M-51 Industrial

Preliminary Drainage Report

Prepared for

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October 2023 **Job No: C21-170**

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SECTION 1.0: PROJECT OVERVIEW

The M-51 Industrial purposes the development of a light industrial building. Project development includes construction of four ± 259,000 SF of industrial buildings and ± 1,101,700 SF of associated, drive aisles, sidewalk, and utilities on a 76.25-acre site in Marysville, WA. The final industrial complex will contain three detention ponds. Detention Pond 1 will be built out South to hold stormwater runoff from four buildings roofs, and portion of the pavement, sidewalk, and landscape. Detention Pond 2 will be built out East to hold stormwater runoff from the portion of the pavement, sidewalk, and landscape. The discharge conveyance from Pond 1 and 2 will be routed east to discharge to the Edge Comb Creek. Detention Pond 3 will be built out West to hold portion of Pavement, sidewalk, and landscape. The discharge conveyance from Pond 3 will be routed west to the discharge to the permanent stormwater flow control facility along 51st Ave NE.

The M-51 Industrial project site is located at 16329 51st Ave NE, Marysville, WA 98271 and is comprised of parcels #31052700200700, 31052700201000, 31052700301100, and 31052700300100. The site lies within the NW ¼ and SW ¼ of Section 27, Township 31 N, Range 5 E within the City of Marysville. See Vicinity Map in Appendix A for relative location.

1.1 EXISTING SITE

The project parcel totals 76.25 acres. The subject property is currently zoned as light industrial. A residential farm occupies the site with surrounding land being farmed agricultural fields. An existing creek flows just outside of project limits.

The existing topography of the project site descends from north to south at slopes ranging from 0% to 3% with an overall relief of about 2 feet. Soils were observed as primarily native glacial outwash deposits. Test pits revealed groundwater below depths of 1.5 to 4 feet below ground surface.

There are three Category III wetlands north of the site with buffers that extend into the site. Washington State Department of Ecology has provided a preliminary determination that the ditch along 51st Ave NE is a state regulated wetland.

1.2 DOWNSTREAM ANALYSIS

On the existing site, flows generally convey north to south as sheet flow. Sheet flow from the west half of the site enters the 51st Ave ditch and flow from the west half of the site eventually ends up in the Edgecomb creek. From here, flows continue south along these two flow paths before leaving the quarter mile boundary of analysis.

1.3 PROPOSED DEVELOPMENT

The M-51 Industrial purposes the development of a light industrial building. Project development includes construction of four ± 259,000 SF of industrial buildings and ± 1,101,700 SF of associated, drive aisles, sidewalk, and utilities on a 76.25-acre site in Marysville, WA. The final industrial complex will contain three detention ponds. Based on the elevation of the ground water table, the site proposes approximately 2-12 feet of fill across the site for separation from bottom of stormwater flow control facilities. Project development will disturb 71.38 acres. Overall project impact will create 55.02 acres of impervious area, 25.29 acres being pollution generating impervious surfaces (PGIS).

All existing vegetation will be cleared, and conflicting structures will be removed or demolished as part of the development. Construction access to the proposed site will be provided at the existing gravel driveway off 51st Ave NE.

1.4 PROPOSED FLOW CONTROL DESIGN

The proposed project is vested to the requirements of the 2019 Department of Ecology (DOE) Stormwater Management Manual for Western Washington. Flow control mitigation of onsite stormwater runoff will be achieved by routing collected flow through a network of catch basins and closed pipes to three detention ponds located along the outer edges of the site.

The Arlington Airport and FAA require that there is minimal exposure along the existing and future flight paths with permanent standing water. This is to reduce the presence of waterfowl from congregating in the permanent water surfaces along the flight paths and potentially flying into and colliding with aircraft. The proposed ponds are within the north-south flight path of the airport and will require that the ponds not have a permanent water surface. The proposed design is to maintain the existing soil characteristics in the bottom of the pond and not provide a liner to

prevent stormwater infiltration. Although there would be some inherent infiltration within the pond, as a conservative design approach, it is not factored in the pond sizing calculations. This will allow the ponds to fill with water during storm events, draw down through the provided flow control structures at the design release rates, and when the storm event has ended and the drawdown period is over the pond would continue to infiltrate the water remaining below the outfall elevation into the native soils. And thus, the bottom of the pond would have no standing water remaining. This will also require enhanced maintenance of the pond bottom to maintain native soil infiltration characteristics as noted in the O&M portion of this report.

Frontage flows along 51st Ave NE will be collected and routed through a bioswale infiltration system. Flows not infiltrated will continue west into an existing ditch. A portion of 51st Ave NE will bypass detention due to vertical constraints and will discharge directly to the existing ditch along 51st Ave NE.

A Trench Drain system is proposed due to vertical constraints to collect and route the stormwater along with the series of catch basin to the detention ponds. Hydrologic calculations associated to detention and infiltration/bioswale design have been completed using WWHM2012. See section 4.1 for additional description and calculations concerning the proposed flow control measures.

1.5 PROPOSED WATER QUALITY TREATMENT DESIGN

The light industrial nature of the development requires "Enhanced" water quality treatment level. A Perkfilter Vault will provide Enhanced treatment of the site's PGIS surfaces downstream of the onsite storm detention ponds. Frontage flows along 51st will sheet flow into a linear bioswale and will receive treatment for 92.44% of flows. Water quality devices will be designed to be performed in accordance with Volume 5 of the 2019 DOE Manual. Please see Section 4.2 for additional discussion.

1.6 EROSION/SEDIMENTATION CONTROL

Erosion control measures that will be utilized during construction will include a combination of silt fence, storm drain inlet protection, interceptor swales, and sediment ponds. See Section 2.0 for discussion of how SWPPP Elements are addressed.

1.7 MINIMUM REQUIREMENTS

Per 2019 DOE Manual, Minimum Requirements 1-5 apply to the proposed development.

Minimum Requirement #1: Preparation of Stormwater Site Plans: This report along with the construction plans satisfies this minimum requirement. Stormwater runoff will be collected in a system of interceptor swales, routed to temporary sediment ponds, and released at mitigated rates to existing downstream systems. Existing wetland and stream buffers will be preserved.

Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP): A Stormwater Pollution Prevention Plan (SWPPP) will be provided as a separate document at the construction level submittal.

Minimum Requirement #3: Source Control of Pollution: Source control BMPs are not applicable for the subject site as trash/recycle enclosures will be located within the warehouse buildings. See SWPPP for additional details.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls: The site contains two onsite discharge location that lies within a single threshold discharge basin. The site historically flowed from north to south towards Edgecomb Creek along with portions of the site draining south west towards 51st Ave NE. In the developed condition, onsite runoff will be collected and conveyed to one of three proposed detention ponds located along the Sothern, eastern and western property line. Onsite flows will be treated, detained, and released to the existing drainage path at historic rates via a proposed stormwater network that releases mitigated flows into Edgecomb Creek or an existing ditch along 51st Ave NE. Frontage flows will infiltrate into native soils and flows unable to infiltrate will continue south into the existing ditch along 51st. A portion of the onsite access road cannot receive will bypass detention due to vertical constraints and will directly discharge into the existing ditch.

Minimum Requirement #5: Onsite Stormwater Management:

BMP T5.13 soil management practices and detention are the best means of available onsite stormwater management strategies. A French drain system will collect the onsite runoff along

with series of catch basins and convey to the detention ponds and will be released to historic downstream flow paths.

Minimum Requirement #6: Runoff Treatment: All water quality treatment designs have been performed in accordance with Volume 5 of the 2019 DOE Manual. Three Perkfilter Vaults have been proposed to provide Enhanced water treatment to detention flows. Flows along 51st will sheet flow into a roadside bioswale and receive treatment for 92.44% of flows. Please see Section 4.2 for additional discussion.

Minimum Requirement #7: Flow Control: This site will use three detention ponds and associated control structures to provide flow control for onsite developed condition flows. Frontage flows will be collected and directed to a bioswale infiltration system. A design infiltration rate of ¾ in/hr has been used for modeling as suggested by Terra Associates. A portion of the onsite access road will bypass detention due to vertical constraints and will directly discharge into the existing ditch. See Onsite Stormwater Management in Section 4.1 of this report for further discussion and sizing calculations.

Minimum Requirement #8: Wetlands Protection: There are no wetlands reported on the site.

Minimum Requirement #9: Operation and Maintenance: See Operations and Maintenance in Section 6.0 of this report.

SECTION 2.0: RISK ASSESSMENT ANALYSIS AND TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN

2.1 TEMPORARY EROSION AND SEDIMENT CONTROL

A Stormwater Pollution Prevention Plan (SWPPP) has been provided as a separate report. The SWPPP report is modeled under the guidelines of Volume II, Section 3 of the 2019 DOE Manual. Construction SWPPP Element #1 through #13 are addressed below.

Element #1 – Mark Clearing Limits: All clearing limits will be delineated with high visibility plastic/metal or silt fencing. See sheets ER-01 and ER-02 of the construction plans for locations and associated details.

Element #2 – Establish Construction Access: Two construction entrances will serve as access to the site for construction vehicles. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #3 – Control Flow Rates: Two temporary sediment ponds will receive site stormwater. Stored runoff will be pumped into a Baker tank for sediment settlement and discharged as necessary to locations as shown on ER-03 and ER-04

Element #4 – Install Sediment Controls: Silt fence, temporary interceptor swales, check dams, and temporary sediment ponds will be utilized to contain sediments within the clearing limits. See sheets ER-01 to ER-04 of the construction plans for locations and details.

Element #5 – Stabilize Soils: Any exposed soils will be stabilized with plastic covering and/or temporary and permanent seeding and as specified in the Grading and Erosion Control Notes. See sheet ER-05 of the construction plan for notes.

Element #6 – Protect Slopes: Slopes shall be protected with plastic covering and/or temporary and permanent seeding, as specified under Element #5.

Element #7 – Protect Drain Inlets: All storm drain inlets shall be protected throughout all stages of construction. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #8 – Stabilize Channels and Outlets: Channels and outlets shall be stabilized with interceptor swales and check dams. See sheets ER-01 through ER-04 of the construction plans for locations and details.

Element #9 – Control Pollutants: Pollutants shall be controlled as specified in the Pollutant Control Notes. See sheet ER-05 of the construction plans for notes.

Element #10 – Control De-Watering: Disposal options for de-watering water are as specified in the De-Watering Control Notes. See sheet ER-05 of the construction plans for notes.

Element #11 – Maintain BMPs: Maintenance of the BMPs is specified within the Erosion Control Notes. See sheet ER-05 of the construction plans for the Construction Sequence and notes.

Element #12: Manage the Project: The Erosion Control Notes specify seasonal work limitations. Maintenance of the BMPs is specified within the Erosion Control Notes. See sheet ER-05 of the construction plans for the Construction Sequence and notes.

Element #13: Protect LID BMPs: Low impact development (LID) BMPs are not used in this project.

SECTION 3.0: DOWNSTREAM ANALYSIS REPORT

3.1 TASK 1. STUDY AREA DEFINITION AND MAPS

Snohomish County Bare Earth LiDAR, survey, and 2012 aerial photography were the best topographical references available for the area containing the site. The limits of the downstream analysis extend roughly 0.25 miles beyond the subject property's natural discharge location (See Figure 4.0, Downstream Analysis Map).

3.2 TASK 2. RESOURCE REVIEW

All the resources below have been reviewed for existing and potential issues near the project site:

- **Adopted Basin Plans**
  No Adopted Basin Plans were located that include the project site.

- **Drainage Basin**
  This site is located within the Quilceda Creek basin.

- **Floodplain / Floodway (FEMA) maps**
  According to FEMA floodplain mapping, the subject property is not within a floodplain. Reference the FEMA FIS study in Appendix B as necessary.

- **Critical Areas Map**
  The City of Marysville Critical Areas map indicates that there are no wetlands within the bounds of the project site. Upon further investigation from Soundview Consultants, there are no wetlands identified on site. See Appendix B for City of Marysville Critical Areas map.

- **Drainage Complaints**
  No drainage complaints were identified.

- **Road Drainage Problems**
  No issues were identified near the proposed site.

- **Soil Survey**

  The existing topography of the project site descends from north to south at slopes ranging from 0% to 3% with an overall relief of about 2 feet. A geotechnical evaluation of the site performed by Cobalt Geosciences determined that soils onsite are primarily native glacial outwash deposits. Test pits revealed groundwater below depths of 1.5 to 2 feet below ground surface. A design infiltration rate of ¾ in/hr is assigned to the site. Infiltration is feasible on this site with shallow infiltration design, however, is not recommended due to the need for additional fill to provide separation between infiltration device and groundwater elevation. Appendix B for USDA Soil Map, Snohomish County Area, Washington, and soil classification description.

- **Wetland Inventory Maps**

  The City of Marysville Critical Areas map indicates that there are no wetlands within the bounds of the project site. Upon further investigation from Soundview Consultants, there are no wetlands identified on site. There are three Category III wetlands north of the site with buffers that extend into the site. Washington State Department of Ecology has provided a preliminary determination that the ditch along 51st Ave NE is a state regulated wetland. See Appendix B for City of Marysville Inventory map. See Appendix B for City of Marysville Critical Areas map.

- **Migrating River Studies**

  Migrating River Studies are considered to be not applicable to the proposed site development.

- **Section 303d List of Polluted Waters**

  Washington State Department of Ecology's Water Quality Assessment for Washington does not contain any listings downstream of the project site within the typical 0.25 analysis distance for bacteria.

- **Water Quality Problems**

  No known water quality problems are present onsite or downstream of the site.

- **Stormwater Compliance Plans**

Not applicable to the proposed project.

3.3 TASK 3. FIELD INSPECTION/DOWNSTREAM ANALYSIS

On February 6th, 2020, a Downstream Analysis was performed at the site. The weather consisted of 51ºF and cloudy skies. The following observations were verified during the visit.The subject property contains a single-family residence, barn, and associated outbuilding structures and the remaining site contains vegetation.

Upstream:

The ditch along the western property line along 51st Ave NE flows North to South. Approximately 1,000+ LF of northern offsite ditch flows south along project frontage. Per infield conditions the ditch appears near flat with vegetative growth along the bottom of ditch. As the existing water table exists ~2 feet below existing grade, it is likely that the water table perches the roadside ditch. These flows converge with Downstream Flow Path 2. Tributary parcels are agricultural sites that infiltrate prior to entering the ditch, however, it has been estimated that ~105 acres may be tributary to the ditch. Refer to the Figure 4.0 Downstream Map for basin delineation. In the developed condition the ditch along project frontage will be channelized into a 24" diameter perforated culvert and will discharge into the existing ditch south of the site continuing the existing flow path. See Appendix B images 4-5.

Onsite:

Flow in the existing condition is considered to convey southward. Flows generally are seen to infiltrate into agricultural pasture surfaces. Flows that do not infiltrate discharge into Edgecomb Creek and the existing ditch along 51st. See Figure 4.0, "Downstream Analysis Map" for map exhibits of the discharge location. The drainage flow path from the site is described below.

Flow Paths:

The site contains two onsite discharge locations and two threshold discharge basins. The site historically flowed from north to south with Edgecomb creek bordering the site to the east and the 51st Ave ditch bordering the site to the west. Storm runoff from the site eventually enters each of these flow paths and leaves the quarter mile boundary of analysis. See Figure 4.0,

"Downstream Analysis Map" for map exhibits of the discharge location. The drainage flow path from the site is described below.

3.4 TASK 4. DRAINAGE SYSTEM DESCRIPTION AND PROBLEM DESCRIPTIONS

Based on the information and all the resources available including visual inspection of the downstream flow path, there is no evidence of existing or anticipated downstream drainage problems. All flows are adequately carried into/through existing drainage structures/conveyances.

3.5 TASK 5. MITIGATION OF EXISTING OR POTENTIAL DRAINAGE PROBLEMS

No evidence of existing or potential problems with upstream or downstream drainage conveyances/infrastructure was found. Mitigation is not required.

SECTION 4.0: FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

4.1 FLOW CONTROL

Flow control will be provided for onsite hard surfaces and converted land covers via detention and infiltration. Three detention ponds located along the northern, eastern and southern property lines will collect, store, and mitigate runoff associated with onsite development. A portion of the site access will bypass detention due to vertical constraints and proximity to the ground water table and will direct discharge into the downstream ditch, however has been accounted for as bypass in Pond modeling. Frontage flows will sheet flow into a bioswale/infiltration trench located along the extents of frontage improvements within the planter strip. Flows tributary to the bioswale have been designed to infiltrate 75.93% of runoff, flows now infiltrated will discharge into an existing ditch.

Due to the presence of high ground water table one to two feet below existing grade the site will introduce 6 – 12 feet of fill throughout the project to provide adequate separation from the high groundwater table and bottom of flow control facilities. As such grassed embankments from the filled site to existing graded will be required around the majority of the perimeter of the site.

The basins associated with site development have been broken up into sub-basins for a clearer representation of the basins associated to each flow control device. The predeveloped and developed conditions were modeled in WWHM2012, a continuous hydrologic modeling for the purpose of flow control sizing and flow-duration control. Based on the site location, WWHM2012 used a Precipitation Scale factor of 1.2.

As the existing onsite structures do not surpass 30% of the site area, the project is considered new development. The pre-developed condition (forested) is applied to all onsite landcover to be converted for development. Site soils will be modeled as tall within WWHM as the observed ground water table is within 5-ft of the existing ground surface. Refer to the Geotechnical Report for groundwater information. For visual representation of the following predeveloped and

developed conditions see Figure 4.0, "Predeveloped Hydrology Map" and Figure 5.0 "Developed Hydrology Map".

4.1.1 PREDEVELOPED HYDROLOGY

For visual representation of the following predeveloped and developed conditions see Figure 4.0, "Predeveloped Hydrology Map" and Figure 5.0 "Developed Hydrology Map".

South Pond 1 Basin:

South Pond 1 Basin includes pastured landcover in the predeveloped forested condition that will be directed to South Pond 1. The Basin has been shown in WWHM for South Pond 1 as:

Table 4-1.1.1 – Predeveloped Conditions Areas: South Pond 1 Basin – WWHM South Pond 1

South Pond 1 Basin	
Land Cover	**Area**
Forest, Flat	56.85 AC
Total	**56.85 AC**

East Pond 2 Basin:

East Pond 2 Basin includes pastured landcover in the predeveloped forested condition that will be directed to East Pond 2 along the east property line. The East Pond 2 Basin has been shown in WWHM for East Pond 2 as:

Table 4-1.1.2 – Predeveloped Conditions Areas: East Pond 2 Basin – WWHM East Pond 2

East Pond 2 Basin	
Land Cover	**Area**
Forest, Flat	9.87 AC
Total	**9.87 AC**

West Pond 3 Basin:

West Pond 3 Basin includes pastured landcover in the predeveloped forested condition that will be directed to West Pond 3 along the east property line. The East Pond 3 Basin has been shown in WWHM for East Pond 3 as:

Table 4-1.1.3a – Predeveloped Conditions Areas: East Pond 3 Basin – WWHM East Pond 3

West Pond 3 Basin	
Land Cover	**Area**
Forest, Flat	9.53 AC
Total	**9.53 AC**

51ST Ave NE Bioswale Infiltration Trench Basin:

Basin 4 includes frontage improvements along 51st Ave NE and portions of onsite area tributary to frontage flows will be tributary to the proposed storm bioswale/infiltration system. Undeveloped portions of the basin will be converted for improvements along 51st Ave NE and has been modeled in the predeveloped condition as a forested land cover.

Table 4-1.1.4 – Predeveloped Conditions Areas: 51ST Ave NE Bioswale Infiltration Trench Basin – WWHM 51st Ave NE Bioswale Infiltration Trench Basin

51st Ave NE Bioswale Infiltration Trench Basin	
Land Cover	**Area**
Forest, Flat	1.04 AC
Total	**1.04 AC**

4.1.2 DEVELOPED SITE HYDROLOGY

Onsite project improvements consist of impervious surfaces associated with the 2,266,124 sq ft industrial building, pavement, and sidewalk. Approximately 55.02 acres of impervious surfaces will be produced as part of development, 25.29 acres being PGHS. The onsite drainage system will consist of catch basins, Trench Drains, stormwater conveyance pipe, three detention ponds, and a bioswale/infiltration trench. For visual representation of the following predeveloped and developed conditions see Figure 4.0, "Predeveloped Hydrology Map" and Figure 5.0 "Developed Hydrology Map".

South Pond 1 Basin:

South Pond 1 Basin includes the proposed roof of 4 buildings, and portions of pavement that will be directed to South Pond 1. The Basin has been shown in WWHM for South Pond 1 as:

Table 4-1.2.1 – Developed Conditions Areas: South Pond 1 Basin – WWHM South Pond 1

South Pond 1 Basin	
Land Cover	**Area**
Roads, Flat	12.94 AC
Roof, Flat	23.80 AC
Sidewalk, Flat	0.23 AC
Pond	8.75 AC
Bypass Road	0.08 AC
Bypass Sidewalk	0.092 AC
Pasture, Flat	11.038 AC
Total	**56.85 AC**

East Pond 2 Basin:

East Pond 2 Basin includes a portion of pavement that will be directed to East Pond 2. The East Pond 2 Basin has been shown in WWHM for East Pond 2 as:

Table 4-1.2.2 – Developed Conditions Areas: East Pond 2 – WWHM East Pond 2

East Pond 2 Basin	
Land Cover	**Area**
Road, Flat	5.03 AC
Sidewalk, Flat	0.20 AC
Pond	2.26 AC
Bypass Road	0.16 AC
Bypass Sidewalk	0.024 AC
Pasture, Flat	2.196 AC
Total	**9.87 AC**

West Pond 3 Basin:

West Pond 3 Basin includes portion pavement that will be directed to West Pond. The West Pond 3 Basin has been shown in WWHM for West Pond 3 as:

Table 4-1.2.3a – Developed Conditions Areas: West Pond 3 Basin – WWHM West Pond 3

West Pond 3 Basin	
Land Cover	**Area**
Road, Flat	5.92 AC
Sidewalk, Flat	0.13 AC
Pond	1.20 AC
Pasture, Flat	2.28 AC
Total	**9.53 AC**

51ST Ave NE Bioswale Infiltration Trench Basin:

Basin 4 includes frontage improvements along 51st Ave NE and portions of onsite area tributary to frontage flows to the proposed storm bioswale/infiltration system. The Basin 4 has been shown in WWHM for the Bioswale Infiltration Trench as:

Table 4-1.2.4 – Developed Conditions Areas: 51st Ave NE Bioswale Infiltration Trench Basin - WWHM 51st Ave NE Bioswale Infiltration Trench Basin

51st Ave NE Bioswale Infiltration Trench Basin	
Land Cover	**Area**
Road, Flat	0.85 AC
Sidewalk, Flat	0.19 AC
Total	**1.04 AC**

4.1.3 ARLINGTON AIRPORT AND FAA

The Arlington Airport and FAA require that there is minimal exposure along the existing and future flight paths with permanent standing water. This is to reduce the presence of waterfowl from congregating in the permanent water surfaces along the flight paths and potentially flying into and colliding with aircraft. The proposed ponds are within the north-south flight path of the airport and will require that the ponds not have a permanent water surface. The proposed design is to maintain the existing soil characteristics in the bottom of the pond and not provide a liner to prevent stormwater infiltration. Although there would be some inherent infiltration within the pond, as a conservative design approach, it is not factored in the pond sizing calculations. This will allow the ponds to fill with water during storm events, draw down through the provided flow control structures at the design release rates, and when the storm event has ended, and the drawdown period is over the pond would continue to infiltrate the water remaining below the outfall elevation into the native soils. And thus, the bottom of the pond would have no standing water remaining. This will also require enhanced maintenance of the pond bottom to maintain native soil infiltration characteristics as noted in the O&M portion of this report.

4.1.4 SOUTH POND 1

South Pond 1 will detain, and release collected stormwater runoff from South Pond 1 Basin. The pond is located along the southern parcel. The pond is currently proposed to discharge via ditch along 59th Ave NE into the existing Edge Comb Creek.

A summary of the modeled and provided detention pond dimensions, discharge rates and water surface elevations can be found below. The detention bottom elevation was set at approximately the existing grade in the area. This was designed so that seasonal high-water tables would not interfere with pond storage. See Appendix C for Pond 1 WWHM output and volume calculations.

Table 4.1.4.1 – South Pond 1: Design Summary

Description	**Value**
Modeled Live Surface Area:	6.98 AC
Provided Live Surface Area:	6.98 AC
Volume Modeled:	26.176 AC-FT
Volume Provided:	26.176 AC-FT
Bottom Pond EL:	115.50
Begin Live Storage EL:	116.0
Riser Height:	3.5 FT
Top of Riser EL:	119.50
Top of Pond EL:	120.50
Internal Side Slopes:	3:1(H:V)
Separation to Seasonal Groundwater EL:	~ 6”-2’

The following table provides a summary of flow rates and water surface elevations:

Table 4.1.4.2 – Detention South Pond 1: Flow Rates and Water Surface Elevation by Storm Event

Storm Event	**Predeveloped Rate (cfs)**	**Unmitigated Rate (cfs)**	**Mitigated Rates (cfs)**	**Water Surface Elevation**
2-Year	1.9102	24.6964	0.7848	117.95
10-Year	3.7170	39.9939	1.2485	118.87
50-Year	5.7800	56.1129	1.7614	119.60
100-Year	6.8052	63.8087	2.0132	119.89

An overflow structure and emergency overflow spillway are proposed for South Pond 1 due to the volume of runoff contained and unmitigated peak flows. A 48” diameter overflow structure

will intake overflow water surface flows in the event the control structure intake pipe becomes clogged. A 35' wide emergency overflow spillway has been proposed to release flows at a water surface elevation 0.20' higher than the riser. The emergency spillway has been designed using the 100-year unmitigated flow rate with a safety design factor of 1.6, per the 2019 DOE manual equation as shown below.

$$\text{Length of Weir} = \mathbf{L} = [Q_{100}/(3.21H^{3/2})] - 2.4H$$
$$= 102.094 \text{ cfs} / (3.21*1^{3/2})] - 2.4*1$$
$$= 29.41 \text{ ft} \gg \text{round to } 35 \text{ ft}$$

Where:

Q_{100} = 100-year peak flowrate multiplied by a factor of 1.6 = 63.8087 cfs * 1.6 = **102.094 cfs**

H = Height of water over weir = **1 ft** (0.4 ft minimum)

4.1.5 EAST POND 2

East Detention Pond 2 will detain, and release collected stormwater runoff from East Pond 2 Basin. The pond is located along the East property line. The pond is currently proposed to discharge via ditch along 59th Ave NE into the existing Edge Comb Creek.

A summary of the modeled and provided detention pond dimensions, discharge rates and water surface elevations can be found below. The detention bottom elevation was set at approximately the existing grade in the area. This was designed so that seasonal high-water tables would not interfere with pond storage. See Appendix C for Pond 2 WWHM output and volume calculations.

Table 4.1.5.1 – East Pond 2: Design Summary

Description	**Value**
Modeled Live Surface Area:	1.33 AC
Provided Live Surface Area:	1.33 AC
Volume Modeled:	5.466 AC-FT
Volume Provided:	5.466 AC-FT
Bottom Pond EL:	115.50
Begin Live Storage EL:	116.0
Riser Height:	3.5 FT
Top of Riser EL:	119.50
Top of Pond EL:	120.50
Internal Side Slopes:	3:1(H:V)
Separation to Seasonal Groundwater EL:	~ 6"-2'

The following table provides a summary of flow rates and water surface elevations:

Table 4.1.5.2 – Detention East Pond 2: Flow Rates and Water Surface Elevation by Storm Event

Storm Event	Predeveloped Rate (cfs)	Unmitigated Rate (cfs)	Mitigated Rates (cfs)	Water Surface Elevation
2-Year	0.4899	4.0594	0.2106	118.22
10-Year	1.2502	6.5874	0.4138	118.85
50-Year	2.4587	9.2557	0.6564	119.13
100-Year	3.1879	10.5309	0.7802	119.21

An overflow inlet and emergency overflow spillway are proposed for Pond 2 due to the volume of runoff contained and unmitigated peak flows. A jail cage is proposed in the control structure which will intake overflow water surface flows in the event the control structure intake pipe becomes clogged. A 25' wide emergency overflow spillway has been proposed to release flows at a water surface elevation 0.20' higher than the riser. The emergency spillway has been designed using the 100-year unmitigated flow rate with a safety design factor of 1.6, per the 2019 DOE manual equation as shown below.

$$\text{Length of Weir} = \mathbf{L} = [Q_{l00}/(3.21H^{3/2})] - 2.4H$$
$$= [16.8494 \text{ cfs} / (3.21*0.4^{3/2})] – 2.4*0.4$$
$$= 19.79 \text{ ft} \gg \text{round to } 25 \text{ ft}$$

Where:

Q_{100} = 100-year peak flowrate multiplied by a factor of 1.6 = 10.5309 cfs * 1.6 = **16.8494 cfs**

H = Height of water over weir = **0.4 ft** (minimum)

4.1.6 WEST POND 3

West Detention Pond 3 will detain, and release collected stormwater runoff from West Pond 3 Basin and has been sized within the WWHM modeling. The pond is located along west property line of development. Flows mitigated through Detention Pond 3 will release via 51st Ave NE Bioswale and ultimately into the relocated Edge Comb Creek.

A summary of the modeled and provided detention pond dimensions, discharge rates and water surface elevations can be found below. The detention bottom elevation was set at approximately the existing grade in the area. This was designed so that seasonal high-water tables would not interfere with pond storage. See Appendix C for Pond 3 WWHM output and volume calculations.

Table 4.1.6.1 – West Pond 3: Design Summary

Description	**Value**
Modeled Live Surface Area:	0.92 AC
Provided Live Surface Area:	0.92 AC
Volume Modeled:	3.912 AC-FT
Volume Provided:	3.912 AC-FT
Bottom Pond EL:	115.50
Begin Live Storage EL:	116.0
Riser Height:	3.75 FT
Top of Riser EL:	119.75
Top of Pond EL:	120.75
Internal Side Slopes:	3:1(H:V)
Separation to Seasonal Groundwater EL:	~ 6″-2′

The following table provides a summary of flow rates and water surface elevations:

Table 4.1.6.2 – West Detention West Pond 3: Flow Rates and Water Surface Elevation by Storm Event

Storm Event	**Predeveloped Rate (cfs)**	**Unmitigated Rate (cfs)**	**Mitigated Rates (cfs)**	**Water Surface Elevation**
2-Year	0.3202	3.9347	0.1682	117.93
10-Year	0.6231	6.3905	0.3298	118.78
50-Year	0.9689	8.9844	0.5503	119.43
100-Year	1.1408	10.2246	0.6726	119.69

An overflow structure and emergency overflow spillway are proposed for Pond 1 due to the volume of runoff contained and unmitigated peak flows. A 48″ diameter overflow structure will intake overflow water surface flows in the event the control structure intake pipe becomes clogged. A 25′ wide emergency overflow spillway has been proposed to release flows at a water surface elevation 0.20′ higher than the riser. The emergency spillway has been designed using the 100-year unmitigated flow rate with a safety design factor of 1.6, per the 2019 DOE manual equation as shown below.

Length of Weir = **L** $= [Q_{l00}/(3.21H^{3/2})] - 2.4H$

$= [16.3594 \text{ cfs} / (3.21*0.4^{3/2})] – 2.4*0.4$

$= 19.18 \text{ ft} \gg$ round to 25 ft

Where:

Q_{100} = 100-year peak flowrate multiplied by a factor of 1.6 = 10.2246 cfs * 1.6 = **16.3594 cfs**

H = Height of water over weir = **0.4 ft** (minimum)

4.1.7 51st AVE NE BIOSWALE INFILTRATION TRENCH

A bioswale infiltration trench system is proposed to collect, and infiltrate 92.44% of flows associated with and tributary to frontage improvements along 51st Ave NE (Basin 3). The trench bottom elevation was set to allow an estimated 12" from bottom of trench to the high ground water table, with the assumption the water table is 18" below grade. As recommended via the Geotech report, a long-term infiltration design rate of ¾ in/hr has been used. Flows not infiltrated will discharge the infiltration trench via 6" culvert and enter the existing ditch along 51st Ave NE and continue downstream. Multiple Type 1L structures are located within the bioswale as overflow structures to intake flows in large storm events. Appendix C for Bioswale/Infiltration Trench WWHM output and infiltration calculations.

Table 4.1.7.1 – 51ST Bioswale Infiltration Trench System: Design Summary

Description	**Value**
Modeled Trench Length:	1340 FT
Bioretention Bottom Width:	1.0 FT
Gravel Trench Width:	3.0 FT
Bioswale Side Slopes:	4:1 (H:V)
Gravel Trench Side Slopes:	0:0 (Vertical)
Bioswale Depth:	0.5 FT
Gravel Trench Depth:	1.0 FT
Infiltration Rate:	0.75 IN/HR
WQ Percent Filtered:	100%
Percent Infiltrated into Native Soils:	92.44 %

The following table provides a summary of flow rates of the remaining non-infiltrated flow that discharge the infiltration system:

Table 4.1.7.2 – 51ST Bioswale Infiltration Trench System: Flow Rates of Un-Infiltrated Flows

Storm Event	Predeveloped Rate (cfs)	Mitigated Rates (cfs)
2-Year	0.0349	0.0191
10-Year	0.0680	0.0221
50-Year	0.1057	0.0244
100-Year	0.1245	0.0253

4.2 WATER QUALITY TREATMENT

All water quality treatment designs have been performed in accordance with Volume 5 of the 2019 DOE Manual. Three Perkfilter Media Filtration Vaults by Oldcastle Infrastructure have been proposed to provide enhanced stormwater treatment and will be located downstream of the detention ponds. For Perkfilter vault sizing and details refer to Appendix C.

Detention South Pond 1 Perk filter has been sized to treat the 2-year peak flow of 0.7848 cfs. As the 100-year unmitigated peak exceeds 10 cfs, flow that exceeds the offline water quality flowrate of 1.2 cfs will be diverted around the Perk filter via a flow splitter just upstream of the unit. A 8x20 unit is proposed by Oldcastle Infrastructure.

Detention East Pond 2 Perk Filter has been sized to treat the 2-year peak flow of 0.2106 cfs. As the 100-year unmitigated peak exceeds 10 cfs, flow that exceeds the offline water quality flowrate of 1.2 cfs will be diverted around the Perk filter via a flow splitter just upstream of the unit. A 6x12 unit is proposed by Oldcastle Infrastructure.

Detention West Pond 3 Perk FIlter has been sized to treat the 2-year peak flow of 0.1682 cfs. As the 100-year unmitigated peak exceeds 10 cfs, flow that exceeds the offline water quality flowrate of 1.2 cfs will be diverted around the Perk filter via a flow splitter just upstream of the unit. A 6x8 unit is proposed by Oldcastle Infrastructure.

Frontage flows along 51st Ave SE will receive water quality via the bioswale located along the extents of the frontage improvements within the planter strip. Per WWHM modeling, 100% of

flows will receive water quality treatment prior to infiltrating. Refer to Appendix C for WWHM output on bioswale modeling.

4.3 LOW IMPACT DESIGN FEASIBILITY

The project design has accounted for Low Impact Design as much as is feasible, given site conditions. Section 1-2.5.5 Minimum Requirement #5: On-site Stormwater Management and Section 5-5.3.1 On-site Stormwater Management BMPS of the 2019 DOE Stormwater Management Manual for Western Washington was applied to the site in order to determine LID feasibility. This section of the 2019 DOE Manual directs projects within the Urban Growth Area to adhere to the Low Impact Development Performance Standard and BMP T5.13: Post-Construction Soil Quality and Depth or choose to implement List #2 BMPs.

Lawn and Landscaped Area:

1. **Post Construction Soil Quality and Depth (BMP T5.13):** *Feasible*. Site will be underlain with BMP T5.13 soils in all pervious areas.

Roofs:

1. **Full Dispersion or Full Downspout Infiltration (BMPs T5.30 or T5.10A)**: *Infeasible*. Flow paths required for full dispersion cannot be provided onsite. Vertical separation from ground water table and downspout infiltration trenches does not allow for infiltration.
2. **Bioretention (BMP T7.30)**: *Infeasible*. Infiltration is not feasible onsite.
3. **Downspout Dispersion Systems (BMP T5.10B)**: *Infeasible*. Site dimensions do not leave enough room for compliant flow paths for dispersion.
4. **Perforated Stub-out Connections (BMP T5.10C):** Inf*easible*. Vertical separation from ground water table and downspout infiltration trenches does not allow for infiltration.

Other Hard Surfaces:

1. **Full Dispersion (BMP T5.30):** *Infeasible*. Site dimensions do not leave enough room for compliant flow paths for dispersion.
2. **Permeable Pavement (BMP T5.15):** *Infeasible*. The site is proposed for industrial use. Permeable pavement not allowed.
3. **Bioretention (BMP T7.30):** *Feasible*. Bioretention has been utilized along 51st Ave NE to treat flows tributary to frontage improved flowline.

4. **Sheet Flow Dispersion or Concentrated Flow Dispersion (BMPs T5.12 or T5.11):** *Infeasible*. Site dimensions do not leave enough room for compliant flow paths for dispersion.

SECTION 5.0: CONVEYANCE ANALYSIS AND DESIGN

Conveyance analysis will be provided within the construction level submittal.

SECTION 6.0: OPERATIONS AND MAINTENANCE MANUAL

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
			(Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Storage Area	Sediment	Accumulated sediment that exceeds ~~10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.~~ 3".	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
6" Dead Storage Area	Facility filled with sediment and/or debris	3" depth of sediment and/or reduced infiltration after storm events	Sediment is removed to designed pond shape and depth.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Table V-4.5.2(2) Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb).	Structure securely attached to wall and outlet pipe. Structure in correct position.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Manhole	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).
Catch Basin	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(6) Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier missing. Bars are loose and rust is causing 50% deterioration to any part of barrier.	Bars in place with no bends more than 3/4 inch. Bars in place according to design. Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

Table V-4.5.2(7) Maintenance Standards - Energy Dissipaters

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External:			

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow"□ of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged.	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flows Out Top of "Distributor"□ Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn	Structure replaced to design standards.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		spot exceeding one square foot which would make structure unsound.	
	Other Defects	See "Catch Basins"□ (No. 5).	See "Catch Basins"□ (No. 5).

Table V-4.5.2(15) Maintenance Standards - Manufactured Media Filters

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
		weeds and other vegetation starts to take over.	
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Table V-4.5.2(9) Maintenance Standards - Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.

Table V-4.5.2(8) Maintenance Standards - Typical Biofiltration Swale

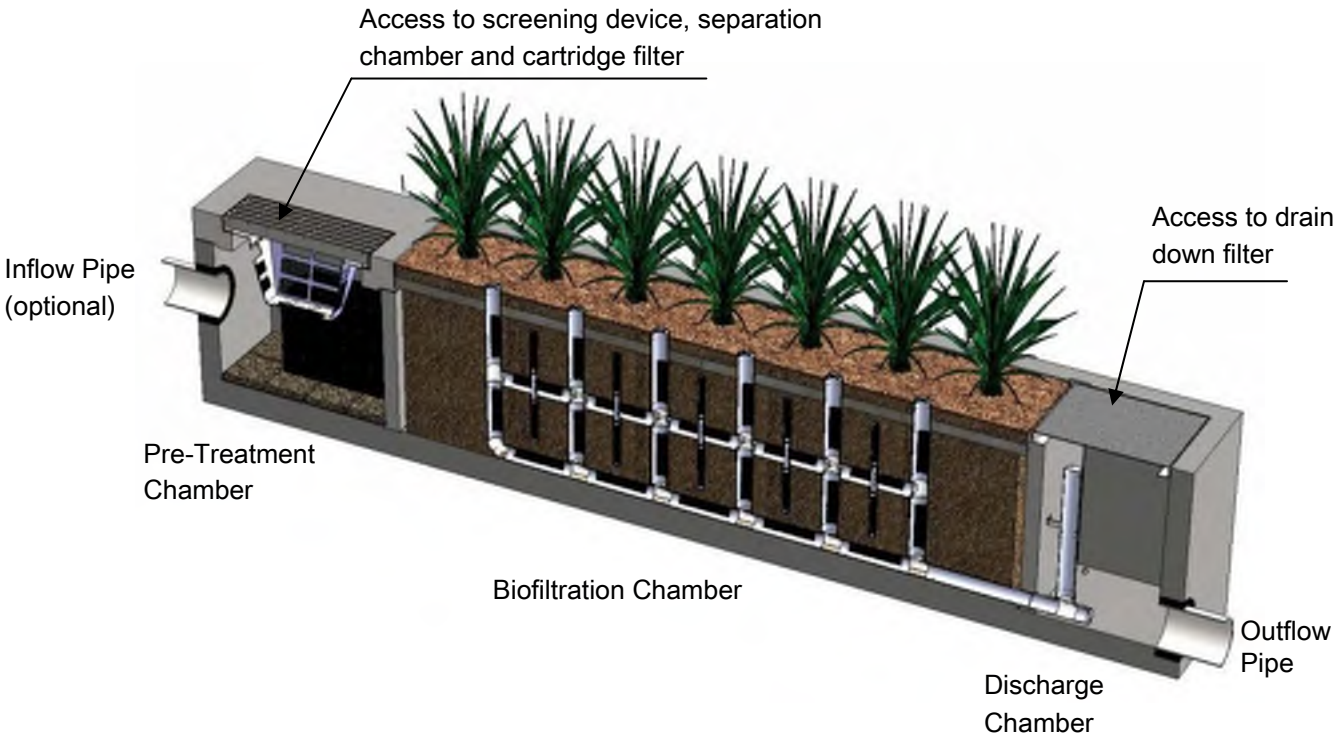
Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See "Detention Ponds" (No. 1).	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

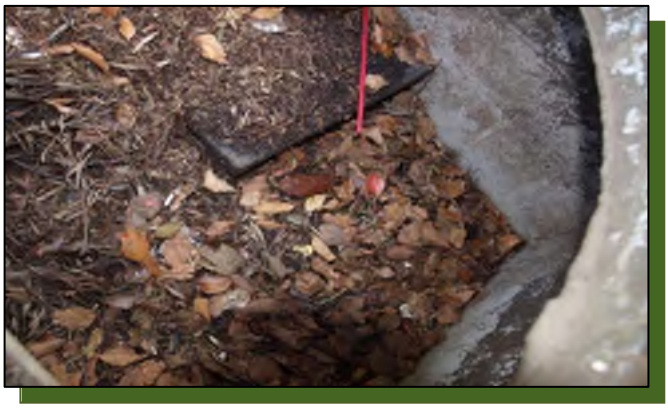
Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ___/___/___ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

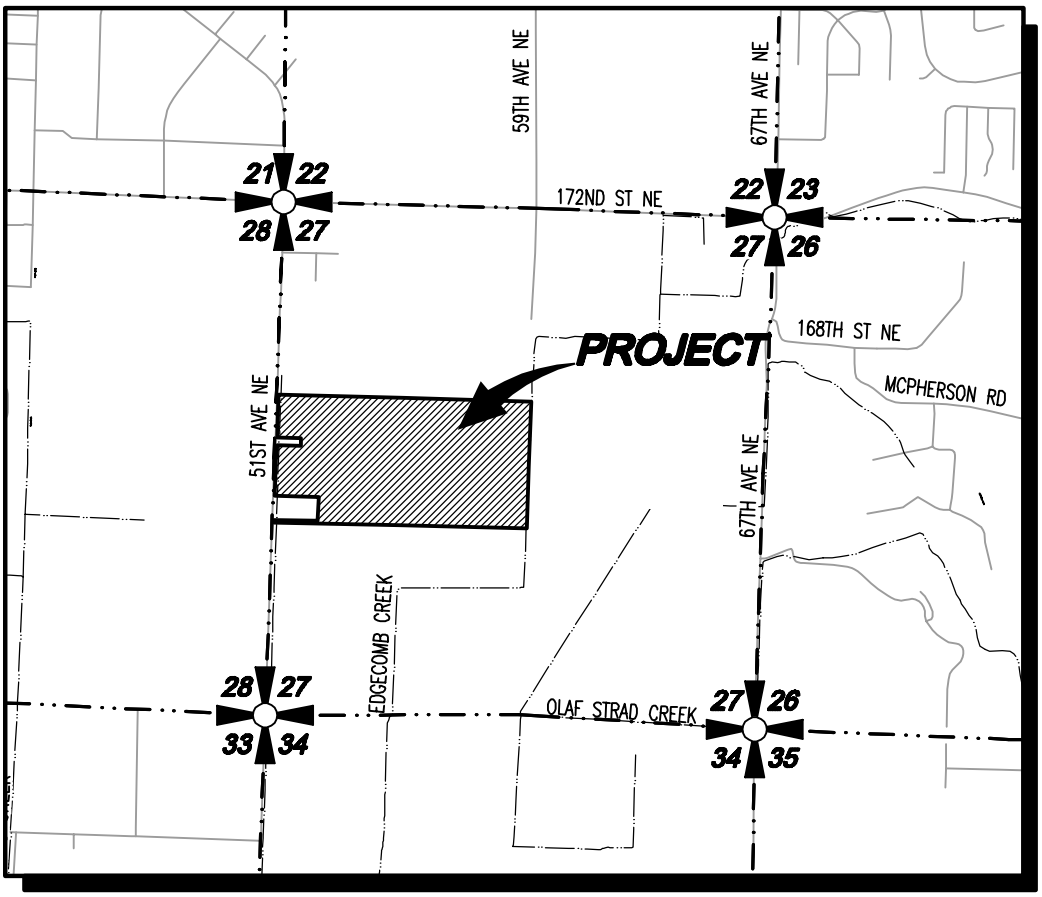
SECTION 7.0: SPECIAL REPORTS AND STUDIES

The following reports have been conducted with past submittals or with reference to this project:

- Geotechnical Report, Terra Associates, Inc., dated August 14, 2020
- Wetland and Fish and Wildlife Habitat Assessment Report, Soundview Consultants, dated August 2020
- Traffic Impact Analysis, July 2020

Appendix A: Project Overview

1. Figure 1.0 – Vicinity Map
2. Figure 2.0 – Existing Conditions Map
3. Figure 3.0 – Developed Conditions Map



VICINITY MAP

SCALE: 1"=2000'

Drawing: P:\Civil\2021\C21-170 M-51 - Early Clear and Grade Permit\Drawings\Exhibits\C21170E-EX-VM.dwg Plotted: Apr 26, 2023 - 1:30pm

LDC | Surveying Engineering Planning

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20210 142nd Avenue NE
Woodinville, WA 98072

Kent
1851 Central Pl S, #101
Kent, WA 98030

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M-51 INDUSTRIAL, LLC

M-51 INDUSTRIAL

VICINITY MAP

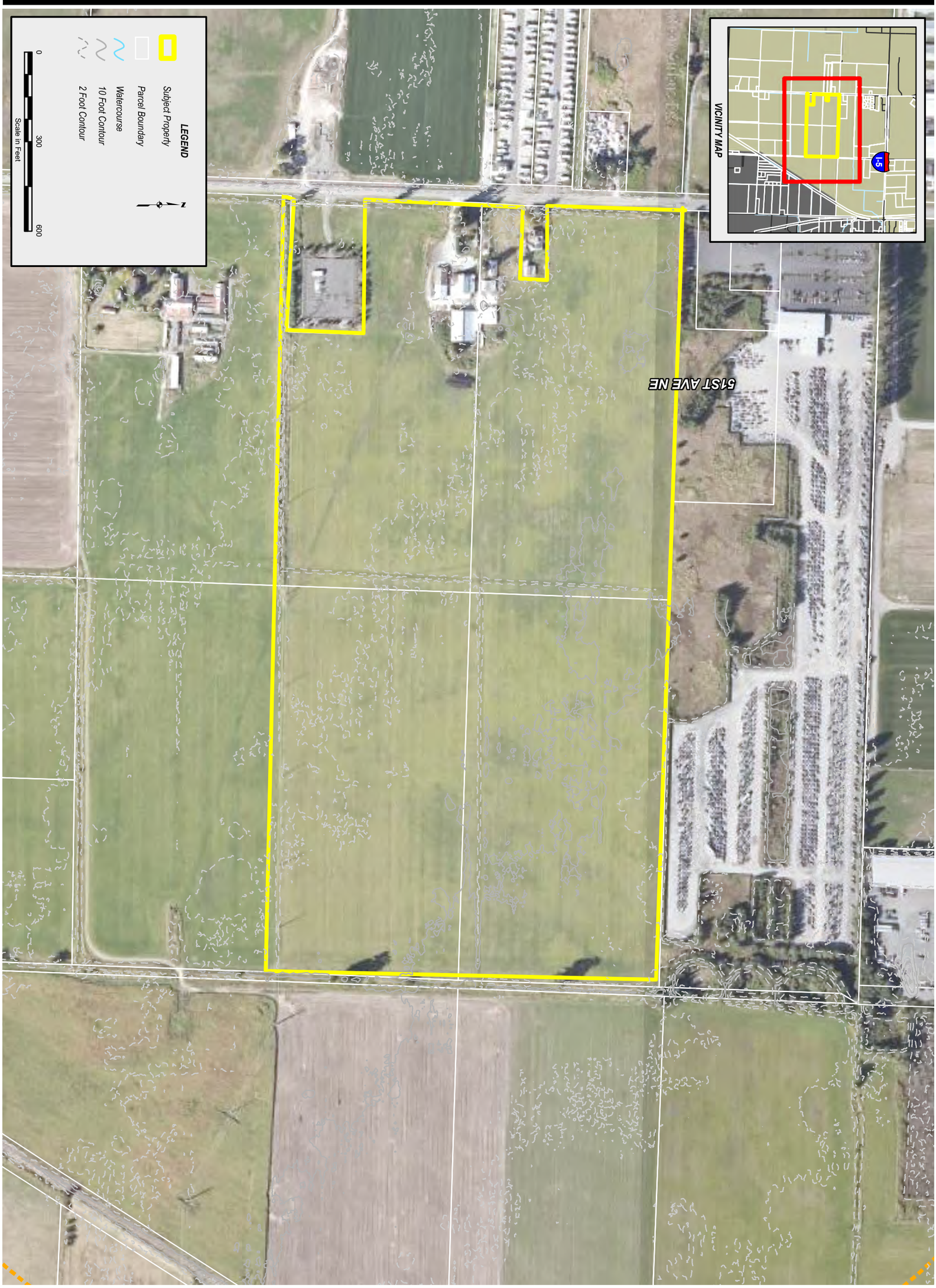

FIGURE: 2.0

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601 FEET

REVISION:
JOB NUMBER: C21.170
DRAWING NAME: C21.170-1.0
DESIGNER: CTIWEYANG
DRAWING BY: CTIWEYANG
DATE: 4/25/2023
SCALE: AS SHOWN
JURISDICTION: MARYSVILLE

M-51 INDUSTRIAL, LLC

M-51 INDUSTRIAL

EXISTING CONDITIONS MAP

LDC Surveying Engineering Planning

Woodinville
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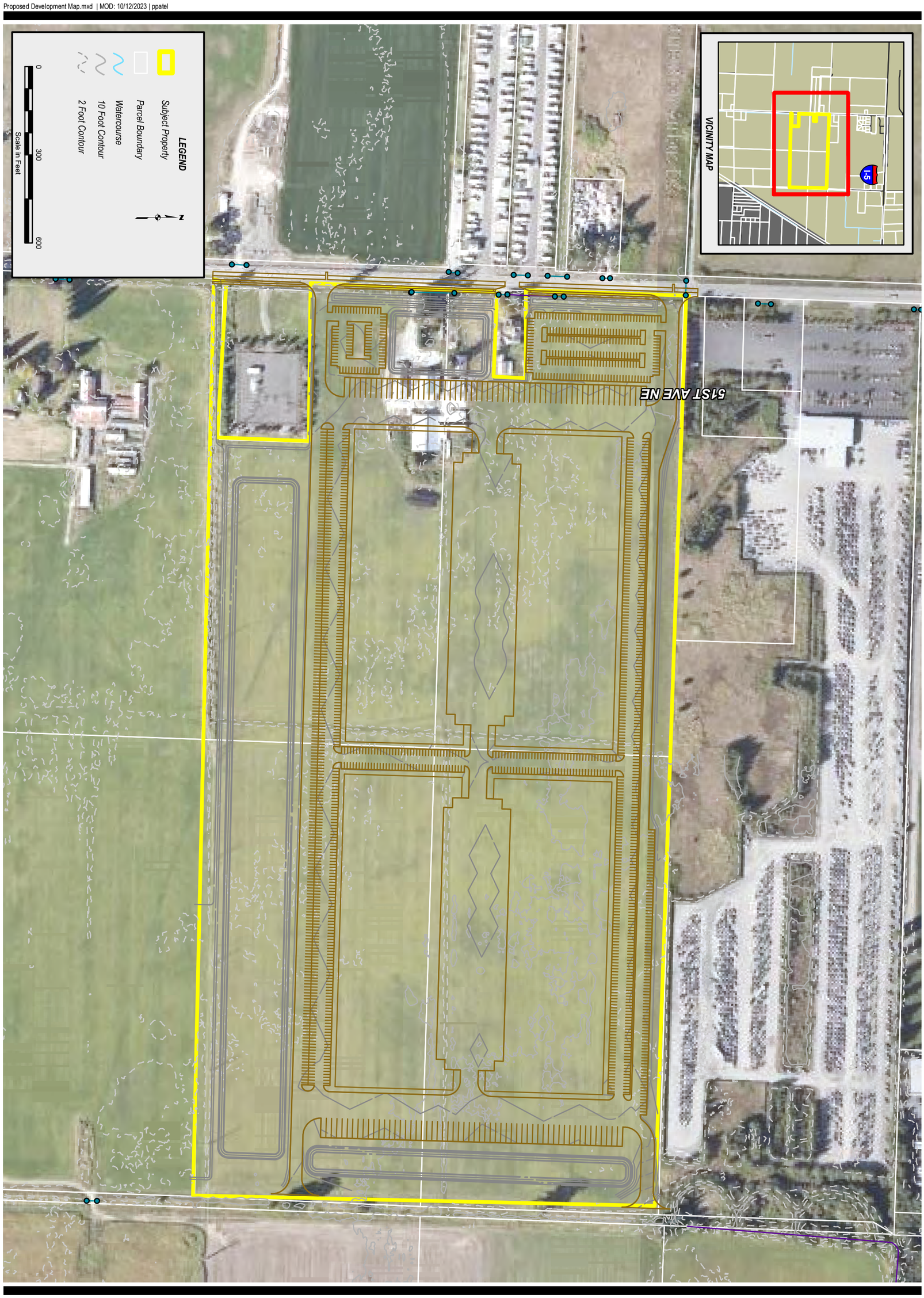
Kent
1651 Central Pl S, #101
Kent, WA 98030
P 425.402.2893

www.LDCcorp.com

SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
SNOHOMISH COUNTY GIS	PARCEL BOUNDARY
SNOHOMISH COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.



M-51 INDUSTRIAL

DEVELOPMENT CONDITION MAP

M-51 INDUSTRIAL, LLC

FIGURE: 3.0

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601 FEET

REVISION:
JOB NUMBER: C21-170
DRAWING NAME: C21-170-10
DESIGNER: PPATEL
DRAWING BY: PPATEL
DATE: 10/12/2023
SCALE: AS SHOWN
JURISDICTION: MARYSVILLE

LDC Surveying Engineering Planning

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SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
SNOHOMISH COUNTY GIS	PARCEL BOUNDARY
SNOHOMISH COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LiDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

Appendix B: Resource Review

1. Figure 4.0 - Downstream Analysis Map
2. City of Marysville Critical Areas Map
3. Downstream Site Visit Pictures
4. FEMA Floodplain Map – Panel #53061C0709E
5. USGS Soils Map
6. USGS Soils Description
7. 303d Listings

Downstream Map.mxd | MOD: 4/26/2023 | ppatel

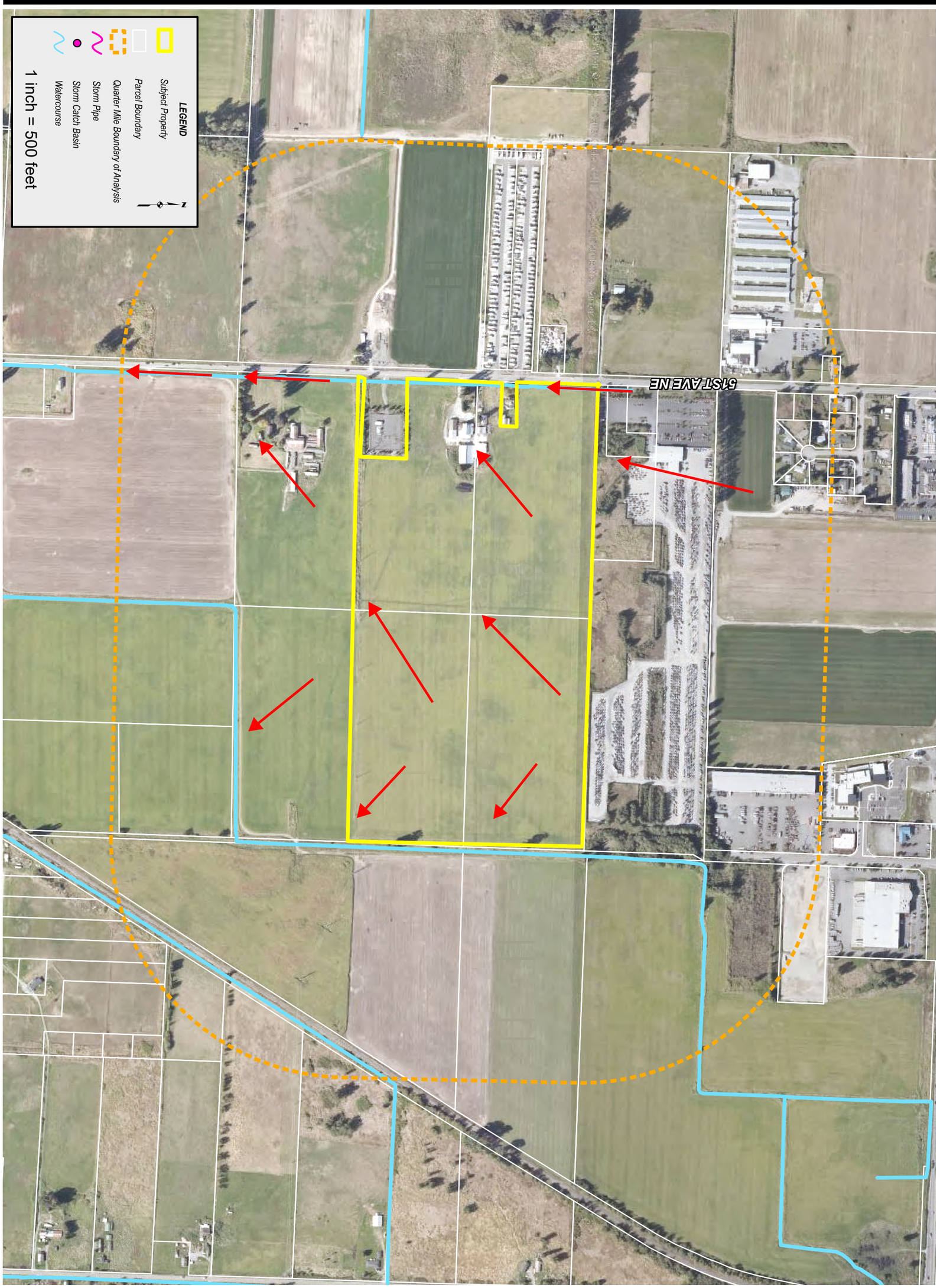

FIGURE: 4.0

REVISION:
JOB NUMBER: C21-170
DRAWING NAME: C21-170-1.0
DESIGNER: PPATEL
DRAWING BY: PPATEL
DATE: 4/26/2023
SCALE: AS SHOWN
JURISDICTION: MARYSVILLE

NAD 1983 HARN
STATEPLANE WASHINGTON

M-51 INDUSTRIAL, LLC

M-51 INDUSTRIAL
DOWNSTREAM MAP

LDC Surveying Engineering Planning

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Kent, WA 98030
F 425.482.2893

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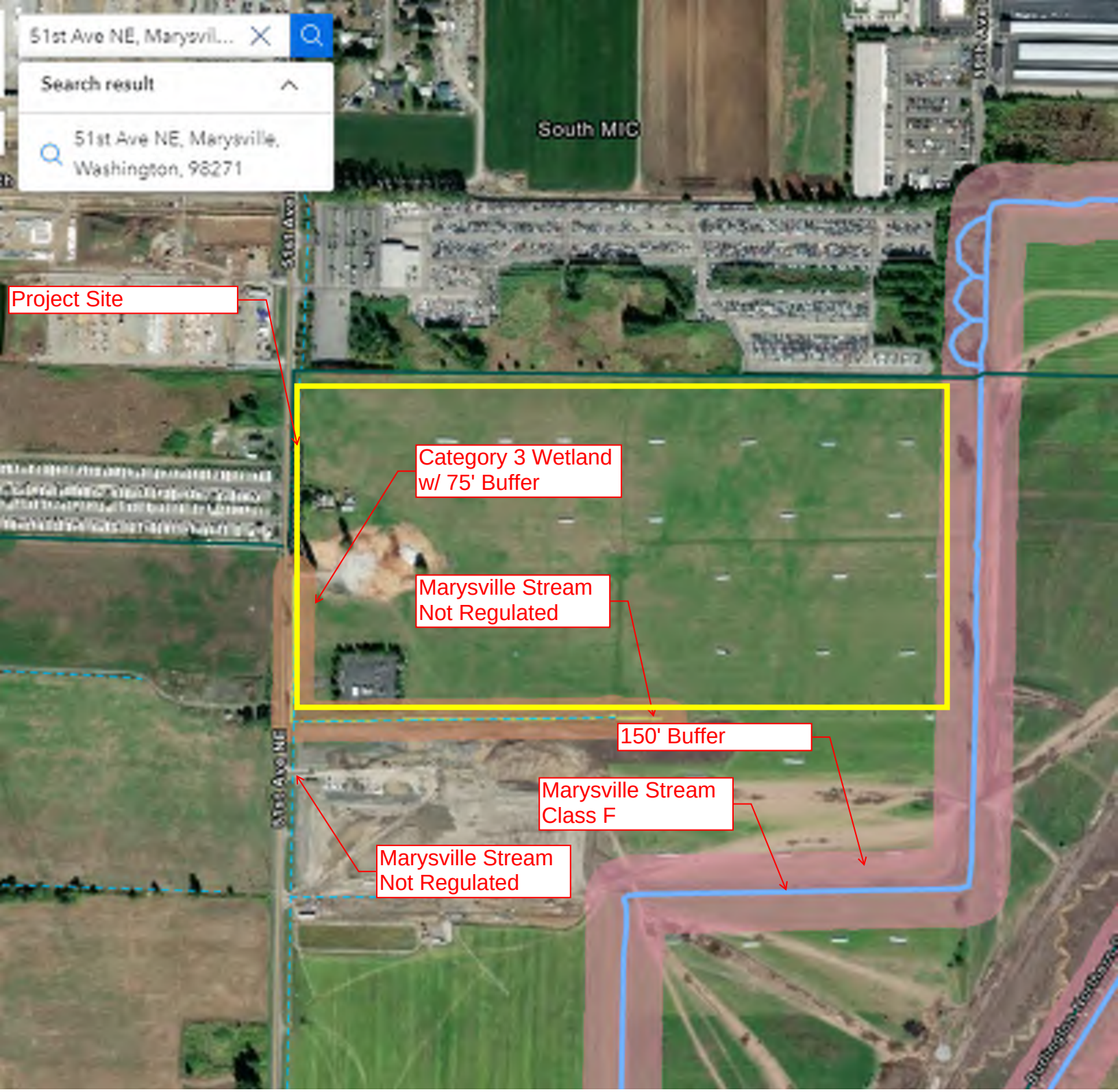
SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.


51st Ave NE, Marysvil...
Search result
51st Ave NE, Marysville, Washington, 98271
South MIC
51st Ave NE
Project Site
Category 3 Wetland w/ 75' Buffer
Marysville Stream Not Regulated
150' Buffer
Marysville Stream Class F
Marysville Stream Not Regulated

Critical Areas

2012

1:18,000

0 500 1,000 2,000 3,000 Feet

Data shown on this map represents known critical areas however, other critical areas may exist This map is meant for general information purposes only and is not meant to replace critical areas surveys by qualified consultants.

Printed: December 2019

M-51 Project Site

Ditch 'X'

Relocated Edgecomb Creek

"Old" Edgecomb Creek - Filled/Relocated

7,300 LF

2,000'-0"

End of 59th Ave. Ditch and Location of Overflow to Edgecomb Creek

Relocated Edgecomb Creek

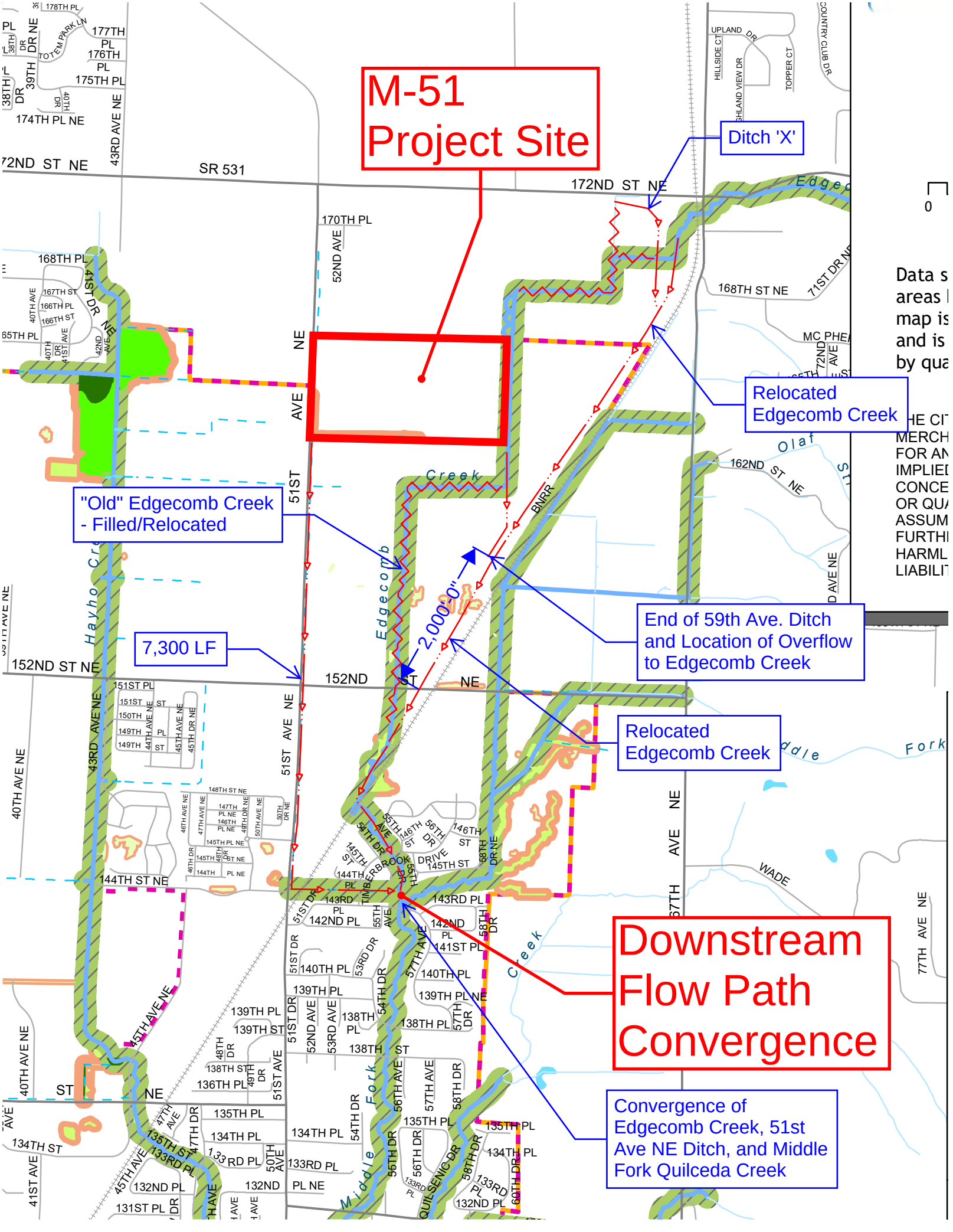
Downstream Flow Path Convergence

Convergence of Edgecomb Creek, 51st Ave NE Ditch, and Middle Fork Quilceda Creek

Legend

Marysville stream classes
- S - 200' buffer
- F - 150' buffer
- NS - 50' buffer
- Unknown
- Not regulated
- Outside area

Delineated wetlands
- category 1 - 125' buffer
- category 2 - 100' buffer
- category 3 - 75' buffer
- category 4 - 35' buffer
- 25 percent top-of-bank
- Stream buffers
- Wetland buffers
- Assumed stream wetlands
- Stream wetland buffers
- Lake & slough buffers
- 13' LIDAR floodplain contour
- Top-of-bank 25' buffer
- Marysville city limits
- Urban growth area


M-51
Project Site
Ditch 'X'
Relocated
Edgecomb Creek
"Old" Edgecomb Creek
- Filled/Relocated
7,300 LF
End of 59th Ave. Ditch
and Location of Overflow
to Edgecomb Creek
Relocated
Edgecomb Creek
Downstream
Flow Path
Convergence
Convergence of
Edgecomb Creek, 51st
Ave NE Ditch, and Middle
Fork Quilceda Creek
2,000'-0"
SR 531
172ND ST NE
152ND ST NE
144TH ST NE
51ST AVE NE
43RD AVE NE
40TH AVE NE
45TH AVE NE
Edgecomb Creek
Middle Fork
Hayho Cr
BNRR

Site Visit Pictures

Image 1: Image of existing land cover, dense grasses for agriculture

Image 2: Existing Ditch along 51st Ave NE

Image 3: Existing stream located offsite south east of the project site

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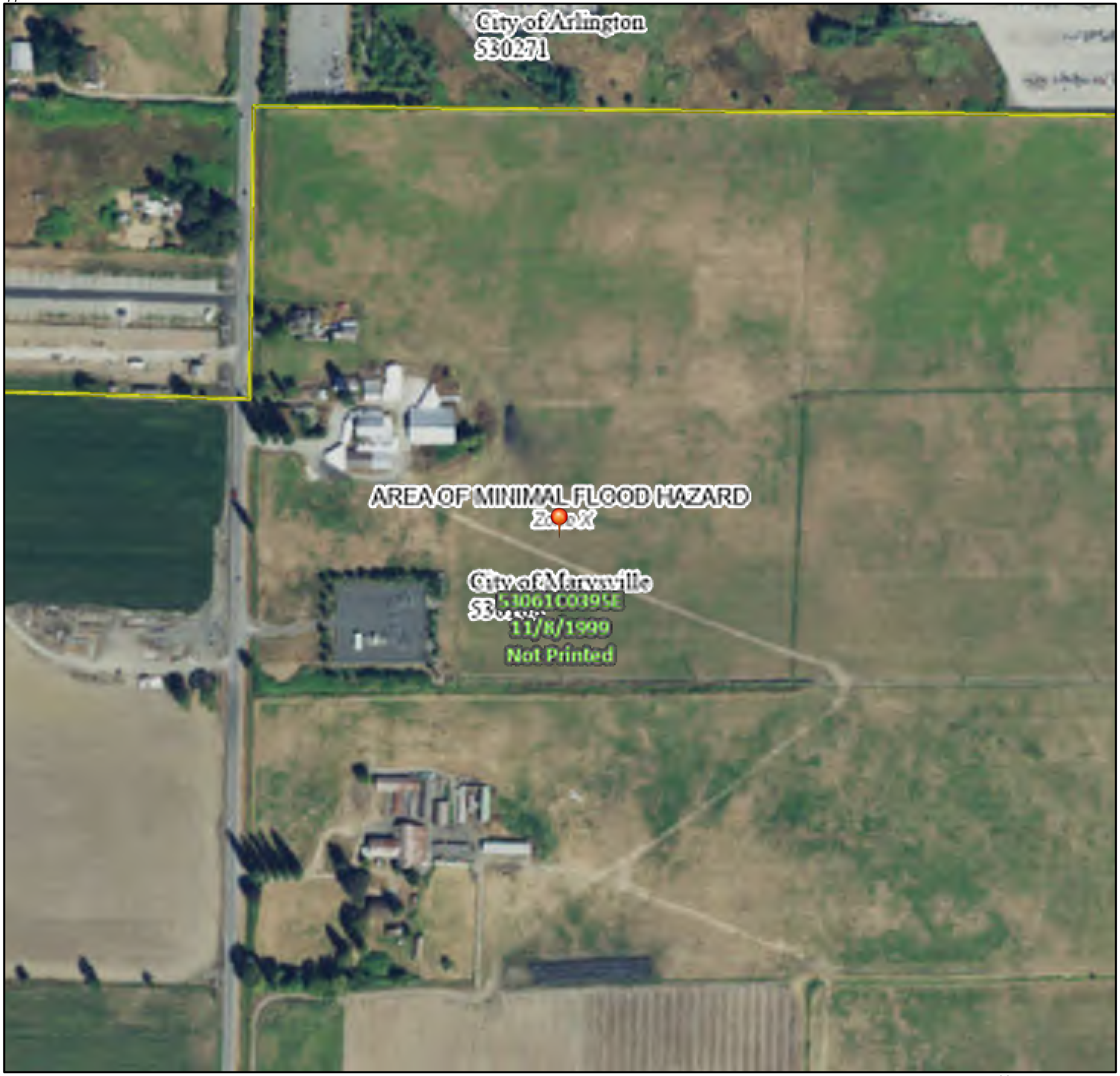

Map Scale: 1:4,430 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 23, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 16, 2020—Aug 19, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13	Custer fine sandy loam	40.2	52.0%
39	Norma loam	37.0	48.0%
Totals for Area of Interest		**77.2**	**100.0%**

Snohomish County Area, Washington

13—Custer fine sandy loam

Map Unit Setting

National map unit symbol: 2hy0
Elevation: 0 to 150 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if irrigated and drained

Map Unit Composition

Custer, undrained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Custer, Undrained

Setting

Landform: Outwash plains
Parent material: Glacial outwash

Typical profile

H1 - 0 to 9 inches: fine sandy loam
H2 - 9 to 35 inches: sand
H3 - 35 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

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

Minor Components

Norma, undrained
Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Indianola
Percent of map unit: 5 percent
Hydric soil rating: No

Custer, drained
Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 23, Aug 31, 2021

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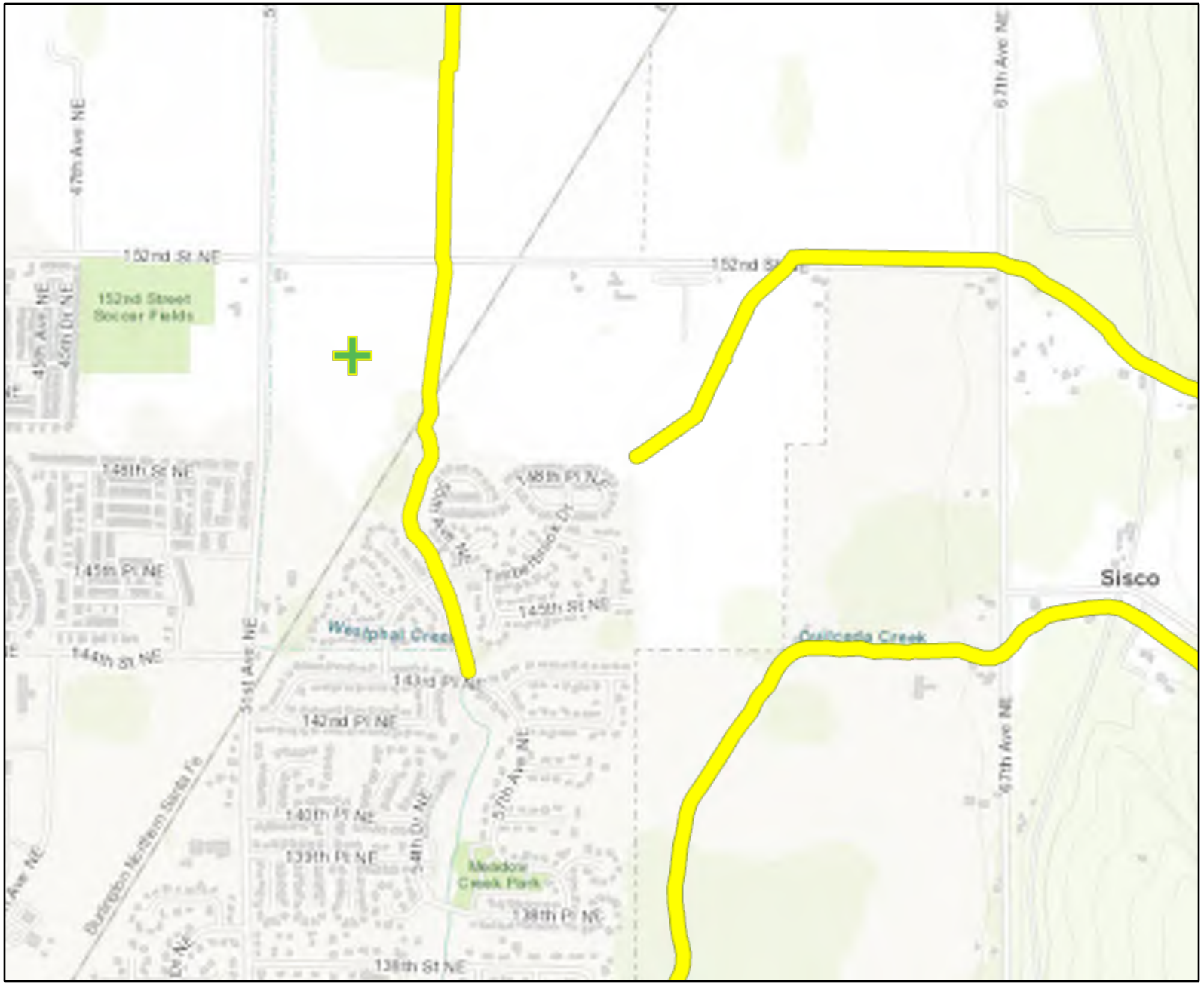
0DS



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6HGLPHQW

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0LOHV

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6RXUFHV (VUL +(5(*DUDLQ ,QWHUPHGLDWH LQFUHPHQW 3 &RUS *(%&2 86*6
)$2 136 15&$1 *HR%DVH ,*1 .GDVWHU 1/ 2UGQDQFH 6XUYH\ (VUL

DEPARTMENT OF ECOLOGY
State of Washington

LISTING_ID	CURRENT_CATEGORY	ASSESSMENT_UNIT_ID	WATERBODY_NAME	PARAMETER_NAME	MEDIUM_NAME	TMDL_NAME	DESIGNATED_USE	STUDY_ID	LOCATION_ID	SOURCE_DB_NAME
7298	1	171100110000 98_001_001	QUILCEDA CREEK, M.F.	Bacteria - Fecal coliform	Water	Snohomish River Tributaries Bacteria TMDL	Recreation - Primary Contact	SNOCO_TMDLMONITORING	QCMFU_SNOCO	EIM
7301	2	171100110027 37_001_001	QUILCEDA CREEK, M.F.	Dissolved Oxygen	Water	Snohomish River Estuary Multiparameter TMDL	Aquatic Life - Salmonid Spawning, Rearing, and Migration	AJOH0026; SNOCO_TMDLMONITORING	QCRMF1; QCLU_SNOCO	EIM; EIM
7307	1	171100110027 37_001_001	QUILCEDA CREEK, M.F.	Bacteria - Fecal coliform	Water	Snohomish River Tributaries Bacteria TMDL	Recreation - Primary Contact	SNOCO_TMDLMONITORING	QCLU_SNOCO	EIM
9806	4A	171100110001 04_001_001	QUILCEDA CREEK, M.F.	Bacteria - Fecal coliform	Water	Snohomish River Tributaries Bacteria TMDL	Recreation - Primary Contact	G0000291	QCMF	EIM
9807	2	171100110005 28_001_001	QUILCEDA CREEK, M.F.	Bacteria - Fecal coliform	Water	Snohomish River Tributaries Bacteria TMDL	Recreation - Primary Contact			
97026	2	171100110000 98_001_001	QUILCEDA CREEK, M.F.	Thallium	Water		Water Supply - Domestic Water	FS2699; FS2699; FS2699	FS2699-28; FS2699-33; FS2699-35	EIM; EIM; EIM

Appendix C: Detention and Water Quality Analysis Data

1. Figure 5.0 – Predeveloped Hydrology Map
2. Figure 6.0 – Developed Hydrology Map
3. WWHM Output: Pond 1
4. WWHM Output: Pond 2
5. WWHM Output: Pond 3
6. WWHM Output: Bioswale/Infiltration Trench System
7. Modular Wetland by Forterra Detail: Pond 1
8. Modular Wetland by Forterra Detail: Pond 2
9. Modular Wetland by Forterra Detail: Pond 3

M-51 INDUSTRIAL

PREDEVELOPED HYDROLOGY MAP

M-51 INDUSTRIAL, LLC

LDC
Surveying
Engineering
Planning

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18431 Central Pl S #101
Kent, WA 98032
T 425.806.1869 www.LDCcorp.com F 425.482.2893

Woodinville
20219 142nd Avenue NE
Woodinville, WA 98072

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601 FEET

REVISION:
JOB NUMBER: C21-170
DRAWING NAME: C21-170-1.0
DESIGNER: PPATEL
DRAWING BY: PPATEL
DATE: 10/12/2023
SCALE: AS SHOWN
JURISDICTION: MARYSVILLE

FIGURE: 5.0

SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
SNOHOMISH COUNTY GIS	PARCEL BOUNDARY
SNOHOMISH COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

SOUTH POND 1 BASIN - 56.85 AC

EAST POND 2 BASIN - 9.87 AC

WEST POND 3 BASIN - 9.53 AC

51ST AVE NE BIOSWALE BASIN - 1.04 AC

51ST AVE NE

VICINITY MAP

I-5

LEGEND

Subject Property

Parcel Boundary

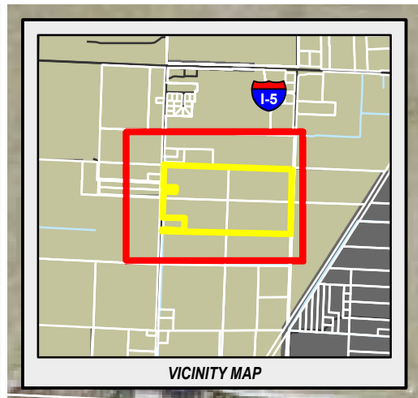
Watercourse

10 Foot Contour

2 Foot Contour

0 300 600

Scale in Feet



VICINITY MAP

SOUTH POND 1 BASIN	
ROAD -	12.94 AC
ROOF -	23.80 AC
SIDEWALK -	0.23 AC
POND -	8.75 AC
BYPASS ROAD -	0.08 AC
BYPASS SIDEWALK -	0.092 AC
PASTURE -	11.038 AC
TOTAL -	56.85 AC

EAST POND 2 BASIN	
ROAD -	5.03 AC
SIDEWALK -	0.20 AC
POND -	2.26 AC
BYPASS ROAD -	0.16 AC
BYPASS SIDEWALK -	0.024 AC
PASTURE -	2.196 AC
TOTAL -	9.87 AC

WEST POND 3 BASIN	
ROAD -	5.92 AC
SIDEWALK -	0.13 AC
POND -	1.20 AC
PASTURE -	2.28 AC
TOTAL -	9.53 AC

51ST AVE NE BIOSWALE BASIN	
ROAD -	0.85 AC
SIDEWALK -	0.19 AC
TOTAL -	1.04 AC

ST AVE NE

POND 2 BYPASS

POND 1 BYPASS

NEED TO ADD SIDEWALK ALIGNMENT

LEGEND

- Subject Property
- Parcel Boundary
- Watercourse
- 10 Foot Contour
- 2 Foot Contour

N

0 300 600

Scale in Feet

SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
SNOHOMISH COUNTY GIS	PARCEL BOUNDARY
SNOHOMISH COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

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M-51 INDUSTRIAL, LLC

M-51 INDUSTRIAL

DEVELOPMENT HYDROLOGY MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601 FEET

REVISION:	
JOB NUMBER:	C21-170
DRAWING NAME:	C21-170-1.0
DESIGNER:	PPATEL
DRAWING BY:	PPATEL
DATE:	10/12/2023
SCALE:	AS SHOWN
JURISDICTION:	MARYSVILLE

FIGURE:

6.0

Developed Hydrology Map.mxd | MOD: 10/12/2023 | ppatel

WWHM2012

PROJECT REPORT

SOUTH POND 1

General Model Information

Project Name:	wwhm Pond 01_20231016
Site Name:	M-51 Industrial
Site Address:	51st Ave NE
City:	Marrysville, WA
Report Date:	10/19/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2018/10/10
Version:	4.2.16

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

South Pond 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	56.85
Pervious Total	56.85
Impervious Land Use	acre
Impervious Total	0
Basin Total	56.85

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

South Pond 1 Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	11.038
Pervious Total	11.038

Impervious Land Use	acre
ROADS FLAT	12.94
ROOF TOPS FLAT	23.8
SIDEWALKS FLAT	0.23
POND	8.75
Impervious Total	45.72
Basin Total	56.758

Element Flows To:

Surface	Interflow	Groundwater
South Pond 1	South Pond 1	

South Pond 1 Bypass

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.08
SIDEWALKS FLAT	0.012
Impervious Total	0.092
Basin Total	0.092

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

South Pond 1

Bottom Length: 1900.00 ft.
Bottom Width: 160.00 ft.
Depth: 4.5 ft.
Volume at riser head: 26.1758 acre-feet.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 3.5 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 4.5 in. Elevation:0 ft.
Orifice 2 Diameter: 5.25 in. Elevation:2.95 ft.
Orifice 3 Diameter: 4.25 in. Elevation:3 ft.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

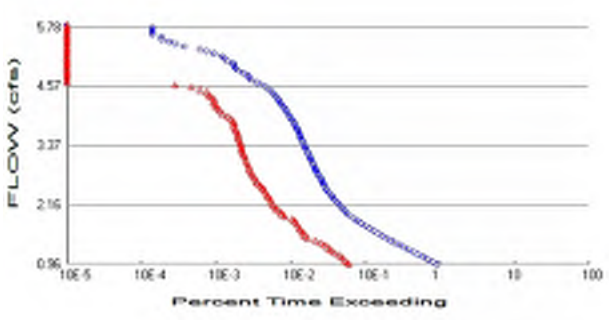
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	6.978	0.000	0.000	0.000
0.0500	6.993	0.349	0.122	0.000
0.1000	7.007	0.699	0.173	0.000
0.1500	7.021	1.050	0.212	0.000
0.2000	7.035	1.401	0.245	0.000
0.2500	7.049	1.753	0.274	0.000
0.3000	7.064	2.106	0.301	0.000
0.3500	7.078	2.460	0.325	0.000
0.4000	7.092	2.814	0.347	0.000
0.4500	7.106	3.169	0.368	0.000
0.5000	7.121	3.524	0.388	0.000
0.5500	7.135	3.881	0.407	0.000
0.6000	7.149	4.238	0.425	0.000
0.6500	7.163	4.596	0.443	0.000
0.7000	7.177	4.954	0.459	0.000
0.7500	7.192	5.314	0.475	0.000
0.8000	7.206	5.674	0.491	0.000
0.8500	7.220	6.034	0.506	0.000
0.9000	7.234	6.396	0.521	0.000
0.9500	7.249	6.758	0.535	0.000
1.0000	7.263	7.121	0.549	0.000
1.0500	7.277	7.484	0.563	0.000
1.1000	7.292	7.848	0.576	0.000
1.1500	7.306	8.213	0.589	0.000
1.2000	7.320	8.579	0.602	0.000
1.2500	7.334	8.945	0.614	0.000
1.3000	7.349	9.312	0.626	0.000
1.3500	7.363	9.680	0.638	0.000
1.4000	7.377	10.04	0.650	0.000
1.4500	7.392	10.41	0.661	0.000
1.5000	7.406	10.78	0.673	0.000
1.5500	7.420	11.15	0.684	0.000
1.6000	7.435	11.53	0.695	0.000

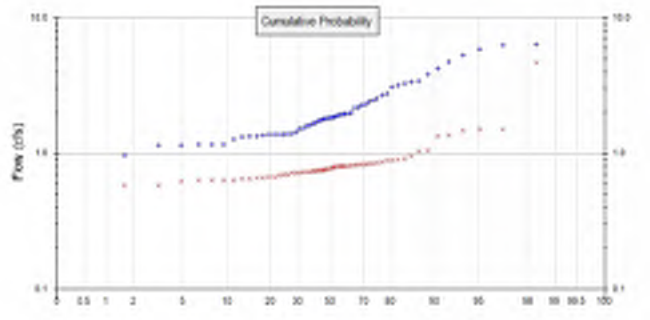
1.6500	7.449	11.90	0.705	0.000
1.7000	7.463	12.27	0.716	0.000
1.7500	7.478	12.64	0.726	0.000
1.8000	7.492	13.02	0.737	0.000
1.8500	7.506	13.39	0.747	0.000
1.9000	7.521	13.77	0.757	0.000
1.9500	7.535	14.15	0.767	0.000
2.0000	7.549	14.52	0.777	0.000
2.0500	7.564	14.90	0.786	0.000
2.1000	7.578	15.28	0.796	0.000
2.1500	7.592	15.66	0.805	0.000
2.2000	7.607	16.04	0.815	0.000
2.2500	7.621	16.42	0.824	0.000
2.3000	7.635	16.80	0.833	0.000
2.3500	7.650	17.18	0.842	0.000
2.4000	7.664	17.57	0.851	0.000
2.4500	7.679	17.95	0.860	0.000
2.5000	7.693	18.33	0.868	0.000
2.5500	7.707	18.72	0.877	0.000
2.6000	7.722	19.10	0.886	0.000
2.6500	7.736	19.49	0.894	0.000
2.7000	7.751	19.88	0.903	0.000
2.7500	7.765	20.27	0.911	0.000
2.8000	7.779	20.65	0.919	0.000
2.8500	7.794	21.04	0.927	0.000
2.9000	7.808	21.43	0.935	0.000
2.9500	7.823	21.82	0.943	0.000
3.0000	7.837	22.22	1.119	0.000
3.0500	7.852	22.61	1.305	0.000
3.1000	7.866	23.00	1.412	0.000
3.1500	7.880	23.40	1.499	0.000
3.2000	7.895	23.79	1.576	0.000
3.2500	7.909	24.18	1.645	0.000
3.3000	7.924	24.58	1.709	0.000
3.3500	7.938	24.98	1.768	0.000
3.4000	7.953	25.37	1.825	0.000
3.4500	7.967	25.77	1.878	0.000
3.5000	7.982	26.17	1.929	0.000
3.5500	7.996	26.57	2.156	0.000
3.6000	8.011	26.97	2.527	0.000
3.6500	8.025	27.37	2.989	0.000
3.7000	8.040	27.77	3.519	0.000
3.7500	8.054	28.18	4.096	0.000
3.8000	8.069	28.58	4.700	0.000
3.8500	8.083	28.98	5.312	0.000
3.9000	8.098	29.39	5.911	0.000
3.9500	8.112	29.79	6.478	0.000
4.0000	8.127	30.20	6.994	0.000
4.0500	8.141	30.61	7.448	0.000
4.1000	8.156	31.01	7.830	0.000
4.1500	8.170	31.42	8.141	0.000
4.2000	8.185	31.83	8.391	0.000
4.2500	8.199	32.24	8.605	0.000
4.3000	8.214	32.65	8.905	0.000
4.3500	8.228	33.06	9.134	0.000
4.4000	8.243	33.47	9.356	0.000
4.4500	8.257	33.89	9.572	0.000
4.5000	8.272	34.30	9.783	0.000

4.5500	8.287	34.71	9.990	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 56.85
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 11.038
Total Impervious Area: 45.812

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	1.910182
5 year	2.93028
10 year	3.717006
25 year	4.842592
50 year	5.780028
100 year	6.80524

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.784751
5 year	1.049097
10 year	1.248498
25 year	1.529645
50 year	1.761371
100 year	2.013168

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	1.909	0.699
1950	1.951	0.801
1951	1.745	0.671
1952	1.376	0.651
1953	1.153	0.649
1954	6.240	0.728
1955	2.459	1.362
1956	2.170	1.506
1957	2.689	0.795
1958	1.943	0.744

1959	1.927	0.743
1960	1.795	0.758
1961	3.393	0.885
1962	1.675	0.625
1963	2.760	0.722
1964	1.986	0.580
1965	1.658	0.767
1966	0.971	0.689
1967	1.969	0.717
1968	2.395	0.780
1969	5.822	0.726
1970	1.373	0.714
1971	2.168	1.348
1972	1.600	0.695
1973	1.513	0.822
1974	3.275	0.803
1975	1.333	0.630
1976	1.371	0.756
1977	1.157	0.656
1978	1.373	0.657
1979	3.821	0.634
1980	1.791	0.665
1981	1.403	0.632
1982	1.820	0.823
1983	3.103	0.736
1984	1.873	1.046
1985	2.269	0.918
1986	5.335	1.496
1987	2.545	1.044
1988	1.318	0.833
1989	1.342	0.635
1990	1.781	0.806
1991	1.834	0.803
1992	1.398	0.790
1993	1.158	0.576
1994	1.272	0.815
1995	1.865	0.845
1996	3.182	0.830
1997	6.328	4.657
1998	1.165	0.713
1999	1.521	0.815
2000	1.142	0.863
2001	0.458	0.496
2002	1.734	0.895
2003	1.358	0.737
2004	2.285	0.836
2005	1.591	0.744
2006	4.235	0.949
2007	3.351	0.890
2008	4.703	1.477
2009	1.433	0.804

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	6.3276	4.6570
2	6.2398	1.5060
3	5.8220	1.4964

4	5.3348	1.4768
5	4.7033	1.3620
6	4.2353	1.3478
7	3.8211	1.0457
8	3.3930	1.0438
9	3.3510	0.9491
10	3.2752	0.9175
11	3.1822	0.8947
12	3.1032	0.8904
13	2.7600	0.8848
14	2.6889	0.8630
15	2.5452	0.8448
16	2.4585	0.8364
17	2.3947	0.8335
18	2.2849	0.8302
19	2.2686	0.8226
20	2.1704	0.8223
21	2.1682	0.8149
22	1.9858	0.8145
23	1.9691	0.8060
24	1.9512	0.8042
25	1.9432	0.8034
26	1.9268	0.8030
27	1.9086	0.8006
28	1.8734	0.7950
29	1.8646	0.7897
30	1.8339	0.7801
31	1.8200	0.7666
32	1.7948	0.7578
33	1.7907	0.7560
34	1.7810	0.7443
35	1.7446	0.7437
36	1.7338	0.7432
37	1.6749	0.7374
38	1.6585	0.7362
39	1.5997	0.7277
40	1.5908	0.7261
41	1.5207	0.7224
42	1.5134	0.7168
43	1.4332	0.7141
44	1.4029	0.7127
45	1.3976	0.6992
46	1.3763	0.6948
47	1.3734	0.6889
48	1.3733	0.6708
49	1.3713	0.6646
50	1.3584	0.6567
51	1.3424	0.6561
52	1.3333	0.6510
53	1.3184	0.6486
54	1.2722	0.6345
55	1.1646	0.6337
56	1.1576	0.6322
57	1.1568	0.6300
58	1.1531	0.6246
59	1.1422	0.5803
60	0.9709	0.5759
61	0.4582	0.4965

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.9551	19601	1285	6	Pass
1.0038	17023	1201	7	Pass
1.0526	14679	1108	7	Pass
1.1013	12733	1016	7	Pass
1.1500	10919	935	8	Pass
1.1988	9454	817	8	Pass
1.2475	8175	735	8	Pass
1.2962	7078	678	9	Pass
1.3450	6141	603	9	Pass
1.3937	5319	532	10	Pass
1.4425	4656	453	9	Pass
1.4912	4066	359	8	Pass
1.5399	3559	327	9	Pass
1.5887	3140	315	10	Pass
1.6374	2761	297	10	Pass
1.6861	2447	283	11	Pass
1.7349	2154	269	12	Pass
1.7836	1894	254	13	Pass
1.8324	1657	241	14	Pass
1.8811	1508	225	14	Pass
1.9298	1371	177	12	Pass
1.9786	1252	165	13	Pass
2.0273	1154	153	13	Pass
2.0760	1068	138	12	Pass
2.1248	1009	130	12	Pass
2.1735	950	124	13	Pass
2.2222	888	119	13	Pass
2.2710	826	115	13	Pass
2.3197	777	109	14	Pass
2.3685	734	104	14	Pass
2.4172	686	99	14	Pass
2.4659	649	94	14	Pass
2.5147	622	88	14	Pass
2.5634	602	83	13	Pass
2.6121	583	76	13	Pass
2.6609	561	73	13	Pass
2.7096	538	70	13	Pass
2.7584	507	67	13	Pass
2.8071	487	64	13	Pass
2.8558	473	62	13	Pass
2.9046	457	60	13	Pass
2.9533	440	59	13	Pass
3.0020	424	57	13	Pass
3.0508	410	55	13	Pass
3.0995	394	53	13	Pass
3.1482	380	52	13	Pass
3.1970	368	49	13	Pass
3.2457	353	48	13	Pass
3.2945	341	47	13	Pass
3.3432	333	47	14	Pass
3.3919	322	46	14	Pass
3.4407	313	45	14	Pass
3.4894	302	43	14	Pass

3.5381	293	42	14	Pass
3.5869	284	42	14	Pass
3.6356	276	41	14	Pass
3.6843	265	40	15	Pass
3.7331	257	38	14	Pass
3.7818	241	37	15	Pass
3.8306	234	37	15	Pass
3.8793	226	36	15	Pass
3.9280	212	33	15	Pass
3.9768	205	30	14	Pass
4.0255	195	26	13	Pass
4.0742	187	24	12	Pass
4.1230	177	23	12	Pass
4.1717	166	21	12	Pass
4.2205	160	21	13	Pass
4.2692	150	20	13	Pass
4.3179	146	20	13	Pass
4.3667	135	18	13	Pass
4.4154	128	17	13	Pass
4.4641	120	16	13	Pass
4.5129	111	13	11	Pass
4.5616	99	10	10	Pass
4.6103	85	6	7	Pass
4.6591	75	0	0	Pass
4.7078	63	0	0	Pass
4.7566	59	0	0	Pass
4.8053	56	0	0	Pass
4.8540	49	0	0	Pass
4.9028	42	0	0	Pass
4.9515	39	0	0	Pass
5.0002	37	0	0	Pass
5.0490	36	0	0	Pass
5.0977	30	0	0	Pass
5.1465	28	0	0	Pass
5.1952	26	0	0	Pass
5.2439	20	0	0	Pass
5.2927	16	0	0	Pass
5.3414	13	0	0	Pass
5.3901	8	0	0	Pass
5.4389	6	0	0	Pass
5.4876	5	0	0	Pass
5.5363	4	0	0	Pass
5.5851	4	0	0	Pass
5.6338	3	0	0	Pass
5.6826	3	0	0	Pass
5.7313	3	0	0	Pass
5.7800	3	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
South Pond 1 POC	☐	8818.32			☐	0.00			
Total Volume Infiltrated		8818.32	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.

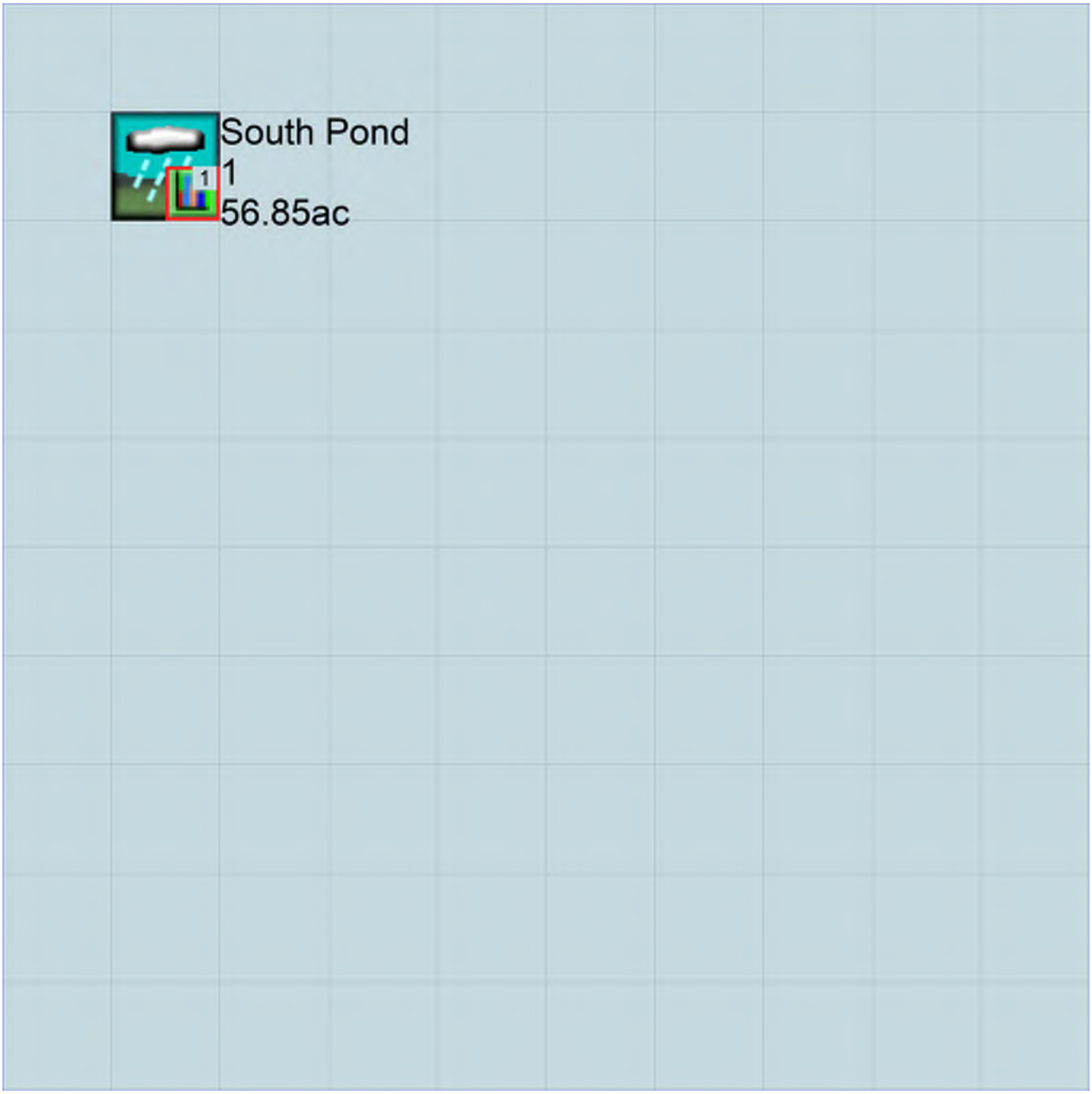
PERLND Changes

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   wwhm Pond 01_20231016.wdm
MESSU       25   Prewwhm Pond 01_20231016.MES
            27   Prewwhm Pond 01_20231016.L61
            28   Prewwhm Pond 01_20231016.L62
            30   POCwwhm Pond 01_202310161.dat
END FILES

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

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
South Pond 1***
PERLND  10                       56.85     COPY   501     12
PERLND  10                       56.85     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Pond 01_20231016.wdm
MESSU       25   Mitwwhm Pond 01_20231016.MES
            27   Mitwwhm Pond 01_20231016.L61
            28   Mitwwhm Pond 01_20231016.L62
            30   POCwwhm Pond 01_202310161.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND       4
      IMPLND       8
      IMPLND      14
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        South Pond  1               MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         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           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
```

```
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13          0.15       0.4       0.3         6       0.5       0.4
  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
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
   14         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
   14         0    0    4    0    0    0    1    9
  END PRINT-INFO
```

```
  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
   14         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   14            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
South Pond 1 Basin***
PERLND  13                      11.038     RCHRES   1      2
PERLND  13                      11.038     RCHRES   1      3
IMPLND   1                       12.94     RCHRES   1      5
IMPLND   4                        23.8     RCHRES   1      5
IMPLND   8                        0.23     RCHRES   1      5
IMPLND  14                        8.75     RCHRES   1      5
South Pond 1 Bypass***
IMPLND   1                        0.08     COPY   501     15
IMPLND   1                        0.08     COPY   601     15
IMPLND   8                       0.012     COPY   501     15
IMPLND   8                       0.012     COPY   601     15

******Routing******
PERLND  13                      11.038     COPY     1     12
IMPLND   1                       12.94     COPY     1     15
IMPLND   4                        23.8     COPY     1     15
IMPLND   8                        0.23     COPY     1     15
IMPLND  14                        8.75     COPY     1     15
PERLND  13                      11.038     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

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

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

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

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

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

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.36       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  6.978880  0.000000  0.000000
  0.050000  6.993069  0.349299  0.122876
  0.100000  7.007263  0.699307  0.173774
  0.150000  7.021460  1.050025  0.212828
  0.200000  7.035662  1.401453  0.245753
  0.250000  7.049868  1.753591  0.274760
  0.300000  7.064078  2.106440  0.300985
  0.350000  7.078292  2.459999  0.325101
  0.400000  7.092511  2.814269  0.347547
  0.450000  7.106733  3.169250  0.368629
  0.500000  7.120960  3.524943  0.388570
  0.550000  7.135190  3.881347  0.407535
  0.600000  7.149425  4.238462  0.425657
  0.650000  7.163664  4.596289  0.443037
  0.700000  7.177907  4.954828  0.459762
```

0.750000	7.192154	5.314080	0.475899
0.800000	7.206406	5.674044	0.491506
0.850000	7.220661	6.034721	0.506633
0.900000	7.234921	6.396110	0.521321
0.950000	7.249185	6.758213	0.535606
1.000000	7.263453	7.121029	0.549520
1.050000	7.277725	7.484558	0.563091
1.100000	7.292001	7.848801	0.576342
1.150000	7.306281	8.213758	0.589295
1.200000	7.320566	8.579430	0.601969
1.250000	7.334854	8.945815	0.614382
1.300000	7.349147	9.312915	0.626550
1.350000	7.363444	9.680730	0.638485
1.400000	7.377745	10.04926	0.650201
1.450000	7.392050	10.41850	0.661710
1.500000	7.406359	10.78846	0.673022
1.550000	7.420672	11.15914	0.684147
1.600000	7.434990	11.53053	0.695094
1.650000	7.449312	11.90264	0.705872
1.700000	7.463637	12.27546	0.716487
1.750000	7.477967	12.64900	0.726947
1.800000	7.492301	13.02326	0.737259
1.850000	7.506639	13.39823	0.747428
1.900000	7.520982	13.77392	0.757461
1.950000	7.535328	14.15033	0.767363
2.000000	7.549679	14.52746	0.777139
2.050000	7.564033	14.90530	0.786793
2.100000	7.578392	15.28386	0.796331
2.150000	7.592755	15.66314	0.805755
2.200000	7.607122	16.04314	0.815070
2.250000	7.621493	16.42385	0.824280
2.300000	7.635869	16.80529	0.833389
2.350000	7.650248	17.18744	0.842399
2.400000	7.664632	17.57031	0.851313
2.450000	7.679020	17.95390	0.860135
2.500000	7.693411	18.33821	0.868868
2.550000	7.707807	18.72324	0.877514
2.600000	7.722208	19.10899	0.886075
2.650000	7.736612	19.49546	0.894554
2.700000	7.751020	19.88265	0.902954
2.750000	7.765433	20.27057	0.911276
2.800000	7.779849	20.65920	0.919523
2.850000	7.794270	21.04855	0.927697
2.900000	7.808695	21.43863	0.935799
2.950000	7.823124	21.82942	0.943832
3.000000	7.837557	22.22094	1.119046
3.050000	7.851995	22.61318	1.305824
3.100000	7.866436	23.00614	1.412215
3.150000	7.880882	23.39982	1.499636
3.200000	7.895331	23.79423	1.576196
3.250000	7.909785	24.18935	1.645415
3.300000	7.924243	24.58520	1.709222
3.350000	7.938705	24.98178	1.768819
3.400000	7.953172	25.37907	1.825014
3.450000	7.967642	25.77710	1.878383
3.500000	7.982117	26.17584	1.929353
3.550000	7.996595	26.57531	2.156104
3.600000	8.011078	26.97550	2.527518
3.650000	8.025565	27.37641	2.989897
3.700000	8.040056	27.77806	3.519334
3.750000	8.054551	28.18042	4.096056
3.800000	8.069051	28.58351	4.700468
3.850000	8.083554	28.98733	5.312392
3.900000	8.098062	29.39187	5.911441
3.950000	8.112573	29.79713	6.478022
4.000000	8.127089	30.20312	6.994720
4.050000	8.141609	30.60984	7.447991
4.100000	8.156133	31.01728	7.830093
4.150000	8.170661	31.42545	8.141234
4.200000	8.185194	31.83435	8.391900

```
  4.250000  8.199730  32.24397  8.605360
  4.300000  8.214271  32.65432  8.905933
  4.350000  8.228816  33.06540  9.134209
  4.400000  8.243365  33.47721  9.356311
  4.450000  8.257918  33.88974  9.572731
  4.500000  8.272475  34.30300  9.783896
  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    1.2           PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2           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***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

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

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

Relevant data are:
DATE/TIME: 1967/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-3.027E-03     0.00000  0.0000E+00     0.00000  -1.777E-08

Where:

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

```
ERROR/WARNING ID:   238   1

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

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

Relevant data are:
DATE/TIME: 1994/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.987E-02     0.00000  0.0000E+00     0.00000  -2.661E-09

Where:

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

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WWHM2012

PROJECT REPORT

EAST POND 2

General Model Information

Project Name:	wwhm Pond 02_20231016
Site Name:	M-51 Industrial
Site Address:	51st Ave NE
City:	Marrysville, WA
Report Date:	10/19/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2018/10/10
Version:	4.2.16

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

East Pond 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	9.87
Pervious Total	9.87
Impervious Land Use	acre
Impervious Total	0
Basin Total	9.87

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

East Pond 2 Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	2.196
Pervious Total	2.196

Impervious Land Use	acre
ROADS FLAT	5.03
SIDEWALKS FLAT	0.2
POND	2.26
Impervious Total	7.49
Basin Total	9.686

Element Flows To:

Surface	Interflow	Groundwater
East Pond 2	East Pond 2	

East Pond 2 Bypass

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.16
SIDEWALKS FLAT	0.024
Impervious Total	0.184
Basin Total	0.184

Element Flows To:

Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

East Pond 2

Bottom Length: 890.00 ft.
Bottom Width: 65.00 ft.
Depth: 4.5 ft.
Volume at riser head: 5.4657 acre-feet.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 3.5 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 1.5 in. Elevation:0 ft.
Orifice 2 Diameter: 4.21 in. Elevation:2.3345 ft.
Orifice 3 Diameter: 2.66 in. Elevation:2.98625000000004 ft.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

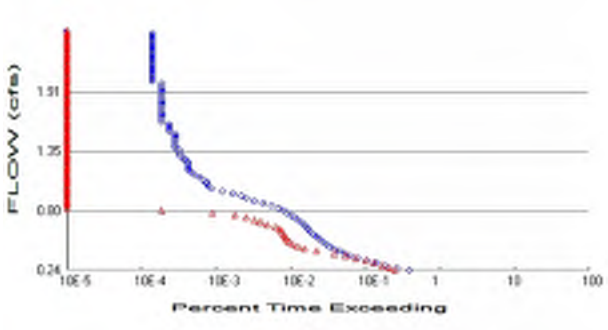
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	1.328	0.000	0.000	0.000
0.0500	1.334	0.066	0.013	0.000
0.1000	1.341	0.133	0.019	0.000
0.1500	1.347	0.200	0.023	0.000
0.2000	1.354	0.268	0.027	0.000
0.2500	1.361	0.336	0.030	0.000
0.3000	1.367	0.404	0.033	0.000
0.3500	1.374	0.472	0.036	0.000
0.4000	1.380	0.541	0.038	0.000
0.4500	1.387	0.611	0.041	0.000
0.5000	1.394	0.680	0.043	0.000
0.5500	1.400	0.750	0.045	0.000
0.6000	1.407	0.820	0.047	0.000
0.6500	1.413	0.891	0.049	0.000
0.7000	1.420	0.962	0.051	0.000
0.7500	1.427	1.033	0.052	0.000
0.8000	1.433	1.104	0.054	0.000
0.8500	1.440	1.176	0.056	0.000
0.9000	1.447	1.248	0.057	0.000
0.9500	1.453	1.321	0.059	0.000
1.0000	1.460	1.394	0.061	0.000
1.0500	1.467	1.467	0.062	0.000
1.1000	1.473	1.540	0.064	0.000
1.1500	1.480	1.614	0.065	0.000
1.2000	1.487	1.688	0.066	0.000
1.2500	1.493	1.763	0.068	0.000
1.3000	1.500	1.838	0.069	0.000
1.3500	1.507	1.913	0.070	0.000
1.4000	1.513	1.988	0.072	0.000
1.4500	1.520	2.064	0.073	0.000
1.5000	1.527	2.141	0.074	0.000
1.5500	1.533	2.217	0.076	0.000
1.6000	1.540	2.294	0.077	0.000

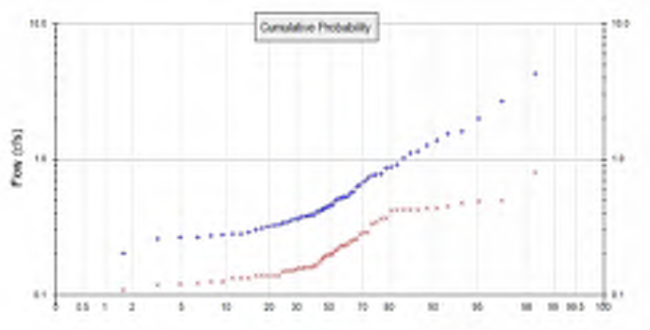
1.6500	1.547	2.371	0.078	0.000
1.7000	1.554	2.449	0.079	0.000
1.7500	1.560	2.527	0.080	0.000
1.8000	1.567	2.605	0.081	0.000
1.8500	1.574	2.683	0.083	0.000
1.9000	1.581	2.762	0.084	0.000
1.9500	1.587	2.841	0.085	0.000
2.0000	1.594	2.921	0.086	0.000
2.0500	1.601	3.001	0.087	0.000
2.1000	1.607	3.081	0.088	0.000
2.1500	1.614	3.162	0.089	0.000
2.2000	1.621	3.243	0.090	0.000
2.2500	1.628	3.324	0.091	0.000
2.3000	1.635	3.405	0.092	0.000
2.3500	1.641	3.487	0.153	0.000
2.4000	1.648	3.570	0.217	0.000
2.4500	1.655	3.652	0.259	0.000
2.5000	1.662	3.735	0.292	0.000
2.5500	1.668	3.818	0.320	0.000
2.6000	1.675	3.902	0.346	0.000
2.6500	1.682	3.986	0.369	0.000
2.7000	1.689	4.070	0.391	0.000
2.7500	1.696	4.155	0.411	0.000
2.8000	1.702	4.240	0.430	0.000
2.8500	1.709	4.325	0.448	0.000
2.9000	1.716	4.411	0.465	0.000
2.9500	1.723	4.497	0.482	0.000
3.0000	1.730	4.583	0.520	0.000
3.0500	1.736	4.670	0.562	0.000
3.1000	1.743	4.757	0.593	0.000
3.1500	1.750	4.844	0.620	0.000
3.2000	1.757	4.932	0.645	0.000
3.2500	1.764	5.020	0.668	0.000
3.3000	1.771	5.108	0.691	0.000
3.3500	1.778	5.197	0.712	0.000
3.4000	1.784	5.286	0.732	0.000
3.4500	1.791	5.375	0.752	0.000
3.5000	1.798	5.465	0.771	0.000
3.5500	1.805	5.555	0.967	0.000
3.6000	1.812	5.646	1.309	0.000
3.6500	1.819	5.737	1.743	0.000
3.7000	1.826	5.828	2.246	0.000
3.7500	1.833	5.919	2.796	0.000
3.8000	1.839	6.011	3.375	0.000
3.8500	1.846	6.103	3.963	0.000
3.9000	1.853	6.196	4.538	0.000
3.9500	1.860	6.289	5.081	0.000
4.0000	1.867	6.382	5.575	0.000
4.0500	1.874	6.475	6.006	0.000
4.1000	1.881	6.569	6.366	0.000
4.1500	1.888	6.663	6.656	0.000
4.2000	1.895	6.758	6.886	0.000
4.2500	1.902	6.853	7.079	0.000
4.3000	1.909	6.948	7.359	0.000
4.3500	1.915	7.044	7.568	0.000
4.4000	1.922	7.140	7.770	0.000
4.4500	1.929	7.236	7.967	0.000
4.5000	1.936	7.333	8.160	0.000

4.5500	1.943	7.430	8.347	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 9.87
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.196
Total Impervious Area: 7.674

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.489864
5 year	0.883558
10 year	1.250188
25 year	1.866071
50 year	2.458716
100 year	3.187878

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.210626
5 year	0.324143
10 year	0.413843
25 year	0.544964
50 year	0.656371
100 year	0.780244

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.779	0.150
1950	0.684	0.289
1951	0.426	0.139
1952	0.413	0.149
1953	0.388	0.160
1954	1.995	0.228
1955	0.731	0.488
1956	0.440	0.424
1957	0.769	0.156
1958	1.539	0.257

1959	0.412	0.139
1960	0.564	0.139
1961	4.297	0.367
1962	0.511	0.139
1963	1.143	0.163
1964	0.634	0.132
1965	0.318	0.198
1966	0.204	0.125
1967	0.459	0.230
1968	0.521	0.236
1969	2.689	0.254
1970	0.309	0.150
1971	0.580	0.425
1972	0.653	0.199
1973	0.392	0.189
1974	1.022	0.288
1975	0.524	0.166
1976	0.362	0.174
1977	0.259	0.125
1978	0.277	0.133
1979	1.382	0.182
1980	0.532	0.138
1981	0.281	0.122
1982	0.430	0.210
1983	0.862	0.230
1984	0.378	0.439
1985	0.511	0.424
1986	1.271	0.494
1987	0.496	0.449
1988	0.266	0.194
1989	0.465	0.158
1990	0.341	0.133
1991	0.351	0.282
1992	0.377	0.153
1993	0.301	0.108
1994	0.282	0.201
1995	0.364	0.341
1996	0.762	0.363
1997	1.620	0.804
1998	0.385	0.160
1999	0.289	0.332
2000	0.329	0.247
2001	0.108	0.109
2002	0.339	0.436
2003	0.264	0.120
2004	0.449	0.217
2005	0.322	0.119
2006	1.106	0.477
2007	0.875	0.417
2008	0.910	0.423
2009	0.273	0.158

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	4.2967	0.8044
2	2.6895	0.4945
3	1.9952	0.4882

4	1.6198	0.4767
5	1.5385	0.4486
6	1.3821	0.4390
7	1.2707	0.4359
8	1.1427	0.4247
9	1.1061	0.4245
10	1.0221	0.4242
11	0.9095	0.4234
12	0.8753	0.4174
13	0.8624	0.3674
14	0.7790	0.3628
15	0.7690	0.3411
16	0.7623	0.3324
17	0.7314	0.2894
18	0.6840	0.2878
19	0.6529	0.2818
20	0.6343	0.2566
21	0.5798	0.2539
22	0.5645	0.2468
23	0.5317	0.2358
24	0.5245	0.2304
25	0.5213	0.2299
26	0.5111	0.2281
27	0.5106	0.2172
28	0.4963	0.2104
29	0.4645	0.2008
30	0.4591	0.1993
31	0.4488	0.1985
32	0.4397	0.1937
33	0.4298	0.1890
34	0.4264	0.1819
35	0.4127	0.1740
36	0.4119	0.1659
37	0.3915	0.1634
38	0.3880	0.1601
39	0.3855	0.1595
40	0.3778	0.1585
41	0.3768	0.1581
42	0.3643	0.1562
43	0.3620	0.1529
44	0.3505	0.1502
45	0.3414	0.1499
46	0.3386	0.1491
47	0.3291	0.1392
48	0.3220	0.1390
49	0.3180	0.1389
50	0.3090	0.1386
51	0.3013	0.1383
52	0.2889	0.1327
53	0.2817	0.1326
54	0.2813	0.1323
55	0.2770	0.1251
56	0.2731	0.1246
57	0.2655	0.1224
58	0.2641	0.1203
59	0.2594	0.1191
60	0.2039	0.1093
61	0.1083	0.1076

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2449	8250	5311	64	Pass
0.2673	5694	4457	78	Pass
0.2897	4021	3580	89	Pass
0.3120	2997	2755	91	Pass
0.3344	2218	2152	97	Pass
0.3567	1692	1589	93	Pass
0.3791	1360	1181	86	Pass
0.4015	1129	823	72	Pass
0.4238	960	476	49	Pass
0.4462	805	324	40	Pass
0.4685	698	267	38	Pass
0.4909	633	227	35	Pass
0.5133	570	201	35	Pass
0.5356	518	186	35	Pass
0.5580	477	179	37	Pass
0.5804	433	172	39	Pass
0.6027	394	164	41	Pass
0.6251	369	152	41	Pass
0.6474	346	134	38	Pass
0.6698	322	103	31	Pass
0.6922	294	85	28	Pass
0.7145	266	70	26	Pass
0.7369	239	54	22	Pass
0.7592	215	38	17	Pass
0.7816	192	19	9	Pass
0.8040	170	4	2	Pass
0.8263	148	0	0	Pass
0.8487	119	0	0	Pass
0.8711	91	0	0	Pass
0.8934	69	0	0	Pass
0.9158	55	0	0	Pass
0.9381	46	0	0	Pass
0.9605	36	0	0	Pass
0.9829	26	0	0	Pass
1.0052	19	0	0	Pass
1.0276	17	0	0	Pass
1.0499	16	0	0	Pass
1.0723	16	0	0	Pass
1.0947	14	0	0	Pass
1.1170	13	0	0	Pass
1.1394	11	0	0	Pass
1.1618	10	0	0	Pass
1.1841	9	0	0	Pass
1.2065	9	0	0	Pass
1.2288	9	0	0	Pass
1.2512	9	0	0	Pass
1.2736	8	0	0	Pass
1.2959	8	0	0	Pass
1.3183	7	0	0	Pass
1.3406	7	0	0	Pass
1.3630	7	0	0	Pass
1.3854	6	0	0	Pass
1.4077	6	0	0	Pass

1.4301	6	0	0	Pass
1.4525	6	0	0	Pass
1.4748	6	0	0	Pass
1.4972	6	0	0	Pass
1.5195	6	0	0	Pass
1.5419	5	0	0	Pass
1.5643	5	0	0	Pass
1.5866	5	0	0	Pass
1.6090	5	0	0	Pass
1.6313	4	0	0	Pass
1.6537	4	0	0	Pass
1.6761	4	0	0	Pass
1.6984	4	0	0	Pass
1.7208	4	0	0	Pass
1.7431	4	0	0	Pass
1.7655	4	0	0	Pass
1.7879	4	0	0	Pass
1.8102	4	0	0	Pass
1.8326	4	0	0	Pass
1.8550	4	0	0	Pass
1.8773	4	0	0	Pass
1.8997	4	0	0	Pass
1.9220	4	0	0	Pass
1.9444	4	0	0	Pass
1.9668	4	0	0	Pass
1.9891	4	0	0	Pass
2.0115	3	0	0	Pass
2.0338	3	0	0	Pass
2.0562	3	0	0	Pass
2.0786	3	0	0	Pass
2.1009	3	0	0	Pass
2.1233	3	0	0	Pass
2.1457	3	0	0	Pass
2.1680	3	0	0	Pass
2.1904	3	0	0	Pass
2.2127	3	0	0	Pass
2.2351	3	0	0	Pass
2.2575	3	0	0	Pass
2.2798	3	0	0	Pass
2.3022	3	0	0	Pass
2.3245	3	0	0	Pass
2.3469	3	0	0	Pass
2.3693	3	0	0	Pass
2.3916	3	0	0	Pass
2.4140	3	0	0	Pass
2.4364	3	0	0	Pass
2.4587	3	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
East Pond 2 POC	☐	1471.13			☐	0.00			
Total Volume Infiltrated		1471.13	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

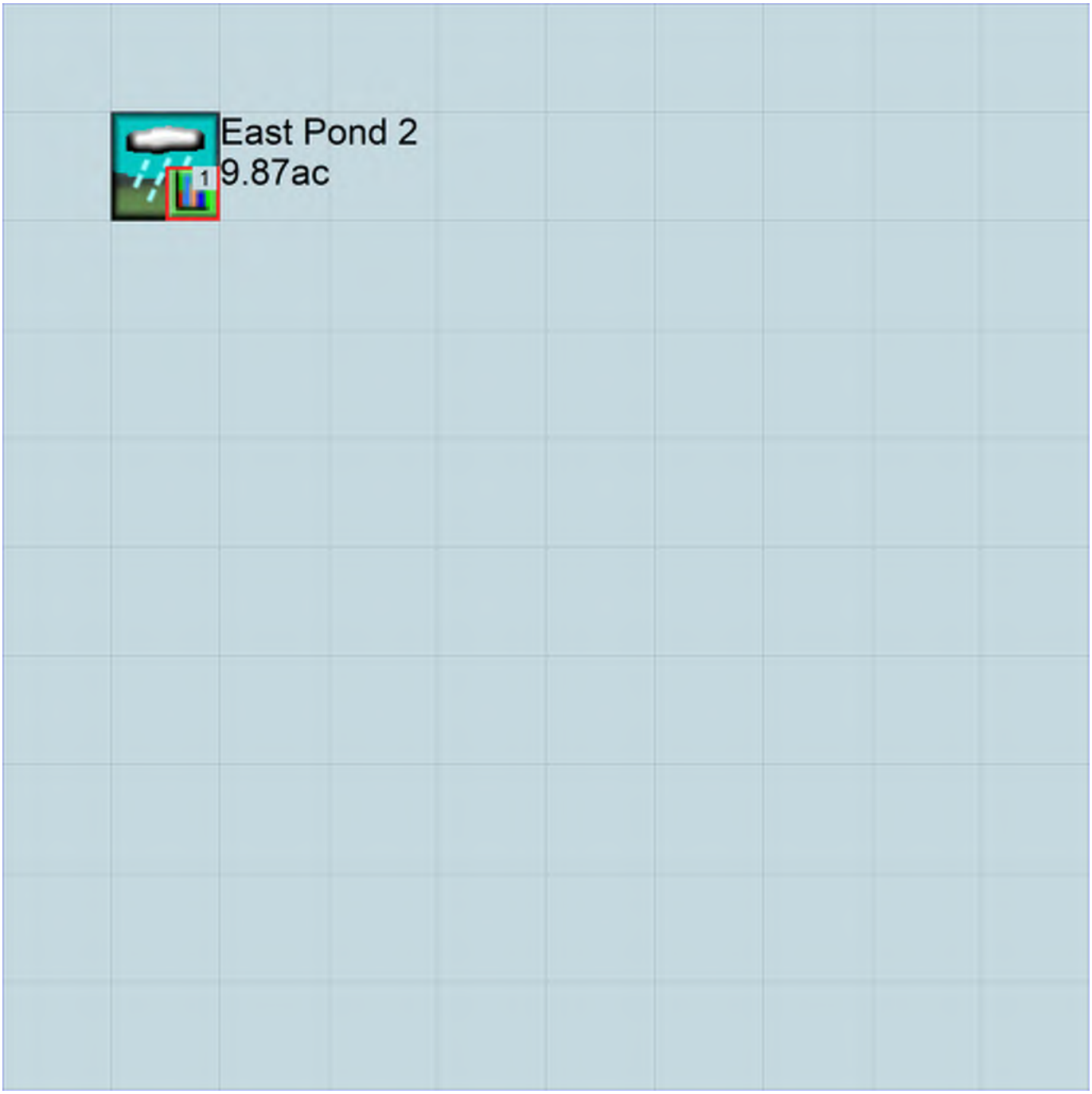
PERLND Changes

No PERLND changes have been made.

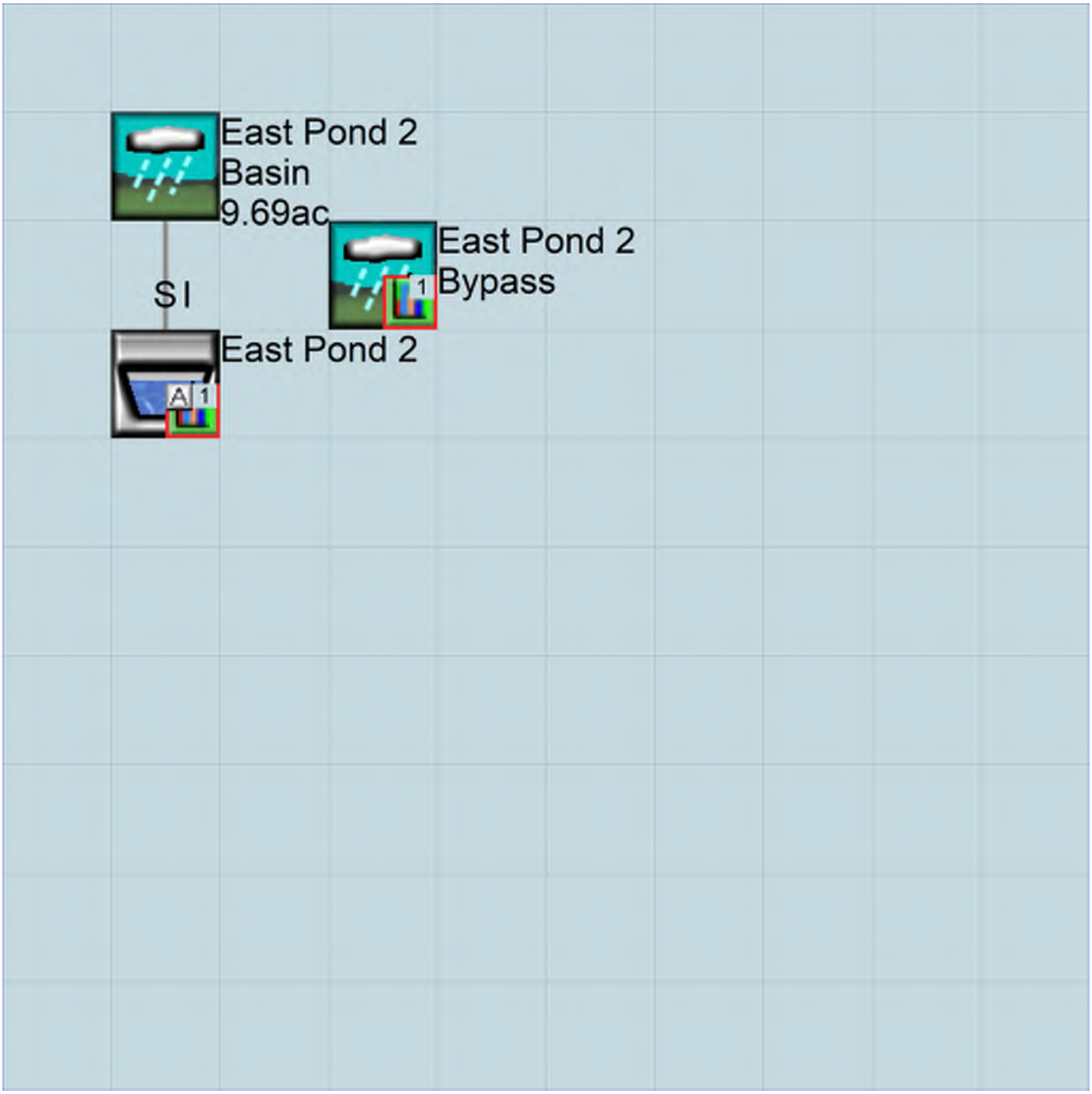
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Pond 02_20231016.wdm
MESSU       25   Prewwhm Pond 02_20231016.MES
            27   Prewwhm Pond 02_20231016.L61
            28   Prewwhm Pond 02_20231016.L62
            30   POCwwhm Pond 02_202310161.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        East Pond 2                MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13          0.15       0.4       0.3         6       0.5       0.4
  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
   13             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
East Pond 2***
PERLND  13                       9.87     COPY   501     12
PERLND  13                       9.87     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Pond 02_20231016.wdm
MESSU       25   Mitwwhm Pond 02_20231016.MES
            27   Mitwwhm Pond 02_20231016.L61
            28   Mitwwhm Pond 02_20231016.L62
            30   POCwwhm Pond 02_202310161.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND       8
      IMPLND      14
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        East Pond 2                MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         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           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                 ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13          0.15       0.4       0.3         6       0.5       0.4
  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
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
   14      POND                   1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
   14         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
   14         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
```

```
    8         0    0    0    0    0
   14         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   14            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    8              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    8              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
East Pond 2 Basin***
PERLND  13                       2.196     RCHRES   1      2
PERLND  13                       2.196     RCHRES   1      3
IMPLND   1                        5.03     RCHRES   1      5
IMPLND   8                         0.2     RCHRES   1      5
IMPLND  14                        2.26     RCHRES   1      5
East Pond 2 Bypass***
IMPLND   1                        0.16     COPY   501     15
IMPLND   1                        0.16     COPY   601     15
IMPLND   8                       0.024     COPY   501     15
IMPLND   8                       0.024     COPY   601     15

******Routing******
PERLND  13                       2.196     COPY     1     12
IMPLND   1                        5.03     COPY     1     15
IMPLND   8                         0.2     COPY     1     15
IMPLND  14                        2.26     COPY     1     15
PERLND  13                       2.196     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

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



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

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

```
    1     East Pond 2             1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
    1             1      0.17       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  1.328053  0.000000  0.000000
  0.050000  1.334632  0.066567  0.013653
  0.100000  1.341216  0.133463  0.019308
  0.150000  1.347803  0.200689  0.023648
  0.200000  1.354395  0.268244  0.027306
  0.250000  1.360991  0.336128  0.030529
  0.300000  1.367590  0.404343  0.033443
  0.350000  1.374194  0.472888  0.036122
  0.400000  1.380803  0.541762  0.038616
  0.450000  1.387415  0.610968  0.040959
  0.500000  1.394031  0.680504  0.043174
  0.550000  1.400652  0.750371  0.045282
  0.600000  1.407276  0.820569  0.047295
  0.650000  1.413905  0.891099  0.049226
  0.700000  1.420538  0.961960  0.051085
  0.750000  1.427175  1.033153  0.052878
  0.800000  1.433816  1.104678  0.054612
  0.850000  1.440462  1.176535  0.056293
  0.900000  1.447111  1.248724  0.057925
  0.950000  1.453765  1.321246  0.059512
  1.000000  1.460422  1.394100  0.061058
  1.050000  1.467084  1.467288  0.062566
  1.100000  1.473750  1.540809  0.064038
  1.150000  1.480420  1.614663  0.065477
  1.200000  1.487095  1.688851  0.066885
```

```
  1.250000  1.493773  1.763373  0.068265
  1.300000  1.500455  1.838229  0.069617
  1.350000  1.507142  1.913418  0.070943
  1.400000  1.513833  1.988943  0.072245
  1.450000  1.520528  2.064802  0.073523
  1.500000  1.527227  2.140996  0.074780
  1.550000  1.533930  2.217525  0.076016
  1.600000  1.540637  2.294389  0.077233
  1.650000  1.547349  2.371588  0.078430
  1.700000  1.554064  2.449124  0.079610
  1.750000  1.560784  2.526995  0.080772
  1.800000  1.567508  2.605202  0.081918
  1.850000  1.574236  2.683746  0.083048
  1.900000  1.580968  2.762626  0.084162
  1.950000  1.587704  2.841843  0.085263
  2.000000  1.594444  2.921396  0.086349
  2.050000  1.601189  3.001287  0.087421
  2.100000  1.607938  3.081515  0.088481
  2.150000  1.614690  3.162081  0.089528
  2.200000  1.621447  3.242985  0.090563
  2.250000  1.628208  3.324226  0.091587
  2.300000  1.634973  3.405806  0.092599
  2.350000  1.641743  3.487723  0.153481
  2.400000  1.648516  3.569980  0.217686
  2.450000  1.655294  3.652575  0.259032
  2.500000  1.662075  3.735509  0.292210
  2.550000  1.668861  3.818783  0.320780
  2.600000  1.675651  3.902396  0.346284
  2.650000  1.682445  3.986348  0.369556
  2.700000  1.689243  4.070640  0.391110
  2.750000  1.696046  4.155272  0.411286
  2.800000  1.702852  4.240245  0.430327
  2.850000  1.709663  4.325558  0.448410
  2.900000  1.716478  4.411211  0.465670
  2.950000  1.723296  4.497206  0.482214
  3.000000  1.730119  4.583541  0.520641
  3.050000  1.736947  4.670218  0.561957
  3.100000  1.743778  4.757236  0.593081
  3.150000  1.750613  4.844596  0.620410
  3.200000  1.757453  4.932297  0.645458
  3.250000  1.764296  5.020341  0.668889
  3.300000  1.771144  5.108727  0.691074
  3.350000  1.777996  5.197455  0.712247
  3.400000  1.784852  5.286527  0.732569
  3.450000  1.791712  5.375941  0.752160
  3.500000  1.798577  5.465698  0.771107
  3.550000  1.805445  5.555798  0.967334
  3.600000  1.812318  5.646243  1.309522
  3.650000  1.819194  5.737030  1.743813
  3.700000  1.826075  5.828162  2.246170
  3.750000  1.832960  5.919638  2.796710
  3.800000  1.839849  6.011458  3.375751
  3.850000  1.846743  6.103623  3.963038
  3.900000  1.853640  6.196133  4.538119
  3.950000  1.860542  6.288987  5.081345
  4.000000  1.867447  6.382187  5.575252
  4.050000  1.874357  6.475732  6.006253
  4.100000  1.881271  6.569623  6.366571
  4.150000  1.888189  6.663859  6.656379
  4.200000  1.895111  6.758442  6.886134
  4.250000  1.902037  6.853370  7.079079
  4.300000  1.908968  6.948646  7.359509
  4.350000  1.915902  7.044267  7.567991
  4.400000  1.922841  7.140236  7.770631
  4.450000  1.929784  7.236551  7.967901
  4.500000  1.936731  7.333214  8.160214
  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    1.2           PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2           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***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL       REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL       REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL       REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL       REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL       REPL
END EXT TARGETS

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

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

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

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

```
ERROR/WARNING ID:   238   1

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

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

Relevant data are:
DATE/TIME: 1948/12/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.053E-03     0.00000  0.0000E+00     0.00000  -2.452E-07

Where:

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

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Local (360)943-0304

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WWHM2012

PROJECT REPORT

WEST POND 3

General Model Information

Project Name:	wwhm Pond 03_20231016
Site Name:	M-51 Industrial
Site Address:	51st Ave NE
City:	Marrysville, WA
Report Date:	10/19/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2018/10/10
Version:	4.2.16

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

West Pond 3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	9.53
Pervious Total	9.53
Impervious Land Use	acre
Impervious Total	0
Basin Total	9.53

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

West Pond 3 Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	2.28
Pervious Total	2.28

Impervious Land Use	acre
ROADS FLAT	5.92
SIDEWALKS FLAT	0.13
POND	1.2
Impervious Total	7.25
Basin Total	9.53

Element Flows To:

Surface	Interflow	Groundwater
West Pond 3	West Pond 3	

Routing Elements
Predeveloped Routing

Mitigated Routing

West Pond 3

Bottom Length: 250.00 ft.
Bottom Width: 160.00 ft.
Depth: 4.75 ft.
Volume at riser head: 3.9123 acre-feet.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 3.75 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 2 in. Elevation:0 ft.
Orifice 2 Diameter: 2.75 in. Elevation:2.33333333333333 ft.
Orifice 3 Diameter: 3.5 in. Elevation:2.70833333333333 ft.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

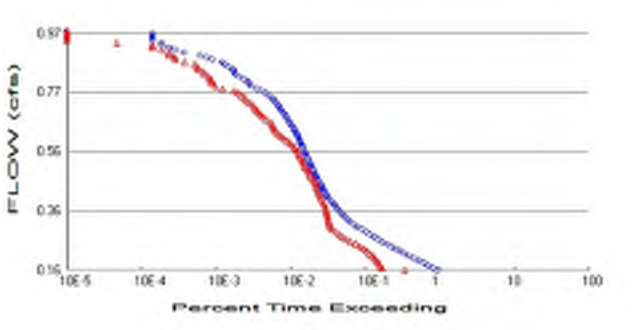
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.918	0.000	0.000	0.000
0.0528	0.921	0.048	0.024	0.000
0.1056	0.924	0.097	0.035	0.000
0.1583	0.927	0.146	0.043	0.000
0.2111	0.930	0.195	0.049	0.000
0.2639	0.933	0.244	0.055	0.000
0.3167	0.936	0.293	0.061	0.000
0.3694	0.939	0.343	0.066	0.000
0.4222	0.942	0.392	0.070	0.000
0.4750	0.945	0.442	0.074	0.000
0.5278	0.948	0.492	0.078	0.000
0.5806	0.951	0.542	0.082	0.000
0.6333	0.954	0.593	0.086	0.000
0.6861	0.957	0.643	0.089	0.000
0.7389	0.960	0.694	0.093	0.000
0.7917	0.963	0.744	0.096	0.000
0.8444	0.966	0.795	0.099	0.000
0.8972	0.969	0.846	0.102	0.000
0.9500	0.972	0.898	0.105	0.000
1.0028	0.975	0.949	0.108	0.000
1.0556	0.978	1.001	0.111	0.000
1.1083	0.981	1.052	0.114	0.000
1.1611	0.985	1.104	0.117	0.000
1.2139	0.988	1.156	0.119	0.000
1.2667	0.991	1.209	0.122	0.000
1.3194	0.994	1.261	0.124	0.000
1.3722	0.997	1.314	0.127	0.000
1.4250	1.000	1.366	0.129	0.000
1.4778	1.003	1.419	0.132	0.000
1.5306	1.006	1.472	0.134	0.000
1.5833	1.009	1.525	0.136	0.000
1.6361	1.012	1.579	0.138	0.000
1.6889	1.016	1.632	0.141	0.000

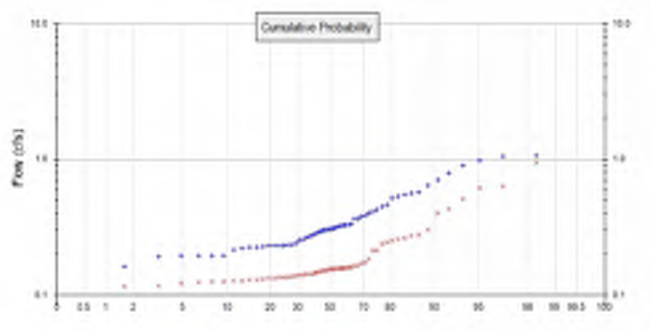
1.7417	1.019	1.686	0.143	0.000
1.7944	1.022	1.740	0.145	0.000
1.8472	1.025	1.794	0.147	0.000
1.9000	1.028	1.848	0.149	0.000
1.9528	1.031	1.902	0.151	0.000
2.0056	1.034	1.957	0.153	0.000
2.0583	1.038	2.012	0.155	0.000
2.1111	1.041	2.067	0.157	0.000
2.1639	1.044	2.122	0.159	0.000
2.2167	1.047	2.177	0.161	0.000
2.2694	1.050	2.232	0.163	0.000
2.3222	1.053	2.288	0.165	0.000
2.3750	1.057	2.343	0.209	0.000
2.4278	1.060	2.399	0.232	0.000
2.4806	1.063	2.455	0.249	0.000
2.5333	1.066	2.512	0.264	0.000
2.5861	1.069	2.568	0.277	0.000
2.6389	1.073	2.624	0.289	0.000
2.6917	1.076	2.681	0.300	0.000
2.7444	1.079	2.738	0.374	0.000
2.7972	1.082	2.795	0.420	0.000
2.8500	1.085	2.852	0.455	0.000
2.9028	1.089	2.910	0.486	0.000
2.9556	1.092	2.967	0.513	0.000
3.0083	1.095	3.025	0.539	0.000
3.0611	1.098	3.083	0.562	0.000
3.1139	1.102	3.141	0.584	0.000
3.1667	1.105	3.199	0.605	0.000
3.2194	1.108	3.258	0.625	0.000
3.2722	1.111	3.316	0.644	0.000
3.3250	1.115	3.375	0.663	0.000
3.3778	1.118	3.434	0.681	0.000
3.4306	1.121	3.493	0.698	0.000
3.4833	1.125	3.552	0.715	0.000
3.5361	1.128	3.612	0.731	0.000
3.5889	1.131	3.672	0.747	0.000
3.6417	1.134	3.731	0.763	0.000
3.6944	1.138	3.791	0.778	0.000
3.7472	1.141	3.852	0.793	0.000
3.8000	1.144	3.912	0.985	0.000
3.8528	1.148	3.972	1.344	0.000
3.9056	1.151	4.033	1.805	0.000
3.9583	1.154	4.094	2.339	0.000
4.0111	1.158	4.155	2.924	0.000
4.0639	1.161	4.216	3.535	0.000
4.1167	1.164	4.278	4.150	0.000
4.1694	1.168	4.339	4.743	0.000
4.2222	1.171	4.401	5.294	0.000
4.2750	1.174	4.463	5.782	0.000
4.3278	1.178	4.525	6.195	0.000
4.3806	1.181	4.587	6.528	0.000
4.4333	1.184	4.650	6.788	0.000
4.4861	1.188	4.712	6.997	0.000
4.5389	1.191	4.775	7.280	0.000
4.5917	1.195	4.838	7.498	0.000
4.6444	1.198	4.901	7.710	0.000
4.6972	1.201	4.964	7.916	0.000
4.7500	1.205	5.028	8.117	0.000

4.8028	1.208	5.092	8.312	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 9.53
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.28
Total Impervious Area: 7.25

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.320212
5 year	0.491215
10 year	0.623097
25 year	0.811784
50 year	0.96893
100 year	1.140791

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.16823
5 year	0.255535
10 year	0.329804
25 year	0.445662
50 year	0.550256
100 year	0.672629

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.320	0.140
1950	0.327	0.156
1951	0.292	0.132
1952	0.231	0.126
1953	0.193	0.126
1954	1.046	0.147
1955	0.412	0.277
1956	0.364	0.301
1957	0.451	0.164
1958	0.326	0.143

1959	0.323	0.148
1960	0.301	0.155
1961	0.569	0.252
1962	0.281	0.129
1963	0.463	0.139
1964	0.333	0.115
1965	0.278	0.155
1966	0.163	0.132
1967	0.330	0.134
1968	0.401	0.157
1969	0.976	0.142
1970	0.230	0.138
1971	0.363	0.403
1972	0.268	0.142
1973	0.254	0.159
1974	0.549	0.152
1975	0.223	0.122
1976	0.230	0.146
1977	0.194	0.133
1978	0.230	0.128
1979	0.641	0.135
1980	0.300	0.127
1981	0.235	0.128
1982	0.305	0.185
1983	0.520	0.137
1984	0.314	0.431
1985	0.380	0.262
1986	0.894	0.627
1987	0.427	0.511
1988	0.221	0.213
1989	0.225	0.123
1990	0.299	0.164
1991	0.307	0.154
1992	0.234	0.159
1993	0.194	0.117
1994	0.213	0.157
1995	0.313	0.257
1996	0.533	0.211
1997	1.061	0.938
1998	0.195	0.135
1999	0.255	0.158
2000	0.191	0.272
2001	0.077	0.103
2002	0.291	0.174
2003	0.228	0.150
2004	0.383	0.238
2005	0.267	0.151
2006	0.710	0.244
2007	0.562	0.170
2008	0.788	0.609
2009	0.240	0.157

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.0607	0.9381
2	1.0460	0.6271
3	0.9760	0.6090

4	0.8943	0.5107
5	0.7884	0.4305
6	0.7100	0.4025
7	0.6405	0.3006
8	0.5688	0.2773
9	0.5617	0.2724
10	0.5490	0.2616
11	0.5334	0.2573
12	0.5202	0.2517
13	0.4627	0.2437
14	0.4507	0.2380
15	0.4267	0.2127
16	0.4121	0.2106
17	0.4014	0.1849
18	0.3830	0.1743
19	0.3803	0.1704
20	0.3638	0.1643
21	0.3635	0.1638
22	0.3329	0.1592
23	0.3301	0.1590
24	0.3271	0.1579
25	0.3258	0.1574
26	0.3230	0.1571
27	0.3199	0.1567
28	0.3140	0.1559
29	0.3126	0.1548
30	0.3074	0.1547
31	0.3051	0.1541
32	0.3009	0.1523
33	0.3002	0.1509
34	0.2986	0.1499
35	0.2925	0.1484
36	0.2906	0.1466
37	0.2808	0.1456
38	0.2780	0.1430
39	0.2682	0.1423
40	0.2667	0.1422
41	0.2549	0.1396
42	0.2537	0.1395
43	0.2403	0.1384
44	0.2352	0.1371
45	0.2343	0.1349
46	0.2307	0.1345
47	0.2302	0.1344
48	0.2302	0.1335
49	0.2299	0.1317
50	0.2277	0.1316
51	0.2250	0.1287
52	0.2235	0.1279
53	0.2210	0.1276
54	0.2133	0.1267
55	0.1952	0.1260
56	0.1941	0.1258
57	0.1939	0.1230
58	0.1933	0.1224
59	0.1915	0.1167
60	0.1628	0.1149
61	0.0768	0.1034

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1601	19635	7249	36	Pass
0.1683	17073	3559	20	Pass
0.1764	14778	3364	22	Pass
0.1846	12863	3193	24	Pass
0.1928	11088	3020	27	Pass
0.2010	9586	2855	29	Pass
0.2091	8181	2680	32	Pass
0.2173	7110	2417	33	Pass
0.2255	6179	2212	35	Pass
0.2336	5358	2019	37	Pass
0.2418	4714	1802	38	Pass
0.2500	4126	1597	38	Pass
0.2581	3559	1368	38	Pass
0.2663	3142	1179	37	Pass
0.2745	2774	1062	38	Pass
0.2827	2470	967	39	Pass
0.2908	2182	867	39	Pass
0.2990	1922	771	40	Pass
0.3072	1657	722	43	Pass
0.3153	1512	708	46	Pass
0.3235	1377	697	50	Pass
0.3317	1259	684	54	Pass
0.3398	1164	671	57	Pass
0.3480	1069	660	61	Pass
0.3562	1009	649	64	Pass
0.3644	952	642	67	Pass
0.3725	892	625	70	Pass
0.3807	830	614	73	Pass
0.3889	782	594	75	Pass
0.3970	733	574	78	Pass
0.4052	687	549	79	Pass
0.4134	650	529	81	Pass
0.4215	623	515	82	Pass
0.4297	603	500	82	Pass
0.4379	585	487	83	Pass
0.4461	561	474	84	Pass
0.4542	538	462	85	Pass
0.4624	508	445	87	Pass
0.4706	489	428	87	Pass
0.4787	473	402	84	Pass
0.4869	459	389	84	Pass
0.4951	440	374	85	Pass
0.5032	424	355	83	Pass
0.5114	411	331	80	Pass
0.5196	395	321	81	Pass
0.5278	380	313	82	Pass
0.5359	369	301	81	Pass
0.5441	353	287	81	Pass
0.5523	341	278	81	Pass
0.5604	333	268	80	Pass
0.5686	322	257	79	Pass
0.5768	313	244	77	Pass
0.5849	305	234	76	Pass

0.5931	293	212	72	Pass
0.6013	284	196	69	Pass
0.6095	276	172	62	Pass
0.6176	267	159	59	Pass
0.6258	257	146	56	Pass
0.6340	243	131	53	Pass
0.6421	234	127	54	Pass
0.6503	226	124	54	Pass
0.6585	212	120	56	Pass
0.6666	205	116	56	Pass
0.6748	195	100	51	Pass
0.6830	187	90	48	Pass
0.6912	177	84	47	Pass
0.6993	166	79	47	Pass
0.7075	160	74	46	Pass
0.7157	151	70	46	Pass
0.7238	146	66	45	Pass
0.7320	135	60	44	Pass
0.7402	128	55	42	Pass
0.7483	121	52	42	Pass
0.7565	111	47	42	Pass
0.7647	100	42	42	Pass
0.7729	87	37	42	Pass
0.7810	75	26	34	Pass
0.7892	63	21	33	Pass
0.7974	59	19	32	Pass
0.8055	56	18	32	Pass
0.8137	50	18	36	Pass
0.8219	43	17	39	Pass
0.8300	39	15	38	Pass
0.8382	37	14	37	Pass
0.8464	36	12	33	Pass
0.8546	32	12	37	Pass
0.8627	28	11	39	Pass
0.8709	26	8	30	Pass
0.8791	19	6	31	Pass
0.8872	16	6	37	Pass
0.8954	13	5	38	Pass
0.9036	8	5	62	Pass
0.9117	6	4	66	Pass
0.9199	5	3	60	Pass
0.9281	4	3	75	Pass
0.9363	4	1	25	Pass
0.9444	3	0	0	Pass
0.9526	3	0	0	Pass
0.9608	3	0	0	Pass
0.9689	3	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
West Pond 3 POC	☐	1434.75			☐	0.00			
Total Volume Infiltrated		1434.75	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

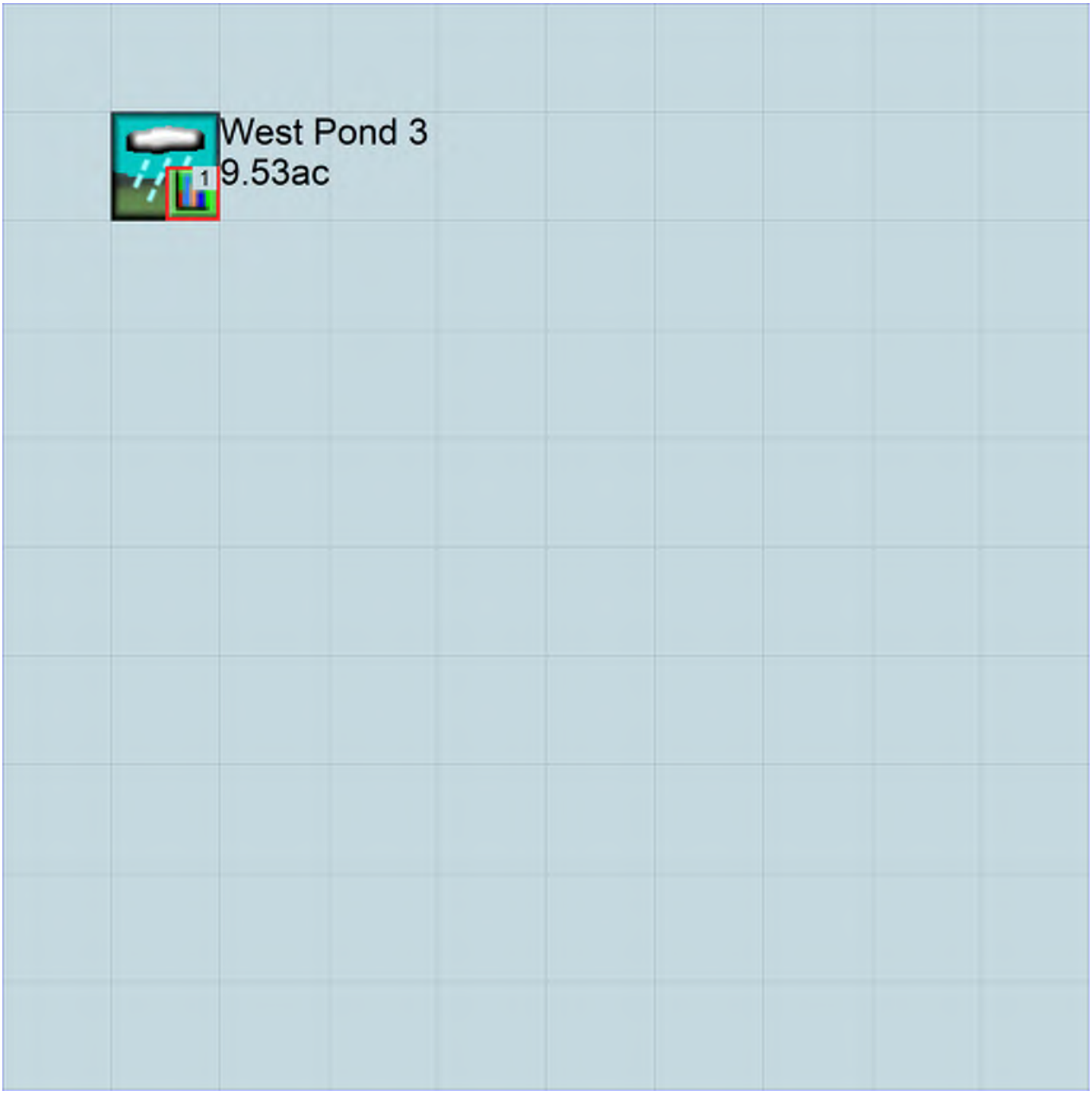
PERLND Changes

No PERLND changes have been made.

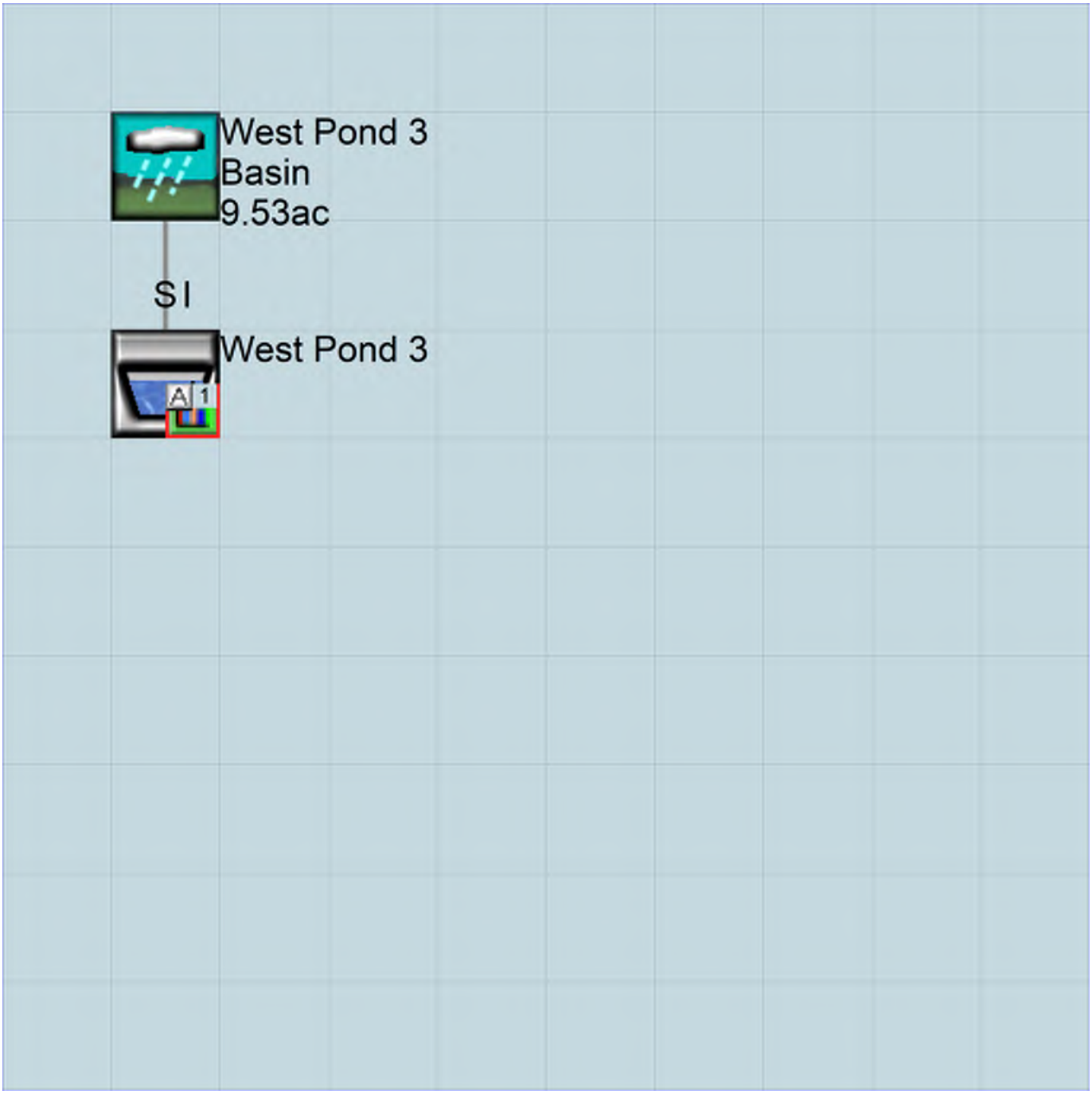
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Pond 03_20231016.wdm
MESSU       25   Prewwhm Pond 03_20231016.MES
            27   Prewwhm Pond 03_20231016.L61
            28   Prewwhm Pond 03_20231016.L62
            30   POCwwhm Pond 03_202310161.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        West Pond 3                MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
West Pond 3***
PERLND  10                       9.53     COPY   501     12
PERLND  10                       9.53     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Pond 03_20231016.wdm
MESSU       25   Mitwwhm Pond 03_20231016.MES
            27   Mitwwhm Pond 03_20231016.L61
            28   Mitwwhm Pond 03_20231016.L62
            30   POCwwhm Pond 03_202310161.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND       8
      IMPLND      14
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        West Pond 3                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           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13           0.15       0.4       0.3         6       0.5       0.4
  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
   13              0         0         0         0       2.5          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                  in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
   14      POND                   1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
   14         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
   14         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    8         0    0    0    0    0
   14         0    0    0    0    0
```

```
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   14            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    8              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    8              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
West Pond 3 Basin***
PERLND  13                       2.28     RCHRES   1      2
PERLND  13                       2.28     RCHRES   1      3
IMPLND   1                       5.92     RCHRES   1      5
IMPLND   8                       0.13     RCHRES   1      5
IMPLND  14                        1.2     RCHRES   1      5

******Routing******
PERLND  13                       2.28     COPY     1     12
IMPLND   1                       5.92     COPY     1     15
IMPLND   8                       0.13     COPY     1     15
IMPLND  14                        1.2     COPY     1     15
PERLND  13                       2.28     COPY     1     13
RCHRES   1                          1     COPY   501     16
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     West Pond 3            1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

```
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

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

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1               1      0.05       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.918274  0.000000  0.000000
  0.052778  0.921257  0.048543  0.024937
  0.105556  0.924244  0.097244  0.035266
  0.158333  0.927236  0.146102  0.043192
  0.211111  0.930233  0.195119  0.049874
  0.263889  0.933234  0.244294  0.055761
  0.316667  0.936240  0.293627  0.061083
  0.369444  0.939250  0.343119  0.065977
  0.422222  0.942265  0.392770  0.070532
  0.475000  0.945285  0.442581  0.074811
  0.527778  0.948309  0.492551  0.078858
  0.580556  0.951338  0.542680  0.082707
  0.633333  0.954372  0.592970  0.086384
  0.686111  0.957410  0.643419  0.089912
  0.738889  0.960453  0.694030  0.093306
  0.791667  0.963500  0.744801  0.096581
  0.844444  0.966552  0.795733  0.099748
  0.897222  0.969609  0.846826  0.102818
  0.950000  0.972670  0.898080  0.105799
  1.002778  0.975735  0.949497  0.108698
  1.055556  0.978806  1.001075  0.111522
  1.108333  0.981881  1.052815  0.114276
  1.161111  0.984960  1.104718  0.116965
  1.213889  0.988044  1.156783  0.119594
  1.266667  0.991133  1.209012  0.122166
  1.319444  0.994227  1.261403  0.124685
  1.372222  0.997324  1.313958  0.127154
  1.425000  1.000427  1.366676  0.129576
  1.477778  1.003534  1.419559  0.131954
  1.530556  1.006646  1.472605  0.134290
  1.583333  1.009762  1.525816  0.136586
  1.636111  1.012883  1.579191  0.138843
```

```
  1.688889  1.016009  1.632731  0.141065
  1.741667  1.019139  1.686437  0.143252
  1.794444  1.022274  1.740307  0.145406
  1.847222  1.025413  1.794343  0.147529
  1.900000  1.028557  1.848545  0.149622
  1.952778  1.031706  1.902914  0.151686
  2.005556  1.034859  1.957448  0.153722
  2.058333  1.038017  2.012149  0.155732
  2.111111  1.041179  2.067016  0.157715
  2.163889  1.044347  2.122051  0.159675
  2.216667  1.047518  2.177253  0.161610
  2.269444  1.050694  2.232623  0.163523
  2.322222  1.053875  2.288160  0.165413
  2.375000  1.057061  2.343865  0.209173
  2.427778  1.060251  2.399739  0.232199
  2.480556  1.063445  2.455781  0.249702
  2.533333  1.066645  2.511991  0.264547
  2.586111  1.069848  2.568371  0.277739
  2.638889  1.073057  2.624920  0.289772
  2.691667  1.076270  2.681638  0.300934
  2.744444  1.079488  2.738526  0.374578
  2.797222  1.082710  2.795584  0.420430
  2.850000  1.085937  2.852812  0.455882
  2.902778  1.089168  2.910211  0.486388
  2.955556  1.092404  2.967780  0.513780
  3.008333  1.095645  3.025521  0.538955
  3.061111  1.098890  3.083432  0.562434
  3.113889  1.102140  3.141515  0.584556
  3.166667  1.105395  3.199769  0.605556
  3.219444  1.108654  3.258195  0.625605
  3.272222  1.111918  3.316794  0.644834
  3.325000  1.115186  3.375565  0.663344
  3.377778  1.118459  3.434508  0.681218
  3.430556  1.121736  3.493624  0.698523
  3.483333  1.125019  3.552914  0.715313
  3.536111  1.128305  3.612376  0.731636
  3.588889  1.131597  3.672013  0.747532
  3.641667  1.134893  3.731823  0.763034
  3.694444  1.138193  3.791807  0.778173
  3.747222  1.141498  3.851966  0.792975
  3.800000  1.144808  3.912299  0.985313
  3.852778  1.148122  3.972807  1.344829
  3.905556  1.151441  4.033489  1.805574
  3.958333  1.154765  4.094348  2.339844
  4.011111  1.158093  4.155381  2.924361
  4.063889  1.161426  4.216591  3.535834
  4.116667  1.164763  4.277976  4.150300
  4.169444  1.168105  4.339538  4.743850
  4.222222  1.171452  4.401277  5.294107
  4.275000  1.174803  4.463192  5.782194
  4.327778  1.178159  4.525284  6.195082
  4.380556  1.181519  4.587553  6.528261
  4.433333  1.184884  4.650000  6.788677
  4.486111  1.188254  4.712624  6.997922
  4.538889  1.191628  4.775427  7.280136
  4.591667  1.195007  4.838407  7.498681
  4.644444  1.198390  4.901566  7.710688
  4.697222  1.201778  4.964904  7.916720
  4.750000  1.205171  5.028421  8.117264
  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    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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WWHM2012

PROJECT REPORT

51ST AVE NE BIOSWALE
INFILTRATION TRENCH

General Model Information

Project Name:	wwhm Bioswale
Site Name:	M-51 Industrial
Site Address:	51st Ave NE
City:	Marrysville, WA
Report Date:	10/19/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2018/10/10
Version:	4.2.16

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

West Pond 3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.04
Pervious Total	1.04
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.04

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

West Pond 3 Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.85
SIDEWALKS FLAT	0.19
Impervious Total	1.04
Basin Total	1.04

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention 1

Bottom Length:	1340.00 ft.
Bottom Width:	3.00 ft.
Material thickness of first layer:	0.333
Material type for first layer:	SMMWW
Material thickness of second layer:	0.667
Material type for second layer:	SMMWW
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.75
Infiltration safety factor:	1
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	197.932
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	214.116
Percent Infiltrated:	92.44
Total Precip Applied to Facility:	24.19
Total Evap From Facility:	11.586
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	1
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	16.184
Total Outflow (ac-ft.):	214.116
Percent Through Underdrain:	7.56
Discharge Structure	
Riser Height:	0.33 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.3404	0.0000	0.0000	0.0000
0.0165	0.3372	0.0006	0.0000	0.0000
0.0329	0.3331	0.0013	0.0000	0.0000
0.0494	0.3290	0.0019	0.0000	0.0000
0.0658	0.3249	0.0026	0.0000	0.0006
0.0823	0.3208	0.0033	0.0001	0.0013
0.0987	0.3167	0.0041	0.0002	0.0025
0.1152	0.3126	0.0048	0.0002	0.0031
0.1316	0.3085	0.0056	0.0004	0.0044
0.1481	0.3044	0.0065	0.0006	0.0068
0.1645	0.3003	0.0073	0.0007	0.0079
0.1810	0.2962	0.0082	0.0009	0.0104
0.1974	0.2921	0.0091	0.0014	0.0158
0.2139	0.2880	0.0100	0.0019	0.0199
0.2303	0.2839	0.0110	0.0021	0.0219
0.2468	0.2798	0.0120	0.0027	0.0287
0.2632	0.2757	0.0130	0.0034	0.0350
0.2797	0.2716	0.0140	0.0036	0.0377
0.2961	0.2675	0.0151	0.0046	0.0475

0.3126	0.2634	0.0162	0.0055	0.0565
0.3290	0.2593	0.0173	0.0059	0.0603
0.3455	0.2552	0.0184	0.0071	0.0737
0.3619	0.2511	0.0196	0.0084	0.0859
0.3784	0.2470	0.0208	0.0089	0.0909
0.3948	0.2430	0.0220	0.0105	0.1085
0.4113	0.2389	0.0232	0.0122	0.1247
0.4277	0.2348	0.0245	0.0128	0.1310
0.4442	0.2307	0.0258	0.0148	0.1529
0.4606	0.2266	0.0271	0.0152	0.1559
0.4771	0.2225	0.0285	0.0154	0.1590
0.4935	0.2185	0.0299	0.0156	0.1621
0.5100	0.2144	0.0313	0.0160	0.1652
0.5264	0.2103	0.0327	0.0162	0.1683
0.5429	0.2062	0.0342	0.0164	0.1714
0.5593	0.2021	0.0357	0.0168	0.1745
0.5758	0.1981	0.0372	0.0169	0.1776
0.5922	0.1940	0.0387	0.0171	0.1806
0.6087	0.1899	0.0403	0.0175	0.1837
0.6251	0.1858	0.0419	0.0176	0.1868
0.6416	0.1817	0.0435	0.0178	0.1899
0.6580	0.1777	0.0451	0.0182	0.1930
0.6745	0.1736	0.0468	0.0183	0.1961
0.6909	0.1695	0.0485	0.0185	0.1992
0.7074	0.1655	0.0502	0.0188	0.2023
0.7238	0.1614	0.0520	0.0190	0.2054
0.7403	0.1573	0.0538	0.0191	0.2085
0.7567	0.1532	0.0556	0.0195	0.2116
0.7732	0.1492	0.0574	0.0196	0.2147
0.7896	0.1451	0.0593	0.0198	0.2178
0.8061	0.1410	0.0611	0.0201	0.2209
0.8225	0.1370	0.0630	0.0202	0.2240
0.8390	0.1329	0.0650	0.0204	0.2271
0.8554	0.1288	0.0670	0.0207	0.2302
0.8719	0.1248	0.0689	0.0208	0.2333
0.8883	0.1207	0.0710	0.0210	0.2364
0.9048	0.1166	0.0730	0.0213	0.2395
0.9212	0.1126	0.0751	0.0214	0.2426
0.9377	0.1085	0.0772	0.0216	0.2457
0.9541	0.1045	0.0793	0.0218	0.2488
0.9706	0.1004	0.0814	0.0220	0.2519
0.9870	0.0963	0.0836	0.0221	0.2550
1.0000	0.0923	0.0854	0.0271	0.2574

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
1.0000	0.3404	0.0854	0.0000	0.8509	0.0031
1.0165	0.3445	0.0910	0.0000	0.8509	0.0062
1.0329	0.3486	0.0967	0.0000	0.8646	0.0093
1.0494	0.3527	0.1025	0.0000	0.8784	0.0124
1.0658	0.3568	0.1083	0.0000	0.8922	0.0155
1.0823	0.3609	0.1142	0.0000	0.9059	0.0186
1.0987	0.3651	0.1202	0.0000	0.9197	0.0218
1.1152	0.3692	0.1262	0.0000	0.9335	0.0249
1.1316	0.3733	0.1323	0.0000	0.9472	0.0280
1.1481	0.3774	0.1385	0.0000	0.9610	0.0311
1.1645	0.3815	0.1447	0.0000	0.9748	0.0342
1.1810	0.3856	0.1510	0.0000	0.9886	0.0373

1.1974	0.3897	0.1574	0.0000	1.0023	0.0404
1.2139	0.3938	0.1639	0.0000	1.0161	0.0435
1.2303	0.3980	0.1704	0.0000	1.0299	0.0466
1.2468	0.4021	0.1770	0.0000	1.0436	0.0498
1.2632	0.4062	0.1836	0.0000	1.0574	0.0529
1.2797	0.4103	0.1903	0.0000	1.0712	0.0560
1.2961	0.4144	0.1971	0.0000	1.0850	0.0591
1.3126	0.4186	0.2040	0.0000	1.0987	0.0622
1.3290	0.4227	0.2109	0.0000	1.1125	0.0653
1.3455	0.4268	0.2179	0.0204	1.1263	0.0685
1.3619	0.4309	0.2249	0.0605	1.1400	0.0716
1.3784	0.4350	0.2320	0.1127	1.1538	0.0747
1.3948	0.4392	0.2392	0.1747	1.1676	0.0778
1.4113	0.4433	0.2465	0.2449	1.1813	0.0809
1.4277	0.4474	0.2538	0.3223	1.1951	0.0841
1.4442	0.4516	0.2612	0.4058	1.2089	0.0872
1.4606	0.4557	0.2687	0.4945	1.2227	0.0903
1.4771	0.4598	0.2762	0.5878	1.2364	0.0934
1.4935	0.4639	0.2838	0.6846	1.2502	0.0941
1.4970	0.4648	0.2854	0.7841	1.2531	0.0000

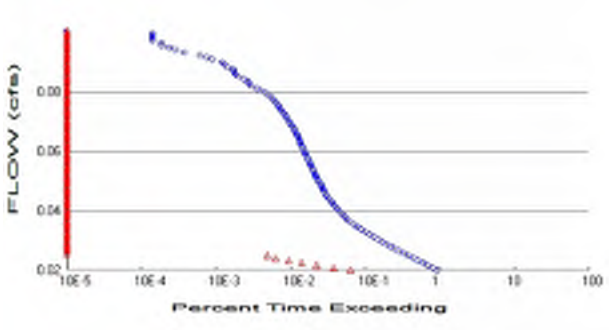
Surface retention 1

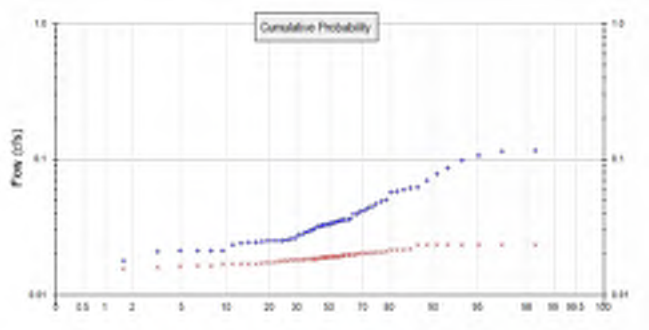
Element Flows To:

Outlet 1	Outlet 2
	Bioretention 1

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.04
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 1.04

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.034944
5 year	0.053606
10 year	0.067998
25 year	0.088589
50 year	0.105738
100 year	0.124493

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.019052
5 year	0.020999
10 year	0.022142
25 year	0.023469
50 year	0.02439
100 year	0.025265

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.035	0.018
1950	0.036	0.021
1951	0.032	0.020
1952	0.025	0.018
1953	0.021	0.018
1954	0.114	0.020
1955	0.045	0.022
1956	0.040	0.017
1957	0.049	0.019
1958	0.036	0.023

1959	0.035	0.019
1960	0.033	0.018
1961	0.062	0.023
1962	0.031	0.018
1963	0.050	0.021
1964	0.036	0.018
1965	0.030	0.015
1966	0.018	0.015
1967	0.036	0.023
1968	0.044	0.020
1969	0.107	0.020
1970	0.025	0.017
1971	0.040	0.020
1972	0.029	0.023
1973	0.028	0.019
1974	0.060	0.020
1975	0.024	0.020
1976	0.025	0.019
1977	0.021	0.018
1978	0.025	0.016
1979	0.070	0.023
1980	0.033	0.017
1981	0.026	0.018
1982	0.033	0.019
1983	0.057	0.019
1984	0.034	0.018
1985	0.042	0.021
1986	0.098	0.021
1987	0.047	0.019
1988	0.024	0.017
1989	0.025	0.018
1990	0.033	0.016
1991	0.034	0.019
1992	0.026	0.017
1993	0.021	0.017
1994	0.023	0.016
1995	0.034	0.018
1996	0.058	0.019
1997	0.116	0.023
1998	0.021	0.021
1999	0.028	0.017
2000	0.021	0.020
2001	0.008	0.018
2002	0.032	0.016
2003	0.025	0.017
2004	0.042	0.023
2005	0.029	0.020
2006	0.077	0.019
2007	0.061	0.020
2008	0.086	0.023
2009	0.026	0.019

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1158	0.0234
2	0.1141	0.0234
3	0.1065	0.0234

4	0.0976	0.0234
5	0.0860	0.0234
6	0.0775	0.0234
7	0.0699	0.0234
8	0.0621	0.0234
9	0.0613	0.0218
10	0.0599	0.0214
11	0.0582	0.0214
12	0.0568	0.0213
13	0.0505	0.0209
14	0.0492	0.0206
15	0.0466	0.0204
16	0.0450	0.0203
17	0.0438	0.0203
18	0.0418	0.0202
19	0.0415	0.0201
20	0.0397	0.0199
21	0.0397	0.0199
22	0.0363	0.0197
23	0.0360	0.0196
24	0.0357	0.0196
25	0.0355	0.0195
26	0.0352	0.0192
27	0.0349	0.0192
28	0.0343	0.0191
29	0.0341	0.0191
30	0.0335	0.0190
31	0.0333	0.0190
32	0.0328	0.0190
33	0.0328	0.0189
34	0.0326	0.0188
35	0.0319	0.0187
36	0.0317	0.0185
37	0.0306	0.0185
38	0.0303	0.0184
39	0.0293	0.0184
40	0.0291	0.0183
41	0.0278	0.0182
42	0.0277	0.0182
43	0.0262	0.0181
44	0.0257	0.0181
45	0.0256	0.0178
46	0.0252	0.0178
47	0.0251	0.0175
48	0.0251	0.0174
49	0.0251	0.0173
50	0.0249	0.0171
51	0.0246	0.0170
52	0.0244	0.0169
53	0.0241	0.0169
54	0.0233	0.0168
55	0.0213	0.0168
56	0.0212	0.0165
57	0.0212	0.0163
58	0.0211	0.0163
59	0.0209	0.0158
60	0.0178	0.0155
61	0.0084	0.0153

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0175	19605	1345	6	Pass
0.0184	16996	805	4	Pass
0.0193	14675	477	3	Pass
0.0201	12737	300	2	Pass
0.0210	10934	200	1	Pass
0.0219	9445	133	1	Pass
0.0228	8166	103	1	Pass
0.0237	7078	0	0	Pass
0.0246	6130	0	0	Pass
0.0255	5313	0	0	Pass
0.0264	4656	0	0	Pass
0.0273	4068	0	0	Pass
0.0282	3548	0	0	Pass
0.0291	3136	0	0	Pass
0.0300	2759	0	0	Pass
0.0308	2447	0	0	Pass
0.0317	2145	0	0	Pass
0.0326	1894	0	0	Pass
0.0335	1656	0	0	Pass
0.0344	1508	0	0	Pass
0.0353	1370	0	0	Pass
0.0362	1250	0	0	Pass
0.0371	1154	0	0	Pass
0.0380	1069	0	0	Pass
0.0389	1009	0	0	Pass
0.0398	949	0	0	Pass
0.0407	888	0	0	Pass
0.0415	825	0	0	Pass
0.0424	777	0	0	Pass
0.0433	734	0	0	Pass
0.0442	687	0	0	Pass
0.0451	648	0	0	Pass
0.0460	622	0	0	Pass
0.0469	602	0	0	Pass
0.0478	583	0	0	Pass
0.0487	561	0	0	Pass
0.0496	538	0	0	Pass
0.0505	506	0	0	Pass
0.0514	487	0	0	Pass
0.0522	473	0	0	Pass
0.0531	457	0	0	Pass
0.0540	440	0	0	Pass
0.0549	424	0	0	Pass
0.0558	410	0	0	Pass
0.0567	394	0	0	Pass
0.0576	380	0	0	Pass
0.0585	368	0	0	Pass
0.0594	353	0	0	Pass
0.0603	341	0	0	Pass
0.0612	333	0	0	Pass
0.0621	322	0	0	Pass
0.0629	313	0	0	Pass
0.0638	302	0	0	Pass

0.0647	293	0	0	Pass
0.0656	284	0	0	Pass
0.0665	276	0	0	Pass
0.0674	265	0	0	Pass
0.0683	257	0	0	Pass
0.0692	241	0	0	Pass
0.0701	234	0	0	Pass
0.0710	226	0	0	Pass
0.0719	212	0	0	Pass
0.0727	205	0	0	Pass
0.0736	195	0	0	Pass
0.0745	187	0	0	Pass
0.0754	177	0	0	Pass
0.0763	166	0	0	Pass
0.0772	160	0	0	Pass
0.0781	150	0	0	Pass
0.0790	146	0	0	Pass
0.0799	135	0	0	Pass
0.0808	128	0	0	Pass
0.0817	120	0	0	Pass
0.0826	111	0	0	Pass
0.0834	99	0	0	Pass
0.0843	85	0	0	Pass
0.0852	75	0	0	Pass
0.0861	63	0	0	Pass
0.0870	59	0	0	Pass
0.0879	56	0	0	Pass
0.0888	50	0	0	Pass
0.0897	42	0	0	Pass
0.0906	39	0	0	Pass
0.0915	37	0	0	Pass
0.0924	36	0	0	Pass
0.0933	30	0	0	Pass
0.0941	28	0	0	Pass
0.0950	26	0	0	Pass
0.0959	19	0	0	Pass
0.0968	16	0	0	Pass
0.0977	13	0	0	Pass
0.0986	8	0	0	Pass
0.0995	6	0	0	Pass
0.1004	5	0	0	Pass
0.1013	4	0	0	Pass
0.1022	4	0	0	Pass
0.1031	3	0	0	Pass
0.1040	3	0	0	Pass
0.1048	3	0	0	Pass
0.1057	3	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 1 POC	☐	194.85			☐	92.44			
Total Volume Infiltrated		194.85	0.00	0.00		92.44	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.

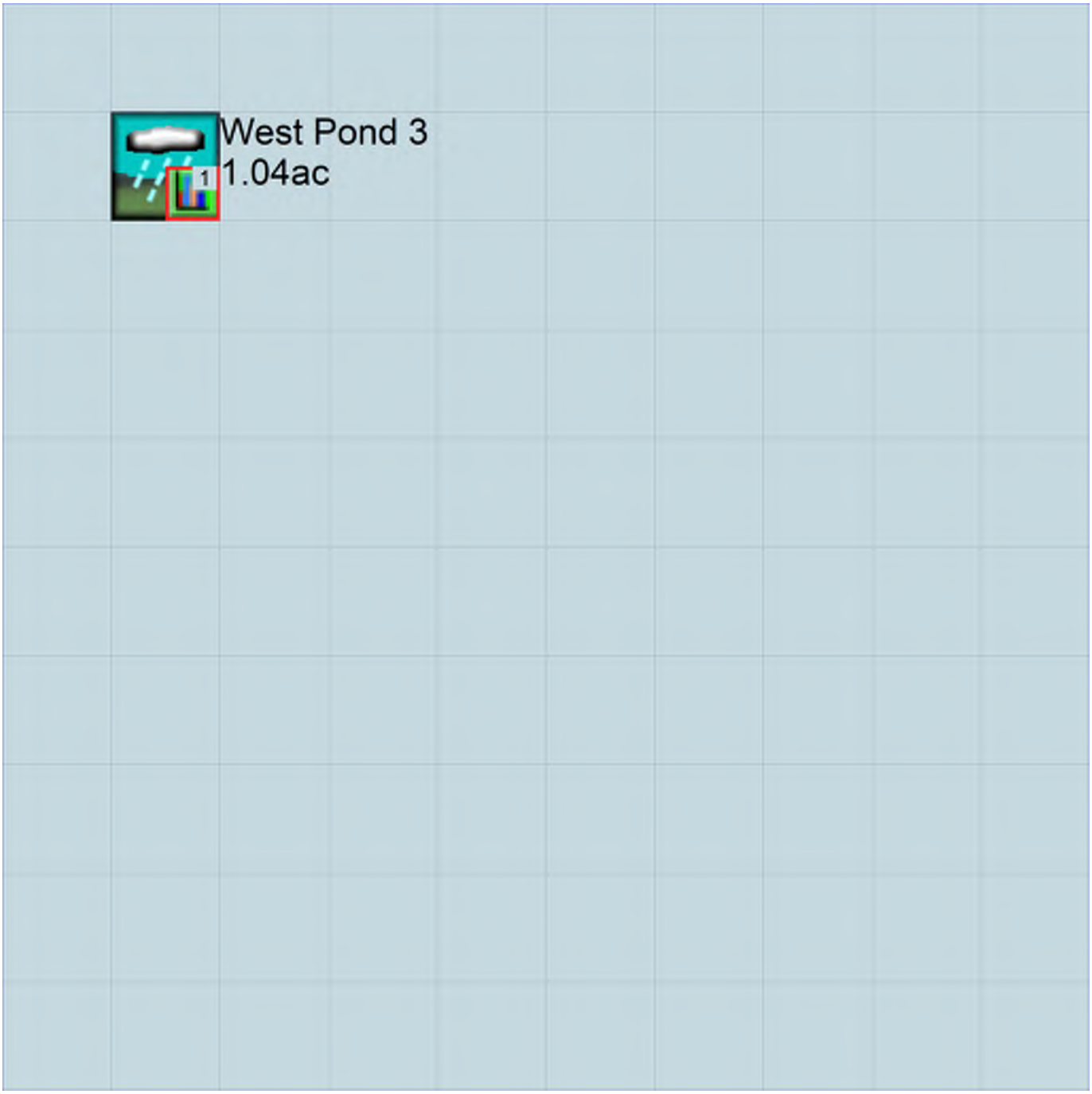
PERLND Changes

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   wwhm Bioswale.wdm
MESSU       25   Prewwhm Bioswale.MES
            27   Prewwhm Bioswale.L61
            28   Prewwhm Bioswale.L62
            30   POCwwhm Bioswale1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        West Pond 3                MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
West Pond 3***
PERLND  10                       1.04     COPY   501     12
PERLND  10                       1.04     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       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   wwhm Bioswale.wdm
MESSU       25   Mitwwhm Bioswale.MES
            27   Mitwwhm Bioswale.L61
            28   Mitwwhm Bioswale.L62
            30   POCwwhm Bioswale1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      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  1        MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    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           ***
    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   ***
    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    *********
    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     ***
    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
    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
    1             0         0
    8             0         0
  END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
West Pond 3 Basin***
IMPLND   1                       0.85     RCHRES   1      5
IMPLND   8                       0.19     RCHRES   1      5

******Routing******
IMPLND   1                       0.85     COPY     1     15
IMPLND   8                       0.19     COPY     1     15
RCHRES   1                          1     RCHRES   2      8
RCHRES   2                          1     COPY   501     17
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-014    3    1    1    1   28    0    1
    2     Bioretention  1         2    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  6  0  0       0  1  0  0  0       2  1  2  2  2
    2       0  1  0  0    4  5  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      0.25       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPECIAL-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            =  3974.38
*** 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 SPECIAL-ACTIONS
FTABLES
  FTABLE      2
   62    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.340404  0.000000  0.000000  0.000000
  0.016451  0.337168  0.000613  0.000000  0.000000
  0.032901  0.333063  0.001252  0.000000  0.000000
  0.049352  0.328959  0.001918  0.000000  0.000000
  0.065802  0.324856  0.002610  0.000031  0.000568
  0.082253  0.320753  0.003328  0.000090  0.001303
  0.098703  0.316652  0.004073  0.000197  0.002482
  0.115154  0.312551  0.004844  0.000239  0.003084
  0.131604  0.308451  0.005642  0.000365  0.004361
  0.148055  0.304352  0.006466  0.000607  0.006815
  0.164505  0.300253  0.007316  0.000684  0.007886
  0.180956  0.296156  0.008193  0.000941  0.010378
  0.197407  0.292059  0.009096  0.001449  0.015840
```

```
  0.213857  0.287963  0.010026  0.001882  0.019918
  0.230308  0.283867  0.010982  0.002071  0.021888
  0.246758  0.279773  0.011964  0.002717  0.028717
  0.263209  0.275679  0.012973  0.003383  0.034960
  0.279659  0.271586  0.014009  0.003646  0.037747
  0.296110  0.267494  0.015070  0.004578  0.047542
  0.312560  0.263403  0.016159  0.005529  0.056499
  0.329011  0.259312  0.017273  0.005875  0.060271
  0.345462  0.255223  0.018415  0.007147  0.073664
  0.361912  0.251134  0.019582  0.008437  0.085924
  0.378363  0.247046  0.020777  0.008876  0.090860
  0.394813  0.242958  0.021997  0.010542  0.108522
  0.411264  0.238872  0.023245  0.012226  0.124708
  0.427714  0.234786  0.024518  0.012768  0.130997
  0.444165  0.230701  0.025818  0.014807  0.152860
  0.460615  0.226617  0.027145  0.015214  0.155945
  0.477066  0.222534  0.028498  0.015417  0.159031
  0.493516  0.218451  0.029878  0.015615  0.162117
  0.509967  0.214369  0.031284  0.016001  0.165204
  0.526418  0.210288  0.032717  0.016194  0.168291
  0.542868  0.206208  0.034176  0.016383  0.171379
  0.559319  0.202129  0.035662  0.016751  0.174468
  0.575769  0.198050  0.037174  0.016935  0.177557
  0.592220  0.193973  0.038713  0.017115  0.180647
  0.608670  0.189896  0.040279  0.017468  0.183737
  0.625121  0.185819  0.041871  0.017644  0.186828
  0.641571  0.181744  0.043489  0.017817  0.189920
  0.658022  0.177669  0.045135  0.018156  0.193012
  0.674473  0.173596  0.046806  0.018326  0.196105
  0.690923  0.169523  0.048505  0.018492  0.199198
  0.707374  0.165450  0.050229  0.018819  0.202292
  0.723824  0.161379  0.051981  0.018983  0.205387
  0.740275  0.157308  0.053759  0.019143  0.208482
  0.756725  0.153238  0.055564  0.019459  0.211578
  0.773176  0.149169  0.057395  0.019618  0.214675
  0.789626  0.145101  0.059253  0.019773  0.217772
  0.806077  0.141034  0.061137  0.020079  0.220869
  0.822527  0.136967  0.063048  0.020233  0.223968
  0.838978  0.132901  0.064986  0.020385  0.227066
  0.855429  0.128836  0.066950  0.020682  0.230166
  0.871879  0.124772  0.068941  0.020832  0.233266
  0.888330  0.120708  0.070959  0.020979  0.236367
  0.904780  0.116646  0.073003  0.021268  0.239468
  0.921231  0.112584  0.075074  0.021415  0.242570
  0.937681  0.108523  0.077172  0.021559  0.245672
  0.954132  0.104463  0.079296  0.021842  0.248775
  0.970582  0.100403  0.081447  0.021990  0.251879
  0.987033  0.096344  0.083624  0.022140  0.254983
  1.000000  0.092287  0.091239  0.027137  0.257431
  END FTABLE  2
  FTABLE      1
   32    6
     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.092287  0.000000  0.000000  0.000000  0.003105
  0.016451  0.344510  0.005634  0.000000  0.850853  0.003105
  0.032901  0.348617  0.011335  0.000000  0.864623  0.006211
  0.049352  0.352725  0.017104  0.000000  0.878394  0.009318
  0.065802  0.356834  0.022940  0.000000  0.892164  0.012425
  0.082253  0.360943  0.028844  0.000000  0.905934  0.015533
  0.098703  0.365053  0.034815  0.000000  0.919705  0.018641
  0.115154  0.369164  0.040854  0.000000  0.933475  0.021750
  0.131604  0.373276  0.046961  0.000000  0.947246  0.024860
  0.148055  0.377389  0.053136  0.000000  0.961016  0.027970
  0.164505  0.381502  0.059378  0.000000  0.974787  0.031080
  0.180956  0.385616  0.065687  0.000000  0.988557  0.034192
  0.197407  0.389731  0.072065  0.000000  1.002328  0.037304
  0.213857  0.393847  0.078510  0.000000  1.016098  0.040416
```

```
  0.230308  0.397964  0.085023  0.000000  1.029869  0.043530
  0.246758  0.402081  0.091604  0.000000  1.043639  0.046643
  0.263209  0.406199  0.098252  0.000000  1.057410  0.049758
  0.279659  0.410318  0.104968  0.000000  1.071180  0.052873
  0.296110  0.414438  0.111752  0.000000  1.084950  0.055988
  0.312560  0.418559  0.118603  0.000000  1.098721  0.059104
  0.329011  0.422680  0.125523  0.000000  1.112491  0.062221
  0.345462  0.426802  0.132510  0.020404  1.126262  0.065338
  0.361912  0.430925  0.139565  0.060460  1.140032  0.068456
  0.378363  0.435049  0.146688  0.112720  1.153803  0.071575
  0.394813  0.439173  0.153879  0.174711  1.167573  0.074694
  0.411264  0.443299  0.161137  0.244933  1.181344  0.077814
  0.427714  0.447425  0.168464  0.322267  1.195114  0.080934
  0.444165  0.451552  0.175858  0.405763  1.208885  0.084055
  0.460615  0.455679  0.183320  0.494544  1.222655  0.087177
  0.477066  0.459808  0.190850  0.587759  1.236425  0.090299
  0.493516  0.463937  0.198448  0.684558  1.250196  0.093422
  0.497000  0.464812  0.200066  0.784079  1.253112  0.094083
  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    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            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    1.2            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   1006 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1        1      WDM   1007 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1        1      WDM   1008 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1009 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1010 STAG     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1011 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       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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Local (360)943-0304

www.clearcreeksolutions.com

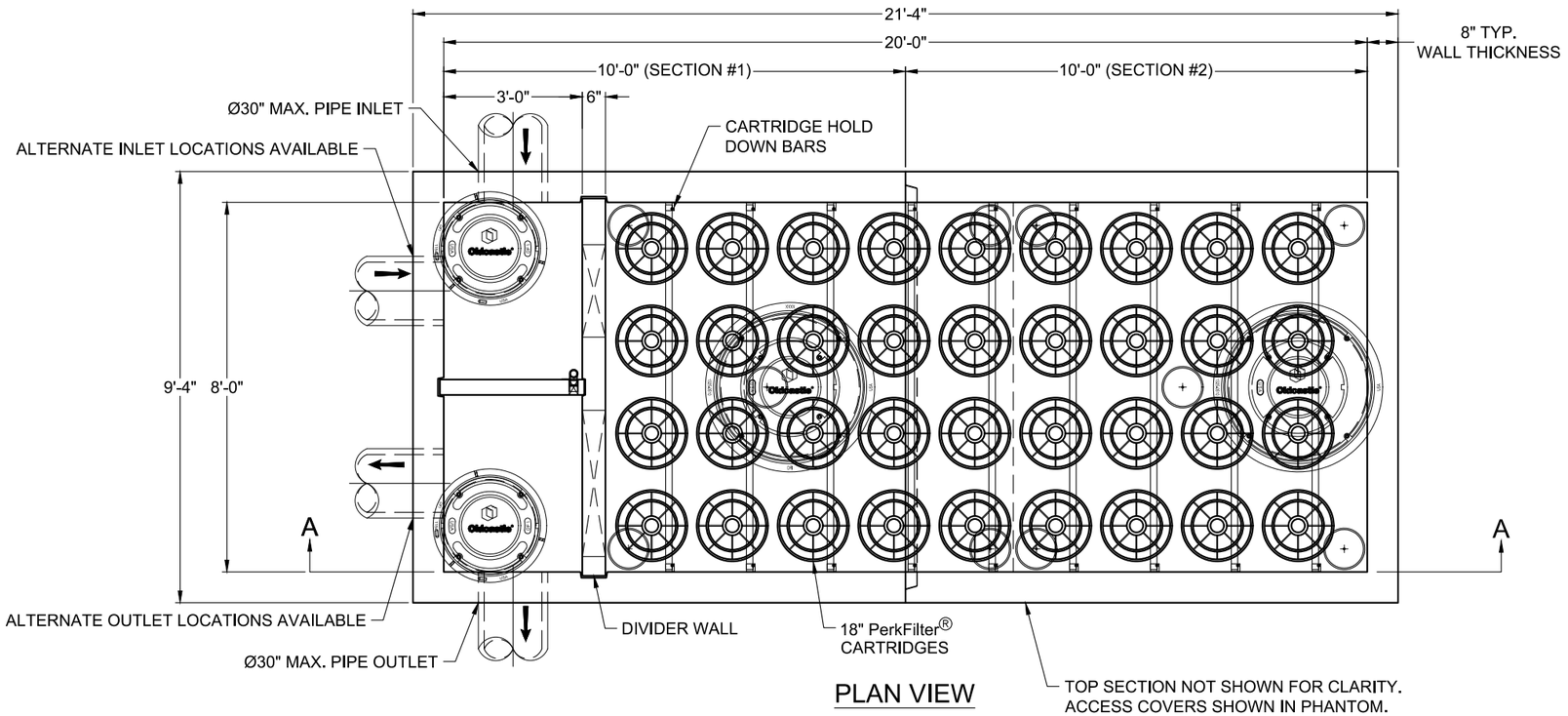
SITE SPECIFIC DATA	
Structure ID	-
Treatment Flow Rate (gpm/cfs)	-
Peak Flow Rate (cfs)	-
Cartridge Quantity	-
Rim Elevation	-

Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet 1	-	-	-	-
Inlet 2	-	-	-	-
Outlet	-	-	-	-

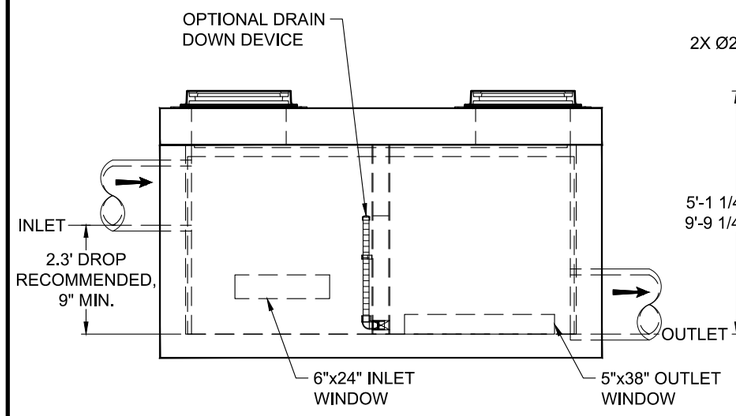
Notes:
-

PERFORMANCE SPECIFICATIONS	
Peak Treatment Capacities:[1]	
Max. Cartridge Quantity	36
NJDEP 80% Removal, 75 micron	1.636 cfs
WA Ecology GULD - Basic & Phosphorus	0.818 cfs
Max. Bypass Capacity	14.4 cfs

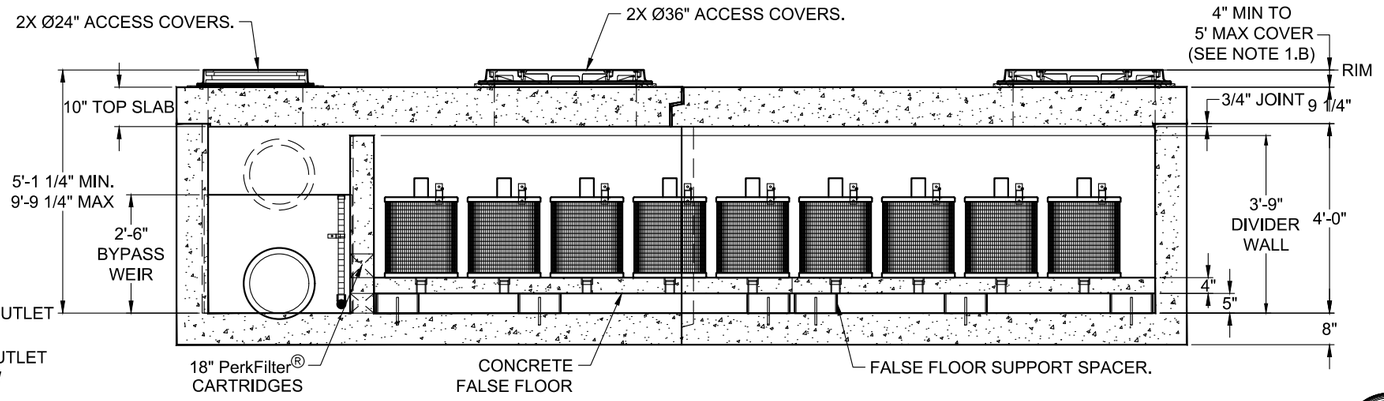
1. Contact Oldcastle for alternative treatment and peak flow capacities.



PLAN VIEW



LEFT END VIEW



SECTION A-A

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW OF THIS SUBMITTAL.
8. OVERSIZED HOLES TO ACCOMMODATE SPECIFIC PIPE TYPE MUST BE CONCENTRIC TO PIPE ID. AFTER PIPES ARE INSTALLED, ALL ANNULAR SPACES SHALL BE FILLED WITH A MINIMUM OF 3,000 PSI CONCRETE FOR FULL THICKNESS OF PRECAST WALLS. PIPES ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT OLDCASTLE INFRASTRUCTURE.
13. MAXIMUM PICK WEIGHTS:
   A. TOP: XX,XXX LBS
   B. BASE: XX,XXX LBS*
   (* COMBINED WEIGHT OF BASE INCLUDES DIVIDER WALLS, FALSE FLOOR, AND PRODUCT INTERNALS.)
14. INTERNALS SHALL CONSIST OF CARTRIDGES, WEIR WALL, FALSE FLOOR, FALSE FLOOR SUPPORT SPACERS, AND DIVIDER WALL.

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

PerkFilter® Vault (STANDARD)
8'x20' With 18" Cartridges

CUSTOMER
-

PROJECT NAME
-

SHEET NAME	REVISION	SHEET
Specifier Drawing PFV-820-18	-	1 OF 1
	REV DATE -	

Media Filtration

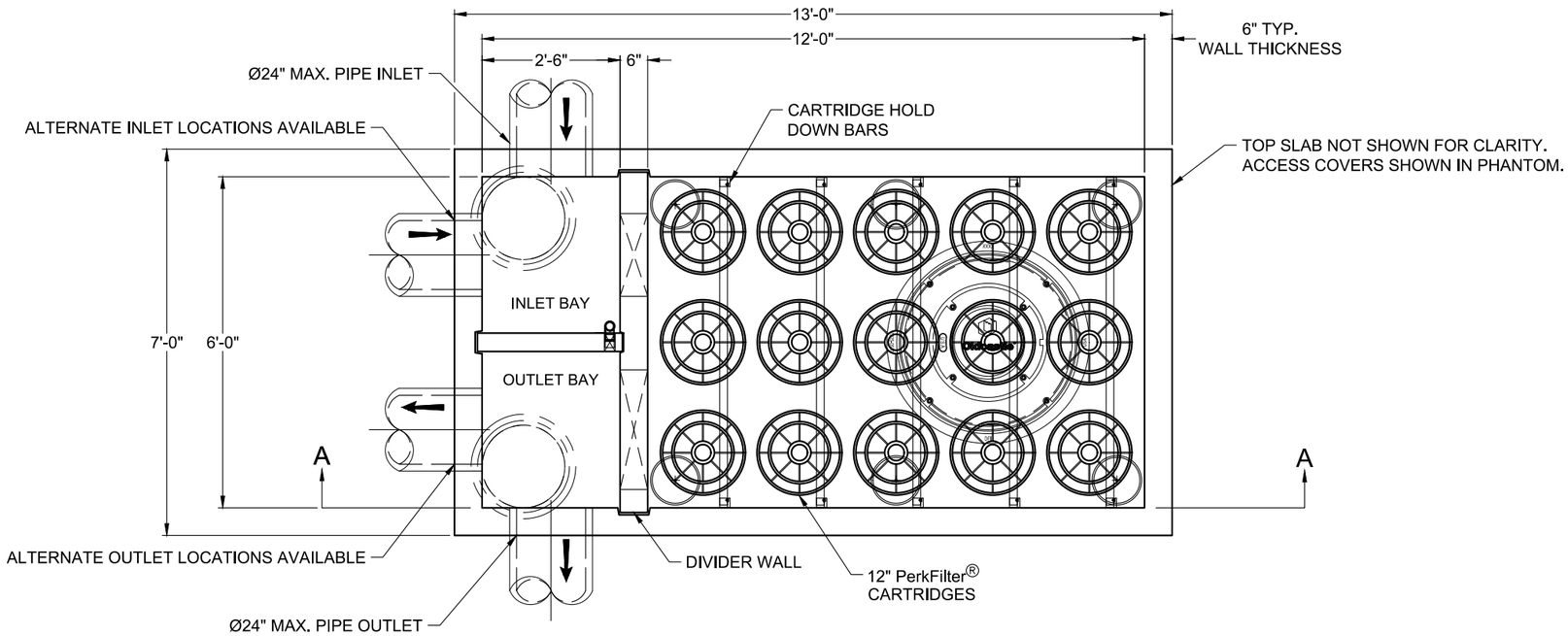
SITE SPECIFIC DATA	
Structure ID	-
Treatment Flow Rate (gpm/cfs)	-
Peak Flow Rate (cfs)	-
Cartridge Quantity	-
Rim Elevation	-

Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet 1	-	-	-	-
Inlet 2	-	-	-	-
Outlet	-	-	-	-

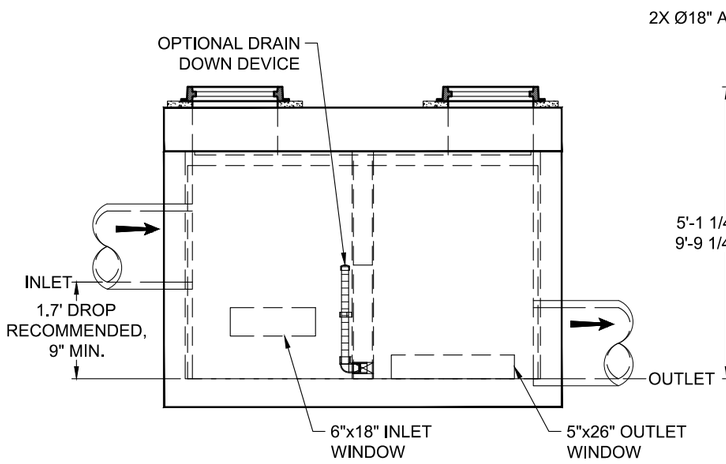
Notes:
-

PERFORMANCE SPECIFICATIONS	
Peak Treatment Capacities:[1]	
Max. Cartridge Quantity	15
NJDEP 80% Removal, 75 micron	0.455 cfs
WA Ecology GULD - Basic & Phosphorus	0.227 cfs
Max. Bypass Capacity	20.9 cfs

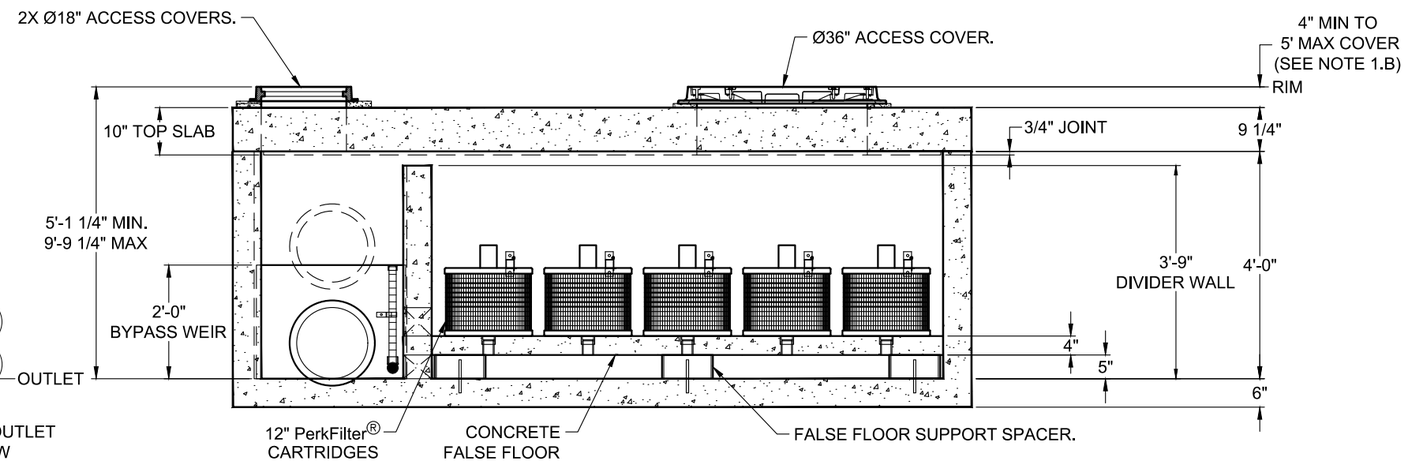
1. Contact Oldcastle for alternative treatment and peak flow capacities.



PLAN VIEW



LEFT END VIEW



SECTION A-A

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW OF THIS SUBMITTAL.
8. OVERSIZED HOLES TO ACCOMMODATE SPECIFIC PIPE TYPE MUST BE CONCENTRIC TO PIPE ID. AFTER PIPES ARE INSTALLED, ALL ANNULAR SPACES SHALL BE FILLED WITH A MINIMUM OF 3,000 PSI CONCRETE FOR FULL THICKNESS OF PRECAST WALLS. PIPES ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT OLDCASTLE INFRASTRUCTURE.
13. MAXIMUM PICK WEIGHTS:
   A. TOP: XX,XXX LBS
   B. BASE: XX,XXX LBS*
   (* COMBINED WEIGHT OF BASE INCLUDES DIVIDER WALLS, FALSE FLOOR, AND PRODUCT INTERNALS.)
14. INTERNALS SHALL CONSIST OF CARTRIDGES, WEIR WALL, FALSE FLOOR, FALSE FLOOR SUPPORT SPACERS, AND DIVIDER WALL.

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PerkFilter® Vault (STANDARD)
6'x12' With 12" Cartridges

CUSTOMER
-

PROJECT NAME
-

SHEET NAME	REVISION	SHEET
Specifier Drawing PFV-612-12	-	1 OF 1
	REV DATE -	

Media Filtration

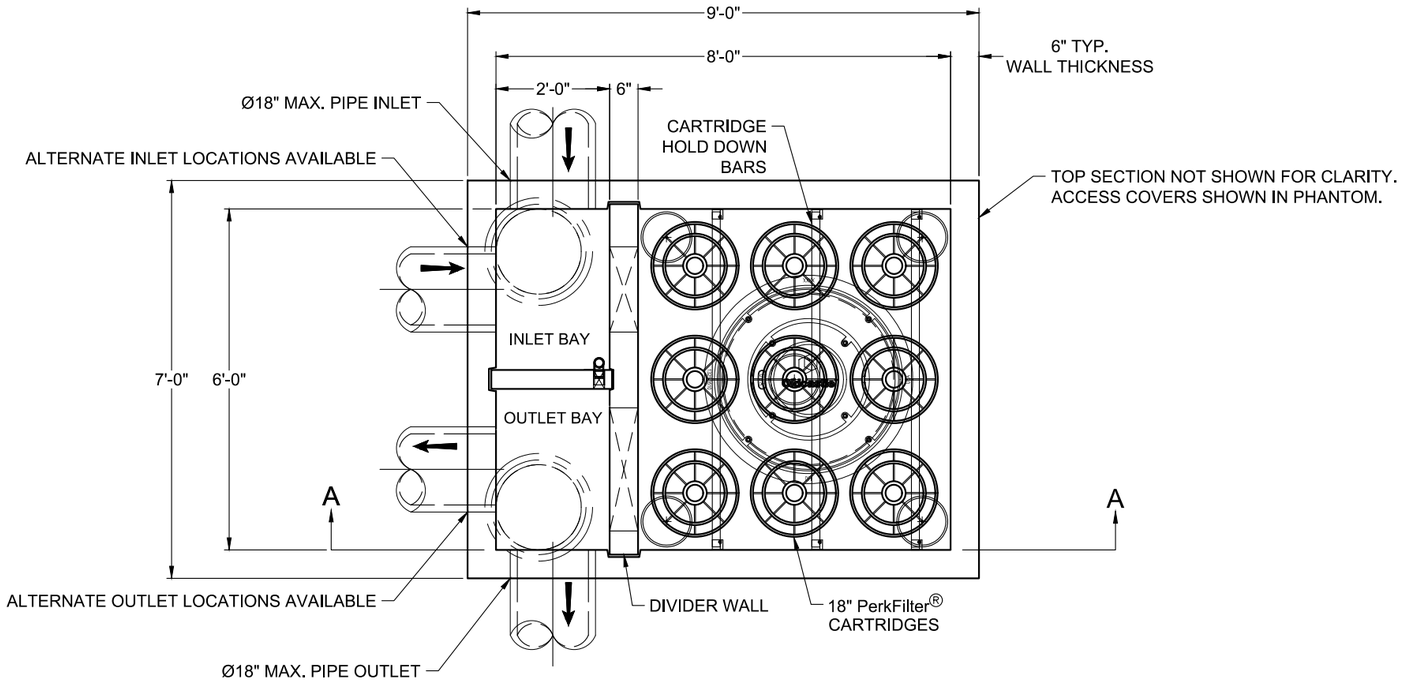
SITE SPECIFIC DATA	
Structure ID	-
Treatment Flow Rate (gpm/cfs)	-
Peak Flow Rate (cfs)	-
Cartridge Quantity	-
Rim Elevation	-

Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet 1	-	-	-	-
Inlet 2	-	-	-	-
Outlet	-	-	-	-

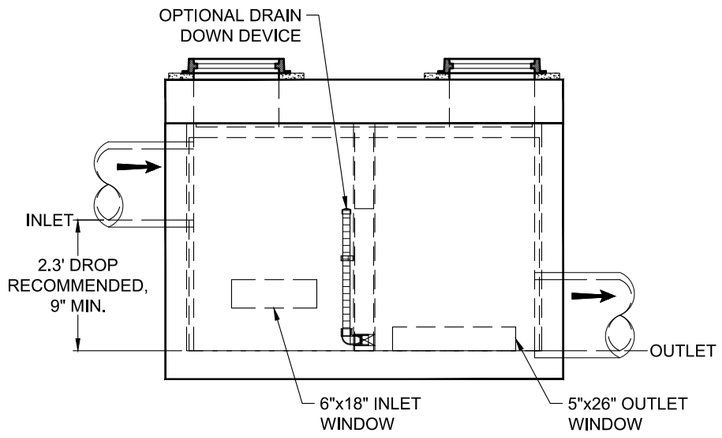
Notes:
-

PERFORMANCE SPECIFICATIONS	
Peak Treatment Capacities:[1]	
Max. Cartridge Quantity	9
NJDEP 80% Removal, 75 micron	0.409 cfs
WA Ecology GULD - Basic & Phosphorus	0.205 cfs
Max. Bypass Capacity	9.6 cfs

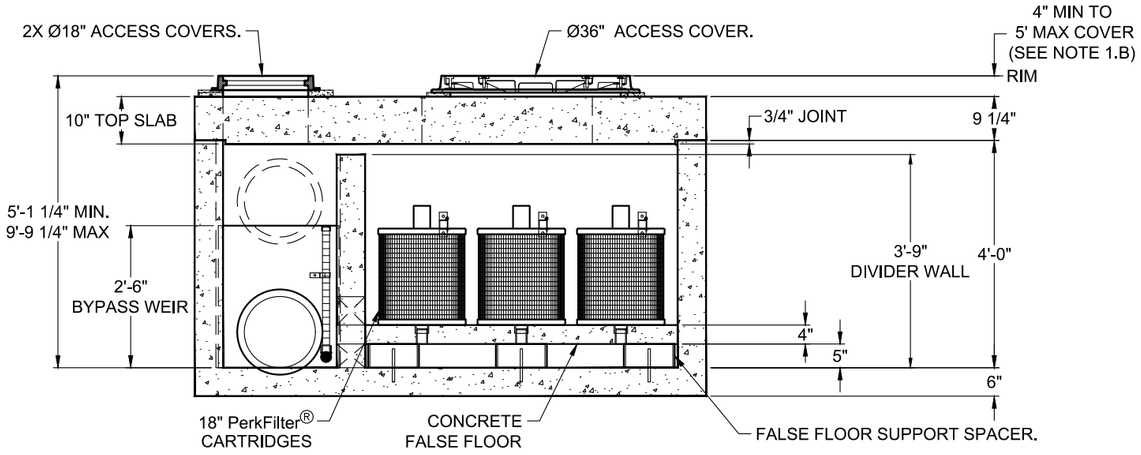
1. Contact Oldcastle for alternative treatment and peak flow capacities.



PLAN VIEW



LEFT END VIEW



SECTION A-A

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW OF THIS SUBMITTAL.
8. OVERSIZED HOLES TO ACCOMMODATE SPECIFIC PIPE TYPE MUST BE CONCENTRIC TO PIPE ID. AFTER PIPES ARE INSTALLED, ALL ANNULAR SPACES SHALL BE FILLED WITH A MINIMUM OF 3,000 PSI CONCRETE FOR FULL THICKNESS OF PRECAST WALLS. PIPES ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT OLDCASTLE INFRASTRUCTURE.
13. MAXIMUM PICK WEIGHTS:
   A. TOP: XX,XXX LBS
   B. BASE: XX,XXX LBS*
   (* COMBINED WEIGHT OF BASE INCLUDES DIVIDER WALLS, FALSE FLOOR, AND PRODUCT INTERNALS.)
14. INTERNALS SHALL CONSIST OF CARTRIDGES, WEIR WALL, FALSE FLOOR, FALSE FLOOR SUPPORT SPACERS, AND DIVIDER WALL.

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CUSTOMER
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PROJECT NAME
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SHEET NAME	REVISION	SHEET
Specifier Drawing PFV-68-18	-	1 OF 1
	REV DATE -	

Appendix D: Conveyance Analysis and Design

N/A