02199
25 year	0.025526
50 year	0.028233
100 year	0.031005

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.009056
5 year	0.011915
10 year	0.013962
25 year	0.016728
50 year	0.018924
100 year	0.02124

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.020	0.010
1950	0.021	0.011
1951	0.012	0.010
1952	0.011	0.007
1953	0.012	0.008
1954	0.012	0.008
1955	0.014	0.009
1956	0.014	0.009
1957	0.016	0.011
1958	0.013	0.007

1959	0.013	0.007
1960	0.013	0.010
1961	0.013	0.008
1962	0.012	0.006
1963	0.013	0.007
1964	0.013	0.008
1965	0.016	0.008
1966	0.011	0.008
1967	0.019	0.010
1968	0.021	0.011
1969	0.015	0.008
1970	0.014	0.008
1971	0.017	0.008
1972	0.017	0.011
1973	0.011	0.007
1974	0.015	0.007
1975	0.018	0.010
1976	0.012	0.008
1977	0.013	0.007
1978	0.016	0.012
1979	0.022	0.006
1980	0.019	0.010
1981	0.016	0.011
1982	0.022	0.016
1983	0.018	0.013
1984	0.012	0.006
1985	0.016	0.010
1986	0.014	0.010
1987	0.021	0.011
1988	0.013	0.007
1989	0.016	0.006
1990	0.027	0.019
1991	0.022	0.016
1992	0.011	0.008
1993	0.010	0.006
1994	0.011	0.006
1995	0.014	0.008
1996	0.015	0.011
1997	0.015	0.009
1998	0.015	0.007
1999	0.030	0.016
2000	0.015	0.011
2001	0.017	0.008
2002	0.019	0.012
2003	0.015	0.007
2004	0.028	0.020
2005	0.013	0.010
2006	0.011	0.007
2007	0.026	0.016
2008	0.021	0.019
2009	0.020	0.011

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0303	0.0199
2	0.0283	0.0195
3	0.0272	0.0194

4	0.0265	0.0162
5	0.0225	0.0161
6	0.0217	0.0161
7	0.0217	0.0160
8	0.0213	0.0127
9	0.0213	0.0122
10	0.0213	0.0119
11	0.0212	0.0113
12	0.0198	0.0113
13	0.0197	0.0112
14	0.0195	0.0110
15	0.0193	0.0110
16	0.0186	0.0109
17	0.0183	0.0107
18	0.0178	0.0106
19	0.0175	0.0106
20	0.0169	0.0104
21	0.0166	0.0103
22	0.0162	0.0102
23	0.0161	0.0101
24	0.0159	0.0101
25	0.0159	0.0101
26	0.0159	0.0100
27	0.0157	0.0098
28	0.0155	0.0097
29	0.0151	0.0092
30	0.0150	0.0091
31	0.0150	0.0088
32	0.0148	0.0084
33	0.0147	0.0083
34	0.0146	0.0083
35	0.0142	0.0083
36	0.0141	0.0083
37	0.0141	0.0083
38	0.0138	0.0083
39	0.0138	0.0083
40	0.0134	0.0082
41	0.0130	0.0080
42	0.0130	0.0079
43	0.0129	0.0078
44	0.0129	0.0077
45	0.0129	0.0074
46	0.0127	0.0074
47	0.0127	0.0073
48	0.0127	0.0071
49	0.0124	0.0070
50	0.0123	0.0070
51	0.0120	0.0069
52	0.0119	0.0069
53	0.0117	0.0069
54	0.0115	0.0068
55	0.0114	0.0066
56	0.0114	0.0062
57	0.0110	0.0062
58	0.0108	0.0062
59	0.0108	0.0059
60	0.0106	0.0057
61	0.0099	0.0057

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0076	1801	917	50	Pass
0.0078	1636	848	51	Pass
0.0080	1472	786	53	Pass
0.0082	1343	709	52	Pass
0.0085	1226	518	42	Pass
0.0087	1101	485	44	Pass
0.0089	1002	438	43	Pass
0.0091	920	399	43	Pass
0.0093	852	367	43	Pass
0.0095	789	335	42	Pass
0.0097	725	304	41	Pass
0.0099	665	280	42	Pass
0.0101	610	256	41	Pass
0.0103	571	236	41	Pass
0.0105	533	220	41	Pass
0.0107	490	207	42	Pass
0.0110	451	182	40	Pass
0.0112	420	170	40	Pass
0.0114	389	156	40	Pass
0.0116	364	149	40	Pass
0.0118	339	140	41	Pass
0.0120	317	135	42	Pass
0.0122	296	128	43	Pass
0.0124	272	119	43	Pass
0.0126	256	113	44	Pass
0.0128	239	108	45	Pass
0.0130	222	107	48	Pass
0.0132	208	101	48	Pass
0.0135	193	94	48	Pass
0.0137	181	90	49	Pass
0.0139	171	85	49	Pass
0.0141	161	79	49	Pass
0.0143	148	73	49	Pass
0.0145	139	65	46	Pass
0.0147	135	59	43	Pass
0.0149	122	57	46	Pass
0.0151	113	55	48	Pass
0.0153	108	50	46	Pass
0.0155	105	46	43	Pass
0.0157	100	42	42	Pass
0.0160	92	38	41	Pass
0.0162	87	27	31	Pass
0.0164	84	20	23	Pass
0.0166	73	20	27	Pass
0.0168	71	20	28	Pass
0.0170	65	20	30	Pass
0.0172	63	20	31	Pass
0.0174	62	19	30	Pass
0.0176	58	18	31	Pass
0.0178	54	17	31	Pass
0.0180	54	16	29	Pass
0.0182	52	15	28	Pass
0.0184	50	15	30	Pass

0.0187	46	15	32	Pass
0.0189	45	14	31	Pass
0.0191	40	12	30	Pass
0.0193	38	12	31	Pass
0.0195	33	8	24	Pass
0.0197	32	3	9	Pass
0.0199	29	0	0	Pass
0.0201	28	0	0	Pass
0.0203	25	0	0	Pass
0.0205	22	0	0	Pass
0.0207	21	0	0	Pass
0.0209	20	0	0	Pass
0.0212	17	0	0	Pass
0.0214	13	0	0	Pass
0.0216	12	0	0	Pass
0.0218	9	0	0	Pass
0.0220	9	0	0	Pass
0.0222	9	0	0	Pass
0.0224	9	0	0	Pass
0.0226	8	0	0	Pass
0.0228	8	0	0	Pass
0.0230	8	0	0	Pass
0.0232	8	0	0	Pass
0.0234	8	0	0	Pass
0.0237	8	0	0	Pass
0.0239	8	0	0	Pass
0.0241	7	0	0	Pass
0.0243	7	0	0	Pass
0.0245	7	0	0	Pass
0.0247	7	0	0	Pass
0.0249	7	0	0	Pass
0.0251	7	0	0	Pass
0.0253	6	0	0	Pass
0.0255	6	0	0	Pass
0.0257	6	0	0	Pass
0.0259	6	0	0	Pass
0.0262	6	0	0	Pass
0.0264	6	0	0	Pass
0.0266	5	0	0	Pass
0.0268	5	0	0	Pass
0.0270	4	0	0	Pass
0.0272	3	0	0	Pass
0.0274	3	0	0	Pass
0.0276	2	0	0	Pass
0.0278	2	0	0	Pass
0.0280	2	0	0	Pass
0.0282	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
retention B POC	☐	5.85			☐	0.00			
Total Volume Infiltrated		5.85	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 = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

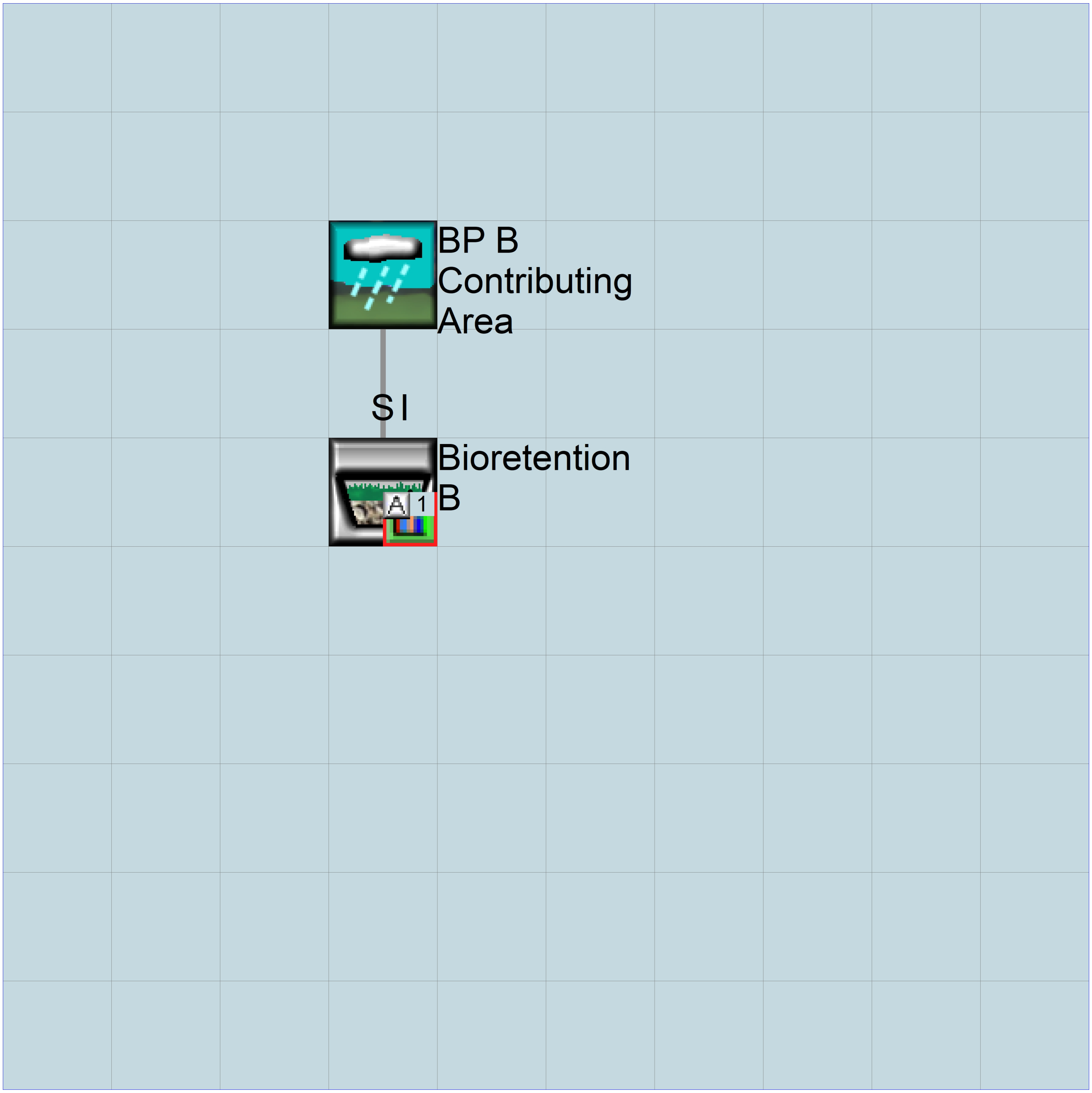
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION B.wdm
MESSU      25   PreBIORETENTION B.MES
           27   PreBIORETENTION B.L61
           28   PreBIORETENTION B.L62
           30   POCBIORETENTION B1.dat
END FILES

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

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

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

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

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

END IMPLND
```

```
SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP B Contributing Area***
IMPLND   4                        0.04     COPY   501     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



<-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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
```

```
END EXT SOURCES

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

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       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       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION B.wdm
MESSU      25   MitBIORETENTION B.MES
           27   MitBIORETENTION B.L61
           28   MitBIORETENTION B.L62
           30   POCBIORETENTION B1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      GENER        2
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface retention  B        MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
  END GEN-INFO
  *** Section PWATER***

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

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

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

  IWAT-STATE1
```

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

END IMPLND

SCHEMATIC
<-Source->                   <--Area-->     <-Target->   MBLK   ***
<Name>   #                   <-factor->     <Name>   #   Tbl#   ***
BP B Contributing Area***
IMPLND   4                         0.04     RCHRES   1      5

******Routing******
IMPLND   4                         0.04     COPY     1     15
RCHRES   1                            1     RCHRES   2      8
RCHRES   2                            1     COPY   501     16
RCHRES   1                            1     COPY   501     17
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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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     Surface retentio-011    2    1    1    1   28    0    1
    2     Bioretention  B         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
    2         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
    2         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  5  0  0  0       0  1  0  0  0       2  1  2  2  2
    2        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      0.01       0.0       0.0       0.0       0.0
    2             2      0.01       0.0       0.0       0.0       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  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           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
*** User-Defined Variable Quantity Lines
***                          addr
***                        <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL               4
  UVQUAN v2m2   GLOBAL     WORKSP  1         3
  UVQUAN vpo2   GLOBAL     WORKSP  2         3
  UVQUAN v2d2   GENER    2 K       1         3
*** User-Defined Target Variable Names
***                  addr or                        addr or
***                 <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  156.59
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   69    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.002686  0.000000  0.000000
  0.042088  0.002686  0.000045  0.000000
  0.084176  0.002686  0.000090  0.000000
  0.126264  0.002686  0.000136  0.000000
  0.168352  0.002686  0.000181  0.000000
  0.210440  0.002686  0.000226  0.000000
  0.252527  0.002686  0.000271  0.000000
  0.294615  0.002686  0.000317  0.000063
  0.336703  0.002686  0.000362  0.000108
  0.378791  0.002686  0.000408  0.000169
  0.420879  0.002686  0.000453  0.000247
  0.462967  0.002686  0.000498  0.000346
  0.505055  0.002686  0.000544  0.000465
  0.547143  0.002686  0.000589  0.000607
  0.589231  0.002686  0.000635  0.000772
  0.631319  0.002686  0.000680  0.000963
  0.673407  0.002686  0.000725  0.001180
  0.715495  0.002686  0.000771  0.001425
  0.757582  0.002686  0.000816  0.001699
  0.799670  0.002686  0.000862  0.002002
  0.841758  0.002686  0.000907  0.002336
  0.883846  0.002686  0.000952  0.002685
  0.925934  0.002686  0.000998  0.002702
```

0.968022	0.002686	0.001043	0.003101
1.010110	0.002686	0.001088	0.003451
1.052198	0.002686	0.001134	0.003533
1.094286	0.002686	0.001179	0.004000
1.136374	0.002686	0.001225	0.004502
1.178462	0.002686	0.001270	0.005041
1.220549	0.002686	0.001315	0.005617
1.262637	0.002686	0.001361	0.005990
1.304725	0.002686	0.001406	0.006230
1.346813	0.002686	0.001452	0.006882
1.388901	0.002686	0.001497	0.007574
1.430989	0.002686	0.001542	0.008306
1.473077	0.002686	0.001588	0.008330
1.515165	0.002686	0.001633	0.009078
1.557253	0.002686	0.001679	0.009891
1.599341	0.002686	0.001724	0.010747
1.641429	0.002686	0.001769	0.011046
1.683516	0.002686	0.001815	0.011644
1.725604	0.002686	0.001860	0.012583
1.767692	0.002686	0.001907	0.013563
1.809780	0.002686	0.001954	0.014583
1.851868	0.002686	0.002001	0.015635
1.893956	0.002686	0.002048	0.016250
1.936044	0.002686	0.002095	0.024375
1.978132	0.002686	0.002142	0.024375
2.020220	0.002686	0.002188	0.024375
2.062308	0.002686	0.002235	0.024375
2.104396	0.002686	0.002282	0.024375
2.146484	0.002686	0.002329	0.024375
2.188571	0.002686	0.002376	0.024375
2.230659	0.002686	0.002423	0.024375
2.272747	0.002686	0.002470	0.024375
2.314835	0.002686	0.002517	0.024375
2.356923	0.002686	0.002564	0.024375
2.399011	0.002686	0.002611	0.024375
2.441099	0.002686	0.002658	0.024375
2.483187	0.002686	0.002705	0.024375
2.525275	0.002686	0.002751	0.024375
2.567363	0.002686	0.002798	0.024375
2.609451	0.002686	0.002845	0.024375
2.651538	0.002686	0.002892	0.024375
2.693626	0.002686	0.002939	0.024375
2.735714	0.002686	0.002986	0.024375
2.777802	0.002686	0.003033	0.024375
2.819890	0.002686	0.003080	0.024375
2.830000	0.002686	0.003595	0.024375

END FTABLE 2
FTABLE 1
25 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.002686	0.000000	0.000000	0.000000		
0.042088	0.002686	0.000113	0.000000	0.019414		
0.084176	0.002686	0.000226	0.000000	0.019870		
0.126264	0.002686	0.000339	0.000000	0.020326		
0.168352	0.002686	0.000452	0.000000	0.020782		
0.210440	0.002686	0.000565	0.000000	0.021238		
0.252527	0.002686	0.000678	0.000000	0.021694		
0.294615	0.002686	0.000791	0.000000	0.022150		
0.336703	0.002686	0.000904	0.000000	0.022606		
0.378791	0.002686	0.001017	0.000000	0.023062		
0.420879	0.002686	0.001130	0.000000	0.023518		
0.462967	0.002686	0.001244	0.000000	0.023974		
0.505055	0.002686	0.001357	0.001271	0.024430		
0.547143	0.002686	0.001470	0.035627	0.024886		
0.589231	0.002686	0.001583	0.084946	0.025342		
0.631319	0.002686	0.001696	0.124401	0.025798		
0.673407	0.002686	0.001809	0.145730	0.026254		
0.715495	0.002686	0.001922	0.162456	0.026710		
0.757582	0.002686	0.002035	0.177613	0.027165		

```
    0.799670  0.002686  0.002148  0.191575  0.027621
    0.841758  0.002686  0.002261  0.204586  0.028077
    0.883846  0.002686  0.002374  0.216818  0.028533
    0.925934  0.002686  0.002487  0.228396  0.028989
    0.968022  0.002686  0.002600  0.239414  0.029445
    1.000000  0.002686  0.002686  0.249948  0.029792
    END FTABLE  1
  END FTABLES

  EXT SOURCES
  <-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
  <Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
  WDM      2 PREC      ENGL    1              PERLND   1 999 EXTNL  PREC
  WDM      2 PREC      ENGL    1              IMPLND   1 999 EXTNL  PREC
  WDM      1 EVAP      ENGL    0.76           PERLND   1 999 EXTNL  PETINP
  WDM      1 EVAP      ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
  WDM      2 PREC      ENGL    1              RCHRES   1     EXTNL  PREC
  WDM      1 EVAP      ENGL    0.5            RCHRES   1     EXTNL  POTEV
  WDM      1 EVAP      ENGL    0.76           RCHRES   2     EXTNL  POTEV

  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   2 HYDR   RO      1 1        1      WDM   1000 FLOW     ENGL      REPL
  RCHRES   2 HYDR   STAGE   1 1        1      WDM   1001 STAG     ENGL      REPL
  RCHRES   1 HYDR   STAGE   1 1        1      WDM   1002 STAG     ENGL      REPL
  RCHRES   1 HYDR   O       1 1        1      WDM   1003 FLOW     ENGL      REPL
  COPY     1 OUTPUT MEAN    1 1     48.4      WDM    701 FLOW     ENGL      REPL
  COPY   501 OUTPUT MEAN    1 1     48.4      WDM    801 FLOW     ENGL      REPL
  END EXT TARGETS

  MASS-LINK
  <Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
  <Name>            <Name> # #<-factor->     <Name>                <Name> # #***
    MASS-LINK        5
  IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
    END MASS-LINK    5

    MASS-LINK        8
  RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
    END MASS-LINK    8

    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

    MASS-LINK       17
  RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
    END MASS-LINK   17


  END MASS-LINK

  END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: BIORETENTION C

Site Name:	
Site Address:	
City:	
Report Date:	8/17/2023
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

BP C Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.01
Impervious Total	0.01
Basin Total	0.01

Mitigated Land Use

BP C Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.01
Impervious Total	0.01
Basin Total	0.01

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention C

Bottom Length:	13.25 ft.
Bottom Width:	3.00 ft.
Material thickness of first layer:	0.25
Material type for first layer:	Sand
Material thickness of second layer:	1.5
Material type for second layer:	SMMWW
Material thickness of third layer:	1.08
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.33
Orifice Diameter (in.):	3.9
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	1.576
Total Outflow (ac-ft.):	1.576
Percent Through Underdrain:	99.99

Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 4 in.
Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0009	0.0000	0.0000	0.0000
0.0421	0.0009	0.0000	0.0000	0.0000
0.0842	0.0009	0.0000	0.0000	0.0000
0.1263	0.0009	0.0000	0.0000	0.0000
0.1684	0.0009	0.0001	0.0000	0.0000
0.2104	0.0009	0.0001	0.0000	0.0000
0.2525	0.0009	0.0001	0.0000	0.0000
0.2946	0.0009	0.0001	0.0000	0.0000
0.3367	0.0009	0.0001	0.0000	0.0000
0.3788	0.0009	0.0001	0.0001	0.0000
0.4209	0.0009	0.0002	0.0001	0.0000
0.4630	0.0009	0.0002	0.0001	0.0000
0.5051	0.0009	0.0002	0.0002	0.0000
0.5471	0.0009	0.0002	0.0002	0.0000
0.5892	0.0009	0.0002	0.0003	0.0000
0.6313	0.0009	0.0002	0.0003	0.0000
0.6734	0.0009	0.0002	0.0004	0.0000
0.7155	0.0009	0.0003	0.0005	0.0000
0.7576	0.0009	0.0003	0.0006	0.0000
0.7997	0.0009	0.0003	0.0007	0.0000
0.8418	0.0009	0.0003	0.0008	0.0000
0.8838	0.0009	0.0003	0.0009	0.0000
0.9259	0.0009	0.0003	0.0009	0.0000
0.9680	0.0009	0.0004	0.0011	0.0000
1.0101	0.0009	0.0004	0.0012	0.0000
1.0522	0.0009	0.0004	0.0012	0.0000
1.0943	0.0009	0.0004	0.0014	0.0000
1.1364	0.0009	0.0004	0.0015	0.0000
1.1785	0.0009	0.0004	0.0017	0.0000

1.2205	0.0009	0.0004	0.0019	0.0000
1.2626	0.0009	0.0005	0.0020	0.0000
1.3047	0.0009	0.0005	0.0021	0.0000
1.3468	0.0009	0.0005	0.0023	0.0000
1.3889	0.0009	0.0005	0.0026	0.0000
1.4310	0.0009	0.0005	0.0028	0.0000
1.4731	0.0009	0.0005	0.0028	0.0000
1.5152	0.0009	0.0006	0.0031	0.0000
1.5573	0.0009	0.0006	0.0034	0.0000
1.5993	0.0009	0.0006	0.0037	0.0000
1.6414	0.0009	0.0006	0.0038	0.0000
1.6835	0.0009	0.0006	0.0040	0.0000
1.7256	0.0009	0.0006	0.0043	0.0000
1.7677	0.0009	0.0006	0.0046	0.0000
1.8098	0.0009	0.0007	0.0050	0.0000
1.8519	0.0009	0.0007	0.0053	0.0000
1.8940	0.0009	0.0007	0.0055	0.0000
1.9360	0.0009	0.0007	0.0083	0.0000
1.9781	0.0009	0.0007	0.0083	0.0000
2.0202	0.0009	0.0007	0.0083	0.0000
2.0623	0.0009	0.0008	0.0083	0.0000
2.1044	0.0009	0.0008	0.0083	0.0000
2.1465	0.0009	0.0008	0.0083	0.0000
2.1886	0.0009	0.0008	0.0083	0.0000
2.2307	0.0009	0.0008	0.0083	0.0000
2.2727	0.0009	0.0008	0.0083	0.0000
2.3148	0.0009	0.0009	0.0083	0.0000
2.3569	0.0009	0.0009	0.0083	0.0000
2.3990	0.0009	0.0009	0.0083	0.0000
2.4411	0.0009	0.0009	0.0083	0.0000
2.4832	0.0009	0.0009	0.0083	0.0000
2.5253	0.0009	0.0009	0.0083	0.0000
2.5674	0.0009	0.0010	0.0083	0.0000
2.6095	0.0009	0.0010	0.0083	0.0000
2.6515	0.0009	0.0010	0.0083	0.0000
2.6936	0.0009	0.0010	0.0083	0.0000
2.7357	0.0009	0.0010	0.0083	0.0000
2.7778	0.0009	0.0010	0.0083	0.0000
2.8199	0.0009	0.0010	0.0083	0.0000
2.8300	0.0009	0.0011	0.0083	0.0000

Bioretention Hydraulic Table

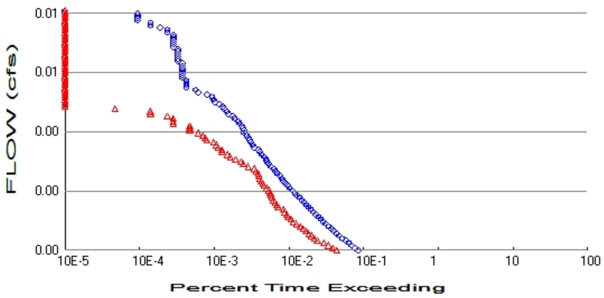
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.8300	0.000913	0.001050	0.0000	0.0066	0.0000
2.8721	0.000913	0.001089	0.0000	0.0066	0.0000
2.9142	0.000913	0.001127	0.0000	0.0068	0.0000
2.9563	0.000913	0.001165	0.0000	0.0069	0.0000
2.9984	0.000913	0.001204	0.0000	0.0071	0.0000
3.0404	0.000913	0.001242	0.0000	0.0072	0.0000
3.0825	0.000913	0.001281	0.0000	0.0074	0.0000
3.1246	0.000913	0.001319	0.0000	0.0075	0.0000
3.1667	0.000913	0.001357	0.0000	0.0077	0.0000
3.2088	0.000913	0.001396	0.0000	0.0078	0.0000
3.2509	0.000913	0.001434	0.0000	0.0080	0.0000
3.2930	0.000913	0.001473	0.0000	0.0081	0.0000
3.3351	0.000913	0.001511	0.0013	0.0083	0.0000
3.3771	0.000913	0.001549	0.0356	0.0085	0.0000
3.4192	0.000913	0.001588	0.0849	0.0086	0.0000

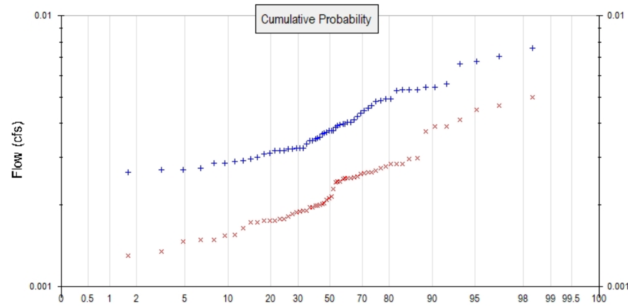
3.4613	0.000913	0.001626	0.1244	0.0088	0.0000
3.5034	0.000913	0.001665	0.1457	0.0089	0.0000
3.5455	0.000913	0.001703	0.1625	0.0091	0.0000
3.5876	0.000913	0.001741	0.1776	0.0092	0.0000
3.6297	0.000913	0.001780	0.1916	0.0094	0.0000
3.6718	0.000913	0.001818	0.2046	0.0095	0.0000
3.7138	0.000913	0.001857	0.2168	0.0097	0.0000
3.7559	0.000913	0.001895	0.2284	0.0098	0.0000
3.7980	0.000913	0.001934	0.2394	0.0100	0.0000
3.8300	0.000913	0.001963	0.2499	0.0101	0.0000

Surface retention C

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	0
Total Impervious Area:	0.01

Mitigated Landuse Totals for POC #1

Total Pervious Area:	0
Total Impervious Area:	0.01

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.003813
5 year	0.004816
10 year	0.005497
25 year	0.006382
50 year	0.007058
100 year	0.007751

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.002201
5 year	0.002912
10 year	0.003413
25 year	0.004081
50 year	0.004605
100 year	0.005152

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.005	0.003
1950	0.005	0.003
1951	0.003	0.002
1952	0.003	0.002
1953	0.003	0.002
1954	0.003	0.002
1955	0.004	0.002
1956	0.003	0.002
1957	0.004	0.003
1958	0.003	0.002

1959	0.003	0.002
1960	0.003	0.002
1961	0.003	0.002
1962	0.003	0.001
1963	0.003	0.002
1964	0.003	0.002
1965	0.004	0.002
1966	0.003	0.002
1967	0.005	0.003
1968	0.005	0.003
1969	0.004	0.002
1970	0.004	0.002
1971	0.004	0.002
1972	0.004	0.003
1973	0.003	0.002
1974	0.004	0.002
1975	0.004	0.002
1976	0.003	0.002
1977	0.003	0.002
1978	0.004	0.003
1979	0.005	0.001
1980	0.005	0.003
1981	0.004	0.003
1982	0.006	0.004
1983	0.005	0.003
1984	0.003	0.001
1985	0.004	0.002
1986	0.003	0.003
1987	0.005	0.003
1988	0.003	0.002
1989	0.004	0.001
1990	0.007	0.004
1991	0.005	0.004
1992	0.003	0.002
1993	0.002	0.001
1994	0.003	0.001
1995	0.004	0.002
1996	0.004	0.003
1997	0.004	0.002
1998	0.004	0.002
1999	0.008	0.004
2000	0.004	0.003
2001	0.004	0.002
2002	0.005	0.003
2003	0.004	0.002
2004	0.007	0.005
2005	0.003	0.003
2006	0.003	0.002
2007	0.007	0.004
2008	0.005	0.005
2009	0.005	0.003

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0076	0.0050
2	0.0071	0.0047
3	0.0068	0.0045

4	0.0066	0.0041
5	0.0056	0.0039
6	0.0054	0.0039
7	0.0054	0.0037
8	0.0053	0.0030
9	0.0053	0.0030
10	0.0053	0.0028
11	0.0053	0.0028
12	0.0049	0.0028
13	0.0049	0.0028
14	0.0049	0.0027
15	0.0048	0.0027
16	0.0047	0.0026
17	0.0046	0.0026
18	0.0045	0.0026
19	0.0044	0.0026
20	0.0042	0.0025
21	0.0041	0.0025
22	0.0040	0.0025
23	0.0040	0.0025
24	0.0040	0.0025
25	0.0040	0.0025
26	0.0040	0.0024
27	0.0039	0.0024
28	0.0039	0.0024
29	0.0038	0.0023
30	0.0038	0.0022
31	0.0038	0.0021
32	0.0037	0.0021
33	0.0037	0.0020
34	0.0037	0.0020
35	0.0036	0.0020
36	0.0035	0.0020
37	0.0035	0.0020
38	0.0035	0.0020
39	0.0034	0.0020
40	0.0034	0.0019
41	0.0032	0.0019
42	0.0032	0.0019
43	0.0032	0.0019
44	0.0032	0.0019
45	0.0032	0.0018
46	0.0032	0.0018
47	0.0032	0.0018
48	0.0032	0.0018
49	0.0031	0.0018
50	0.0031	0.0017
51	0.0030	0.0017
52	0.0030	0.0017
53	0.0029	0.0016
54	0.0029	0.0015
55	0.0029	0.0015
56	0.0029	0.0015
57	0.0027	0.0015
58	0.0027	0.0015
59	0.0027	0.0013
60	0.0026	0.0013
61	0.0025	0.0013

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0019	1802	937	51	Pass
0.0020	1637	820	50	Pass
0.0020	1474	723	49	Pass
0.0021	1343	622	46	Pass
0.0021	1227	511	41	Pass
0.0022	1102	467	42	Pass
0.0022	1003	434	43	Pass
0.0023	920	392	42	Pass
0.0023	853	358	41	Pass
0.0024	791	332	41	Pass
0.0024	726	301	41	Pass
0.0025	665	270	40	Pass
0.0025	610	244	40	Pass
0.0026	571	227	39	Pass
0.0026	533	206	38	Pass
0.0027	488	199	40	Pass
0.0027	450	186	41	Pass
0.0028	419	181	43	Pass
0.0028	389	153	39	Pass
0.0029	364	146	40	Pass
0.0029	338	140	41	Pass
0.0030	316	133	42	Pass
0.0031	295	126	42	Pass
0.0031	271	121	44	Pass
0.0032	256	120	46	Pass
0.0032	238	115	48	Pass
0.0033	221	107	48	Pass
0.0033	206	99	48	Pass
0.0034	193	95	49	Pass
0.0034	181	90	49	Pass
0.0035	171	87	50	Pass
0.0035	161	84	52	Pass
0.0036	148	83	56	Pass
0.0036	139	78	56	Pass
0.0037	135	74	54	Pass
0.0037	122	61	50	Pass
0.0038	113	52	46	Pass
0.0038	108	49	45	Pass
0.0039	105	41	39	Pass
0.0039	100	35	35	Pass
0.0040	92	32	34	Pass
0.0040	87	27	31	Pass
0.0041	84	27	32	Pass
0.0041	73	24	32	Pass
0.0042	71	23	32	Pass
0.0042	65	21	32	Pass
0.0043	63	17	26	Pass
0.0044	62	16	25	Pass
0.0044	58	15	25	Pass
0.0045	54	13	24	Pass
0.0045	54	10	18	Pass
0.0046	52	10	19	Pass
0.0046	50	10	20	Pass

0.0047	46	6	13	Pass
0.0047	45	6	13	Pass
0.0048	40	6	15	Pass
0.0048	38	5	13	Pass
0.0049	33	3	9	Pass
0.0049	32	3	9	Pass
0.0050	29	1	3	Pass
0.0050	28	0	0	Pass
0.0051	25	0	0	Pass
0.0051	22	0	0	Pass
0.0052	21	0	0	Pass
0.0052	20	0	0	Pass
0.0053	17	0	0	Pass
0.0053	13	0	0	Pass
0.0054	12	0	0	Pass
0.0054	9	0	0	Pass
0.0055	9	0	0	Pass
0.0055	9	0	0	Pass
0.0056	9	0	0	Pass
0.0057	8	0	0	Pass
0.0057	8	0	0	Pass
0.0058	8	0	0	Pass
0.0058	8	0	0	Pass
0.0059	8	0	0	Pass
0.0059	8	0	0	Pass
0.0060	8	0	0	Pass
0.0060	7	0	0	Pass
0.0061	7	0	0	Pass
0.0061	7	0	0	Pass
0.0062	7	0	0	Pass
0.0062	7	0	0	Pass
0.0063	7	0	0	Pass
0.0063	6	0	0	Pass
0.0064	6	0	0	Pass
0.0064	6	0	0	Pass
0.0065	6	0	0	Pass
0.0065	6	0	0	Pass
0.0066	6	0	0	Pass
0.0066	5	0	0	Pass
0.0067	5	0	0	Pass
0.0067	4	0	0	Pass
0.0068	3	0	0	Pass
0.0068	3	0	0	Pass
0.0069	2	0	0	Pass
0.0070	2	0	0	Pass
0.0070	2	0	0	Pass
0.0071	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
retention C POC	☐	1.43			☐	0.00			
Total Volume Infiltrated		1.43	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 = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

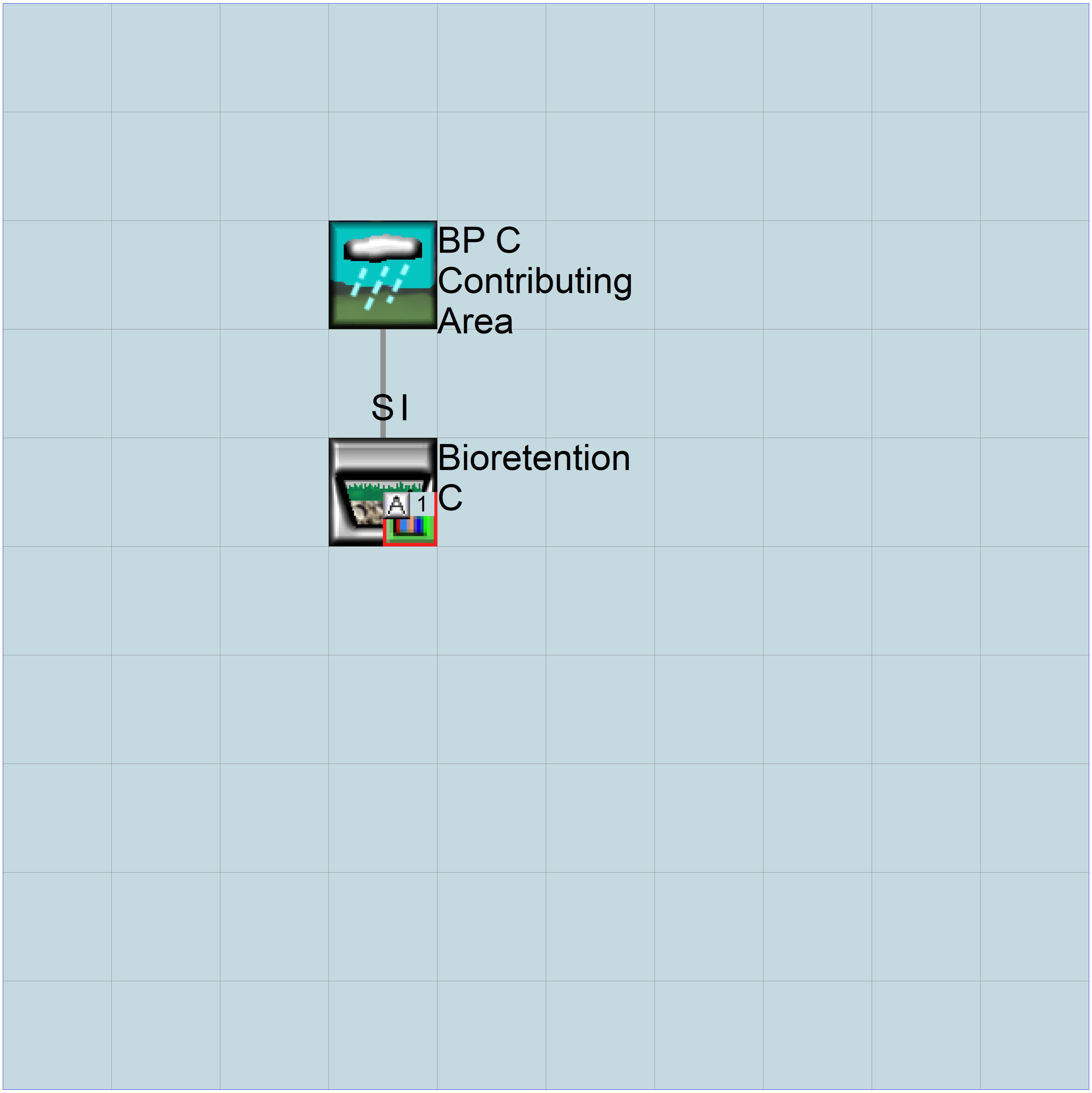
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION C.wdm
MESSU      25   PreBIORETENTION C.MES
           27   PreBIORETENTION C.L61
           28   PreBIORETENTION C.L62
           30   POCBIORETENTION C1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        BP C Contributing Area      MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                             in  out           ***
  END GEN-INFO
  *** Section PWATER***

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

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

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

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

END IMPLND
```

```
SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP C Contributing Area***
IMPLND   4                        0.01     COPY   501     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



<-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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
```

```
END EXT SOURCES

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

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       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       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION C.wdm
MESSU      25   MitBIORETENTION C.MES
           27   MitBIORETENTION C.L61
           28   MitBIORETENTION C.L62
           30   POCBIORETENTION C1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      GENER        2
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface retention  C        MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
  END GEN-INFO
  *** Section PWATER***

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

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

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

  IWAT-STATE1
```

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP C Contributing Area***
IMPLND   4                        0.01     RCHRES   1      5

******Routing******
IMPLND   4                        0.01     COPY     1     15
RCHRES   1                           1     RCHRES   2      8
RCHRES   2                           1     COPY   501     16
RCHRES   1                           1     COPY   501     17
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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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     Surface retentio-011    2    1    1    1   28    0    1
    2     Bioretention  C         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
    2         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
    2         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  5  0  0  0       0  1  0  0  0       2  1  2  2  2
    2        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      0.01       0.0       0.0       0.0       0.0
    2             2      0.01       0.0       0.0       0.0       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  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           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
*** User-Defined Variable Quantity Lines
***                          addr
***                        <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                  addr or                      addr or
***                 <------>                     <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  53.2
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   69    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000913  0.000000  0.000000
  0.042088  0.000913  0.000015  0.000000
  0.084176  0.000913  0.000031  0.000000
  0.126264  0.000913  0.000046  0.000000
  0.168352  0.000913  0.000061  0.000000
  0.210440  0.000913  0.000077  0.000000
  0.252527  0.000913  0.000092  0.000000
  0.294615  0.000913  0.000108  0.000021
  0.336703  0.000913  0.000123  0.000037
  0.378791  0.000913  0.000138  0.000057
  0.420879  0.000913  0.000154  0.000084
  0.462967  0.000913  0.000169  0.000117
  0.505055  0.000913  0.000185  0.000158
  0.547143  0.000913  0.000200  0.000206
  0.589231  0.000913  0.000216  0.000262
  0.631319  0.000913  0.000231  0.000327
  0.673407  0.000913  0.000246  0.000401
  0.715495  0.000913  0.000262  0.000484
  0.757582  0.000913  0.000277  0.000577
  0.799670  0.000913  0.000293  0.000680
  0.841758  0.000913  0.000308  0.000794
  0.883846  0.000913  0.000324  0.000912
  0.925934  0.000913  0.000339  0.000918
```

0.968022	0.000913	0.000354	0.001053
1.010110	0.000913	0.000370	0.001172
1.052198	0.000913	0.000385	0.001200
1.094286	0.000913	0.000401	0.001359
1.136374	0.000913	0.000416	0.001530
1.178462	0.000913	0.000431	0.001713
1.220549	0.000913	0.000447	0.001908
1.262637	0.000913	0.000462	0.002035
1.304725	0.000913	0.000478	0.002117
1.346813	0.000913	0.000493	0.002338
1.388901	0.000913	0.000509	0.002573
1.430989	0.000913	0.000524	0.002822
1.473077	0.000913	0.000539	0.002830
1.515165	0.000913	0.000555	0.003084
1.557253	0.000913	0.000570	0.003361
1.599341	0.000913	0.000586	0.003651
1.641429	0.000913	0.000601	0.003753
1.683516	0.000913	0.000617	0.003956
1.725604	0.000913	0.000632	0.004275
1.767692	0.000913	0.000648	0.004608
1.809780	0.000913	0.000664	0.004955
1.851868	0.000913	0.000680	0.005312
1.893956	0.000913	0.000696	0.005521
1.936044	0.000913	0.000712	0.008281
1.978132	0.000913	0.000728	0.008281
2.020220	0.000913	0.000744	0.008281
2.062308	0.000913	0.000759	0.008281
2.104396	0.000913	0.000775	0.008281
2.146484	0.000913	0.000791	0.008281
2.188571	0.000913	0.000807	0.008281
2.230659	0.000913	0.000823	0.008281
2.272747	0.000913	0.000839	0.008281
2.314835	0.000913	0.000855	0.008281
2.356923	0.000913	0.000871	0.008281
2.399011	0.000913	0.000887	0.008281
2.441099	0.000913	0.000903	0.008281
2.483187	0.000913	0.000919	0.008281
2.525275	0.000913	0.000935	0.008281
2.567363	0.000913	0.000951	0.008281
2.609451	0.000913	0.000967	0.008281
2.651538	0.000913	0.000983	0.008281
2.693626	0.000913	0.000999	0.008281
2.735714	0.000913	0.001014	0.008281
2.777802	0.000913	0.001030	0.008281
2.819890	0.000913	0.001046	0.008281
2.830000	0.000913	0.001221	0.008281

END FTABLE 2
FTABLE 1
25 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.000913	0.000000	0.000000	0.000000		
0.042088	0.000913	0.000038	0.000000	0.006596		
0.084176	0.000913	0.000077	0.000000	0.006751		
0.126264	0.000913	0.000115	0.000000	0.006906		
0.168352	0.000913	0.000154	0.000000	0.007061		
0.210440	0.000913	0.000192	0.000000	0.007216		
0.252527	0.000913	0.000230	0.000000	0.007370		
0.294615	0.000913	0.000269	0.000000	0.007525		
0.336703	0.000913	0.000307	0.000000	0.007680		
0.378791	0.000913	0.000346	0.000000	0.007835		
0.420879	0.000913	0.000384	0.000000	0.007990		
0.462967	0.000913	0.000422	0.000000	0.008145		
0.505055	0.000913	0.000461	0.001271	0.008300		
0.547143	0.000913	0.000499	0.035627	0.008455		
0.589231	0.000913	0.000538	0.084946	0.008610		
0.631319	0.000913	0.000576	0.124401	0.008765		
0.673407	0.000913	0.000615	0.145730	0.008919		
0.715495	0.000913	0.000653	0.162456	0.009074		
0.757582	0.000913	0.000691	0.177613	0.009229		

```
  0.799670  0.000913  0.000730  0.191575  0.009384
  0.841758  0.000913  0.000768  0.204586  0.009539
  0.883846  0.000913  0.000807  0.216818  0.009694
  0.925934  0.000913  0.000845  0.228396  0.009849
  0.968022  0.000913  0.000883  0.239414  0.010004
  1.000000  0.000913  0.000913  0.249948  0.010122
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1               PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1               IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76            IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1               RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5             RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76            RCHRES   2     EXTNL  POTEV

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   2 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1002 STAG     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1003 FLOW     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

  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

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: BIORETENTION D

Site Name:	
Site Address:	
City:	
Report Date:	8/17/2023
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

BP D Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.035
Impervious Total	0.035
Basin Total	0.035

Mitigated Land Use

BP D Contributing Area

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.035
Impervious Total	0.035
Basin Total	0.035

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention D

Bottom Length:	13.37 ft.
Bottom Width:	5.92 ft.
Material thickness of first layer:	0.25
Material type for first layer:	Sand
Material thickness of second layer:	1.5
Material type for second layer:	SMMWW
Material thickness of third layer:	1.08
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.33
Orifice Diameter (in.):	3.9
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	5.569
Total Outflow (ac-ft.):	5.569
Percent Through Underdrain:	100

Discharge Structure

Riser Height: 0.5 ft.

Riser Diameter: 4 in.

Element Flows To:

Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0018	0.0000	0.0000	0.0000
0.0421	0.0018	0.0000	0.0000	0.0000
0.0842	0.0018	0.0001	0.0000	0.0000
0.1263	0.0018	0.0001	0.0000	0.0000
0.1684	0.0018	0.0001	0.0000	0.0000
0.2104	0.0018	0.0002	0.0000	0.0000
0.2525	0.0018	0.0002	0.0000	0.0000
0.2946	0.0018	0.0002	0.0000	0.0000
0.3367	0.0018	0.0002	0.0001	0.0000
0.3788	0.0018	0.0003	0.0001	0.0000
0.4209	0.0018	0.0003	0.0002	0.0000
0.4630	0.0018	0.0003	0.0002	0.0000
0.5051	0.0018	0.0004	0.0003	0.0000
0.5471	0.0018	0.0004	0.0004	0.0000
0.5892	0.0018	0.0004	0.0005	0.0000
0.6313	0.0018	0.0005	0.0007	0.0000
0.6734	0.0018	0.0005	0.0008	0.0000
0.7155	0.0018	0.0005	0.0010	0.0000
0.7576	0.0018	0.0006	0.0011	0.0000
0.7997	0.0018	0.0006	0.0014	0.0000
0.8418	0.0018	0.0006	0.0016	0.0000
0.8838	0.0018	0.0006	0.0018	0.0000
0.9259	0.0018	0.0007	0.0018	0.0000
0.9680	0.0018	0.0007	0.0021	0.0000
1.0101	0.0018	0.0007	0.0023	0.0000
1.0522	0.0018	0.0008	0.0024	0.0000
1.0943	0.0018	0.0008	0.0027	0.0000
1.1364	0.0018	0.0008	0.0030	0.0000
1.1785	0.0018	0.0009	0.0034	0.0000

1.2205	0.0018	0.0009	0.0038	0.0000
1.2626	0.0018	0.0009	0.0041	0.0000
1.3047	0.0018	0.0010	0.0042	0.0000
1.3468	0.0018	0.0010	0.0047	0.0000
1.3889	0.0018	0.0010	0.0051	0.0000
1.4310	0.0018	0.0010	0.0056	0.0000
1.4731	0.0018	0.0011	0.0056	0.0000
1.5152	0.0018	0.0011	0.0061	0.0000
1.5573	0.0018	0.0011	0.0067	0.0000
1.5993	0.0018	0.0012	0.0073	0.0000
1.6414	0.0018	0.0012	0.0075	0.0000
1.6835	0.0018	0.0012	0.0079	0.0000
1.7256	0.0018	0.0013	0.0085	0.0000
1.7677	0.0018	0.0013	0.0092	0.0000
1.8098	0.0018	0.0013	0.0099	0.0000
1.8519	0.0018	0.0014	0.0106	0.0000
1.8940	0.0018	0.0014	0.0110	0.0000
1.9360	0.0018	0.0014	0.0165	0.0000
1.9781	0.0018	0.0014	0.0165	0.0000
2.0202	0.0018	0.0015	0.0165	0.0000
2.0623	0.0018	0.0015	0.0165	0.0000
2.1044	0.0018	0.0015	0.0165	0.0000
2.1465	0.0018	0.0016	0.0165	0.0000
2.1886	0.0018	0.0016	0.0165	0.0000
2.2307	0.0018	0.0016	0.0165	0.0000
2.2727	0.0018	0.0017	0.0165	0.0000
2.3148	0.0018	0.0017	0.0165	0.0000
2.3569	0.0018	0.0017	0.0165	0.0000
2.3990	0.0018	0.0018	0.0165	0.0000
2.4411	0.0018	0.0018	0.0165	0.0000
2.4832	0.0018	0.0018	0.0165	0.0000
2.5253	0.0018	0.0019	0.0165	0.0000
2.5674	0.0018	0.0019	0.0165	0.0000
2.6095	0.0018	0.0019	0.0165	0.0000
2.6515	0.0018	0.0020	0.0165	0.0000
2.6936	0.0018	0.0020	0.0165	0.0000
2.7357	0.0018	0.0020	0.0165	0.0000
2.7778	0.0018	0.0021	0.0165	0.0000
2.8199	0.0018	0.0021	0.0165	0.0000
2.8300	0.0018	0.0021	0.0165	0.0000

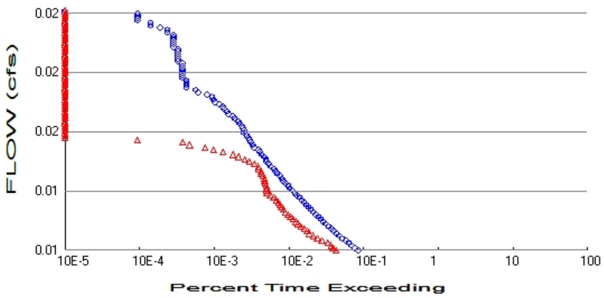
Bioretention Hydraulic Table

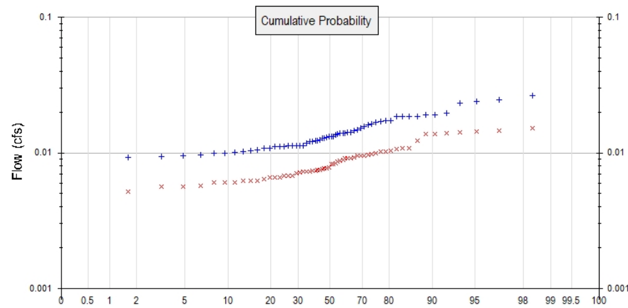
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.8300	0.001817	0.002091	0.0000	0.0131	0.0000
2.8721	0.001817	0.002168	0.0000	0.0131	0.0000
2.9142	0.001817	0.002244	0.0000	0.0134	0.0000
2.9563	0.001817	0.002321	0.0000	0.0138	0.0000
2.9984	0.001817	0.002397	0.0000	0.0141	0.0000
3.0404	0.001817	0.002474	0.0000	0.0144	0.0000
3.0825	0.001817	0.002550	0.0000	0.0147	0.0000
3.1246	0.001817	0.002626	0.0000	0.0150	0.0000
3.1667	0.001817	0.002703	0.0000	0.0153	0.0000
3.2088	0.001817	0.002779	0.0000	0.0156	0.0000
3.2509	0.001817	0.002856	0.0000	0.0159	0.0000
3.2930	0.001817	0.002932	0.0000	0.0162	0.0000
3.3351	0.001817	0.003009	0.0013	0.0165	0.0000
3.3771	0.001817	0.003085	0.0356	0.0168	0.0000
3.4192	0.001817	0.003162	0.0849	0.0171	0.0000

3.4613	0.001817	0.003238	0.1244	0.0175	0.0000
3.5034	0.001817	0.003315	0.1457	0.0178	0.0000
3.5455	0.001817	0.003391	0.1625	0.0181	0.0000
3.5876	0.001817	0.003468	0.1776	0.0184	0.0000
3.6297	0.001817	0.003544	0.1916	0.0187	0.0000
3.6718	0.001817	0.003621	0.2046	0.0190	0.0000
3.7138	0.001817	0.003697	0.2168	0.0193	0.0000
3.7559	0.001817	0.003774	0.2284	0.0196	0.0000
3.7980	0.001817	0.003850	0.2394	0.0199	0.0000
3.8300	0.001817	0.003908	0.2499	0.0202	0.0000

Surface retention D

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.035

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.035

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.013344
5 year	0.016855
10 year	0.019241
25 year	0.022335
50 year	0.024704
100 year	0.02713

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.00819
5 year	0.010474
10 year	0.012008
25 year	0.01398
50 year	0.015477
100 year	0.017

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

Year	Predeveloped	Mitigated
1949	0.017	0.009
1950	0.019	0.011
1951	0.011	0.009
1952	0.010	0.007
1953	0.010	0.007
1954	0.011	0.007
1955	0.012	0.008
1956	0.012	0.008
1957	0.014	0.010
1958	0.011	0.006

1959	0.011	0.006
1960	0.011	0.008
1961	0.012	0.008
1962	0.010	0.006
1963	0.011	0.006
1964	0.011	0.008
1965	0.014	0.007
1966	0.009	0.007
1967	0.016	0.009
1968	0.019	0.010
1969	0.013	0.008
1970	0.012	0.007
1971	0.015	0.008
1972	0.015	0.010
1973	0.009	0.006
1974	0.014	0.007
1975	0.016	0.009
1976	0.010	0.007
1977	0.011	0.007
1978	0.014	0.011
1979	0.019	0.006
1980	0.017	0.009
1981	0.014	0.010
1982	0.020	0.014
1983	0.016	0.012
1984	0.010	0.006
1985	0.014	0.009
1986	0.012	0.009
1987	0.019	0.010
1988	0.011	0.007
1989	0.014	0.005
1990	0.024	0.015
1991	0.019	0.014
1992	0.010	0.007
1993	0.009	0.005
1994	0.009	0.006
1995	0.012	0.007
1996	0.013	0.009
1997	0.013	0.008
1998	0.013	0.006
1999	0.026	0.014
2000	0.013	0.010
2001	0.014	0.007
2002	0.017	0.011
2003	0.013	0.006
2004	0.025	0.015
2005	0.011	0.009
2006	0.010	0.007
2007	0.023	0.014
2008	0.019	0.014
2009	0.017	0.010

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0265	0.0152
2	0.0248	0.0146
3	0.0238	0.0143

4	0.0232	0.0142
5	0.0197	0.0140
6	0.0190	0.0138
7	0.0190	0.0137
8	0.0187	0.0123
9	0.0187	0.0109
10	0.0186	0.0108
11	0.0185	0.0107
12	0.0173	0.0104
13	0.0172	0.0103
14	0.0170	0.0102
15	0.0169	0.0099
16	0.0163	0.0098
17	0.0160	0.0096
18	0.0156	0.0096
19	0.0153	0.0095
20	0.0148	0.0095
21	0.0145	0.0093
22	0.0141	0.0091
23	0.0141	0.0091
24	0.0139	0.0091
25	0.0139	0.0089
26	0.0139	0.0087
27	0.0137	0.0086
28	0.0135	0.0084
29	0.0132	0.0083
30	0.0132	0.0083
31	0.0131	0.0078
32	0.0130	0.0077
33	0.0129	0.0077
34	0.0128	0.0075
35	0.0124	0.0075
36	0.0124	0.0075
37	0.0123	0.0074
38	0.0121	0.0073
39	0.0121	0.0073
40	0.0117	0.0073
41	0.0114	0.0073
42	0.0113	0.0071
43	0.0113	0.0071
44	0.0113	0.0068
45	0.0113	0.0068
46	0.0111	0.0067
47	0.0111	0.0065
48	0.0111	0.0065
49	0.0109	0.0065
50	0.0108	0.0064
51	0.0105	0.0063
52	0.0104	0.0062
53	0.0102	0.0062
54	0.0101	0.0061
55	0.0100	0.0061
56	0.0100	0.0060
57	0.0096	0.0057
58	0.0095	0.0056
59	0.0094	0.0056
60	0.0093	0.0052
61	0.0087	0.0049

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0067	1800	915	50	Pass
0.0069	1636	835	51	Pass
0.0070	1472	785	53	Pass
0.0072	1343	711	52	Pass
0.0074	1226	592	48	Pass
0.0076	1102	512	46	Pass
0.0078	1002	451	45	Pass
0.0079	920	405	44	Pass
0.0081	852	378	44	Pass
0.0083	789	344	43	Pass
0.0085	725	309	42	Pass
0.0087	665	284	42	Pass
0.0089	610	262	42	Pass
0.0090	571	244	42	Pass
0.0092	532	225	42	Pass
0.0094	488	207	42	Pass
0.0096	450	191	42	Pass
0.0098	419	181	43	Pass
0.0100	389	170	43	Pass
0.0101	364	162	44	Pass
0.0103	339	155	45	Pass
0.0105	317	144	45	Pass
0.0107	296	133	44	Pass
0.0109	271	120	44	Pass
0.0110	256	108	42	Pass
0.0112	238	108	45	Pass
0.0114	222	108	48	Pass
0.0116	208	106	50	Pass
0.0118	193	102	52	Pass
0.0120	181	101	55	Pass
0.0121	171	100	58	Pass
0.0123	161	96	59	Pass
0.0125	148	91	61	Pass
0.0127	139	90	64	Pass
0.0129	135	85	62	Pass
0.0130	122	83	68	Pass
0.0132	113	73	64	Pass
0.0134	107	63	58	Pass
0.0136	105	55	52	Pass
0.0138	100	45	45	Pass
0.0140	92	38	41	Pass
0.0141	87	28	32	Pass
0.0143	84	21	25	Pass
0.0145	73	16	21	Pass
0.0147	71	10	14	Pass
0.0149	66	8	12	Pass
0.0151	63	2	3	Pass
0.0152	62	0	0	Pass
0.0154	58	0	0	Pass
0.0156	54	0	0	Pass
0.0158	54	0	0	Pass
0.0160	52	0	0	Pass
0.0161	50	0	0	Pass

0.0163	46	0	0	Pass
0.0165	45	0	0	Pass
0.0167	40	0	0	Pass
0.0169	38	0	0	Pass
0.0171	33	0	0	Pass
0.0172	32	0	0	Pass
0.0174	29	0	0	Pass
0.0176	28	0	0	Pass
0.0178	25	0	0	Pass
0.0180	22	0	0	Pass
0.0181	21	0	0	Pass
0.0183	20	0	0	Pass
0.0185	17	0	0	Pass
0.0187	13	0	0	Pass
0.0189	12	0	0	Pass
0.0191	9	0	0	Pass
0.0192	9	0	0	Pass
0.0194	9	0	0	Pass
0.0196	9	0	0	Pass
0.0198	8	0	0	Pass
0.0200	8	0	0	Pass
0.0202	8	0	0	Pass
0.0203	8	0	0	Pass
0.0205	8	0	0	Pass
0.0207	8	0	0	Pass
0.0209	8	0	0	Pass
0.0211	7	0	0	Pass
0.0212	7	0	0	Pass
0.0214	7	0	0	Pass
0.0216	7	0	0	Pass
0.0218	7	0	0	Pass
0.0220	7	0	0	Pass
0.0222	6	0	0	Pass
0.0223	6	0	0	Pass
0.0225	6	0	0	Pass
0.0227	6	0	0	Pass
0.0229	6	0	0	Pass
0.0231	6	0	0	Pass
0.0232	5	0	0	Pass
0.0234	5	0	0	Pass
0.0236	4	0	0	Pass
0.0238	3	0	0	Pass
0.0240	3	0	0	Pass
0.0242	2	0	0	Pass
0.0243	2	0	0	Pass
0.0245	2	0	0	Pass
0.0247	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
retention D POC	☐	5.07			☐	0.00			
Total Volume Infiltrated		5.07	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 = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

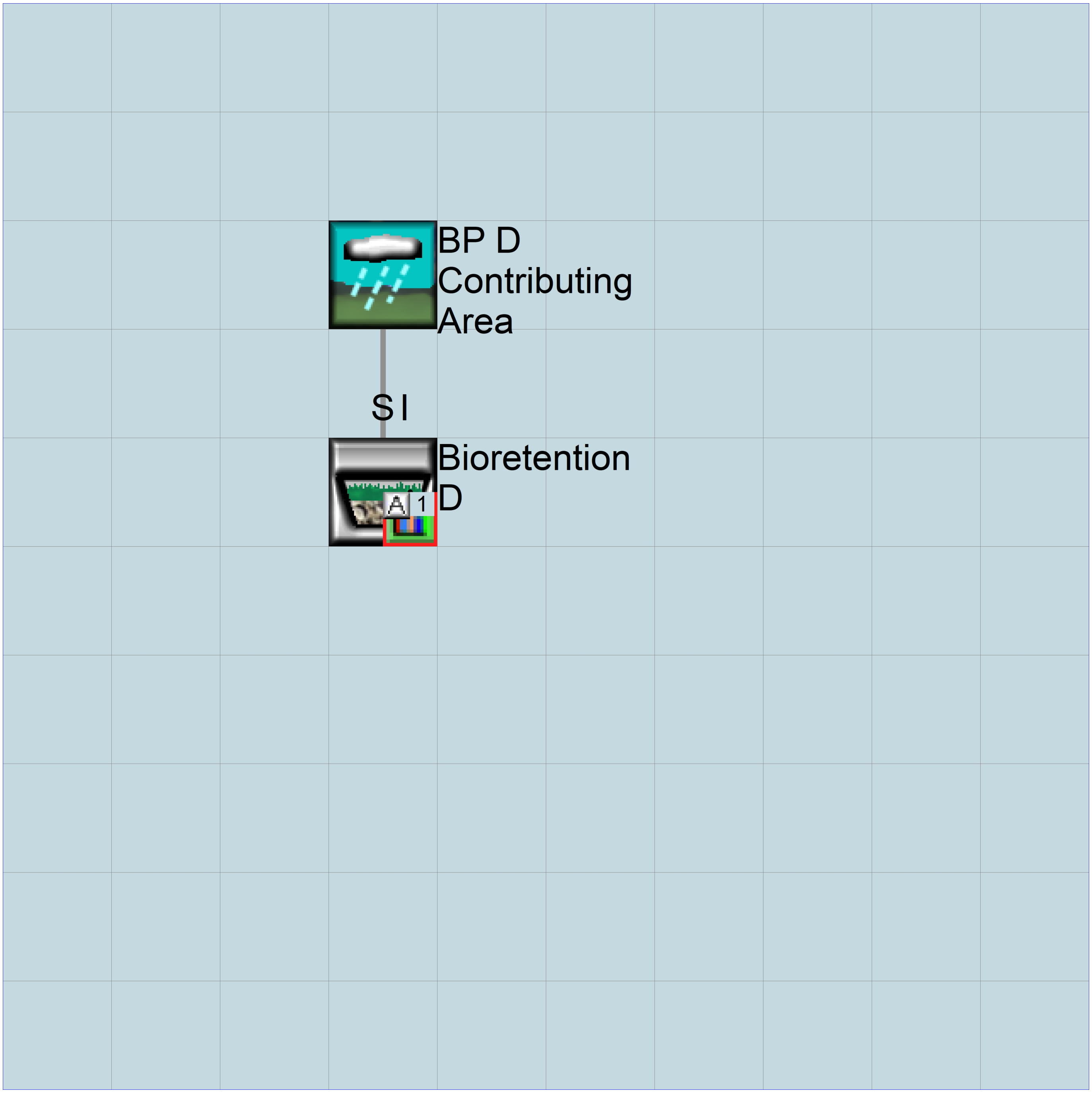
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------->***
<-ID->                                                             ***
WDM        26   BIORETENTION D.wdm
MESSU      25   PreBIORETENTION D.MES
           27   PreBIORETENTION D.L61
           28   PreBIORETENTION D.L62
           30   POCBIORETENTION D1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        BP D Contributing Area      MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                            in  out           ***
  END GEN-INFO
  *** Section PWATER***

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

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

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

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

END IMPLND
```

```
SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP D Contributing Area***
IMPLND   4                       0.035     COPY   501     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



<-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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
```

```
END EXT SOURCES

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

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       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       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   BIORETENTION D.wdm
MESSU      25   MitBIORETENTION D.MES
           27   MitBIORETENTION D.L61
           28   MitBIORETENTION D.L62
           30   POCBIORETENTION D1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      GENER        2
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface retention  D        MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
  END GEN-INFO
  *** Section PWATER***

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

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

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

  IWAT-STATE1
```

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
BP D Contributing Area***
IMPLND   4                       0.035     RCHRES   1      5

******Routing******
IMPLND   4                       0.035     COPY     1     15
RCHRES   1                           1     RCHRES   2      8
RCHRES   2                           1     COPY   501     16
RCHRES   1                           1     COPY   501     17
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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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     Surface retentio-011    2    1    1    1   28    0    1
    2     Bioretention  D         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
    2         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
    2         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  5  0  0  0       0  1  0  0  0       2  1  2  2  2
    2        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      0.01       0.0       0.0       0.0       0.0
    2             2      0.01       0.0       0.0       0.0       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  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           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
*** User-Defined Variable Quantity Lines
***                          addr
***                        <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                  addr or                        addr or
***                 <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  105.93
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   69    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.001817  0.000000  0.000000
  0.042088  0.001817  0.000031  0.000000
  0.084176  0.001817  0.000061  0.000000
  0.126264  0.001817  0.000092  0.000000
  0.168352  0.001817  0.000122  0.000000
  0.210440  0.001817  0.000153  0.000000
  0.252527  0.001817  0.000184  0.000000
  0.294615  0.001817  0.000214  0.000043
  0.336703  0.001817  0.000245  0.000073
  0.378791  0.001817  0.000276  0.000114
  0.420879  0.001817  0.000306  0.000167
  0.462967  0.001817  0.000337  0.000234
  0.505055  0.001817  0.000368  0.000314
  0.547143  0.001817  0.000399  0.000410
  0.589231  0.001817  0.000429  0.000522
  0.631319  0.001817  0.000460  0.000651
  0.673407  0.001817  0.000491  0.000798
  0.715495  0.001817  0.000521  0.000964
  0.757582  0.001817  0.000552  0.001149
  0.799670  0.001817  0.000583  0.001354
  0.841758  0.001817  0.000614  0.001580
  0.883846  0.001817  0.000644  0.001816
  0.925934  0.001817  0.000675  0.001828
```

0.968022	0.001817	0.000706	0.002098
1.010110	0.001817	0.000736	0.002334
1.052198	0.001817	0.000767	0.002390
1.094286	0.001817	0.000798	0.002706
1.136374	0.001817	0.000828	0.003046
1.178462	0.001817	0.000859	0.003410
1.220549	0.001817	0.000890	0.003800
1.262637	0.001817	0.000921	0.004052
1.304725	0.001817	0.000951	0.004215
1.346813	0.001817	0.000982	0.004656
1.388901	0.001817	0.001013	0.005124
1.430989	0.001817	0.001043	0.005619
1.473077	0.001817	0.001074	0.005635
1.515165	0.001817	0.001105	0.006141
1.557253	0.001817	0.001136	0.006692
1.599341	0.001817	0.001166	0.007270
1.641429	0.001817	0.001197	0.007473
1.683516	0.001817	0.001228	0.007877
1.725604	0.001817	0.001258	0.008512
1.767692	0.001817	0.001290	0.009176
1.809780	0.001817	0.001322	0.009866
1.851868	0.001817	0.001354	0.010577
1.893956	0.001817	0.001385	0.010993
1.936044	0.001817	0.001417	0.016490
1.978132	0.001817	0.001449	0.016490
2.020220	0.001817	0.001480	0.016490
2.062308	0.001817	0.001512	0.016490
2.104396	0.001817	0.001544	0.016490
2.146484	0.001817	0.001576	0.016490
2.188571	0.001817	0.001607	0.016490
2.230659	0.001817	0.001639	0.016490
2.272747	0.001817	0.001671	0.016490
2.314835	0.001817	0.001703	0.016490
2.356923	0.001817	0.001734	0.016490
2.399011	0.001817	0.001766	0.016490
2.441099	0.001817	0.001798	0.016490
2.483187	0.001817	0.001830	0.016490
2.525275	0.001817	0.001861	0.016490
2.567363	0.001817	0.001893	0.016490
2.609451	0.001817	0.001925	0.016490
2.651538	0.001817	0.001957	0.016490
2.693626	0.001817	0.001988	0.016490
2.735714	0.001817	0.002020	0.016490
2.777802	0.001817	0.002052	0.016490
2.819890	0.001817	0.002083	0.016490
2.830000	0.001817	0.002432	0.016490

END FTABLE 2
FTABLE 1
25 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.001817	0.000000	0.000000	0.000000		
0.042088	0.001817	0.000076	0.000000	0.013134		
0.084176	0.001817	0.000153	0.000000	0.013442		
0.126264	0.001817	0.000229	0.000000	0.013751		
0.168352	0.001817	0.000306	0.000000	0.014059		
0.210440	0.001817	0.000382	0.000000	0.014368		
0.252527	0.001817	0.000459	0.000000	0.014676		
0.294615	0.001817	0.000535	0.000000	0.014984		
0.336703	0.001817	0.000612	0.000000	0.015293		
0.378791	0.001817	0.000688	0.000000	0.015601		
0.420879	0.001817	0.000765	0.000000	0.015910		
0.462967	0.001817	0.000841	0.000000	0.016218		
0.505055	0.001817	0.000918	0.001271	0.016527		
0.547143	0.001817	0.000994	0.035627	0.016835		
0.589231	0.001817	0.001071	0.084946	0.017144		
0.631319	0.001817	0.001147	0.124401	0.017452		
0.673407	0.001817	0.001224	0.145730	0.017761		
0.715495	0.001817	0.001300	0.162456	0.018069		
0.757582	0.001817	0.001377	0.177613	0.018377		

```
  0.799670  0.001817  0.001453  0.191575  0.018686
  0.841758  0.001817  0.001530  0.204586  0.018994
  0.883846  0.001817  0.001606  0.216818  0.019303
  0.925934  0.001817  0.001682  0.228396  0.019611
  0.968022  0.001817  0.001759  0.239414  0.019920
  1.000000  0.001817  0.001817  0.249948  0.020154
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   2     EXTNL  POTEV

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   2 HYDR   RO      1 1        1     WDM   1000 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE   1 1        1     WDM   1001 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE   1 1        1     WDM   1002 STAG     ENGL      REPL
RCHRES   1 HYDR   O       1 1        1     WDM   1003 FLOW     ENGL      REPL
COPY     1 OUTPUT MEAN    1 1     48.4     WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN    1 1     48.4     WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

  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

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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