



Preliminary Drainage Control Plan

The Reserve

City of Gig Harbor, WA



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September 28, 2022

**CITY OF GIG HARBOR
DEPARTMENT OF PUBLIC WORKS**

The Reserve Civil Permit

In association with PL-PPLAT-22-0001

Certificate of Engineer:

I hereby state that this Drainage Control Plan for The Reserve has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Gig Harbor does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.



Darton Riely-Gibbons, PE
Project Manager

September 28, 2022

DRAINAGE CONTROL PLAN – DRAINAGE REPORT

FOR

THE RESERVE

CITY OF GIG HARBOR, WA

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SECTION 1 – PROPOSED PROJECT DESCRIPTION

This Drainage Control Plan Drainage Report is provided in support of the Civil Permit application for *The Reserve* project to describe the existing stormwater conditions and proposed drainage improvements associated with the development. The project proposes to subdivide and develop approximately 4.09 acres of a total of 9.88 acres in to 14 single-family residential parcels, access roadway, and frontage improvements within the city of Gig Harbor. This report is provided to identify the applicable storm drainage standards and to summarize the analysis and design provisions proposed for the project to comply with the 2016 Gig Harbor Stormwater Management and Site Development Manual (*Manual*) surface water standards.

The Reserve property was annexed to the City of Gig Harbor in 2006. The project is located at 10017 Peacock Hill Avenue NW (PC tax parcel no. 0222323134 & 0222323135). The vicinity map provided below as Figure 1 illustrates the location of the property. More generally, the site is that portion of the south half of the south half of the northwest quarter of the southwest quarter of Section 32 of Township 22 North, Range 2 East, W.M., except Peacock Hill Avenue N.W. in Pierce County, Washington (see Vicinity Map below).

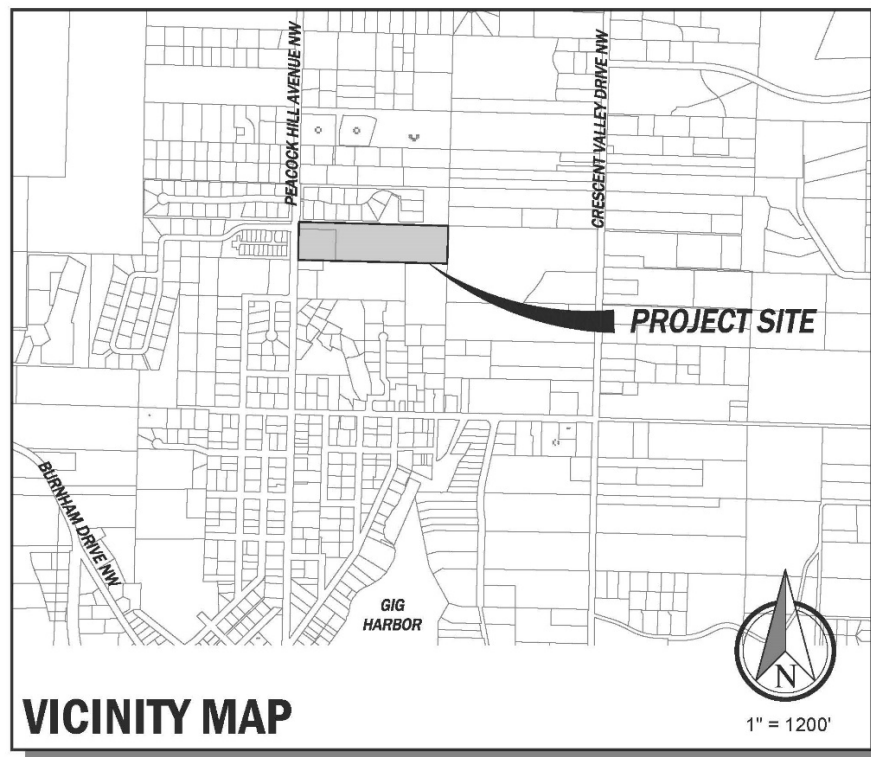


Figure 1 – Vicinity Map

The Reserve site is comprised of two real parcels totaling approximately 9.88 acres. The westerly 4.09 acres of property will be developed and the remainder is currently planned for dedication as permanent open space and critical area tract. No existing structures are currently on the project site. A number of trees of varying type, age, and health condition exist on the site. Many of the trees along the perimeter of the area to be developed will be retained as part of the required screening buffer. Figure 3 illustrates the existing site conditions and Figure 4 represents the proposed site plan.

The proposed final subdivision of The Reserve will create a total of 14 single-family residential lots. In addition, the project will include half street improvements Peacock Hill Avenue an addition of curb, gutter, and sidewalk, as well as extension of the existing sewer system to the north boundary of the project. The project is being designed to conform to the 2016 Gig Harbor Stormwater Management and Site Development Manual (*Manual*) and the 2018 Gig Harbor Public Works Standards (*City Standards*).

The site is zoned R-1 which limits impervious area of the individual residential lots to a maximum of 40% (GHMC 17.16.060, Single Family Residential – Development Standards). The storm drainage analysis performed in support of the site design as summarized by this report considers this maximum impervious lot coverage. The site is expected to be developed during the summer months of 2023 and potentially into spring of 2024. The project total project site consists of 9.88 acres. The project proposes to create 1.84 acres of impervious surfaces which is approximately 18.6% of the site. The remaining site consists of new pervious area of 1.351 acres, 13.7 percent of the site, and 6.685 acres of undisturbed forested area, 67.7 percent of the site. Based on the proposed disturbed area of 3.191 acres, the proposed impervious area and Figure 2.1 – Flow Chart for Determining requirements for New Development (provided as Figure 2 in this report), the project is subject to all minimum requirements, see Figure 2, below.

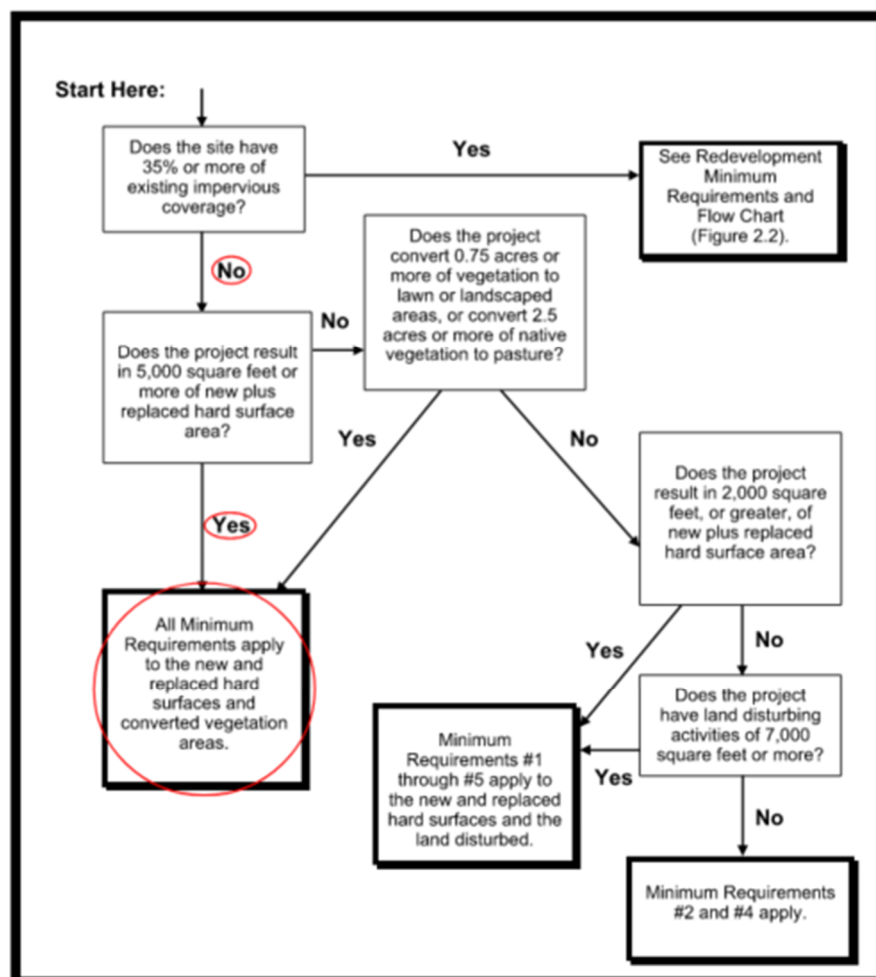


Figure 2.1. Flow Chart for Determining Requirements for New Development.

Figure 2 – Flow Chart for Determining Minimum Requirements

The developed site is required to provide water quality treatment in addition to flow control to mitigate storm water runoff impacts in general accordance with the *Manual*. Controlled storm water releases from this on-site facility will be conveyed via an HDPE tightline and discharged to a new gabion outfall and two dispersion trenches east of the development in the forested area.

The storm drainage standards for the project are established by the Gig Harbor 2016 Stormwater Management and Site Development Manual. The project must comply with all minimum requirements 1 through 10 per Chapter 2 of the manual. Compliance and/or applicability of each of these design standards are summarized below:

City of Gig Harbor Minimum Requirements:

1. **Preparation of Stormwater Site Plans:** Stormwater site plans and drainage control plan herein have been prepared for the subject project. This report and associated drainage control plans have been prepared to address all minimum requirements of the *Manual*. Flow control sizing, water quality sizing is provided in Section 9 of this report. Additional Water Quality sizing and details are provided in Appendix A, WWHM report for the flow control facility sizing are provided in Appendix B. A Wetland Hydroperiod Analysis is provided in Appendix C, and a Backwater Conveyance Analysis is provided in Appendix D. A downstream analysis is also provided in Section 9 and Appendix F.
2. **Construction Stormwater Pollution Prevention:** The Stormwater Pollution Prevention Plan (SWPPP) narrative addressing all 13 elements has been submitted separately from this report. Refer to SWPPP details and specific BMPs are provided with the construction plans and supporting documents.
3. **Source Control of Pollution:** The proposed maintenance guidelines, water quality facility design has all been prepared to manage pollutants from stormwater runoff as part of the permeant Source Control of Pollution. Source Control Pollution created from construction of this project will be addressed within the SWPPP and managed on-site by the CESCL during construction.
4. **Preservation of Natural Drainage Systems and Outfalls:** Existing drainage patterns will be maintained in the developed conditions. On-site areas will be collected, treated and drain to the existing on-site wetland while off-site frontage improvement areas drain to the existing public conveyance system located in Peacock Hill Avenue. Detained flows will discharge to the same locations. The downstream analysis is provided in Section 9 of this report.
5. **On-site Stormwater Management:** As part of Minimum Requirement # 5, all projects subject to this requirement must attempt to utilize flow control BMPs prior to using traditional stormwater treatment and management facilities. The project is a New Development located within the Urban Growth Area (UGA) of Gig Harbor and can choose to either provide a stormwater management system that meets the Low Impact development Performance Standard and Soil Preservation and Amendment BMP or from List # 2 provided in the *Manual* Volume I, Section 2.4.5. The project chooses to select from List # 2 instead of meeting the LID Performance Standard. BMPs for the roofs are hard surfaces are provided below in Table 9.1. Lawn and Landscape area will utilize the soil preservation and amendment BMP per Ecology BMP T5.13. Below Table 9.1, a review of each type of land use proposed on-site and the preferred BMPs for each and their feasibility to be applied to the site.

Table 1.1 – Minimum Requirement # 5 Flow Control BMPs

Flow Control BMPs For Roofs	Flow Control BMPs For Other Hard Surface
65/10 Dispersion or Downspout Infiltration	65/10 Dispersion
Bioretention	Permeable Pavement
Downspout Dispersion	Bioretention
Perforated Pipe Stub-out	Sheet Flow or Concentrated Flow Dispersion

Due to the site layout, topography, and lack of available open spaces, full dispersion is not a feasible flow control BMP for this project. The number of dispersion trenches required to meet 65/10 dispersion requirements, would exceed the full width of the parcel. Additionally, the slope at the east end of the development far exceeds the minimum slope requirement of 15%. Based on these topographic and site restraints, 65/10 dispersion is not feasible for roof areas or other hard surface areas.

Per the Geotechnical Report (Appendix E), infiltration is not a feasible option due to the characteristics of the soil over much of the site, therefore full infiltration, limited infiltration or perforated pipe stub-out for roof areas and permeable pavement for other hard surfaces is not feasible for this site.

The project does not have the ability to infiltrate to make Bioretention facilities feasibility within the site. Additionally, in an effort to reduce earthwork imbalances, the site is required to utilize a maximum slope for the private roadway and daylight style dwelling units. A bioretention meeting the minimum size required for Minimum Requirement # 5 would require a much flatter and larger section of the site then feasible. Therefore, bioretention is not a feasible flow control BMP for roofs or other hard surfaces.

Due to the site layout, topography, and lack of available open spaces, downspout dispersion for roof area and sheet flow and concentrated sheet for other hard surface are not feasible. The topography of the site and layout will not meet the requirements for dispersion of effective impervious

6. **Runoff Treatment:** A Basic Water Quality treatment facility is required for this project. Basic treatment is proposed to be achieved by a water quality facility (SD100) located downstream of the detention vault within the vault access tract. The water quality has been sized accordingly to achieve basic water quality treatment using a Contech 48" StormFilter with (3) 18" Cartridge with PSorb media based on the 2-year storm event using WWHM2012. This water quality facility is located downstream of the detention vault. Treated runoff will discharge through a gabion and dispersion trench west of the wetland buffer recharging the existing wetland.. Summary of the design treatment facility is described in Section 9 and Appendix A of this report. Refer to Figure 4 in the Figures section of this report for a developed site plan.
7. **Flow Control:** The project requires Category A flow control per section 3.1 of the *Manual*. Conservation flow requires developed discharge durations to match predeveloped conditions for discharge rates from 50% of the 2-year design storm to the 50-year design storm. As such, an underground 100ft by 40ft by 13 ft detention vault will be used to accomplish these requirements. Flow control will be accomplished using an underground detention vault. Summary of the flow control facilities is described in Section 9 of this report. WWHM flow control analysis of the detention vault is provided in Appendix B of this report. Refer to Figure 4 in the Figures section of this report for a developed site plan.

8. **Wetland Protection:** The existing wetland on-site will be protected by maintaining the required buffer and by maintaining the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses. During construction the buffer will be maintained as well as delineated by construction orange silt fencing. A Wetland Hydroperiod Analysis has been performed and presented in Appendix C of this report. The hydroperiod analysis follows the Guide Sheets #1 through #3 in Appendix I-B of the *Manual*. The analysis has been provided to the project Wetland Biologist and a letter, verifying the analysis should not result in any adverse impacts to the wetland, is included in the submittal package and at the end of Appendix C.
9. **Operation and Maintenance:** An *Operation and Maintenance Manual* will be provided with the final engineering/construction plans
10. **Financial Liability:** A Bond Quantity Worksheet will be prepared for this project prior to the final engineering package. Approval and all financial guarantees will be provided by the developer.

Other permits that will be obtained subsequent to Civil Permit approval include:

- Construction Stormwater General Permit (Department of Ecology)
- Encroachment Right-of-way (City of Gig Harbor Public Works)

SECTION 2 – EXISTING CONDITIONS

On-site Conditions

The site currently consists of two parcels totaling approximately 9.88 acres of undeveloped, second growth forest. The topography of the western parcel bordering Peacock Hill Avenue generally slopes east at approximately 15%. The eastern parcel also generally slopes to the east but at steeper slopes ranging as high as 45%. The eastern parcel also contains approximately one acre of on-site Category III wetland with a moderate level of function for habitat as identified in the Wetland Analysis Report completed by Soundview Consultants in January 2022. Due to steep slopes as well as the wetland and associated buffer it is unlikely development of the eastern parcel would be possible. As a result, most of the eastern parcel will be in a separate open space parcel. Figure 2 shows the existing conditions.

According to the map titled, “E5: Aquifer Recharge Areas” from the Pierce County website, the project site appears to be in an aquifer recharge and wellhead protection area. The map is attached as Figure 5. Additionally, the figure titled, “Hazard Inventory Site Location,” in Appendix L of the 2011 City of Gig Harbor Water System Plan indicates that the project site is within the 5 year boundary of Well #2, this is attached as Figure 6. The project proposes no direct discharge to groundwater and as such, poses no risk for aquifer contamination as result of the changed land use. GHMC 18.08.188(B) requires a Hydrogeologic Assessment if certain commercial/industrial land uses or operations are proposed on the property, but none of those match the single-family residential use proposed by this project and therefore that assessment/study is not required or included with this re-submittal.

Off-site Conditions

The site is bordered to the west by Peacock Hill Avenue. Peacock Hill Avenue consists of a two-lane minor arterial which currently sheet flows off of the roadway onto the site. The site is bordered to the north and south by single family residential developments. These adjacent developments maintain formal on-site stormwater collection, conveyance, and flow control facilities/features that ultimately discharge easterly. As such, no runoff contributions from adjacent developments are expected or anticipated in the design of the storm facilities for *The Reserve*.

SECTION 3 – INFILTRATION RATES/SOILS REPORTS

On-site Soil Conditions

The soils of the area are characterized generally by the Natural Resource Conservation Services (NCRS) as Haristine gravely sandy loam ranging in slope from 0 to 30 percent (16B, 16C, and 16D) with the majority of the developable area sloping at approximately 15 percent.

The Geotechnical Report for The Reserve prepared by Terra Associates, Inc. dated December 3, 2015 found the existing soil conditions on site to be consistent with Haristine gravely sandy loam as described above. This report is attached in Appendix E.

Infiltration facilities are not proposed for stormwater management per the recommendations in Section 4.8 of the Geotechnical Report.

SECTION 4 – WELLS AND SEPTIC SYSTEMS

Based upon site reconnaissance, survey information, and as-built searches, there does not appear to be existing wells or septic systems on-site. Wells and septic systems shall be shown on the as-builts if found during construction.

SECTION 5 – FUEL TANKS

The site is currently undeveloped in a native forest condition. There are no existing fuel tanks known or expected to be onsite based upon site reconnaissance, survey information, as-built research, and its native forest condition.

SECTION 6 – SUBBASIN DESCRIPTION

Developed On-site Conditions

The Reserve proposes to develop and subdivide two parcels (PC tax parcel no. 0222323134 and 0222323135) consisting of 9.88 acres into 14 individual single-family residential lots and three tracts. The on-site development will include new private road (Road A) and two private access roads with curb, gutter, and sidewalk, and storm, water, and sanitary sewer facilities. The site is zoned R-1 which limits impervious of individual residential lots to a maximum of 40% (GHMC 17.16.060, Single Family Residential – Development Standards).

The detention system has been sized to account for on-site flows, off-site flows from Peacock Hill Ave, and bypass due to grade. A vegetated buffer of 25 feet will be preserved around the perimeter of the plat. The 9.88 acre site in proposed conditions will consists of 1.84 acres of impervious area, 1.35 acres of new pervious area (landscaping) and 6.69 acres of undisturbed forest area. This results in only 18.6% of the site proposed for hard surface and 67.7% of the site left in existing conditions. The remaining 13.7% of the site will be landscaping with amended soils per Ecology BMP T5.13. A WWHM Report has been prepared and is provided in Appendix B of this report. See Figure 4 Developed Site Conditions and Land Use breakdown.

Storm water quality treatment is achieved by a water quality facility located downstream of the detention vault within the SD100 Tract. The water quality facility will be a Contech 48" Storm Filter Manhole with (3) 18" Cartridge with PSorb media filtration system design for the detained 2-year flow rate of 0.0658 cfs. See Appendix A for sizing letter form Contech and detail of the water quality facility. The stormwater vault and drainage structures in SD100 will be privately maintained by the Homeowner's Association.

Developed Off-site Conditions

The frontage of Peacock Hill Avenue includes half street improvements which are extending the width to 24 feet, as well as the addition of curb, gutter and sidewalk. The majority of the additional impervious area will be collected and routed to the existing storm system southwest of the site. A portion near the intersection of the proposed Road A and Peacock Hill Avenue will flow on-site and be treated in the storm vault. The on-site storm detention system has been sized to account for the bypass area associated with the frontage improvements. See Figure 4.

Potential Developed Stormwater Quality and Quantity Impacts

The development of The Reserve will include the addition of roads, sidewalks, driveways, and structures, all of which create impervious area on the site. Portions of the site disturbed but not proposed for impervious surface will have soils amended and landscaped. Most of the site, 67.7%, will be left in existing conditions. The creation of impervious and landscaped area will increase quantity of stormwater generated by the site as runoff. If undetained, the increase in flow rates generated by the site could potentially result in erosion and flooding issues downstream of the site. Untreated stormwater leaving the site is also a concern both with added sediment and potential oil entering the downstream ecosystem. The concerns associated with quantity will be addressed through the use of a detention vault sized to mitigate the increased flow rates and durations from 50 percent of the 2-year design storm to the 50-year design storm consistent with Category A flow control. Quality concerns will be addressed through the use to a water quality facility located downstream of the detention vault which is designed by Contech to filter and removed pollutants per Basic Water Quality Treatment requirements. The proposed overland tightline system is designed and reinforced with pipe anchors to convey stormwater down the existing steep slopes. The gabion energy dissipators is design o reduce

the energy of the water coming through the tightline pipe, and finally the two dispersion trenches are designed to disperse stormwater just outside the wetland buffer for wetland hydroperiod mitigation.

Existing Site Hydrology and Conveyance Systems

The existing conditions of the site are shown in Figure 3. WWHM2012 was used to model the site hydrology and calculate runoff peak flow rates and durations. Existing site conditions (i.e., fully forested for site/frontage and existing impervious for the upstream flow-through area) were considered in the analysis of the pre-developed site to establish allowable target release durations for the developed project in accordance with *Manual* standards for Flow Control. The three existing drainage subbasins used in the WWHM2012 model analysis are summarized in Table 6.1.

Table 6.1 – Land Use Cover, Pre-Developed Site Conditions

Basin	Area (Acres)			
	Total Area	Impervious	Lawn	Forest
Developed Frontage Flow Thru	0.070	0.070	0.000	0.000
Predeveloped Frontage	0.103	0.000	0.000	0.103
Predeveloped Site	4.111	0.000	0.000	4.111
Total	4.284	0.070	0.000	4.204

The WWHM Report is provided in Appendix B.

Developed Site Hydrology and Conveyance Systems

The developed conditions of the site are shown in Figure 4. The site is planned to be improved with roadway, storm drainage, and utility infrastructure in support of 14 new single-family lots. Frontage improvements are also proposed in accordance with City of Gig Harbor road standards along Peacock Hill Avenue. The new private Road A will provide access and connectivity through the site in accordance with the City's current standards. Individual lots were modeled to have a maximum of 40% impervious by area. The developed conditions were split into five subbasins. A summary of the land use areas for each of the developed subbasins is shown in Table 6.2.

Developed site conditions were split into five drainage subbasins, two of which will bypass the proposed detention system. One bypass basin is located in the eastern portion of the site and cannot be conveyed to the vault due to grade restrictions. The other bypass basin includes portions of the developed site frontage which will convey stormwater to the existing storm infrastructure within the Peacock Hill Ave right-of-way. These areas reconnect with the runoff from the site within ½ mile of the discharge point, as a result the area was modeled as bypass in order to over detain for the undetained flows.

Table 6.2 – Land Use Cover, Developed Conditions

Drainage Basins	Area (Acres)			
	Total Area	Impervious	Pasture	Forest
Upstream Flow-Thru - Detained	0.070	0.070	0.000	0.000
Developed Frontage – Detained	0.069	0.069	0.000	0.000
Developed Frontage – Bypass	0.033	0.033	0.000	0.000
Developed Site – Detained	2.961	1.841	0.961	0.159
Developed Site - Bypass	1.150	0.000	0.412	0.739
Total	4.283	2.010	1.373	0.898

SECTION 7 – FLOOD PLAIN ANALYSIS

The project site is not located within or in proximity to a 100-year flood hazard area.

SECTION 8 – AESTHETIC CONSIDERATIONS FOR FACILITIES

The proposed stormwater vault will be excavated into native ground and then backfilled on three of its exterior walls and covered over the top. The easterly face of the vault will be partially exposed, but not viewable from the surrounding properties, in-part due to the topography, but also because of plantings that will provide additional screening. This publicly maintained storm drainage vault will be located within a private tract (SD100) accessible from the public right-of-way by a paved roadway.

SECTION 9 – FACILITY SIZING AND DOWNSTREAM ANALYSIS

Level 1 Downstream Analysis

As part of the Civil Permit, a downstream analysis was performed. A map of the downstream drainage path can be found in Appendix F. In general, runoff from the site flows easterly to the on-site Category III Wetland. From there, runoff will continue southeast in a small unnamed tributary before a confluence with Crescent Creek about 1000 feet downstream of the project site. At this point, Crescent Creek continues to flow south for about 800 feet before discharging to the Gig Harbor bay and ultimately the Puget Sound.

No evidence of drainage concerns were found in observations of the downstream drainage course. However, the whole path could not be followed due to dense forestation and private property. See Appendix F for photos on-site and off-site of the drainage course. The on-site flow control and treatment vault will detain flows in order to release at durations equal to or less than the existing conditions. As a result, no new drainage concerns are anticipated.

Flow Control, Water Quality, and Conveyance Facility Analysis and Design

The hydrologic analysis of the runoff conditions for this project is based on drainage characteristics such as basin area, soil type, and land use (i.e., pervious vs. impervious) in accordance with the *Manual*. The Western Washington Hydrology Model (WWHM2012) was used to evaluate the stormwater runoff conditions for the project site and to design the on-site flow control facilities. The following is a summary of the results of the analysis and the proposed drainage facility improvements for this project.

Runoff Control Design Standards

The pre-developed and developed conditions of the site were modeled using WWHM2012. The *Manual* Volume III Chapter 3.1.1 specifies the flow control standard for discharge to a minor water body as matching developed discharge durations to predeveloped durations for the range of predeveloped discharges from 50 percent of the 2-year design storm up to the full 50-year design storm.

Flow Control

A WWHM report is provided in Appendix B with model results and some of the parameters provided below. The Detention Vault was sized to pass the flow duration frequency analysis in WWHM. The threshold for a passing facility was set to 50% of the 2-year to the full 50-year design storms. Table 9.1 – WWHM Flow Rates, provide the project existing conditions, unmitigated, and mitigated developed flow rates for the project.

Table 9.1 – WWHM Flow Rates

MRI	Flow Rates (CFS)		
	Pre-Developed	Unmitigated	Mitigated
2-year	0.0935	0.7256	0.0658
5-year	0.1476	0.9783	0.1047
10-year	0.1874	1.1627	0.1384
25-year	0.2417	1.4156	0.1916
50-year	0.285	1.6192	0.2402
100-year	0.3304	1.836	0.2975

To obtain these flow rates, the detention vault was sized with the dimensions and control structure configuration shown in Table 9.2 – Detention Vault and Control Structure Parameters.

Table 9.2 – WWHM Flow Rates

Detention Vault		Control Structure	
Height	100 ft	Riser Height	12 ft
Width	40 ft	Riser Dia.	18"
Depth	13 ft	Riser Type	Flat
Freeboard	0.5 ft	Orifice # 1	0.748" @ 0 ft
Sediment Storage	0.5 ft	Orifice # 2	1.6875" @ 7.33 ft
Effective Depth	12 ft	Orifice # 3	1.25" @ 10 ft
Outlet Elev.	212.00	Riser Elev.	224.00

The resulting volumes and design storm stages and elevations are below provided in Table 9.3 – Detention Vault Stage vs. Storage Table.

Table 9.3 – Detention Vault Stage vs. Storage Table

MRI	Stage (ft)	Elevation	Storage (CF)
2-year	5.35	217.35	21,388
5-year	7.14	219.14	28,549
10-year	8.25	220.25	32,985
25-year	9.57	221.57	38,290
50-year	10.51	222.51	42,052
100-year	11.42	223.42	45,670

Water Quality

The *Manual* requires that all proposed projects assess the requirement to provide water quality facilities to treat runoff of pollution-generating impervious surfaces. Basic treatment is proposed to be achieved by a water quality facility located downstream of the detention vault within Tract SD100. The water quality facility has been sized accordingly to achieve the basic water quality treatment standard using a Contech 48" StormFilter with (3) 18" Cartridge with PSorb media. The water quality facility has been sized based on the 2-year storm event using WWHM2012. The 2-year flows are provided in Appendix C which are summarized by Table 9.4. Appendix C also provide a detail of the water quality manhole and sizing letter from Contech.

Table 9.4 – Water Quality Volumes

Structure ID	WQ01
Water Quality Flow Rate (cfs)	0.0658
Peak Flow Rate (cfs)	0.2975
Number of Cartridges	3
Cartridges flow rate (gpm)	12.525
Media Type	PSorb
Structure Size	48" Manhole

Conveyance Analysis:

A conveyance analysis including backwater calculations is provided in Appendix D of this report. The backwater calculations use a Single-Event Hydraulics Model, Autodesk Storm and Sanitary Analysis (SSA) software to perform the calculations. The model utilizes Santa Barbara Urban Hydrograph and SCS Time of Concentration. Appendix D includes a narrative, model layout, backwater calculations and SSA reports for both 25-year, 24-hour and 100-year, 24-hour storm events. The analysis shows that the proposed conveyance system meets the requirements of the *Manual* Vol III, Chapter 4 with precipitation data and analysis perimeters from Appendix III-B. The model results show all conveyance pipes have adequate capacity and manholes maintain a minimum of 0.5' of freeboard for the 25-year event. During the 100-year event, no catch basins overtop. See Appendix D for additional details and model results.

Wetland Protection

A wetland hydroperiod analysis was performed using WWHM and coordination with the project Wetland Biologist. The analysis follows Guide Sheets #1 through #3 in Appendix I-B of the *Manual*. The hydroperiod analysis looks at the tributary area of the wetland downstream of the project at the release point for the treated and detained stormwater coming from the site. The analysis looks at monthly and daily volume averages. Appendix C provided a detailed analysis of the WWHM model and results. The project Wetland Biologist has prepared a letter reviewing the Wetland Hydroperiod Analysis and concludes that they do not anticipate any adverse impacts to the wetland hydrology based on the analysis. See Appendix C for additional details and model results.

Structure Schedule

Table 9.5 – Structure Schedule

CB No.	Vertical	Type	Road Name	Station, Offset, & Side
CB05	RIM=233.07 IE(12"W)=230.00 (IN) IE(12"NE)=230.00 (OUT)	TYPE 2-48" ADS N-12 LCPE PIPE	VAULT ACCESS ROAD	STA. 11+42.42 OFF. 0.02', RT
CB10	RIM=241.84 IE(12"W)=236.78 (IN) IE(12"E)=236.78	TYPE 2-48" ADS N-12 LCPE PIPE	VAULT ACCESS ROAD	STA. 10+44.32 OFF. 5.50', LT
CB20	RIM=253.00 IE(12"SE)=248.00 (IN) IE(12"W)=248.00 (IN) IE(12"E)=248.00 (OUT)	TYPE 2-48" ADS N-12 LCPE PIPE	ROAD A	STA. 3+75.30 OFF. 10.31 LT
CB21	RIM=252.98 IE(12"NW)=248.43 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	ROAD A	STA.3+75.30 OFF. 11.24', RT
CB25	RIM=270.27 IE(12"N)= 263.35 (IN) IE(12"W)= 263.35 (IN) IE(12"S)= 263.35 (IN) IE(12"E)= 263.35 (OUT)	TYPE 2-48" ADS N-12 LCPE PIPE	ROAD A	STA.2+60.17 OFF. 10.37', LT
CB26	RIM=269.68 IE(12"N)=265.68 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	ROAD A	STA.2+63.97 OFF. 11.23', RT
CB27	RIM=266.35 IE(12"S)=263.75 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	PAT100	STA.50+87.35 OFF. 8.75', RT
CB30	RIM=285.79 IE(12"S)=282.63 (IN) IE(12"W)=282.63 (IN) IE(12"E)=282.63 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	ROAD A	STA.1+42.70 OFF. 11.26', LT
CB31	RIM=285.78 IE(12"N)=282.86 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	ROAD A	STA.1+42.72 OFF. 11.26', RT
CB35	RIM=287.86 IE(12"SE)=285.73 (OUT)	TYPE 1(NO SUMP) ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.28+23.06 OFF. 22.25', RT
CB100	IE(12"N)=282.86 (OUT) IE(12"E)=279.20 (IN) EX. IE(12"N)=279.20 (IN) EX. IE(12"S)=279.20 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.26+59.66 OFF. 22.86', LT
CB105	RIM=281.87 IE(12"N)=279.39 (IN) IE(12"E)=279.39 (IN) IE(12"W)=279.39 (OUT)	TYPE 1 ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.26+68.70 OFF. 13.02', RT
CB106	RIM=282.35 IE(12"W)=279.75 (OUT)	TYPE 1 (NO SUMP) ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.26+71.02 OFF. 22.25', RT
CB110	RIM=292.84 IE(12"NE)=287.50 (IN) IE(12"E)=287.50 (IN) IE(12"S)=287.50 (OUT)	TYPE 2-48" ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.29+84.97 OFF. 13.15', RT
CB111	RIM=292.65 IE(12"W)=290.65	TYPE 1(NO SUMP) ADS N-12 LCPE PIPE	PEACOCK HILL AVE	STA.29+84.97 OFF. 22.25', RT
CS01	RIM=229.25 IE(12"NE)=212.00 (IN) IE(12"SW)=212.00 (OUT)	TYPE 2-60" CONTROL STRUCTURE ADS N-12 LCPE	VAULT ACCESS ROAD	STA.11+77.53 OFF. 5.35', RT
WQ01	RIM=230.54 IE(12"NE)=211.90 (IN) IE(12"SE)=209.60 (OUT)	CONTECH SFMH 48" SOLID LOCKING LID HDPE PIPE, ANCHORED	VAULT ACCESS ROAD	STA.11+64.56 OFF. 5.64', RT

SECTION 10 – UTILITIES

Water and sanitary sewer service will be provided by extension of existing public facilities at Peacock Hill Avenue. The extension of onsite water systems will be publicly owned and maintained by the Washington Water Company. The project will extend the City of Gig Harbor's sanitary sewer gravity main within Peacock Hill Avenue for the full frontage length of the site. The onsite sanitary sewer mains are comprised of a 2-inch low pressure force main that that will also be owned and maintained by the City. Each individual single-family residence will be equipped with a grinder pump and private service that will connect and discharge directly to the low pressure main.

Electrical power and natural gas are also expected to serve the property by extension of existing Puget Sound Energy facilities at Peacock Hill Avenue. These systems will be delivered via new mains within a public utility easement (PUE) adjacent to the new right-of-way of Road A. Cable and telephone systems will also be located within this PUE.

SECTION 11 – COVENANTS, DEDICATIONS, EASEMENTS

The on-site storm drainage facilities for this project have been designed and will be constructed in accordance with the applicable provisions of the *Manual*. These facilities will be installed primarily within public right-of-way and a privately owned roadways and storm drainage and open space tract (Tract SD100). Facilities within the right-of-way will be publicly maintained. The private tract will contain privately maintained drainage features including below-grade pipes, catch basin inlets, and a combined detention and water quality vault. The outfall for this vault is proposed as a continuous, mostly above-ground HDPE tightline with a gabion dissipater at the outlet end. This pipe and outfall will be contained in a 15-foot wide private storm drainage easement owed and maintained by the HOA.

SECTION 12 – PROPERTY OWNER’S ASSOCIATION ARTICLES OF INCORPORATION

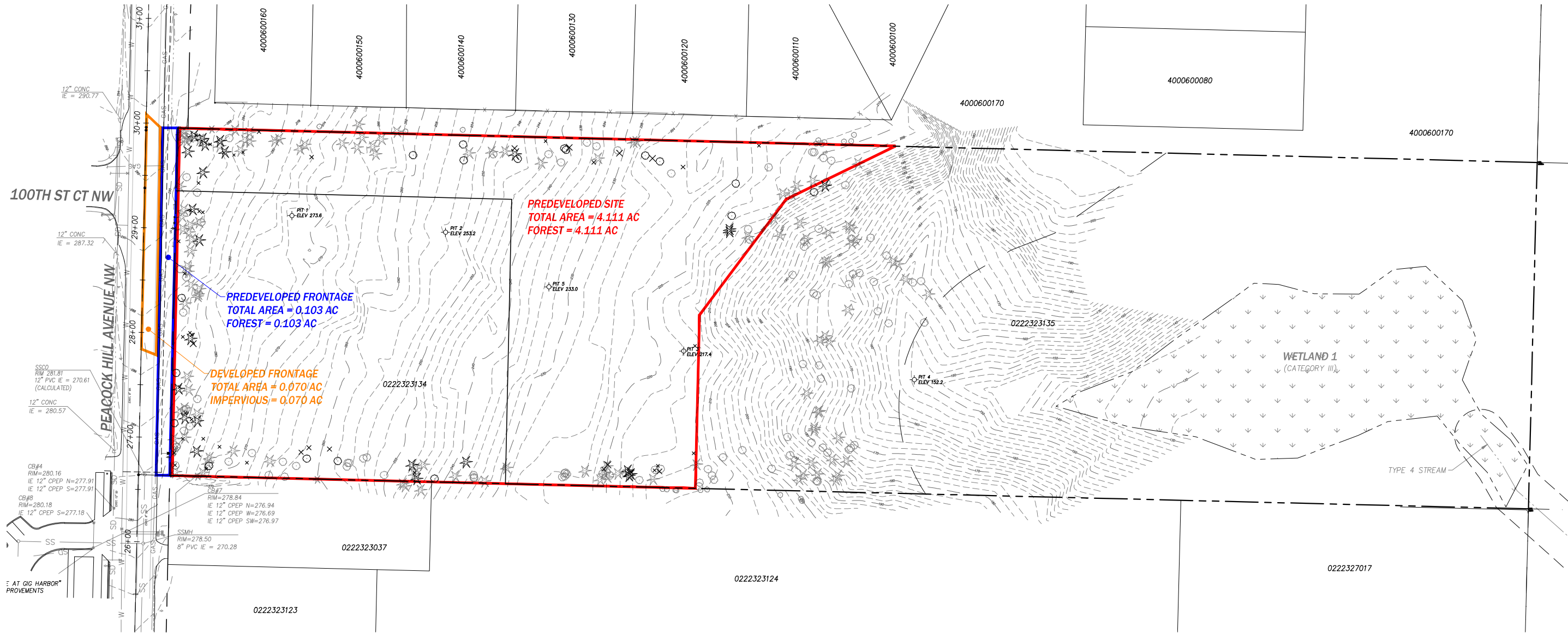
This residential community will have a homeowner’s association (HOA). The articles of incorporation/formation establishing the HOA are typically prepared in conjunction with or immediately prior to final plat. These HOA formation documents are not available at this phase of the project but will be provided to the City once they are available.

SECTION 13 – OTHER PERMITS OR CONDITIONS PLACED ON THE PROJECT

The project is currently in the preliminary design and land use phase. As such, there are not yet any conditions of approval or other permits currently in process. The following is a list of items that will follow and/or be generated by the completion of the preliminary plat process:

- SEPA Determination (City of Gig Harbor)
- Preliminary Plat Conditions of Approval (City of Gig Harbor)
- Construction Stormwater General Permit (Department of Ecology)
- Civil Permit (City of Gig Harbor Public Works)
- Encroachment Right-of-way (City of Gig Harbor Public Works)
- Final Plat (City of Gig Harbor)

FIGURES



SURVEY DATA

EXISTING BOUNDARY, TOPOGRAPHIC, AND PLANIMETRIC INFORMATION SHOWN ON THIS PLAN AND OTHERS IN THIS SET WERE USED AS A BASIS FOR DESIGN AND REPRESENT FIELD SURVEY DATA AND MAPPING PREPARED BY OTAK, INC. (OTAK JOB NO. 3005), AS PROVIDED BY THE PROJECT OWNER, AND DOES NOT REPRESENT WORK BY CPH CONSULTANTS. THE FOLLOWING SURVEY DATA WAS PROVIDED WITH THE TOPOGRAPHIC MAP BY OTAK, INC.:

LEGAL DESCRIPTION

THAT PORTION OF THE SOUTH HALF OF THE SOUTH HALF OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 32, TOWNSHIP 22 NORTH, RANGE 2 EAST, W.M.; EXCEPT PEACOCK HILL AVENUE N.W. (PURDY GIG HARBOR ROAD);

LYING WESTERLY OF THE FOLLOWING DESCRIBED LINE:

COMMENCING AT THE NORTHWEST CORNER OF THE ABOVE DESCRIBED PARCEL; THENCE S.88°32'56"E., 516.25 FEET TO THE TRUE POINT OF BEGINNING OF SAID DESCRIBED LINE; THENCE LEAVING SAID NORTH LINE S. 01°16'45"W, 100.00 FEET; THENCE S.88°32'56"E., 105.25 FEET; THENCE S. 01°16'45"W, 231.48 FEET TO A POINT ON THE SOUTH LINE OF THE ABOVE DESCRIBED PARCEL AND THE TERMINUS OF SAID DESCRIBED LINE, THE SOUTHWEST CORNER OF WHICH BEARS N.88°35'30"W, 621.50 FEET.

CONTAINING AN AREA OF 4.49 ACRES MORE OR LESS.

HORIZONTAL DATUM

NAD 83/91 NOTE: DATUM WAS ESTABLISHED BY HOLDING SPC COORDINATES, WASHINGTON SOUTH ZONE, AT PIERCE COUNTY SURVEY CONTROL POINT #s 401 AND 87 AS PUBLISHED BY SURVEY SECTION OF PIERCE COUNTY DEPARTMENT OF PUBLIC WORKS.

VERTICAL DATUM

N.G.V.D. 29 PROJECT BENCHMARK IS PIERCE COUNTY SURVEY CONTROL POINT #s 401 AND 87

BASIS OF BEARING

NAD 83/91 (BEARING BETWEEN PIERCE COUNTY SURVEY CONTROL POINT #s 401 AND 87 S 01°36'38" W MEASURED AND CALCULATED.

NOTES:

- ALL LOCATIONS, OF EXISTING UTILITIES SHOWN HAVE BEEN ESTABLISHED BY FIELD SURVEY OR OBTAINED FROM AVAILABLE RECORDS AND SHOULD THEREFORE BE CONSIDERED APPROXIMATE ONLY AND NOT NECESSARILY COMPLETE. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO INDEPENDENTLY VERIFY THE ACCURACY OF ALL UTILITY LOCATIONS SHOWN AND TO FURTHER DISCOVER AND AVOID ANY OTHER UTILITIES NOT SHOWN HEREON WHICH MAY BE AFFECTED BY THE IMPLEMENTATION OF THIS PLAN.

CPH
CONSULTANTS

Site Planning • Civil Engineering
Landscape Architecture • Land Use Consulting

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101 South Wenatchee Avenue, Suite C3
Wenatchee, WA 98801 • (509) 293-7731
www.cphconsultants.com

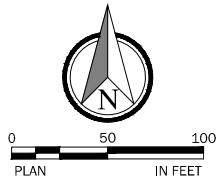
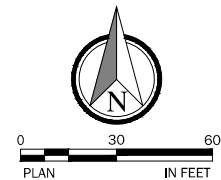


Figure 3-Existing Site Conditions

P:\project\0228_Prospect_Development\21001_The Reserve\Reports\SDR\220826_Final\CAD\Figure 4-Developed Site Conditions.dwg
9/27/2022 10:03 AM RYAN SUDATA



UPSTREAM FLOW-THROUGH-DETAINED
TOTAL AREA = 0.070 AC
IMPERVIOUS = 0.070 AC

DEVELOPED FRONTAGE - DETAINED
TOTAL = 0.069 AC
IMPERVIOUS = 0.069 AC

DEVELOPED FRONTAGE - BYPASS
TOTAL AREA = 0.033 AC
IMPERVIOUS = 0.033 AC

DEVELOPED SITE - DETAINED
TOTAL AREA = 2.961 AC
IMPERVIOUS = 1.841 AC
PASTURE = 0.961 AC
FORESTED = 0.159 AC

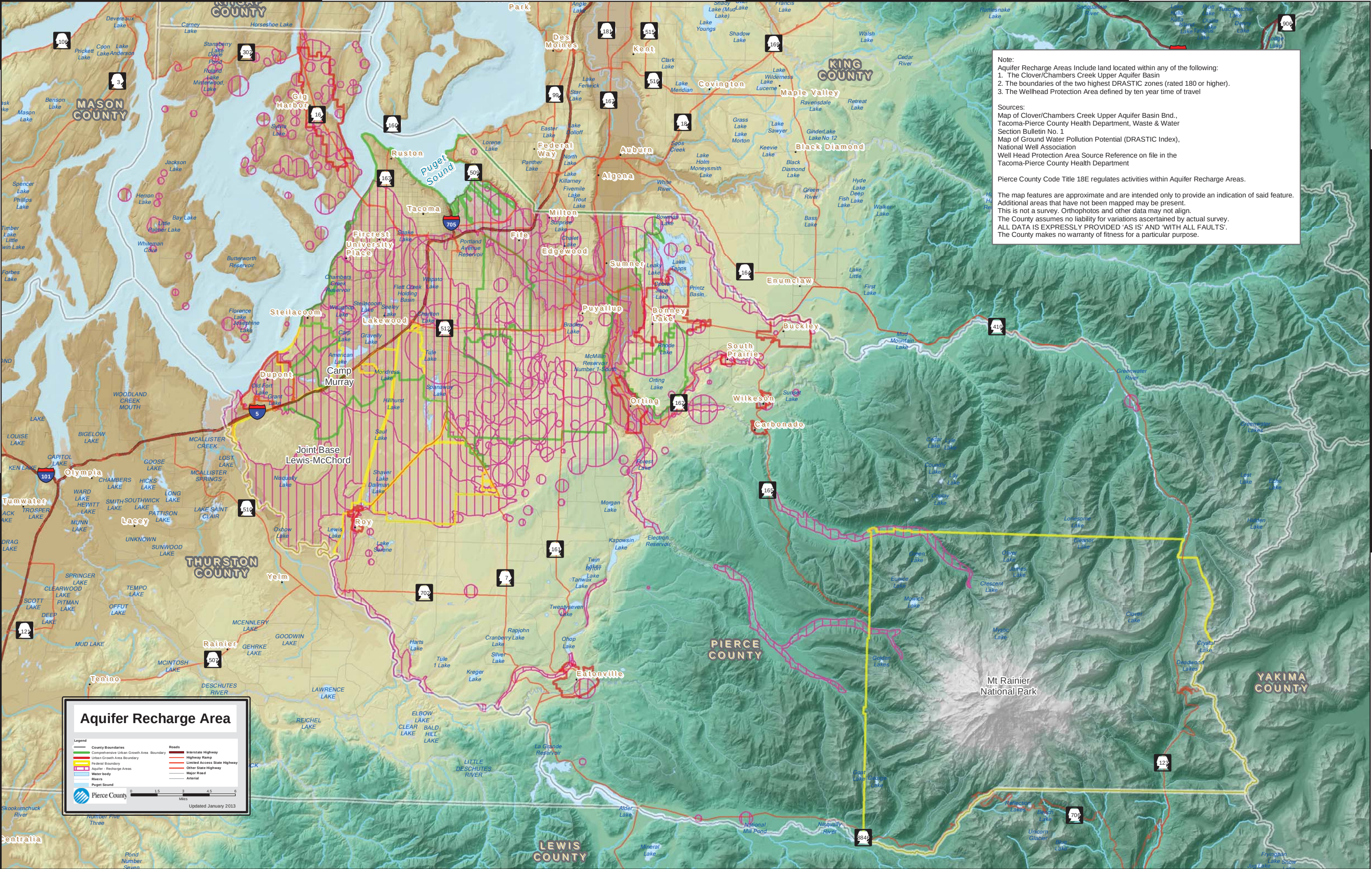
DEVELOPED SITE - BYPASS
TOTAL = 1.151 AC
PASTURE = 0.412 AC
FOREST = 0.739 AC

PROPOSED CONDITIONS LAND USE LEGEND:

	LOT IMPREV. (40%)	(53,307 SF)
	ASPHALT	(21,084 SF)
	CONCRETE	(5,779)
	LANDSCAPE	(58,843 SF)
	FOREST	(291,204 SF)

NOTE:
LOT IMPERVIOUS AREA IS ASSUMED TO BE 40% FOR SIZING OF TREATMENT FACILITIES, FLOW CONTROL FACILITIES AND WETLAND HYDROPERIOD ANALYSIS. THE IMPERVIOUS AREA SHOWN ON THIS MAP ARE NOT EXACT AND ARE SHOWN TO REPRESENT 40% OF EACH SITE. EXACT IMPERVIOUS AREA FOR EACH LOT WILL BE DETERMINED DURING THE INDIVIDUAL BUILDING PERMIT SUBMITTAL, REVIEW AND APPROVAL.

Figure 4-Developed Site Conditions



Note:
Aquifer Recharge Areas Include land located within any of the following:
1. The Clover/Chambers Creek Upper Aquifer Basin
2. The boundaries of the two highest DRASTIC zones (rated 180 or higher).
3. The Wellhead Protection Area defined by ten year time of travel

Sources:
Map of Clover/Chambers Creek Upper Aquifer Basin Bnd., Tacoma-Pierce County Health Department, Waste & Water Section Bulletin No. 1
Map of Ground Water Pollution Potential (DRASTIC Index), National Well Association
Well Head Protection Area Source Reference on file in the Tacoma-Pierce County Health Department

Pierce County Code Title 18E regulates activities within Aquifer Recharge Areas.

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

Aquifer Recharge Area

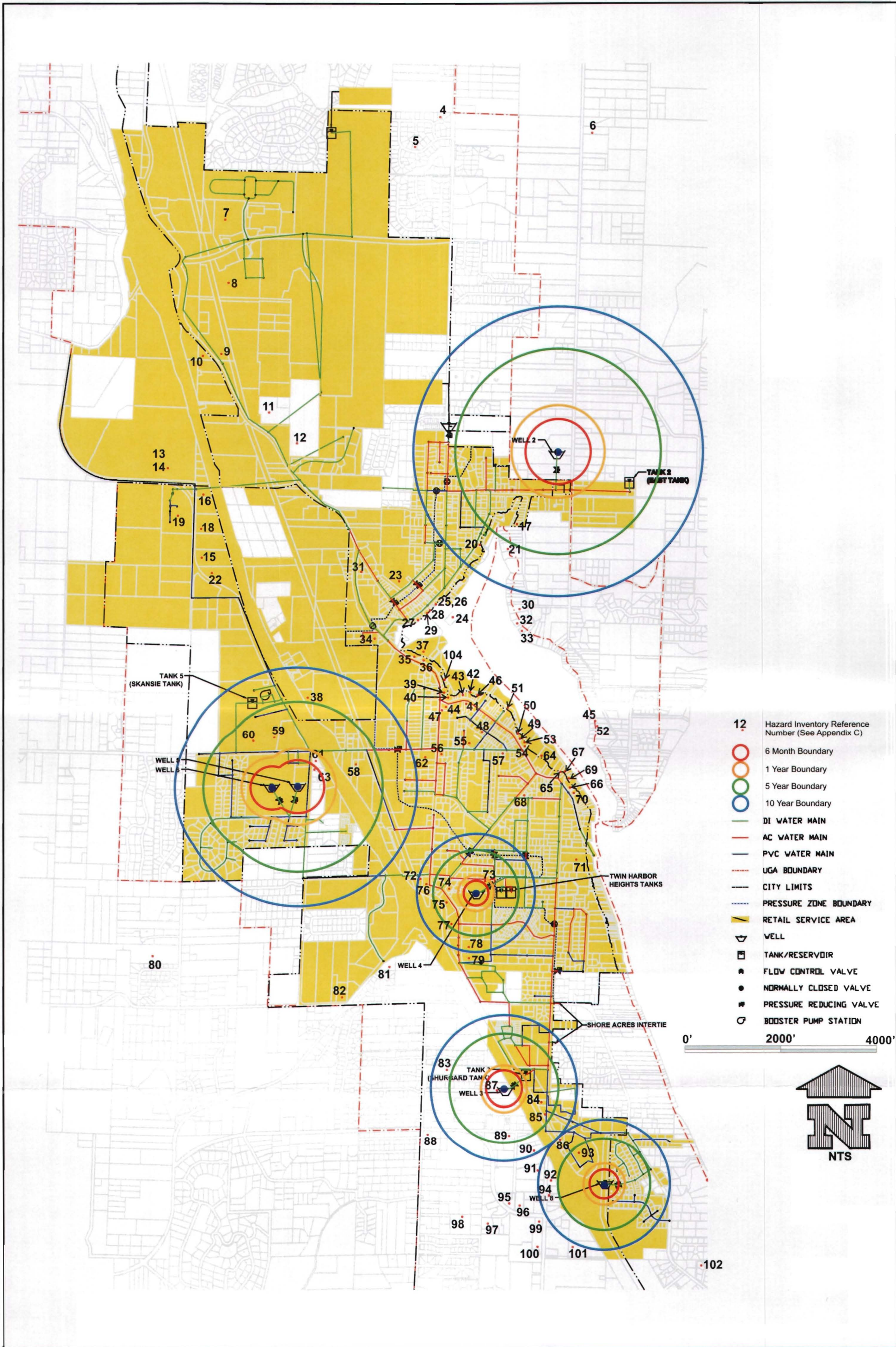
Legend

County Boundaries	Comprehensive Urban Growth Area Boundary	Roads
Urban Growth Area Boundary	Federal Boundary	Interstate Highway
Aquifer Recharge Areas	Water body	Highway Ramp
Rivers	Puget Sound	Limited Access State Highway
		Other State Highway
		Major Road
		Arterial

Pierce County

0 1.5 3 4.5 6 Miles

Updated January 2013



100TH ST CT

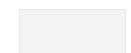
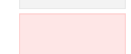
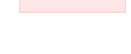
PEACOCK HILL AVENUE

ROAD A

DEVELOPED SITE (DISTURBED)
TOTAL AREA = 3.139 AC
IMPERVIOUS = 1.943 AC
PASTURE = 1.037 AC
FORESTED = 0.159 AC

DEVELOPED SITE (LANDSCAPE)
TOTAL = 1.151 AC
PASTURE = 0.412 AC
FOREST = 0.739 AC

PROPOSED CONDITIONS LAND USE LEGEND:

	LOT IMPREV. (40%)	(53,307 SF)
	ASPHALT	(21,084 SF)
	CONCRETE	(5,779)
	LANDSCAPE	(58,843 SF)
	FOREST	(291,204 SF)

NOTE:
FORESTED AREAS ARE TO BE MAINTAINED THROUGH CONSTRUCTION;
THEREFORE, SOILS WILL NOT BE AMENDED IN THESE AREAS.

SOIL AMENDMENT PLAN CALCULATIONS

OPTION 3 - LAWN AREAS (INCLUDES IMP., PASTURE)
TOTAL AREA DISTURBED=3.392 AC (147,755 SF)
3" IMPORTED TOP SOIL=9.26 CY X (147,755/1000)= 1,368.16 CY

OPTION 3 - LANDSCAPE (INCLUDES DISTURBED LANDSCAPE PASTURE)
TOTAL AREA DISTURBED=0.412 AC (17,947 SF)
6" IMPORTED TOP SOIL=18.5 CY X (17,947/1000)= 332 CY
2" ORGANIC MULCH=6.2 CY X (17,947/1000)= 111 CY

C|P|H
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101 South Wenatchee Avenue, Suite C3
Wenatchee, WA 98801 • (509) 293-7731
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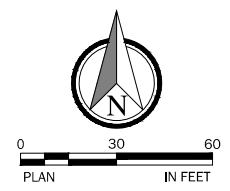


Figure 7-Soil Amendment Plan

APPENDIX A

WATER QUALITY SIZING LETTER AND FACILITY DETAILS

Prepared by Doug Miller on July 8, 2022

The Reserves- Stormwater Treatment

Gig Harbor, WA

Information provided:

- Presiding agency = City of Gig Harbor/ Ecology

Structure ID	SFMH
Water Quality Flow Rate (cfs)	0.0658
Peak Flow Rate (cfs)	0.2975
Number of cartridges	3
Cartridge flow rate (gpm)	12.525
Media type	PSorb
Structure size	48" Manhole
Approximate Price	\$23,200

Assumptions:

- Media = PhosphoSorb (Psorb) cartridges
- Cartridge flow rate = 12.525 gpm
- Drop required from inlet to outlet = 2.3' minimum

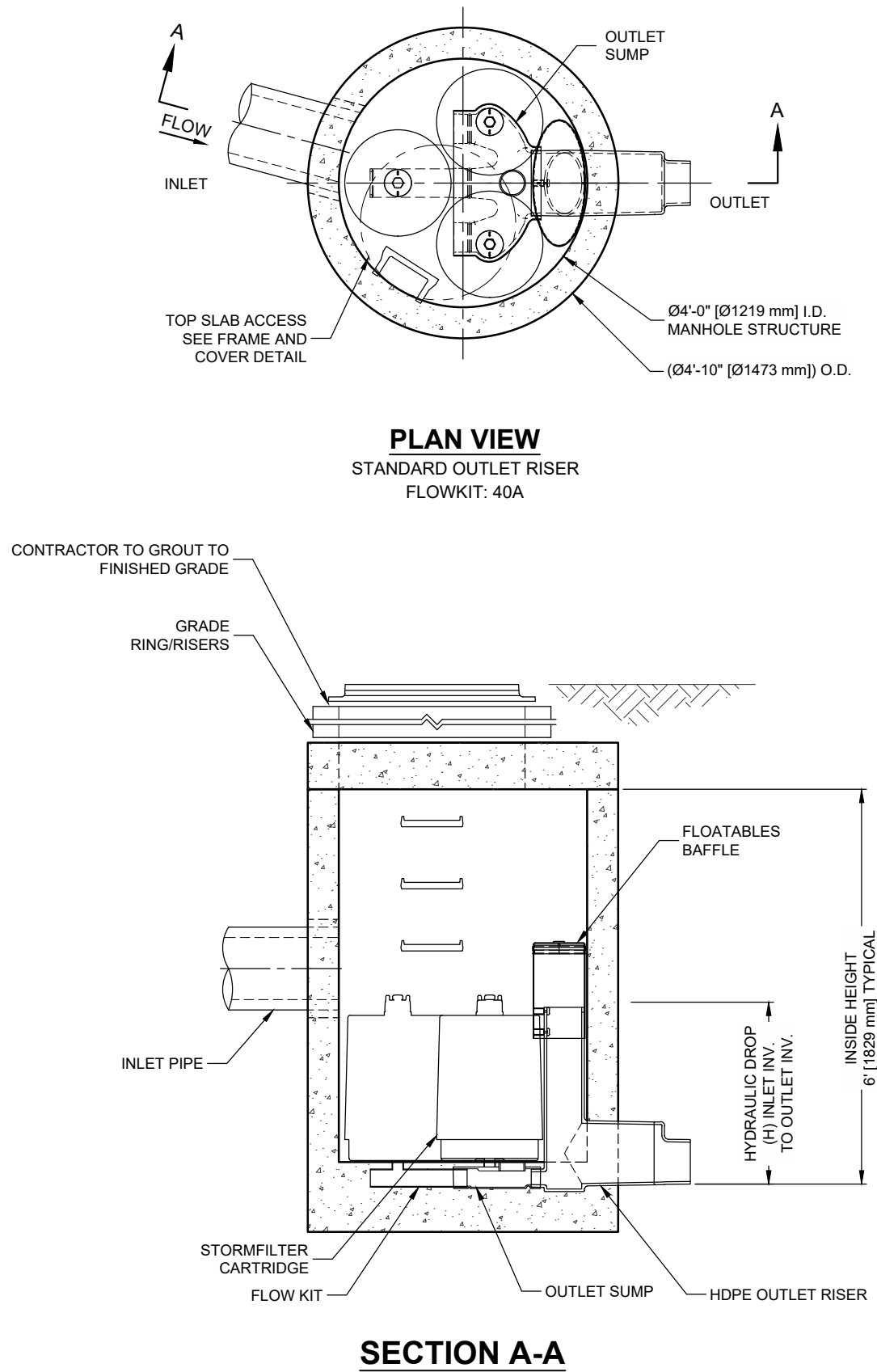
Size and cost estimates:

The StormFilter is a flow-based system and is therefore sized by calculating the peak water quality flow rate associated with the design storm. The water quality flow rate was calculated by the consulting engineer using WWHM and was provided to Contech Engineered Solutions LLC for the purposes of developing this estimate.

The StormFilter for this site was sized based on the above water quality flow rate. To accommodate the flow rate and elevations for this project, Contech Engineered Solutions recommends using (3) – 18" cartridge with PhosphoSorb media in a 48" manhole.

The estimated cost of this system is shown in the above table; this estimate includes a complete system delivered to the job site. The final system cost will depend on the actual depth of the units and whether extras like doors rather than castings are specified. The contractor is responsible for setting the StormFilter manhole and all external plumbing.

I:\STORMWATER\COMOPS\10 STORMFILTER\40 STANDARD DRAWINGS\MANHOLE\SFMH48-DTL.DWG 4/5/2019 10:54 AM



SECTION A-A

The Stormwater Management
StormFilter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING
U.S. PATENTS: 5,322,629; 5,524,576; 5,707,527; 5,985,157; 6,027,639; 6,649,048;
RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

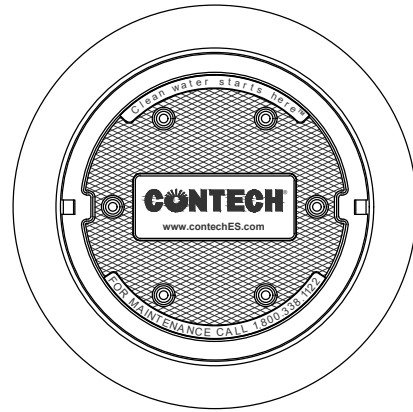
STORMFILTER DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (3). VOLUME SYSTEM IS ALSO AVAILABLE WITH MAXIMUM 3 CARTRIDGES. Ø4 [1219 mm] MANHOLE STORMFILTER PEAK HYDRAULIC CAPACITY IS 1.0 CFS [28.3 L/s] . IF THE SITE CONDITIONS EXCEED 1.0 CFS [28.3 L/s] AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27" [686 mm]			18" [458 mm]			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	2.05' [930 mm]			2.3' [700 mm]			1.6' [550 mm]		
SPECIFIC FLOW RATE (gpm/sf) [L/s/m ²]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]
CARTRIDGE FLOW RATE (gpm) [L/s]	22.5 [1.42]	18.79 [1.19]	11.25 [0.71]	15 [0.95]	12.53 [0.79]	7.5 [0.47]	10 [0.63]	8.35 [0.54]	5 [0.32]

* 1.67 gpm/sf [1.08 L/s/m²] SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	WQ01
WATER QUALITY FLOW RATE (cfs) [L/s]	0.0658 cfs
PEAK FLOW RATE (cfs) [L/s]	0.2975 cfs
RETURN PERIOD OF PEAK FLOW (yrs)	100-year
CARTRIDGE HEIGHT (SEE TABLE ABOVE)	18"
NUMBER OF CARTRIDGES REQUIRED	3
CARTRIDGE FLOW RATE	12.525 gpm
MEDIA TYPE (PERLITE, ZPG, PSORB)	PSORB

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	211.90	LCPE	12"
INLET PIPE #2			
OUTLET PIPE	209.60	LCPE	12"

RIM ELEVATION	230.54
---------------	--------

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
- STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' [1524 mm] AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
- FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES [178 mm]. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
- SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) [L/s] DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft) [m²].
- STORMFILTER STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE.
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
- CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET PIPE(S).
- CONTRACTOR TO PROVIDE AND INSTALL CONNECTOR TO THE OUTLET RISER STUB. STORMFILTER EQUIPPED WITH A DUAL DIAMETER HDPE OUTLET STUB AND SAND COLLAR. IF OUTLET PIPE IS LARGER THAN 8 INCHES [200 mm], CONTRACTOR TO REMOVE THE 8 INCH [200 mm] OUTLET STUB AT MOLDED-IN CUT LINE. COUPLING BY FERNCO OR EQUAL AND PROVIDED BY CONTRACTOR.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

CONTECH
ENGINEERED SOLUTIONS LLC

www.contechES.com

9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069

800-338-1122

513-645-7000

513-645-7993 FAX

SFMH48
STORMFILTER
STANDARD DETAIL

APPENDIX B

WWHM MODEL RESULTS – FLOW CONTROL

WWHM2012
PROJECT REPORT

General Model Information

Project Name: The Reserve_Vault_220630_FINAL
Site Name: The Reserve
Site Address: Peacock Hill Ave
City: Gig Harbor
Report Date: 7/7/2022
Gage: 38 IN CENTRAL
Data Start: 10/01/1901
Data End: 09/30/2059
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2021/08/18
Version: 4.2.18

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Predev Site

Bypass: No

GroundWater: No

Pervious Land Use acre
C, Forest, Mod 4.111

Pervious Total 4.111

Impervious Land Use acre

Impervious Total 0

Basin Total 4.111

Element Flows To:		
Surface	Interflow	Groundwater

Predev Frontage

Bypass: No

GroundWater: No

Pervious Land Use acre
C, Forest, Mod 0.103

Pervious Total 0.103

Impervious Land Use acre

Impervious Total 0

Basin Total 0.103

Element Flows To:		
Surface	Interflow	Groundwater

Dev Frontage

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.07

Impervious Total 0.07

Basin Total 0.07

Element Flows To:
Surface

Interflow

Groundwater

Mitigated Land Use

Dev Site-Detained

Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	0.159
C, Pasture, Mod	0.961

Pervious Total	1.12
----------------	------

Impervious Land Use	acre
ROADS MOD	0.617
ROOF TOPS FLAT	1.224

Impervious Total	1.841
------------------	-------

Basin Total	2.961
-------------	-------

Element Flows To:		
Surface	Interflow	Groundwater
Detention Vault	Detention Vault	

Dev Site-Bypass

Bypass: Yes

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	0.412
C, Forest, Mod	0.739

Pervious Total 1.151

Impervious Land Use acre

Impervious Total 0

Basin Total 1.151

Element Flows To:		
Surface	Interflow	Groundwater

Dev Frontage-Detained

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.069

Impervious Total 0.069

Basin Total 0.069

Element Flows To:

Surface	Interflow	Groundwater
Detention Vault	Detention Vault	

Upstream Flow-thru-detained

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.07

Impervious Total 0.07

Basin Total 0.07

Element Flows To:

Surface	Interflow	Groundwater
Detention Vault	Detention Vault	

Dev Frontage-Bypass

Bypass: Yes

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.033

Impervious Total 0.033

Basin Total 0.033

Element Flows To:
Surface

Interflow

Groundwater

Routing Elements

Predeveloped Routing

Mitigated Routing

Detention Vault

Width: 40 ft.
Length: 100 ft.
Depth: 12.5 ft.
Discharge Structure
Riser Height: 12 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.748 in. Elevation: 0 ft.
Orifice 2 Diameter: 1.6875 in. Elevation: 7.33 ft.
Orifice 3 Diameter: 1.25 in. Elevation: 10 ft.
Element Flows To:
Outlet 1 Outlet 2

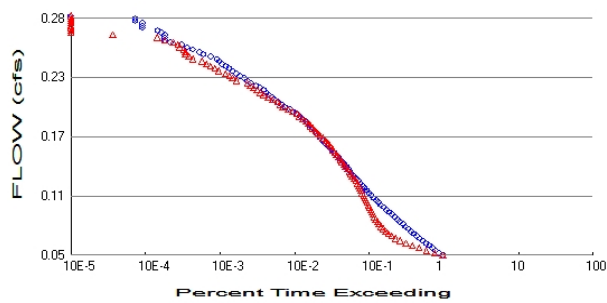
Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.091	0.000	0.000	0.000
0.1389	0.091	0.012	0.005	0.000
0.2778	0.091	0.025	0.008	0.000
0.4167	0.091	0.038	0.009	0.000
0.5556	0.091	0.051	0.011	0.000
0.6944	0.091	0.063	0.012	0.000
0.8333	0.091	0.076	0.013	0.000
0.9722	0.091	0.089	0.015	0.000
1.1111	0.091	0.102	0.016	0.000
1.2500	0.091	0.114	0.017	0.000
1.3889	0.091	0.127	0.017	0.000
1.5278	0.091	0.140	0.018	0.000
1.6667	0.091	0.153	0.019	0.000
1.8056	0.091	0.165	0.020	0.000
1.9444	0.091	0.178	0.021	0.000
2.0833	0.091	0.191	0.021	0.000
2.2222	0.091	0.204	0.022	0.000
2.3611	0.091	0.216	0.023	0.000
2.5000	0.091	0.229	0.024	0.000
2.6389	0.091	0.242	0.024	0.000
2.7778	0.091	0.255	0.025	0.000
2.9167	0.091	0.267	0.025	0.000
3.0556	0.091	0.280	0.026	0.000
3.1944	0.091	0.293	0.027	0.000
3.3333	0.091	0.306	0.027	0.000
3.4722	0.091	0.318	0.028	0.000
3.6111	0.091	0.331	0.028	0.000
3.7500	0.091	0.344	0.029	0.000
3.8889	0.091	0.357	0.029	0.000
4.0278	0.091	0.369	0.030	0.000
4.1667	0.091	0.382	0.031	0.000
4.3056	0.091	0.395	0.031	0.000
4.4444	0.091	0.408	0.032	0.000
4.5833	0.091	0.420	0.032	0.000
4.7222	0.091	0.433	0.033	0.000
4.8611	0.091	0.446	0.033	0.000
5.0000	0.091	0.459	0.034	0.000
5.1389	0.091	0.471	0.034	0.000

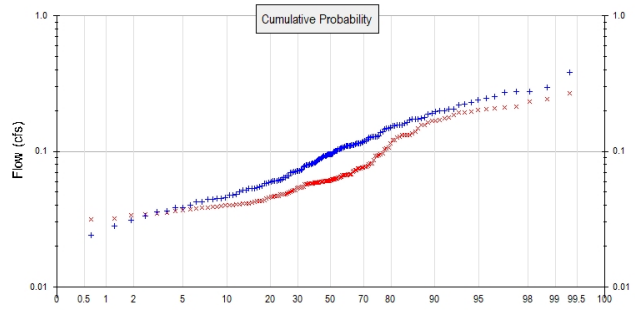
5.2778	0.091	0.484	0.034	0.000
5.4167	0.091	0.497	0.035	0.000
5.5556	0.091	0.510	0.035	0.000
5.6944	0.091	0.522	0.036	0.000
5.8333	0.091	0.535	0.036	0.000
5.9722	0.091	0.548	0.037	0.000
6.1111	0.091	0.561	0.037	0.000
6.2500	0.091	0.573	0.038	0.000
6.3889	0.091	0.586	0.038	0.000
6.5278	0.091	0.599	0.038	0.000
6.6667	0.091	0.612	0.039	0.000
6.8056	0.091	0.624	0.039	0.000
6.9444	0.091	0.637	0.040	0.000
7.0833	0.091	0.650	0.040	0.000
7.2222	0.091	0.663	0.040	0.000
7.3611	0.091	0.676	0.054	0.000
7.5000	0.091	0.688	0.073	0.000
7.6389	0.091	0.701	0.084	0.000
7.7778	0.091	0.714	0.094	0.000
7.9167	0.091	0.727	0.101	0.000
8.0556	0.091	0.739	0.108	0.000
8.1944	0.091	0.752	0.115	0.000
8.3333	0.091	0.765	0.121	0.000
8.4722	0.091	0.778	0.126	0.000
8.6111	0.091	0.790	0.132	0.000
8.7500	0.091	0.803	0.137	0.000
8.8889	0.091	0.816	0.141	0.000
9.0278	0.091	0.829	0.146	0.000
9.1667	0.091	0.841	0.150	0.000
9.3056	0.091	0.854	0.154	0.000
9.4444	0.091	0.867	0.159	0.000
9.5833	0.091	0.880	0.163	0.000
9.7222	0.091	0.892	0.166	0.000
9.8611	0.091	0.905	0.170	0.000
10.000	0.091	0.918	0.174	0.000
10.139	0.091	0.931	0.193	0.000
10.278	0.091	0.943	0.203	0.000
10.417	0.091	0.956	0.212	0.000
10.556	0.091	0.969	0.219	0.000
10.694	0.091	0.982	0.226	0.000
10.833	0.091	0.994	0.233	0.000
10.972	0.091	1.007	0.239	0.000
11.111	0.091	1.020	0.245	0.000
11.250	0.091	1.033	0.251	0.000
11.389	0.091	1.045	0.256	0.000
11.528	0.091	1.058	0.262	0.000
11.667	0.091	1.071	0.267	0.000
11.806	0.091	1.084	0.272	0.000
11.944	0.091	1.096	0.277	0.000
12.083	0.091	1.109	0.664	0.000
12.222	0.091	1.122	1.924	0.000
12.361	0.091	1.135	3.490	0.000
12.500	0.091	1.147	4.935	0.000
12.639	0.091	1.114	5.922	0.000

Analysis Results

POC 1



+ Predeveloped x Mitigated



Predeveloped Landuse Totals for POC #1

Total Pervious Area: 4.214
Total Impervious Area: 0.07

Mitigated Landuse Totals for POC #1

Total Pervious Area: 2.271
Total Impervious Area: 2.013

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.093516
5 year	0.147631
10 year	0.187426
25 year	0.241749
50 year	0.28495
100 year	0.330367

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.065778
5 year	0.104721
10 year	0.138383
25 year	0.191586
50 year	0.240152
100 year	0.297465

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.072	0.058
1903	0.061	0.048
1904	0.141	0.077
1905	0.055	0.054
1906	0.024	0.030
1907	0.146	0.080
1908	0.107	0.061
1909	0.108	0.062
1910	0.154	0.076
1911	0.095	0.063

1912	0.382	0.171
1913	0.147	0.132
1914	0.081	0.054
1915	0.066	0.059
1916	0.093	0.059
1917	0.036	0.032
1918	0.101	0.128
1919	0.077	0.058
1920	0.095	0.062
1921	0.110	0.072
1922	0.111	0.067
1923	0.086	0.059
1924	0.042	0.040
1925	0.053	0.044
1926	0.105	0.062
1927	0.062	0.041
1928	0.080	0.057
1929	0.163	0.082
1930	0.099	0.060
1931	0.092	0.058
1932	0.079	0.055
1933	0.082	0.060
1934	0.204	0.204
1935	0.093	0.131
1936	0.084	0.058
1937	0.151	0.078
1938	0.081	0.058
1939	0.022	0.037
1940	0.088	0.067
1941	0.048	0.036
1942	0.127	0.186
1943	0.074	0.054
1944	0.157	0.114
1945	0.113	0.067
1946	0.082	0.052
1947	0.038	0.035
1948	0.200	0.096
1949	0.174	0.168
1950	0.053	0.043
1951	0.066	0.047
1952	0.275	0.210
1953	0.240	0.194
1954	0.095	0.058
1955	0.072	0.047
1956	0.036	0.037
1957	0.120	0.072
1958	0.252	0.232
1959	0.172	0.194
1960	0.045	0.038
1961	0.157	0.177
1962	0.092	0.061
1963	0.044	0.040
1964	0.056	0.041
1965	0.175	0.167
1966	0.053	0.040
1967	0.091	0.059
1968	0.079	0.060
1969	0.082	0.055

1970	0.123	0.075
1971	0.187	0.174
1972	0.128	0.076
1973	0.170	0.126
1974	0.110	0.060
1975	0.205	0.214
1976	0.114	0.068
1977	0.038	0.034
1978	0.177	0.155
1979	0.054	0.045
1980	0.101	0.064
1981	0.097	0.059
1982	0.043	0.039
1983	0.155	0.105
1984	0.070	0.057
1985	0.110	0.066
1986	0.095	0.063
1987	0.196	0.164
1988	0.114	0.093
1989	0.105	0.062
1990	0.114	0.067
1991	0.092	0.060
1992	0.128	0.132
1993	0.126	0.071
1994	0.190	0.094
1995	0.040	0.047
1996	0.219	0.195
1997	0.084	0.051
1998	0.107	0.068
1999	0.028	0.035
2000	0.079	0.060
2001	0.048	0.038
2002	0.173	0.095
2003	0.115	0.073
2004	0.118	0.068
2005	0.247	0.121
2006	0.064	0.043
2007	0.064	0.050
2008	0.101	0.062
2009	0.071	0.053
2010	0.061	0.050
2011	0.050	0.038
2012	0.079	0.060
2013	0.060	0.043
2014	0.045	0.041
2015	0.087	0.061
2016	0.033	0.034
2017	0.148	0.106
2018	0.272	0.244
2019	0.275	0.201
2020	0.096	0.060
2021	0.131	0.104
2022	0.059	0.046
2023	0.110	0.067
2024	0.298	0.135
2025	0.099	0.065
2026	0.160	0.093
2027	0.058	0.048

2028	0.052	0.043
2029	0.111	0.065
2030	0.199	0.132
2031	0.069	0.046
2032	0.046	0.040
2033	0.059	0.046
2034	0.061	0.042
2035	0.222	0.268
2036	0.127	0.075
2037	0.031	0.032
2038	0.119	0.068
2039	0.052	0.041
2040	0.058	0.051
2041	0.069	0.048
2042	0.231	0.208
2043	0.111	0.076
2044	0.139	0.121
2045	0.096	0.086
2046	0.116	0.156
2047	0.087	0.063
2048	0.109	0.064
2049	0.103	0.061
2050	0.072	0.049
2051	0.104	0.075
2052	0.061	0.048
2053	0.110	0.139
2054	0.129	0.148
2055	0.044	0.039
2056	0.048	0.041
2057	0.071	0.057
2058	0.091	0.059
2059	0.157	0.082

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.3819	0.2684
2	0.2981	0.2444
3	0.2750	0.2322
4	0.2746	0.2145
5	0.2719	0.2102
6	0.2523	0.2083
7	0.2470	0.2044
8	0.2398	0.2009
9	0.2308	0.1954
10	0.2220	0.1941
11	0.2191	0.1936
12	0.2055	0.1858
13	0.2040	0.1771
14	0.1998	0.1745
15	0.1986	0.1705
16	0.1957	0.1682
17	0.1902	0.1671
18	0.1872	0.1640
19	0.1766	0.1558
20	0.1754	0.1554
21	0.1739	0.1478
22	0.1735	0.1393

23	0.1717	0.1352
24	0.1697	0.1323
25	0.1631	0.1319
26	0.1603	0.1316
27	0.1571	0.1315
28	0.1567	0.1283
29	0.1566	0.1257
30	0.1546	0.1214
31	0.1537	0.1206
32	0.1505	0.1137
33	0.1482	0.1062
34	0.1472	0.1054
35	0.1461	0.1035
36	0.1406	0.0960
37	0.1387	0.0954
38	0.1306	0.0939
39	0.1290	0.0929
40	0.1282	0.0929
41	0.1277	0.0859
42	0.1274	0.0816
43	0.1269	0.0816
44	0.1264	0.0800
45	0.1227	0.0781
46	0.1198	0.0766
47	0.1194	0.0765
48	0.1183	0.0760
49	0.1156	0.0757
50	0.1153	0.0748
51	0.1143	0.0747
52	0.1142	0.0745
53	0.1139	0.0729
54	0.1129	0.0724
55	0.1111	0.0715
56	0.1107	0.0706
57	0.1106	0.0681
58	0.1103	0.0680
59	0.1101	0.0678
60	0.1100	0.0676
61	0.1099	0.0672
62	0.1096	0.0671
63	0.1089	0.0669
64	0.1085	0.0669
65	0.1071	0.0668
66	0.1065	0.0665
67	0.1051	0.0650
68	0.1046	0.0650
69	0.1040	0.0637
70	0.1032	0.0636
71	0.1007	0.0632
72	0.1006	0.0631
73	0.1005	0.0629
74	0.0995	0.0623
75	0.0987	0.0620
76	0.0970	0.0620
77	0.0957	0.0619
78	0.0956	0.0617
79	0.0954	0.0612
80	0.0953	0.0607

81	0.0949	0.0606
82	0.0948	0.0605
83	0.0933	0.0605
84	0.0928	0.0602
85	0.0925	0.0602
86	0.0923	0.0601
87	0.0922	0.0601
88	0.0911	0.0600
89	0.0906	0.0599
90	0.0885	0.0599
91	0.0872	0.0593
92	0.0870	0.0591
93	0.0861	0.0591
94	0.0845	0.0590
95	0.0839	0.0586
96	0.0824	0.0586
97	0.0823	0.0584
98	0.0817	0.0582
99	0.0811	0.0580
100	0.0806	0.0577
101	0.0803	0.0577
102	0.0792	0.0576
103	0.0790	0.0575
104	0.0788	0.0575
105	0.0785	0.0574
106	0.0767	0.0550
107	0.0742	0.0547
108	0.0723	0.0543
109	0.0721	0.0543
110	0.0718	0.0541
111	0.0715	0.0529
112	0.0710	0.0518
113	0.0704	0.0514
114	0.0693	0.0509
115	0.0692	0.0502
116	0.0659	0.0499
117	0.0656	0.0489
118	0.0640	0.0484
119	0.0638	0.0481
120	0.0623	0.0481
121	0.0612	0.0481
122	0.0611	0.0470
123	0.0606	0.0470
124	0.0606	0.0466
125	0.0600	0.0461
126	0.0592	0.0460
127	0.0590	0.0456
128	0.0578	0.0447
129	0.0576	0.0439
130	0.0558	0.0431
131	0.0547	0.0431
132	0.0537	0.0428
133	0.0530	0.0427
134	0.0530	0.0417
135	0.0529	0.0414
136	0.0519	0.0414
137	0.0516	0.0412
138	0.0503	0.0408

139	0.0484	0.0408
140	0.0477	0.0403
141	0.0476	0.0403
142	0.0456	0.0400
143	0.0449	0.0397
144	0.0448	0.0388
145	0.0442	0.0387
146	0.0441	0.0383
147	0.0427	0.0382
148	0.0423	0.0379
149	0.0403	0.0372
150	0.0383	0.0369
151	0.0383	0.0365
152	0.0361	0.0355
153	0.0358	0.0348
154	0.0333	0.0341
155	0.0311	0.0339
156	0.0281	0.0318
157	0.0240	0.0316
158	0.0223	0.0299

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0468	53373	53401	100	Pass
0.0492	47872	41495	86	Pass
0.0516	43096	32398	75	Pass
0.0540	38902	25529	65	Pass
0.0564	35202	20709	58	Pass
0.0588	31883	17119	53	Pass
0.0612	28880	14471	50	Pass
0.0636	26243	12465	47	Pass
0.0660	23939	11058	46	Pass
0.0684	21905	9944	45	Pass
0.0708	20088	9147	45	Pass
0.0732	18482	8465	45	Pass
0.0756	16958	7900	46	Pass
0.0780	15590	7479	47	Pass
0.0804	14299	7113	49	Pass
0.0828	13124	6775	51	Pass
0.0853	12099	6498	53	Pass
0.0877	11158	6249	56	Pass
0.0901	10244	6028	58	Pass
0.0925	9429	5773	61	Pass
0.0949	8648	5568	64	Pass
0.0973	7917	5350	67	Pass
0.0997	7318	5174	70	Pass
0.1021	6803	5006	73	Pass
0.1045	6288	4822	76	Pass
0.1069	5856	4639	79	Pass
0.1093	5484	4467	81	Pass
0.1117	5120	4306	84	Pass
0.1141	4775	4143	86	Pass
0.1165	4508	4002	88	Pass
0.1189	4220	3845	91	Pass
0.1213	3948	3681	93	Pass
0.1237	3697	3504	94	Pass
0.1262	3460	3279	94	Pass
0.1286	3243	3137	96	Pass
0.1310	3036	2969	97	Pass
0.1334	2888	2809	97	Pass
0.1358	2734	2663	97	Pass
0.1382	2552	2533	99	Pass
0.1406	2413	2378	98	Pass
0.1430	2277	2265	99	Pass
0.1454	2139	2139	100	Pass
0.1478	1985	2003	100	Pass
0.1502	1870	1902	101	Pass
0.1526	1759	1805	102	Pass
0.1550	1636	1704	104	Pass
0.1574	1529	1621	106	Pass
0.1598	1414	1546	109	Pass
0.1622	1312	1443	109	Pass
0.1647	1217	1326	108	Pass
0.1671	1148	1217	106	Pass
0.1695	1083	1128	104	Pass
0.1719	1019	1052	103	Pass

0.1743	959	975	101	Pass
0.1767	903	906	100	Pass
0.1791	834	847	101	Pass
0.1815	770	783	101	Pass
0.1839	708	705	99	Pass
0.1863	648	646	99	Pass
0.1887	581	591	101	Pass
0.1911	526	517	98	Pass
0.1935	475	449	94	Pass
0.1959	410	383	93	Pass
0.1983	370	351	94	Pass
0.2007	327	327	100	Pass
0.2031	297	279	93	Pass
0.2056	274	244	89	Pass
0.2080	251	213	84	Pass
0.2104	231	192	83	Pass
0.2128	214	174	81	Pass
0.2152	190	155	81	Pass
0.2176	168	141	83	Pass
0.2200	144	129	89	Pass
0.2224	128	92	71	Pass
0.2248	116	81	69	Pass
0.2272	102	74	72	Pass
0.2296	92	65	70	Pass
0.2320	81	53	65	Pass
0.2344	73	47	64	Pass
0.2368	66	41	62	Pass
0.2392	59	36	61	Pass
0.2416	54	32	59	Pass
0.2440	50	24	48	Pass
0.2465	41	21	51	Pass
0.2489	33	19	57	Pass
0.2513	29	19	65	Pass
0.2537	24	18	75	Pass
0.2561	20	16	80	Pass
0.2585	17	15	88	Pass
0.2609	12	13	108	Pass
0.2633	10	10	100	Pass
0.2657	10	8	80	Pass
0.2681	10	2	20	Pass
0.2705	9	0	0	Pass
0.2729	8	0	0	Pass
0.2753	5	0	0	Pass
0.2777	5	0	0	Pass
0.2801	5	0	0	Pass
0.2825	4	0	0	Pass
0.2850	4	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
Detention Vault POC	☐	829.17			☐	0.00			
Total Volume Infiltrated		829.17	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

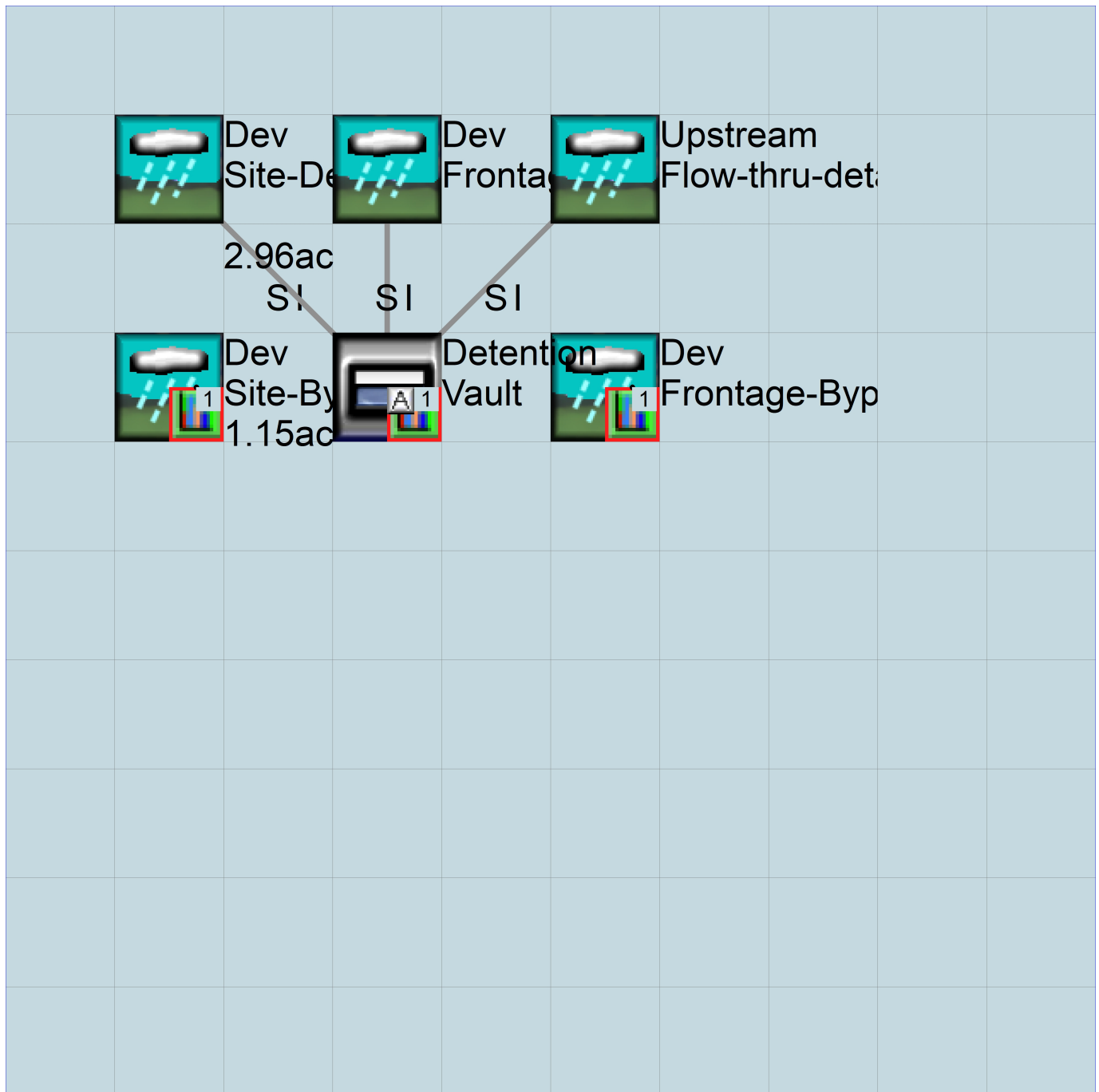
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1901 10 01      END      2059 09 30
RUN INTERP OUTPUT LEVEL    3      0
RESUME     0 RUN          1
UNIT SYSTEM 1
```

END GLOBAL

FILES

```
<File> <Un#> <-----File Name----->***
<-ID->                                     ***
WDM      26    The Reserve_Vault_220630_FINAL.wdm
MESSU    25    PreThe Reserve_Vault_220630_FINAL.MES
          27    PreThe Reserve_Vault_220630_FINAL.L61
          28    PreThe Reserve_Vault_220630_FINAL.L62
          30    POCThe Reserve_Vault_220630_FINAL1.dat
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

```
PERLND    11
IMPLND     1
COPY      501
DISPLY     1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1    Predev Site                MAX                1    2    30    9
```

END DISPLY-INF01

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 ***
```

```
11    C, Forest, Mod    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 ***
11    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 *****
11    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 ***
11 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 KVARV AGWRC
11 0 4.5 0.08 400 0.1 0.5 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
11 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
11 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
11 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 ***
1 ROADS/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
END ACTIVITY

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

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

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

```

```

END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->
<Name> #
Predev Site***
PERLND 11      4.111      COPY 501      12
PERLND 11      4.111      COPY 501      13
Predev Frontage***
PERLND 11      0.103      COPY 501      12
PERLND 11      0.103      COPY 501      13
Dev Frontage***
IMPLND 1      0.07      COPY 501      15

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

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

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

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

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

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

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

HYDR-PARM2
  # - # FTABNO LEN DELTH STCOR KS DB50 ***
  <-----><-----><-----><-----><-----><-----><-----> ***
END HYDR-PARM2

HYDR-INIT
  RCHRES Initial conditions for each HYDR section ***
  # - # *** VOL Initial value of COLIND Initial value of OUTDGT
  *** ac-ft for each possible exit for each possible exit
  <-----><-----> <---><---><---><---><---> *** <---><---><---><---><--->

```

END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES

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

END EXT SOURCES

EXT TARGETS

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

END EXT TARGETS

MASS-LINK

<Volume>	<-Grp>	<-Member-><--Mult-->	<Target>	<-Grp>	<-Member->***
<Name>		<Name> # #<-factor->	<Name>		<Name> # #***
MASS-LINK		12			
PERLND	PWATER	SURO 0.083333	COPY	INPUT	MEAN
END MASS-LINK		12			
MASS-LINK		13			
PERLND	PWATER	IFWO 0.083333	COPY	INPUT	MEAN
END MASS-LINK		13			
MASS-LINK		15			
IMPLND	IWATER	SURO 0.083333	COPY	INPUT	MEAN
END MASS-LINK		15			

END MASS-LINK

END RUN

Mitigated UCI File

RUN

GLOBAL

```
WWM4 model simulation
START      1901 10 01      END      2059 09 30
RUN INTERP OUTPUT LEVEL    3      0
RESUME     0 RUN          1
UNIT SYSTEM 1
```

END GLOBAL

FILES

```
<File> <Un#> <-----File Name----->***
<-ID->                                     ***
WDM      26    The Reserve_Vault_220630_FINAL.wdm
MESSU    25    MitThe Reserve_Vault_220630_FINAL.MES
          27    MitThe Reserve_Vault_220630_FINAL.L61
          28    MitThe Reserve_Vault_220630_FINAL.L62
          30    POCThe Reserve_Vault_220630_FINAL1.dat
```

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

```
PERLND    10
PERLND    14
IMPLND     2
IMPLND     4
PERLND    11
IMPLND     1
RCHRES     1
COPY       1
COPY      501
COPY      601
DISPLY     1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1 PYR DIG2 FIL2 YRND
1      Detention Vault      MAX      1      2      30      9
```

END DISPLY-INF01

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 ***
```

10	C, Forest, Flat	1	1	1	1	27	0
14	C, Pasture, Mod	1	1	1	1	27	0
11	C, Forest, Mod	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
14      0      0      1      0      0      0      0      0      0      0      0      0
11      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
14      0      0      4      0      0      0      0      0      0      0      0      0      1      9
11      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
14      0      0      0      0      0      0      0      0      0      0      0
11      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
14      0      4.5      0.06      400      0.1      0.5      0.996
11      0      4.5      0.08      400      0.1      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
14      0      0      2      2      0      0      0
11      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
14      0.15      0.4      0.3      6      0.5      0.4
11      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
14      0      0      0      0      2.5      1      0
11      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
2      ROADS/MOD      1      1      1      27      0
4      ROOF TOPS/FLAT      1      1      1      27      0
1      ROADS/FLAT      1      1      1      27      0
END GEN-INFO
*** Section IWATER***

```

```

ACTIVITY
<PLS > ***** Active Sections *****

```

```

# - # ATMP SNOW IWAT SLD IWG IQAL ***
2      0      0      1      0      0      0
4      0      0      1      0      0      0
1      0      0      1      0      0      0
END ACTIVITY

```

```

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
2      0      0      4      0      0      0      1      9
4      0      0      4      0      0      0      1      9
1      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 ***
2      0      0      0      0      0
4      0      0      0      0      0
1      0      0      0      0      0
END IWAT-PARM1

```

```

IWAT-PARM2
<PLS > IWater input info: Part 2 ***
# - # *** LSUR SLSUR NSUR RETSC
2      400      0.05      0.1      0.08
4      400      0.01      0.1      0.1
1      400      0.01      0.1      0.1
END IWAT-PARM2

```

```

IWAT-PARM3
<PLS > IWater input info: Part 3 ***
# - # *** PETMAX PETMIN
2      0      0
4      0      0
1      0      0
END IWAT-PARM3

```

```

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # *** RETS SURS
2      0      0
4      0      0
1      0      0
END IWAT-STATE1

```

END IMPLND

```

SCHEMATIC
<-Source->          <-Area-->      <-Target->      MBLK      ***
<Name>  #          <-factor->      <Name>  #      Tbl#      ***
Dev Site-Detained***
PERLND  10          0.159      RCHRES    1        2
PERLND  10          0.159      RCHRES    1        3
PERLND  14          0.961      RCHRES    1        2
PERLND  14          0.961      RCHRES    1        3
IMPLND   2          0.617      RCHRES    1        5
IMPLND   4          1.224      RCHRES    1        5
Dev Frontage-Detained***
IMPLND   1          0.069      RCHRES    1        5
Upstream Flow-thru-detained***
IMPLND   1          0.07       RCHRES    1        5
Dev Site-Bypass***
PERLND  14          0.412      COPY     501      12
PERLND  14          0.412      COPY     601      12
PERLND  14          0.412      COPY     501      13
PERLND  14          0.412      COPY     601      13
PERLND  11          0.739      COPY     501      12
PERLND  11          0.739      COPY     601      12
PERLND  11          0.739      COPY     501      13

```

```

PERLND 11          0.739      COPY    601    13
Dev Frontage-Bypass***
IMPLND 1          0.033      COPY    501    15
IMPLND 1          0.033      COPY    601    15

```

*****Routing*****

```

PERLND 10          0.159      COPY     1    12
PERLND 14          0.961      COPY     1    12
IMPLND 2           0.617      COPY     1    15
IMPLND 4           1.224      COPY     1    15
PERLND 10          0.159      COPY     1    13
PERLND 14          0.961      COPY     1    13
IMPLND 1           0.069      COPY     1    15
IMPLND 1           0.07       COPY     1    15
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      Detention Vault      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
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      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      0.02      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 (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.091827	0.000000	0.000000		
0.138889	0.091827	0.012754	0.005658		
0.277778	0.091827	0.025508	0.008002		
0.416667	0.091827	0.038261	0.009801		
0.555556	0.091827	0.051015	0.011317		
0.694444	0.091827	0.063769	0.012653		
0.833333	0.091827	0.076523	0.013860		
0.972222	0.091827	0.089277	0.014971		
1.111111	0.091827	0.102030	0.016004		
1.250000	0.091827	0.114784	0.016975		
1.388889	0.091827	0.127538	0.017894		
1.527778	0.091827	0.140292	0.018767		
1.666667	0.091827	0.153046	0.019601		
1.805556	0.091827	0.165799	0.020402		
1.944444	0.091827	0.178553	0.021172		
2.083333	0.091827	0.191307	0.021915		
2.222222	0.091827	0.204061	0.022634		
2.361111	0.091827	0.216815	0.023330		
2.500000	0.091827	0.229568	0.024007		
2.638889	0.091827	0.242322	0.024665		
2.777778	0.091827	0.255076	0.025305		
2.916667	0.091827	0.267830	0.025930		
3.055556	0.091827	0.280584	0.026540		
3.194444	0.091827	0.293337	0.027137		
3.333333	0.091827	0.306091	0.027721		
3.472222	0.091827	0.318845	0.028292		
3.611111	0.091827	0.331599	0.028852		
3.750000	0.091827	0.344353	0.029402		
3.888889	0.091827	0.357106	0.029942		
4.027778	0.091827	0.369860	0.030472		
4.166667	0.091827	0.382614	0.030992		
4.305556	0.091827	0.395368	0.031505		
4.444444	0.091827	0.408122	0.032009		
4.583333	0.091827	0.420875	0.032505		
4.722222	0.091827	0.433629	0.032994		
4.861111	0.091827	0.446383	0.033476		
5.000000	0.091827	0.459137	0.033951		
5.138889	0.091827	0.471891	0.034419		
5.277778	0.091827	0.484644	0.034881		
5.416667	0.091827	0.497398	0.035337		
5.555556	0.091827	0.510152	0.035787		
5.694444	0.091827	0.522906	0.036232		
5.833333	0.091827	0.535660	0.036671		
5.972222	0.091827	0.548413	0.037105		
6.111111	0.091827	0.561167	0.037534		
6.250000	0.091827	0.573921	0.037958		
6.388889	0.091827	0.586675	0.038377		
6.527778	0.091827	0.599429	0.038792		
6.666667	0.091827	0.612182	0.039203		
6.805556	0.091827	0.624936	0.039609		
6.944444	0.091827	0.637690	0.040011		
7.083333	0.091827	0.650444	0.040409		
7.222222	0.091827	0.663198	0.040803		
7.361111	0.091827	0.675951	0.041197		
7.500000	0.091827	0.688705	0.041591		
7.638889	0.091827	0.701459	0.041985		
7.777778	0.091827	0.714213	0.042379		
7.916667	0.091827	0.726967	0.042773		
8.055556	0.091827	0.739720	0.043167		
8.194444	0.091827	0.752474	0.043561		
8.333333	0.091827	0.765228	0.043955		
8.472222	0.091827	0.777982	0.044349		

8.611111	0.091827	0.790736	0.132021
8.750000	0.091827	0.803489	0.136998
8.888889	0.091827	0.816243	0.141751
9.027778	0.091827	0.828997	0.146310
9.166667	0.091827	0.841751	0.150697
9.305556	0.091827	0.854505	0.154931
9.444444	0.091827	0.867258	0.159029
9.583333	0.091827	0.880012	0.163003
9.722222	0.091827	0.892766	0.166864
9.861111	0.091827	0.905520	0.170621
10.000000	0.091827	0.918274	0.174284
10.13889	0.091827	0.931027	0.193661
10.27778	0.091827	0.943781	0.203699
10.41667	0.091827	0.956535	0.212139
10.55556	0.091827	0.969289	0.219720
10.69444	0.091827	0.982043	0.226730
10.83333	0.091827	0.994796	0.233320
10.97222	0.091827	1.007550	0.239580
11.11111	0.091827	1.020304	0.245570
11.25000	0.091827	1.033058	0.251331
11.38889	0.091827	1.045812	0.256896
11.52778	0.091827	1.058565	0.262287
11.66667	0.091827	1.071319	0.267525
11.80556	0.091827	1.084073	0.272625
11.94444	0.091827	1.096827	0.277599
12.08333	0.091827	1.109581	0.664750
12.22222	0.091827	1.122334	1.924156
12.36111	0.091827	1.135088	3.490622
12.50000	0.091827	1.147842	4.935523

END FTABLE 1
END FTABLES

EXT SOURCES

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

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member-><--Mult-->Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***
<Name>	#	<Name> # #<-factor->strg	<Name>	#	<Name>	tem	strg	strg***
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
RCHRES	1	HYDR RO 1 1 1	WDM	1000	FLOW	ENGL		REPL
RCHRES	1	HYDR STAGE 1 1 1	WDM	1001	STAG	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 IFW0		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

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APPENDIX C

WETLAND HYDROPERIOD ANALYSIS

WETLAND WATER HYDROPERIOD ANALYSIS

FOR

THE RESERVE

GIG HARBOR, WA

Wetland Hydroperiod Analysis Narrative:

The project proposes to collect on-site runoff from the proposed building roofs, landscape area, sidewalks and roadway runoff from the developed project area and frontage. Stormwater from roof area is collected in gutters and conveyed through downspouts to the proposed conveyance system. Runoff from landscape area, sidewalk, and roadway runoff will sheet flow to catch basins and routed through the pipe networks to a detention vault. The detention vault is designed to discharge stormwater that matches existing predeveloped flow rates for 50% of the 2-year through the full 50-year design storm. The proposed detention vault will discharge runoff through a control structure and finally through a water quality facility for treatment. Runoff from the water quality facility has been designed to meet basic treatment standards per City of Gig Harbor 2016 Stormwater Management & Development Manual. The water quality facility is sized based peak 2-year flow rate associated with the proposed storm design of The Reserve. The treated stormwater is then discharge at a controlled flow rate through a 12" HDPE tightline to an existing wetland within the eastern portion of the project. The wetland has been categorized by Soundview Consultants as a Category III depressional wetland. Soundview Consultants also identified Type 4 (non-fish bearing) stream located within the wetland area. The Reserve development is vested to meet the City of Gig Harbor's 2016 Stormwater Management & Development Manual (SWMDM). Per the SWMDM, the project will result in 5,000 square feet or more of new plus replaced hard surface area; therefore, the project is subject to all 10 minimum requirements. For Minimum Requirement #8, per SWMDM, the wetland is a category II is considered a depressional wetland; therefore, is subject to use the guidelines stated in Appendix 1-B. Since the project is not proposing to use the wetland as treatment, Guide Sheets 1 and 2 will not be applicable in this analysis. The following analysis follows the wetland protection criteria guidelines in Volume 1 Section B.4.

General Wetland Information

1. Size, boundary, and characteristics of proposed project site, wetland contributing drainage area and the wetland and its buffer: **The project site is approximately 9.88 acres in size and proposes to create 1.84 acres of new plus replaced impervious surfaces. The entire site contributes runoff to the wetland in pre and post-developed conditions. The wetland also receives runoff from existing residential developments north of the subject property. The wetland is approximately 176,299 SF including its wetland, stream and buffers. The wetland has a buffer of 150'. See the Wetland and Fish and Wildlife Habitat Assessment technical memorandum prepared by Soundview Consultants LLC for a more detailed analysis of the wetland.**
2. Following Ecology's Wetland Rating System for Western Washington: 2014 Update Determine:
 - a. Wetland Type: **Depressional**
 - b. Wetland Category: **Category III**
 - c. Wetland Habitat Score: **6-7**
3. Presence of rare, endangered, threatened, or sensitive species. **None observed or predicted onsite.**
4. Presence of breeding populations of native amphibian species. **None observed**
5. Use of an Ecology approved continuous simulation mode: **Western Washington Hydrology Model (WWHM) version 2012 by Clear Creek Solutions.**
6. If the TDA Thresholds for I-3.4.7 MR7: Flow Control are triggered, the project proponent may also need: **MR7 Required for Project**
 - a. Legal Access to the Wetland: **Yes**
 - b. Wetland field monitoring data: **Yes, August 2015 (previously by Russell and Associates) and January 2022 (Soundview Consultants)**

Guide Sheet 3A: General Guidelines for Protecting Function and Values of Wetlands

1. Consult regulations issued under federal and state laws that govern the discharge of pollutants. Wetlands are classified as “Waters of the United States” and “Waters of the State” in Washington. ***Russel and Associates conducted field observations in 2016 which was later evaluated by Soundview Consultants in January 19, 2022. The field observations and categorization of the wetland are per the appropriate local, federal, and state laws. For additional information, see the Wetland and Fish and Wildlife Habitat Assessment attached with the Stormwater Pollution Prevention Plan (SWPPP) provided with this project submittal. Additionally, an NPDES permit will be applied for and followed by the project contractor and associated CESCL to ensure compliance with NPDES permit requirements.***
2. Maintain the wetland buffer required by the Critical Areas Ordinance, Chapter 18.08 GHMC. ***The entire 150' wetland buffer, and a steep slope area have been placed in a Critical Area Tract (OS1). This provides a minimum buffer from the closest edge of the development to the wetland edge of 292 feet. The typical separation is approximately 340 feet from edge of wetland to edge of development. The full OS1 tract consists of 252,084 SF (5.79 acres).***
3. Retain areas of native vegetation connecting the wetland and its buffer with nearby wetlands and other contiguous areas of native vegetation. ***The wetland, wetland buffer, stream and steep slope area are all proposed to be located within a Critical Area Tract, OS1. This tract consists of 252,084 SF (5.79 acres) and will be recorded as a protected covenant.***
4. Avoid compaction of soil and introduction of exotic plant species during any work in a wetland. ***No construction activities or land disturbance activities are planned within the wetland or stream area and buffer. An energy dissipator and two dispersion trenches are located just outside of the 150' wetland buffer. These improvements are proposed to maintain the wetland's hydroperiod. Stormwater will be detained and treated onsite per Minimum Requirement # 6 and # 7 prior to being released to the wetland.***
5. Take measures to avoid general physical impacts (e.g. littering and vegetation destruction). Examples are protecting existing buffer zones; discouraging access, especially by vehicles; replacing invasive species with native planting; and developing a stewardship plan that could be implemented by an owner or homeowners' association. ***Typical vehicular traffic cannot feasibly access the wetland or wetland buffer. Split rail fence and signage will be placed at the edge of the proposed development with general wetland information regarding limiting pollutants and other activities that may adversely impact the wetland and associated wildlife and vegetation.***
6. Fences can be useful to restrict dogs and pedestrian access, but they also interfere with wildlife movements. Their use should be very carefully evaluated based on the relative importance of intrusive impacts versus wildlife presence. Fences should generally not be installed when wildlife would be restricted and intrusion is relatively minor. They generally should be used when wildlife passage is not a major issue and the potential for intrusive impacts is high. When wildlife movements and intrusions are both issues, weight the circumstances in making a decision about fencing. ***A proposed split rail fence and signage will be placed at the edge of development notify people of the wetland and stream presence.***
7. If the wetland inlet will be modified for a stormwater management project, use a diffuse flow method, (e.g BMP C2.06 Level Spreader Swale, Volume II, and Downspout Dispersion Systems, Volume III) to discharge water into the wetland in order to prevent flow channelization. ***A gabion outfall is proposed as an energy dissipater, stormwater from the dissipator will be conveyed to two dispersion trenches. The dispersion trenches will disperse stormwater at the edge of the wetland buffer. This method has been analyzed and approved by Soundview Consultants, LLC as an efficient method to mitigate discharge towards the wetland.***

Guide Sheet 3B: Protecting Wetlands from Changes in Water Flows (Hydroperiod)

1. Criterion 1: Total volume of water into a wetland during a single precipitation event should not be more than 20 percent higher or lower than pre-project volumes. *The daily wetland input volumes exceed 20% higher volumes in months April, May, June, July, August, September, October, and November with the highest average daily volume of 102.1% (July 22), on average the daily volumes exceed the threshold by approximately 20-30% with some small outliers. The analysis included an estimation of runoff conveyed by adjacent residential developments north of the subject site using Pierce County GIS.*
2. Total volume of water into a wetland on a monthly basis should not be more than 15 percent higher or lower than pre-project volumes. *The wetland input volumes exceed 20% higher volumes in months May, June, July, August, September, and October with the highest average daily volume of 28.8% more input volume in post-project condition occurring in the month July.*

Wetland Volume-based Analysis:**Guide Sheet 3C: Guidelines for Protecting Wetlands from Pollutants**

1. Use effective erosion control at construction sites in the wetland's drainage catchment. Refer to Volume II of this manual. *An effective use of the erosion control BMPs from Volume II of City of Gig Harbor's SWMDM was provided with the Final Engineering Plans. These plans will be verified and utilized by the CESCL to ensure erosion control standards are being implemented.*
2. Institute a program of source control BMPs and minimize the pollutants that will enter stormwater runoff that drains to the wetland. *A maintenance and source control manual is provided with this submittal that states methods to minimize the pollutants that will enter stormwater runoff that drains into the wetland.*
3. For wetlands that meet the Criteria in Guide Sheet 1, provide water quality treatment consisting of one or more BMPs to treat runoff entering the wetland. *The category III wetland is excluded from the project to be utilized as a treatment or flow control BMP/Facility. Therefore, Guide Sheet 1 will not be applicable.*

DEVELOPED CONTRIB. AREAS
TOTAL AREA = 31.388 AC
IMPERVIOUS=7.307 AC
PASTURE=24.081 AC

PREDEVELOPED SITE
TOTAL AREA = 4.111 AC
FOREST=4.111 AC

PREDEVELOPED FRONTAGE
TOTAL AREA = 0.103 AC
FOREST=0.103 AC

UPSTREAM FLOW-THROUGH
TOTAL AREA = 0.070 AC
FOREST=0.070 AC



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0 20 40
PLAN IN FEET

Figure 1-Wetland Analysis:Existing Conditions

DEVELOPED CONTRIB. AREAS
TOTAL AREA = 31.388 AC
IMPERVIOUS=7.307 AC
PASTURE=24.081 AC

DEVELOPED SITE - DETAINED
TOTAL AREA = 2.938 AC
IMPERVIOUS = 1.841 AC
PASTURE = 0.961 AC
FORESTED=0.159 AC

DEVELOPED FRONTAGE - DETAINED
TOTAL = 0.069 AC
IMPERVIOUS = 0.069 AC

UPSTREAM
FLOW-THROUGH-DETAINED
TOTAL AREA = 0.070 AC
IMPERVIOUS = 0.070 AC

DEVELOPED FRONTAGE - BYPASS
TOTAL AREA = 0.033 AC
IMPERVIOUS = 0.033 AC

DEVELOPED SITE- BYPASS
TOTAL = 1.151 AC
PASTURE = 0.412 AC
FOREST = 0.739 AC



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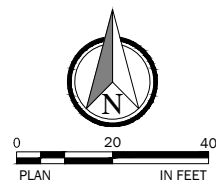


Figure 2-Wetland Analysis: Developed Conditions

WWHM2012
PROJECT REPORT

General Model Information

Project Name: Wetland Analysis
Site Name: The Reserve
Site Address:
City: Gig Harbor
Report Date: 7/7/2022
Gage: 38 IN CENTRAL
Data Start: 10/01/1901
Data End: 09/30/2059
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2021/08/18
Version: 4.2.18

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Predev Site

Bypass: No

GroundWater: No

Pervious Land Use acre
C, Forest, Mod 4.111

Pervious Total 4.111

Impervious Land Use acre

Impervious Total 0

Basin Total 4.111

Element Flows To:		
Surface	Interflow	Groundwater

Predev Frontage

Bypass: No

GroundWater: No

Pervious Land Use acre
C, Forest, Mod 0.103

Pervious Total 0.103

Impervious Land Use acre

Impervious Total 0

Basin Total 0.103

Element Flows To:		
Surface	Interflow	Groundwater

Upstream Flow-through

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.07

Impervious Total 0.07

Basin Total 0.07

Element Flows To:
Surface

Interflow

Groundwater

Dev Wet Contrib Area

Bypass: No

GroundWater: No

Pervious Land Use acre
C, Pasture, Flat 24.081

Pervious Total 24.081

Impervious Land Use acre
ROADS FLAT 4.586
ROOF TOPS FLAT 2.721

Impervious Total 7.307

Basin Total 31.388

Element Flows To:
Surface Interflow Groundwater

Mitigated Land Use

Dev Site-Detained

Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	0.159
C, Pasture, Mod	0.961

Pervious Total	1.12
----------------	------

Impervious Land Use	acre
ROADS MOD	0.617
ROOF TOPS FLAT	1.224

Impervious Total	1.841
------------------	-------

Basin Total	2.961
-------------	-------

Element Flows To:		
Surface	Interflow	Groundwater
Detention Vault	Detention Vault	

Dev Site-Bypass

Bypass: Yes

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	0.412
C, Forest, Mod	0.739

Pervious Total	1.151
----------------	-------

Impervious Land Use	acre
---------------------	------

Impervious Total	0
------------------	---

Basin Total	1.151
-------------	-------

Element Flows To:		
Surface	Interflow	Groundwater

Dev Frontage-Detained

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.07

Impervious Total 0.07

Basin Total 0.07

Element Flows To:

Surface

Detention Vault

Interflow

Detention Vault

Groundwater

Upstream Flow-thru-detained

Bypass: No

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.069

Impervious Total 0.069

Basin Total 0.069

Element Flows To:

Surface	Interflow	Groundwater
Detention Vault	Detention Vault	

Dev Frontage-Bypass

Bypass: Yes

GroundWater: No

Pervious Land Use acre

Pervious Total 0

Impervious Land Use acre
ROADS FLAT 0.033

Impervious Total 0.033

Basin Total 0.033

Element Flows To:
Surface Interflow Groundwater

dev. Wet contrib basin

Bypass: Yes

GroundWater: No

Pervious Land Use acre
C, Pasture, Flat 24.081

Pervious Total 24.081

Impervious Land Use acre
ROADS FLAT 4.586
ROOF TOPS FLAT 2.721

Impervious Total 7.307

Basin Total 31.388

Element Flows To:		
Surface	Interflow	Groundwater

Routing Elements

Predeveloped Routing

Mitigated Routing

Detention Vault

Width: 40 ft.
Length: 100 ft.
Depth: 12.5 ft.
Discharge Structure
Riser Height: 12 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.748 in. Elevation: 0 ft.
Orifice 2 Diameter: 1.6875 in. Elevation: 7.33 ft.
Orifice 3 Diameter: 1.25 in. Elevation: 10 ft.
Element Flows To:
Outlet 1 Outlet 2

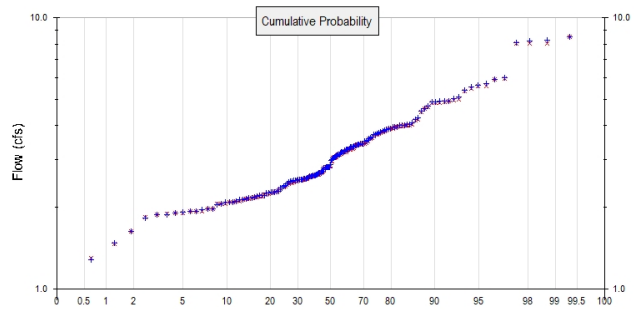
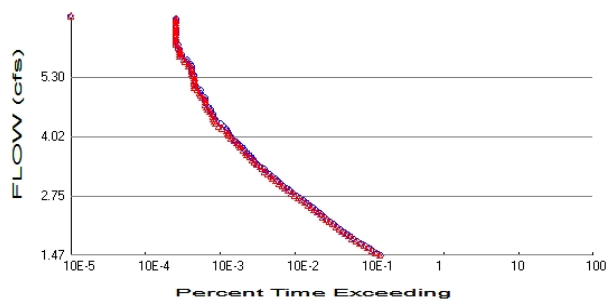
Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.091	0.000	0.000	0.000
0.1389	0.091	0.012	0.005	0.000
0.2778	0.091	0.025	0.008	0.000
0.4167	0.091	0.038	0.009	0.000
0.5556	0.091	0.051	0.011	0.000
0.6944	0.091	0.063	0.012	0.000
0.8333	0.091	0.076	0.013	0.000
0.9722	0.091	0.089	0.015	0.000
1.1111	0.091	0.102	0.016	0.000
1.2500	0.091	0.114	0.017	0.000
1.3889	0.091	0.127	0.017	0.000
1.5278	0.091	0.140	0.018	0.000
1.6667	0.091	0.153	0.019	0.000
1.8056	0.091	0.165	0.020	0.000
1.9444	0.091	0.178	0.021	0.000
2.0833	0.091	0.191	0.021	0.000
2.2222	0.091	0.204	0.022	0.000
2.3611	0.091	0.216	0.023	0.000
2.5000	0.091	0.229	0.024	0.000
2.6389	0.091	0.242	0.024	0.000
2.7778	0.091	0.255	0.025	0.000
2.9167	0.091	0.267	0.025	0.000
3.0556	0.091	0.280	0.026	0.000
3.1944	0.091	0.293	0.027	0.000
3.3333	0.091	0.306	0.027	0.000
3.4722	0.091	0.318	0.028	0.000
3.6111	0.091	0.331	0.028	0.000
3.7500	0.091	0.344	0.029	0.000
3.8889	0.091	0.357	0.029	0.000
4.0278	0.091	0.369	0.030	0.000
4.1667	0.091	0.382	0.031	0.000
4.3056	0.091	0.395	0.031	0.000
4.4444	0.091	0.408	0.032	0.000
4.5833	0.091	0.420	0.032	0.000
4.7222	0.091	0.433	0.033	0.000
4.8611	0.091	0.446	0.033	0.000
5.0000	0.091	0.459	0.034	0.000
5.1389	0.091	0.471	0.034	0.000

5.2778	0.091	0.484	0.034	0.000
5.4167	0.091	0.497	0.035	0.000
5.5556	0.091	0.510	0.035	0.000
5.6944	0.091	0.522	0.036	0.000
5.8333	0.091	0.535	0.036	0.000
5.9722	0.091	0.548	0.037	0.000
6.1111	0.091	0.561	0.037	0.000
6.2500	0.091	0.573	0.038	0.000
6.3889	0.091	0.586	0.038	0.000
6.5278	0.091	0.599	0.038	0.000
6.6667	0.091	0.612	0.039	0.000
6.8056	0.091	0.624	0.039	0.000
6.9444	0.091	0.637	0.040	0.000
7.0833	0.091	0.650	0.040	0.000
7.2222	0.091	0.663	0.040	0.000
7.3611	0.091	0.676	0.054	0.000
7.5000	0.091	0.688	0.073	0.000
7.6389	0.091	0.701	0.084	0.000
7.7778	0.091	0.714	0.094	0.000
7.9167	0.091	0.727	0.101	0.000
8.0556	0.091	0.739	0.108	0.000
8.1944	0.091	0.752	0.115	0.000
8.3333	0.091	0.765	0.121	0.000
8.4722	0.091	0.778	0.126	0.000
8.6111	0.091	0.790	0.132	0.000
8.7500	0.091	0.803	0.137	0.000
8.8889	0.091	0.816	0.141	0.000
9.0278	0.091	0.829	0.146	0.000
9.1667	0.091	0.841	0.150	0.000
9.3056	0.091	0.854	0.154	0.000
9.4444	0.091	0.867	0.159	0.000
9.5833	0.091	0.880	0.163	0.000
9.7222	0.091	0.892	0.166	0.000
9.8611	0.091	0.905	0.170	0.000
10.000	0.091	0.918	0.174	0.000
10.139	0.091	0.931	0.193	0.000
10.278	0.091	0.943	0.203	0.000
10.417	0.091	0.956	0.212	0.000
10.556	0.091	0.969	0.219	0.000
10.694	0.091	0.982	0.226	0.000
10.833	0.091	0.994	0.233	0.000
10.972	0.091	1.007	0.239	0.000
11.111	0.091	1.020	0.245	0.000
11.250	0.091	1.033	0.251	0.000
11.389	0.091	1.045	0.256	0.000
11.528	0.091	1.058	0.262	0.000
11.667	0.091	1.071	0.267	0.000
11.806	0.091	1.084	0.272	0.000
11.944	0.091	1.096	0.277	0.000
12.083	0.091	1.109	0.664	0.000
12.222	0.091	1.122	1.924	0.000
12.361	0.091	1.135	3.490	0.000
12.500	0.091	1.147	4.935	0.000
12.639	0.091	1.114	5.922	0.000

Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 28.295
Total Impervious Area: 7.377

Mitigated Landuse Totals for POC #1

Total Pervious Area: 26.352
Total Impervious Area: 9.32

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	2.945976
5 year	3.993863
10 year	4.745587
25 year	5.763281
50 year	6.571954
100 year	7.424982

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	2.9149
5 year	3.953793
10 year	4.714977
25 year	5.763531
50 year	6.609895
100 year	7.514104

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	3.065	3.061
1903	3.405	3.404
1904	5.034	4.970
1905	1.974	1.974
1906	1.930	1.930
1907	3.494	3.436
1908	2.445	2.431
1909	2.616	2.620
1910	3.353	3.277
1911	3.045	3.049

1912	8.272	8.061
1913	2.093	2.060
1914	8.527	8.500
1915	2.060	2.063
1916	3.269	3.276
1917	1.282	1.297
1918	2.614	2.619
1919	1.914	1.906
1920	2.530	2.515
1921	2.507	2.473
1922	3.642	3.605
1923	2.493	2.462
1924	3.770	3.763
1925	1.831	1.843
1926	3.073	3.072
1927	2.515	2.512
1928	2.358	2.335
1929	3.726	3.729
1930	3.897	3.894
1931	2.261	2.231
1932	2.413	2.392
1933	2.532	2.510
1934	4.275	4.209
1935	1.971	1.934
1936	2.622	2.634
1937	3.722	3.649
1938	2.196	2.170
1939	2.215	2.230
1940	3.907	3.899
1941	3.850	3.842
1942	3.535	3.507
1943	3.044	3.053
1944	4.922	4.863
1945	3.121	3.121
1946	2.868	2.842
1947	1.899	1.908
1948	3.346	3.247
1949	4.025	4.024
1950	2.268	2.263
1951	3.426	3.416
1952	5.736	5.614
1953	5.097	4.984
1954	2.517	2.495
1955	1.965	1.971
1956	1.930	1.930
1957	2.254	2.257
1958	4.049	3.952
1959	3.713	3.709
1960	2.088	2.089
1961	5.928	5.914
1962	2.597	2.596
1963	1.879	1.881
1964	5.623	5.607
1965	3.278	3.192
1966	2.298	2.290
1967	3.430	3.397
1968	2.527	2.528
1969	2.563	2.545

1970	3.210	3.156
1971	3.248	3.189
1972	8.085	8.059
1973	4.623	4.619
1974	3.579	3.571
1975	4.896	4.863
1976	4.533	4.486
1977	1.624	1.627
1978	3.785	3.709
1979	2.811	2.815
1980	3.208	3.194
1981	2.637	2.641
1982	2.165	2.175
1983	3.435	3.423
1984	3.281	3.282
1985	3.944	3.911
1986	2.280	2.248
1987	3.863	3.797
1988	2.216	2.198
1989	2.142	2.108
1990	2.677	2.641
1991	3.128	3.132
1992	2.971	2.953
1993	3.394	3.391
1994	3.088	3.036
1995	2.051	2.062
1996	3.605	3.580
1997	2.477	2.463
1998	3.327	3.285
1999	2.802	2.797
2000	2.823	2.831
2001	2.093	2.084
2002	4.923	4.845
2003	2.667	2.630
2004	3.156	3.152
2005	6.007	5.985
2006	2.816	2.817
2007	3.255	3.264
2008	2.710	2.701
2009	2.170	2.150
2010	2.582	2.593
2011	2.661	2.655
2012	2.804	2.809
2013	2.541	2.534
2014	2.271	2.270
2015	4.707	4.681
2016	2.364	2.366
2017	3.807	3.815
2018	4.009	3.981
2019	5.574	5.500
2020	3.335	3.303
2021	2.990	2.963
2022	3.963	3.957
2023	4.890	4.882
2024	8.190	8.044
2025	2.540	2.536
2026	2.791	2.784
2027	3.116	3.113

2028	1.223	1.228
2029	2.536	2.501
2030	4.012	4.001
2031	1.471	1.464
2032	2.140	2.138
2033	2.683	2.681
2034	2.101	2.108
2035	3.964	3.974
2036	2.492	2.439
2037	2.822	2.825
2038	3.516	3.464
2039	5.387	5.376
2040	2.382	2.381
2041	2.716	2.719
2042	4.041	4.000
2043	3.411	3.404
2044	2.598	2.584
2045	2.203	2.187
2046	2.291	2.303
2047	2.594	2.596
2048	2.140	2.151
2049	3.191	3.190
2050	2.757	2.735
2051	4.216	4.193
2052	2.545	2.545
2053	2.173	2.183
2054	4.922	4.916
2055	2.632	2.625
2056	3.395	3.386
2057	1.884	1.888
2058	3.207	3.199
2059	4.088	4.045

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	8.5270	8.5002
2	8.2724	8.0610
3	8.1900	8.0590
4	8.0848	8.0438
5	6.0072	5.9852
6	5.9278	5.9139
7	5.7356	5.6139
8	5.6231	5.6067
9	5.5736	5.4999
10	5.3868	5.3761
11	5.0974	4.9840
12	5.0339	4.9700
13	4.9232	4.9162
14	4.9217	4.8818
15	4.9216	4.8635
16	4.8962	4.8629
17	4.8904	4.8451
18	4.7070	4.6805
19	4.6232	4.6193
20	4.5327	4.4862
21	4.2748	4.2092
22	4.2164	4.1927

23	4.0875	4.0455
24	4.0489	4.0245
25	4.0413	4.0010
26	4.0252	4.0004
27	4.0123	3.9806
28	4.0089	3.9738
29	3.9645	3.9573
30	3.9632	3.9525
31	3.9436	3.9110
32	3.9072	3.8986
33	3.8971	3.8944
34	3.8625	3.8419
35	3.8496	3.8151
36	3.8066	3.7970
37	3.7848	3.7628
38	3.7699	3.7286
39	3.7255	3.7088
40	3.7217	3.7087
41	3.7128	3.6493
42	3.6418	3.6047
43	3.6053	3.5801
44	3.5787	3.5706
45	3.5353	3.5071
46	3.5160	3.4643
47	3.4941	3.4360
48	3.4354	3.4229
49	3.4304	3.4159
50	3.4263	3.4039
51	3.4111	3.4036
52	3.4047	3.3965
53	3.3954	3.3912
54	3.3945	3.3856
55	3.3526	3.3031
56	3.3456	3.2850
57	3.3351	3.2825
58	3.3273	3.2775
59	3.2809	3.2758
60	3.2777	3.2640
61	3.2694	3.2472
62	3.2552	3.1994
63	3.2477	3.1938
64	3.2103	3.1921
65	3.2083	3.1904
66	3.2071	3.1891
67	3.1909	3.1559
68	3.1562	3.1520
69	3.1285	3.1315
70	3.1209	3.1210
71	3.1163	3.1134
72	3.0881	3.0719
73	3.0734	3.0612
74	3.0654	3.0529
75	3.0452	3.0488
76	3.0440	3.0357
77	2.9895	2.9635
78	2.9712	2.9532
79	2.8681	2.8425
80	2.8227	2.8309

81	2.8223	2.8255
82	2.8164	2.8168
83	2.8109	2.8145
84	2.8042	2.8087
85	2.8024	2.7974
86	2.7911	2.7836
87	2.7569	2.7353
88	2.7156	2.7190
89	2.7103	2.7006
90	2.6830	2.6810
91	2.6767	2.6555
92	2.6675	2.6411
93	2.6606	2.6407
94	2.6375	2.6337
95	2.6323	2.6301
96	2.6219	2.6253
97	2.6161	2.6196
98	2.6143	2.6187
99	2.5984	2.5964
100	2.5973	2.5956
101	2.5943	2.5927
102	2.5818	2.5839
103	2.5633	2.5448
104	2.5453	2.5447
105	2.5408	2.5358
106	2.5404	2.5338
107	2.5356	2.5285
108	2.5318	2.5150
109	2.5303	2.5115
110	2.5273	2.5101
111	2.5167	2.5015
112	2.5146	2.4950
113	2.5071	2.4726
114	2.4931	2.4633
115	2.4919	2.4619
116	2.4774	2.4391
117	2.4448	2.4312
118	2.4132	2.3923
119	2.3820	2.3805
120	2.3644	2.3657
121	2.3581	2.3352
122	2.2980	2.3030
123	2.2911	2.2904
124	2.2797	2.2704
125	2.2709	2.2626
126	2.2678	2.2574
127	2.2614	2.2480
128	2.2538	2.2315
129	2.2158	2.2295
130	2.2149	2.1979
131	2.2032	2.1875
132	2.1959	2.1827
133	2.1734	2.1751
134	2.1704	2.1702
135	2.1646	2.1505
136	2.1423	2.1497
137	2.1399	2.1382
138	2.1397	2.1082

139	2.1007	2.1078
140	2.0932	2.0892
141	2.0932	2.0835
142	2.0878	2.0628
143	2.0598	2.0620
144	2.0512	2.0605
145	1.9744	1.9744
146	1.9706	1.9713
147	1.9651	1.9343
148	1.9298	1.9303
149	1.9298	1.9297
150	1.9140	1.9082
151	1.8992	1.9065
152	1.8838	1.8883
153	1.8787	1.8815
154	1.8306	1.8431
155	1.6241	1.6266
156	1.4709	1.4642
157	1.2821	1.2975
158	1.2229	1.2276

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
1.4730	7889	7673	97	Pass
1.5245	6964	6770	97	Pass
1.5760	6205	6000	96	Pass
1.6275	5467	5293	96	Pass
1.6790	4867	4683	96	Pass
1.7305	4315	4152	96	Pass
1.7820	3798	3640	95	Pass
1.8335	3386	3265	96	Pass
1.8850	3043	2938	96	Pass
1.9365	2735	2647	96	Pass
1.9880	2476	2380	96	Pass
2.0395	2262	2169	95	Pass
2.0910	2050	1955	95	Pass
2.1425	1849	1768	95	Pass
2.1941	1670	1600	95	Pass
2.2456	1515	1451	95	Pass
2.2971	1368	1317	96	Pass
2.3486	1263	1222	96	Pass
2.4001	1158	1111	95	Pass
2.4516	1060	1001	94	Pass
2.5031	971	918	94	Pass
2.5546	874	836	95	Pass
2.6061	796	753	94	Pass
2.6576	726	684	94	Pass
2.7091	655	613	93	Pass
2.7606	585	558	95	Pass
2.8121	534	500	93	Pass
2.8636	484	453	93	Pass
2.9151	441	408	92	Pass
2.9666	388	373	96	Pass
3.0181	361	340	94	Pass
3.0696	329	312	94	Pass
3.1211	306	280	91	Pass
3.1726	277	264	95	Pass
3.2241	253	239	94	Pass
3.2757	233	218	93	Pass
3.3272	215	201	93	Pass
3.3787	193	190	98	Pass
3.4302	174	169	97	Pass
3.4817	166	160	96	Pass
3.5332	157	149	94	Pass
3.5847	146	137	93	Pass
3.6362	136	126	92	Pass
3.6877	127	121	95	Pass
3.7392	119	112	94	Pass
3.7907	110	103	93	Pass
3.8422	101	97	96	Pass
3.8937	95	93	97	Pass
3.9452	87	85	97	Pass
3.9967	81	77	95	Pass
4.0482	75	71	94	Pass
4.0997	72	70	97	Pass
4.1512	70	68	97	Pass

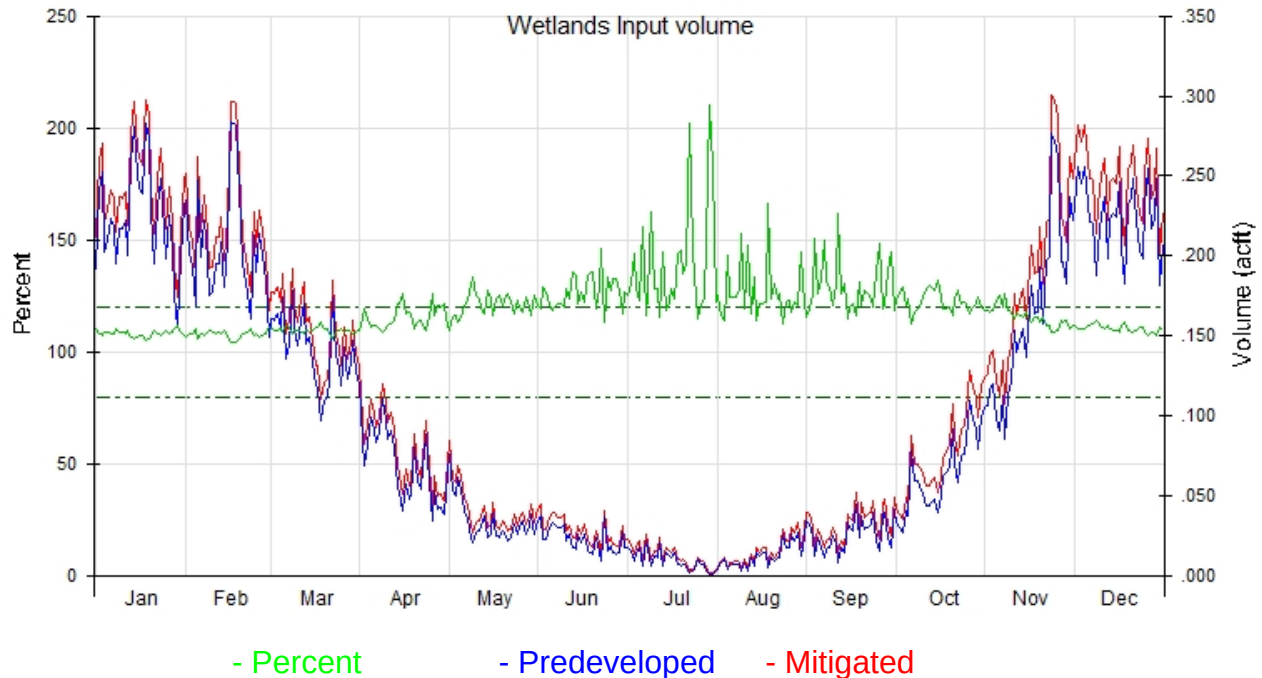
4.2027	67	59	88	Pass
4.2542	62	53	85	Pass
4.3057	56	48	85	Pass
4.3573	49	46	93	Pass
4.4088	47	45	95	Pass
4.4603	45	45	100	Pass
4.5118	44	43	97	Pass
4.5633	41	40	97	Pass
4.6148	41	38	92	Pass
4.6663	39	36	92	Pass
4.7178	36	35	97	Pass
4.7693	35	35	100	Pass
4.8208	35	35	100	Pass
4.8723	35	32	91	Pass
4.9238	31	30	96	Pass
4.9753	30	29	96	Pass
5.0268	30	27	90	Pass
5.0783	27	25	92	Pass
5.1298	26	25	96	Pass
5.1813	25	25	100	Pass
5.2328	25	25	100	Pass
5.2843	25	25	100	Pass
5.3358	25	24	96	Pass
5.3873	24	23	95	Pass
5.4389	23	23	100	Pass
5.4904	23	23	100	Pass
5.5419	23	21	91	Pass
5.5934	22	21	95	Pass
5.6449	20	19	95	Pass
5.6964	20	18	90	Pass
5.7479	17	16	94	Pass
5.7994	17	16	94	Pass
5.8509	16	16	100	Pass
5.9024	16	16	100	Pass
5.9539	15	15	100	Pass
6.0054	15	14	93	Pass
6.0569	14	14	100	Pass
6.1084	14	14	100	Pass
6.1599	14	14	100	Pass
6.2114	14	14	100	Pass
6.2629	14	14	100	Pass
6.3144	14	14	100	Pass
6.3659	14	14	100	Pass
6.4174	14	14	100	Pass
6.4689	14	14	100	Pass
6.5204	14	14	100	Pass
6.5720	14	14	100	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.

Wetland Input Volumes



Wetlands Input Volume for POC 1

Average Annual Volume (acft)

Series 1: 501 POC 1 Predeveloped flow

Series 2: 801 POC 1 Mitigated flow

Month	Series 1	Series 2	Percent	Pass/Fail
Jan	6.9212	7.4804	108.1	Pass
Feb	5.9153	6.3538	107.4	Pass
Mar	4.3911	4.8089	109.5	Pass
Apr	2.1086	2.4043	114.0	Pass
May	1.0771	1.2856	119.4	Fail
Jun	0.6923	0.8606	124.3	Fail
Jul	0.3118	0.4016	128.8	Fail
Aug	0.3570	0.4405	123.4	Fail
Sep	0.7586	0.9532	125.7	Fail
Oct	1.9135	2.3277	121.6	Fail
Nov	4.8351	5.5431	114.6	Pass
Dec	6.9561	7.6725	110.3	Pass

Day	Predevel	Mitigated	Percent	Pass/Fail
Jan1	0.1922	0.2122	110.4	Pass
2	0.2407	0.2600	108.0	Pass
3	0.2525	0.2700	107.0	Pass
4	0.2029	0.2205	108.7	Pass
5	0.2101	0.2290	109.0	Pass
6	0.2233	0.2410	107.9	Pass
7	0.2177	0.2360	108.4	Pass
8	0.1949	0.2148	110.2	Pass
9	0.2172	0.2370	109.2	Pass
10	0.2172	0.2363	108.8	Pass
11	0.2224	0.2405	108.1	Pass
12	0.2005	0.2191	109.3	Pass
13	0.2584	0.2756	106.7	Pass
14	0.2808	0.2970	105.7	Pass

15	0.2500	0.2670	106.8	Pass
16	0.2437	0.2621	107.6	Pass
17	0.2394	0.2568	107.3	Pass
18	0.2825	0.2978	105.4	Pass
19	0.2736	0.2886	105.5	Pass
20	0.2286	0.2445	106.9	Pass
21	0.1955	0.2139	109.4	Pass
22	0.2302	0.2487	108.0	Pass
23	0.2489	0.2669	107.2	Pass
24	0.2326	0.2506	107.7	Pass
25	0.1978	0.2169	109.7	Pass
26	0.2258	0.2437	107.9	Pass
27	0.2042	0.2215	108.5	Pass
28	0.1768	0.1947	110.1	Pass
29	0.1557	0.1744	112.1	Pass
30	0.1995	0.2172	108.9	Pass
31	0.2313	0.2474	107.0	Pass
Feb1	0.2352	0.2511	106.7	Pass
2	0.2010	0.2175	108.2	Pass
3	0.1940	0.2101	108.3	Pass
4	0.1692	0.1864	110.2	Pass
5	0.2473	0.2616	105.8	Pass
6	0.1998	0.2154	107.8	Pass
7	0.2218	0.2384	107.5	Pass
8	0.1980	0.2153	108.7	Pass
9	0.1748	0.1916	109.6	Pass
10	0.1777	0.1933	108.8	Pass
11	0.1956	0.2118	108.2	Pass
12	0.1953	0.2118	108.5	Pass
13	0.2083	0.2245	107.8	Pass
14	0.1810	0.1977	109.2	Pass
15	0.2086	0.2239	107.4	Pass
16	0.2839	0.2964	104.4	Pass
17	0.2833	0.2961	104.5	Pass
18	0.2821	0.2954	104.7	Pass
19	0.2415	0.2553	105.7	Pass
20	0.1959	0.2114	107.9	Pass
21	0.1899	0.2057	108.4	Pass
22	0.1763	0.1924	109.2	Pass
23	0.1606	0.1772	110.3	Pass
24	0.2129	0.2279	107.1	Pass
25	0.1903	0.2056	108.0	Pass
26	0.2139	0.2283	106.7	Pass
27	0.2017	0.2163	107.2	Pass
28	0.1847	0.1993	108.0	Pass
29	0.1494	0.1660	111.1	Pass
Mar1	0.1606	0.1771	110.3	Pass
2	0.1602	0.1759	109.8	Pass
3	0.1641	0.1800	109.7	Pass
4	0.1555	0.1714	110.2	Pass
5	0.1739	0.1894	108.9	Pass
6	0.1353	0.1517	112.1	Pass
7	0.1440	0.1599	111.1	Pass
8	0.1779	0.1924	108.2	Pass
9	0.1548	0.1690	109.2	Pass
10	0.1443	0.1584	109.8	Pass
11	0.1596	0.1732	108.5	Pass
12	0.1703	0.1841	108.1	Pass

13	0.1445	0.1582	109.5	Pass
14	0.1495	0.1622	108.5	Pass
15	0.1335	0.1467	109.8	Pass
16	0.1185	0.1318	111.2	Pass
17	0.1181	0.1312	111.1	Pass
18	0.0975	0.1103	113.2	Pass
19	0.1098	0.1214	110.6	Pass
20	0.1114	0.1226	110.1	Pass
21	0.1227	0.1340	109.2	Pass
22	0.1742	0.1845	105.9	Pass
23	0.1375	0.1498	108.9	Pass
24	0.1307	0.1432	109.5	Pass
25	0.1190	0.1312	110.2	Pass
26	0.1430	0.1550	108.4	Pass
27	0.1235	0.1357	109.9	Pass
28	0.1336	0.1456	109.0	Pass
29	0.1475	0.1593	108.0	Pass
30	0.1280	0.1390	108.6	Pass
31	0.1204	0.1316	109.4	Pass
Apr1	0.0846	0.0972	115.0	Pass
2	0.0691	0.0825	119.4	Pass
3	0.0821	0.0942	114.7	Pass
4	0.0995	0.1109	111.4	Pass
5	0.0918	0.1025	111.7	Pass
6	0.0835	0.0932	111.6	Pass
7	0.0900	0.0996	110.7	Pass
8	0.1102	0.1196	108.5	Pass
9	0.0985	0.1085	110.2	Pass
10	0.0856	0.0955	111.6	Pass
11	0.0907	0.1020	112.4	Pass
12	0.0799	0.0914	114.3	Pass
13	0.0567	0.0687	121.2	Fail
14	0.0525	0.0638	121.5	Fail
15	0.0406	0.0513	126.2	Fail
16	0.0570	0.0667	117.0	Pass
17	0.0476	0.0562	118.0	Pass
18	0.0501	0.0585	116.7	Pass
19	0.0803	0.0884	110.0	Pass
20	0.0593	0.0674	113.6	Pass
21	0.0540	0.0617	114.3	Pass
22	0.0663	0.0741	111.8	Pass
23	0.0885	0.0969	109.5	Pass
24	0.0598	0.0691	115.4	Pass
25	0.0345	0.0434	125.8	Fail
26	0.0536	0.0623	116.2	Pass
27	0.0419	0.0505	120.5	Fail
28	0.0424	0.0509	119.9	Pass
29	0.0384	0.0467	121.7	Fail
30	0.0508	0.0588	115.6	Pass
May1	0.0766	0.0840	109.7	Pass
2	0.0527	0.0608	115.4	Pass
3	0.0500	0.0581	116.1	Pass
4	0.0610	0.0691	113.2	Pass
5	0.0540	0.0625	115.8	Pass
6	0.0401	0.0484	120.7	Fail
7	0.0363	0.0445	122.7	Fail
8	0.0292	0.0370	126.6	Fail
9	0.0203	0.0271	133.4	Fail

10	0.0269	0.0337	125.1	Fail
11	0.0281	0.0348	123.7	Fail
12	0.0312	0.0375	120.3	Fail
13	0.0370	0.0434	117.4	Pass
14	0.0236	0.0301	127.6	Fail
15	0.0258	0.0319	123.9	Fail
16	0.0395	0.0458	116.1	Pass
17	0.0251	0.0311	124.0	Fail
18	0.0235	0.0294	125.0	Fail
19	0.0283	0.0342	120.9	Fail
20	0.0272	0.0335	122.9	Fail
21	0.0222	0.0280	126.3	Fail
22	0.0235	0.0289	123.3	Fail
23	0.0326	0.0381	116.7	Pass
24	0.0255	0.0313	122.7	Fail
25	0.0303	0.0363	119.8	Pass
26	0.0338	0.0399	117.8	Pass
27	0.0261	0.0324	124.1	Fail
28	0.0308	0.0370	120.1	Fail
29	0.0389	0.0452	116.1	Pass
30	0.0265	0.0332	125.3	Fail
31	0.0348	0.0420	120.6	Fail
Jun1	0.0371	0.0443	119.4	Pass
2	0.0228	0.0295	129.2	Fail
3	0.0227	0.0287	126.4	Fail
4	0.0301	0.0365	121.4	Fail
5	0.0331	0.0392	118.4	Pass
6	0.0327	0.0393	120.1	Fail
7	0.0298	0.0363	121.8	Fail
8	0.0298	0.0362	121.3	Fail
9	0.0318	0.0383	120.4	Fail
10	0.0222	0.0285	128.1	Fail
11	0.0255	0.0316	123.9	Fail
12	0.0175	0.0237	135.6	Fail
13	0.0170	0.0228	134.3	Fail
14	0.0257	0.0312	121.3	Fail
15	0.0205	0.0259	126.4	Fail
16	0.0262	0.0320	121.9	Fail
17	0.0167	0.0223	134.1	Fail
18	0.0145	0.0196	135.0	Fail
19	0.0130	0.0176	135.7	Fail
20	0.0238	0.0284	119.3	Pass
21	0.0159	0.0205	128.9	Fail
22	0.0089	0.0130	146.5	Fail
23	0.0360	0.0408	113.2	Pass
24	0.0152	0.0203	133.5	Fail
25	0.0186	0.0237	127.4	Fail
26	0.0148	0.0197	132.8	Fail
27	0.0139	0.0184	133.0	Fail
28	0.0149	0.0190	127.8	Fail
29	0.0268	0.0314	117.1	Pass
30	0.0173	0.0218	126.5	Fail
Jul1	0.0181	0.0227	125.2	Fail
2	0.0151	0.0197	130.3	Fail
3	0.0095	0.0137	144.1	Fail
4	0.0135	0.0174	128.8	Fail
5	0.0175	0.0215	122.7	Fail
6	0.0062	0.0097	155.6	Fail

7	0.0220	0.0256	116.4	Pass
8	0.0169	0.0212	124.9	Fail
9	0.0066	0.0107	162.3	Fail
10	0.0122	0.0157	128.5	Fail
11	0.0118	0.0151	128.1	Fail
12	0.0206	0.0237	115.5	Pass
13	0.0062	0.0089	144.8	Fail
14	0.0146	0.0173	118.5	Pass
15	0.0129	0.0157	122.4	Fail
16	0.0116	0.0149	128.2	Fail
17	0.0140	0.0173	123.4	Fail
18	0.0075	0.0108	143.6	Fail
19	0.0062	0.0091	145.5	Fail
20	0.0077	0.0103	134.6	Fail
21	0.0057	0.0079	139.4	Fail
22	0.0017	0.0034	202.1	Fail
23	0.0031	0.0045	145.9	Fail
24	0.0037	0.0049	134.1	Fail
25	0.0099	0.0114	114.6	Pass
26	0.0074	0.0090	120.7	Fail
27	0.0068	0.0085	124.3	Fail
28	0.0032	0.0048	149.5	Fail
29	0.0011	0.0024	210.3	Fail
30	0.0011	0.0020	182.4	Fail
31	0.0034	0.0042	122.4	Fail
Aug1	0.0037	0.0047	125.5	Fail
2	0.0080	0.0093	116.1	Pass
3	0.0103	0.0117	114.1	Pass
4	0.0038	0.0054	142.9	Fail
5	0.0062	0.0078	124.1	Fail
6	0.0067	0.0084	124.7	Fail
7	0.0073	0.0090	124.2	Fail
8	0.0068	0.0086	127.3	Fail
9	0.0031	0.0047	153.1	Fail
10	0.0084	0.0100	119.0	Pass
11	0.0033	0.0049	147.3	Fail
12	0.0115	0.0135	117.2	Pass
13	0.0058	0.0077	133.6	Fail
14	0.0150	0.0171	114.4	Pass
15	0.0120	0.0147	121.9	Fail
16	0.0143	0.0173	121.2	Fail
17	0.0147	0.0179	122.2	Fail
18	0.0046	0.0076	166.4	Fail
19	0.0114	0.0141	123.6	Fail
20	0.0091	0.0119	130.8	Fail
21	0.0118	0.0145	123.4	Fail
22	0.0113	0.0142	125.8	Fail
23	0.0260	0.0293	112.8	Pass
24	0.0178	0.0218	122.3	Fail
25	0.0180	0.0221	122.7	Fail
26	0.0257	0.0302	117.4	Pass
27	0.0218	0.0266	122.4	Fail
28	0.0273	0.0330	120.9	Fail
29	0.0122	0.0176	144.4	Fail
30	0.0161	0.0210	130.6	Fail
31	0.0338	0.0390	115.4	Pass
Sep1	0.0323	0.0385	119.3	Pass
2	0.0247	0.0310	125.8	Fail

3	0.0121	0.0182	150.5	Fail
4	0.0235	0.0295	125.8	Fail
5	0.0178	0.0237	132.9	Fail
6	0.0114	0.0171	149.8	Fail
7	0.0165	0.0217	131.7	Fail
8	0.0179	0.0231	129.0	Fail
9	0.0250	0.0302	120.9	Fail
10	0.0192	0.0251	130.7	Fail
11	0.0083	0.0134	162.1	Fail
12	0.0173	0.0218	126.2	Fail
13	0.0143	0.0187	130.2	Fail
14	0.0337	0.0388	115.0	Pass
15	0.0300	0.0360	119.9	Pass
16	0.0283	0.0344	121.6	Fail
17	0.0449	0.0520	115.9	Pass
18	0.0241	0.0316	131.3	Fail
19	0.0377	0.0455	120.6	Fail
20	0.0288	0.0367	127.3	Fail
21	0.0304	0.0382	125.7	Fail
22	0.0323	0.0400	123.9	Fail
23	0.0391	0.0468	119.6	Pass
24	0.0221	0.0299	135.4	Fail
25	0.0153	0.0227	148.1	Fail
26	0.0373	0.0446	119.4	Pass
27	0.0394	0.0477	121.1	Fail
28	0.0238	0.0323	135.5	Fail
29	0.0175	0.0252	144.3	Fail
30	0.0412	0.0489	118.7	Pass
Oct1	0.0335	0.0412	122.7	Fail
2	0.0301	0.0380	126.1	Fail
3	0.0271	0.0350	128.9	Fail
4	0.0403	0.0488	121.0	Fail
5	0.0378	0.0467	123.6	Fail
6	0.0780	0.0877	112.4	Pass
7	0.0596	0.0700	117.5	Pass
8	0.0590	0.0703	119.1	Pass
9	0.0560	0.0673	120.2	Fail
10	0.0517	0.0644	124.6	Fail
11	0.0439	0.0563	128.2	Fail
12	0.0433	0.0561	129.6	Fail
13	0.0461	0.0594	128.9	Fail
14	0.0479	0.0610	127.3	Fail
15	0.0392	0.0516	131.7	Fail
16	0.0499	0.0620	124.3	Fail
17	0.0625	0.0744	119.1	Pass
18	0.0649	0.0774	119.3	Pass
19	0.0681	0.0820	120.4	Fail
20	0.0919	0.1070	116.4	Pass
21	0.0700	0.0864	123.5	Fail
22	0.0587	0.0746	127.2	Fail
23	0.0753	0.0917	121.8	Fail
24	0.0766	0.0934	122.1	Fail
25	0.0840	0.1019	121.3	Fail
26	0.1093	0.1278	116.9	Pass
27	0.0981	0.1175	119.8	Pass
28	0.0915	0.1113	121.6	Fail
29	0.0795	0.0992	124.8	Fail
30	0.0993	0.1190	119.8	Pass

31	0.1048	0.1244	118.7	Pass
Nov1	0.1066	0.1263	118.5	Pass
2	0.1161	0.1366	117.7	Pass
3	0.1196	0.1413	118.2	Pass
4	0.0994	0.1222	122.9	Fail
5	0.0903	0.1130	125.1	Fail
6	0.1122	0.1342	119.7	Pass
7	0.0851	0.1070	125.7	Fail
8	0.1131	0.1343	118.8	Pass
9	0.1218	0.1432	117.6	Pass
10	0.1537	0.1762	114.7	Pass
11	0.1401	0.1636	116.8	Pass
12	0.1475	0.1710	115.9	Pass
13	0.1549	0.1792	115.7	Pass
14	0.1364	0.1607	117.8	Pass
15	0.1541	0.1781	115.6	Pass
16	0.1820	0.2065	113.5	Pass
17	0.1635	0.1887	115.4	Pass
18	0.1643	0.1899	115.6	Pass
19	0.1928	0.2181	113.1	Pass
20	0.1579	0.1827	115.7	Pass
21	0.1973	0.2213	112.1	Pass
22	0.1993	0.2231	111.9	Pass
23	0.2771	0.3009	108.6	Pass
24	0.2725	0.2973	109.1	Pass
25	0.2617	0.2875	109.9	Pass
26	0.1963	0.2232	113.7	Pass
27	0.1962	0.2223	113.3	Pass
28	0.1829	0.2086	114.1	Pass
29	0.2373	0.2624	110.6	Pass
30	0.2225	0.2480	111.5	Pass
Dec1	0.2320	0.2587	111.5	Pass
2	0.2554	0.2819	110.4	Pass
3	0.2456	0.2715	110.6	Pass
4	0.2557	0.2818	110.2	Pass
5	0.2447	0.2713	110.8	Pass
6	0.2216	0.2485	112.1	Pass
7	0.2201	0.2469	112.2	Pass
8	0.1873	0.2139	114.2	Pass
9	0.2048	0.2314	113.0	Pass
10	0.2254	0.2507	111.2	Pass
11	0.2367	0.2605	110.1	Pass
12	0.1982	0.2219	111.9	Pass
13	0.2234	0.2462	110.2	Pass
14	0.2269	0.2484	109.5	Pass
15	0.2245	0.2452	109.2	Pass
16	0.2465	0.2680	108.7	Pass
17	0.2056	0.2293	111.5	Pass
18	0.1825	0.2063	113.0	Pass
19	0.2319	0.2532	109.2	Pass
20	0.2374	0.2587	109.0	Pass
21	0.2484	0.2695	108.5	Pass
22	0.2220	0.2434	109.6	Pass
23	0.2035	0.2262	111.2	Pass
24	0.1984	0.2206	111.2	Pass
25	0.2320	0.2519	108.6	Pass
26	0.2551	0.2735	107.2	Pass
27	0.2167	0.2358	108.8	Pass

28	0.2233	0.2418	108.3	Pass
29	0.2488	0.2671	107.4	Pass
30	0.1814	0.2015	111.1	Pass
31	0.2078	0.2272	109.3	Pass

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
Detention Vault POC	☐	829.17			☐	0.00			
Total Volume Infiltrated		829.17	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

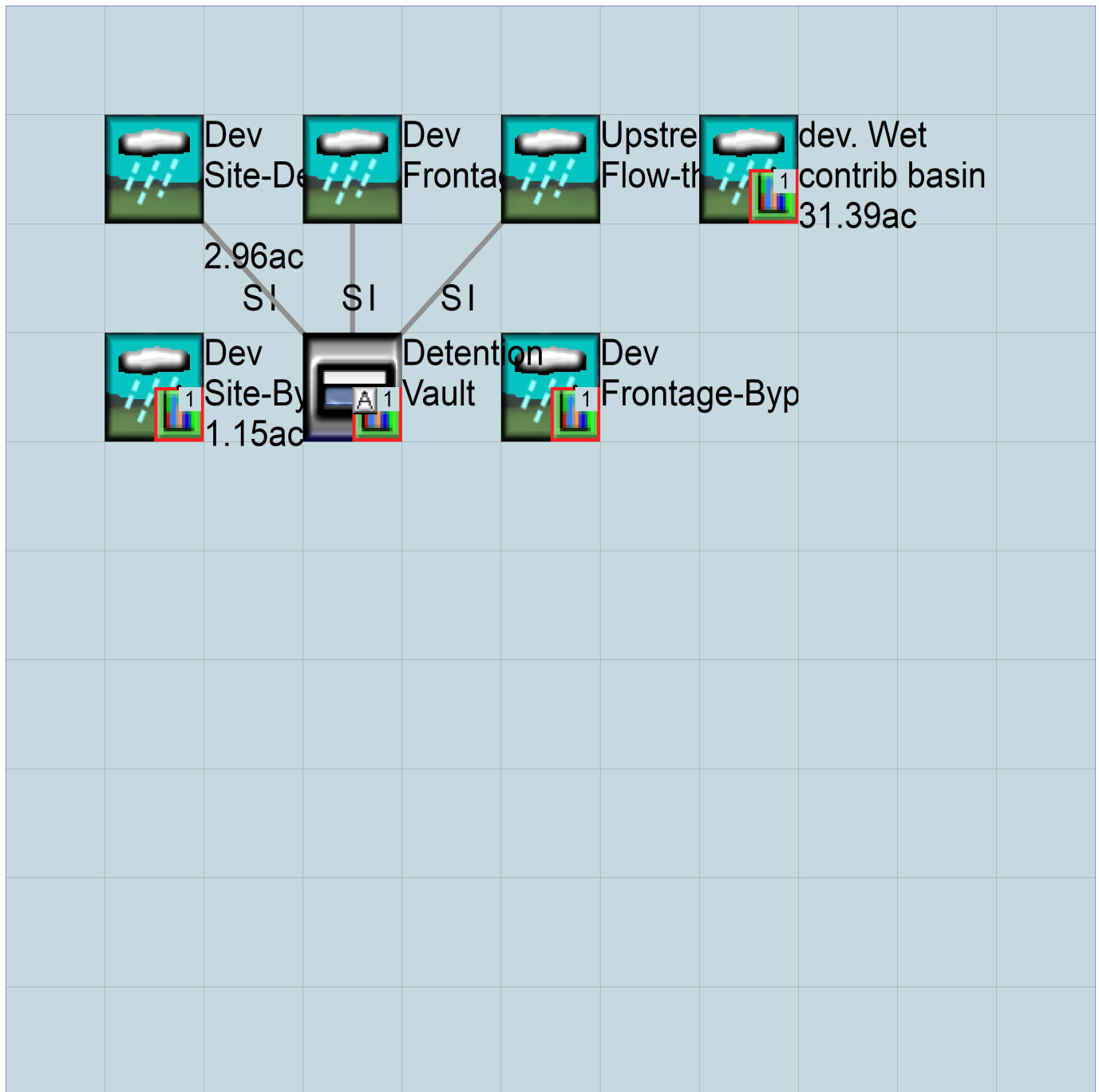
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

WWM4 model simulation
START 1901 10 01 END 2059 09 30
RUN INTERP OUTPUT LEVEL 3 0
RESUME 0 RUN 1 UNIT SYSTEM 1
END GLOBAL

FILES

<File>	<Un#>	<-----File Name----->	***
<-ID->			***
WDM	26	Wetland Analysis.wdm	
MESSU	25	Prewetland Analysis.MES	
	27	Prewetland Analysis.L61	
	28	Prewetland Analysis.L62	
	30	POCWetland Analysis1.dat	

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

PERLND	11
IMPLND	1
PERLND	13
IMPLND	4
COPY	501
DISPLY	1

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

#	-	#	<-----Title----->	***	TRAN	PIVL	DIG1	FIL1	PYR	DIG2	FIL2	YRND
1			Predev Site		MAX				1	2	30	9

END DISPLY-INF01

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	***

11	C, Forest, Mod	1	1	1	1	27	0
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	***
11			0	0	1	0	0	0	0	0	0	0	0	0	
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 *****
11      0      0      4      0      0      0      0      0      0      0      0      0      1      9
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 ***
11      0      0      0      0      0      0      0      0      0      0      0
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 KVARV AGWRC
11      0      4.5      0.08      400      0.1      0.5      0.996
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
11      0      0      2      2      0      0      0
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 ***
11      0.2      0.5      0.35      6      0.5      0.7
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
11      0      0      0      0      2.5      1      0
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
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
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
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
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
END IWAT-PARM2

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

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

END IMPLND

SCHEMATIC
<-Source->      <--Area-->      <-Target->      MBLK      ***
<Name> #      <-factor->      <Name> #      Tbl#      ***
Predev Site***
PERLND 11      4.111      COPY      501      12
PERLND 11      4.111      COPY      501      13
Predev Frontage***
PERLND 11      0.103      COPY      501      12
PERLND 11      0.103      COPY      501      13
Upstream Flow-through***
IMPLND 1      0.07      COPY      501      15
Dev Wet Contrib Area***
PERLND 13      24.081      COPY      501      12
PERLND 13      24.081      COPY      501      13
IMPLND 1      4.586      COPY      501      15
IMPLND 4      2.721      COPY      501      15

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

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

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

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

END GEN-INFO
*** Section RCHRES***

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

```

```

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

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

HYDR-PARM2
  # - # FTABNO LEN DELTH STCOR KS DB50 ***
  <-----><-----><-----><-----><-----><-----><-----> ***
END HYDR-PARM2

HYDR-INIT
  RCHRES  Initial conditions for each HYDR section ***
  # - # *** VOL Initial value of COLIND Initial value of OUTDGT
        *** ac-ft for each possible exit for each possible exit
  <-----><-----> <---><---><---><---><---> *** <---><---><---><---><--->
END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

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

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

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

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

END MASS-LINK

END RUN

```

Mitigated UCI File

RUN

GLOBAL

WWM4 model simulation
START 1901 10 01 END 2059 09 30
RUN INTERP OUTPUT LEVEL 3 0
RESUME 0 RUN 1 UNIT SYSTEM 1
END GLOBAL

FILES

<File>	<Un#>	<-----File Name----->	***
<-ID->			***
WDM	26	Wetland Analysis.wdm	
MESSU	25	MitWetland Analysis.MES	
	27	MitWetland Analysis.L61	
	28	MitWetland Analysis.L62	
	30	POCWetland Analysis1.dat	

END FILES

OPN SEQUENCE

INGRP INDELT 00:15

PERLND	10
PERLND	14
IMPLND	2
IMPLND	4
PERLND	11
IMPLND	1
PERLND	13
RCHRES	1
COPY	1
COPY	501
COPY	601
DISPLY	1

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

#	-	#	<-----Title----->	***	TRAN	PIVL	DIG1	FIL1	PYR	DIG2	FIL2	YRND
1			Detention Vault		MAX				1	2	30	9

END DISPLY-INF01

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	
10	C, Forest, Flat	1	1	1	1	27 0
14	C, Pasture, Mod	1	1	1	1	27 0
11	C, Forest, Mod	1	1	1	1	27 0
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 ***
 10 0 0 1 0 0 0 0 0 0 0 0 0
 14 0 0 1 0 0 0 0 0 0 0 0 0
 11 0 0 1 0 0 0 0 0 0 0 0 0
 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 *****
 10 0 0 4 0 0 0 0 0 0 0 0 1 9
 14 0 0 4 0 0 0 0 0 0 0 0 1 9
 11 0 0 4 0 0 0 0 0 0 0 0 1 9
 13 0 0 4 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
 14 0 0 0 0 0 0 0 0 0 0 0
 11 0 0 0 0 0 0 0 0 0 0 0
 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 KVARV AGWRC
 10 0 4.5 0.08 400 0.05 0.5 0.996
 14 0 4.5 0.06 400 0.1 0.5 0.996
 11 0 4.5 0.08 400 0.1 0.5 0.996
 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
 10 0 0 2 2 0 0 0
 14 0 0 2 2 0 0 0
 11 0 0 2 2 0 0 0
 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 ***
 10 0.2 0.5 0.35 6 0.5 0.7
 14 0.15 0.4 0.3 6 0.5 0.4
 11 0.2 0.5 0.35 6 0.5 0.7
 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
 10 0 0 0 0 2.5 1 0
 14 0 0 0 0 2.5 1 0
 11 0 0 0 0 2.5 1 0
 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		***
2	ROADS/MOD	1	1	1	27	0
4	ROOF TOPS/FLAT	1	1	1	27	0
1	ROADS/FLAT	1	1	1	27	0

END GEN-INFO
 *** Section IWATER***

ACTIVITY

<PLS > ***** Active Sections *****								
#	-	#	ATMP	SNOW	IWAT	SLD	IWG IQAL	***
2			0	0	1	0	0 0	
4			0	0	1	0	0 0	
1			0	0	1	0	0 0	

END ACTIVITY

PRINT-INFO

<ILS > ***** Print-flags ***** PIVL PYR *****									
#	-	#	ATMP	SNOW	IWAT	SLD	IWG IQAL		
2			0	0	4	0	0 0	1	9
4			0	0	4	0	0 0	1	9
1			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	***
2			0	0	0	0 0	
4			0	0	0	0 0	
1			0	0	0	0 0	

END IWAT-PARM1

IWAT-PARM2

<PLS > IWATER input info: Part 2 ***							
#	-	#	***	LSUR	SLSUR	NSUR	RETSC
2				400	0.05	0.1	0.08
4				400	0.01	0.1	0.1
1				400	0.01	0.1	0.1

END IWAT-PARM2

IWAT-PARM3

<PLS > IWATER input info: Part 3 ***					
#	-	#	***	PETMAX	PETMIN
2				0	0
4				0	0
1				0	0

END IWAT-PARM3

IWAT-STATE1

<PLS > *** Initial conditions at start of simulation					
#	-	#	***	RETS	SURS
2				0	0
4				0	0
1				0	0

END IWAT-STATE1

END IMPLND

SCHEMATIC

<-Source->		<-Area-->		<-Target->		MBLK	***
<Name>	#	<-factor->		<Name>	#	Tbl#	***
Dev Site-Detained***							
PERLND	10		0.159	RCHRES	1	2	
PERLND	10		0.159	RCHRES	1	3	
PERLND	14		0.961	RCHRES	1	2	
PERLND	14		0.961	RCHRES	1	3	
IMPLND	2		0.617	RCHRES	1	5	
IMPLND	4		1.224	RCHRES	1	5	
Dev Frontage-Detained***							
IMPLND	1		0.07	RCHRES	1	5	
Upstream Flow-thru-detained***							

```

IMPLND 1 0.069 RCHRES 1 5
Dev Site-Bypass***
PERLND 14 0.412 COPY 501 12
PERLND 14 0.412 COPY 601 12
PERLND 14 0.412 COPY 501 13
PERLND 14 0.412 COPY 601 13
PERLND 11 0.739 COPY 501 12
PERLND 11 0.739 COPY 601 12
PERLND 11 0.739 COPY 501 13
PERLND 11 0.739 COPY 601 13
Dev Frontage-Bypass***
IMPLND 1 0.033 COPY 501 15
IMPLND 1 0.033 COPY 601 15
dev. Wet contrib basin***
PERLND 13 24.081 COPY 501 12
PERLND 13 24.081 COPY 601 12
PERLND 13 24.081 COPY 501 13
PERLND 13 24.081 COPY 601 13
IMPLND 1 4.586 COPY 501 15
IMPLND 1 4.586 COPY 601 15
IMPLND 4 2.721 COPY 501 15
IMPLND 4 2.721 COPY 601 15

```

```

*****Routing*****
PERLND 10 0.159 COPY 1 12
PERLND 14 0.961 COPY 1 12
IMPLND 2 0.617 COPY 1 15
IMPLND 4 1.224 COPY 1 15
PERLND 10 0.159 COPY 1 13
PERLND 14 0.961 COPY 1 13
IMPLND 1 0.07 COPY 1 15
IMPLND 1 0.069 COPY 1 15
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 ***
1 Detention Vault 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 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      0.02      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 0.091827 0.000000 0.000000
0.138889 0.091827 0.012754 0.005658
0.277778 0.091827 0.025508 0.008002
0.416667 0.091827 0.038261 0.009801
0.555556 0.091827 0.051015 0.011317
0.694444 0.091827 0.063769 0.012653
0.833333 0.091827 0.076523 0.013860
0.972222 0.091827 0.089277 0.014971
1.111111 0.091827 0.102030 0.016004
1.250000 0.091827 0.114784 0.016975
1.388889 0.091827 0.127538 0.017894
1.527778 0.091827 0.140292 0.018767
1.666667 0.091827 0.153046 0.019601
1.805556 0.091827 0.165799 0.020402
1.944444 0.091827 0.178553 0.021172
2.083333 0.091827 0.191307 0.021915
2.222222 0.091827 0.204061 0.022634
2.361111 0.091827 0.216815 0.023330
2.500000 0.091827 0.229568 0.024007
2.638889 0.091827 0.242322 0.024665
2.777778 0.091827 0.255076 0.025305
2.916667 0.091827 0.267830 0.025930
3.055556 0.091827 0.280584 0.026540
3.194444 0.091827 0.293337 0.027137
3.333333 0.091827 0.306091 0.027721
3.472222 0.091827 0.318845 0.028292
3.611111 0.091827 0.331599 0.028852
3.750000 0.091827 0.344353 0.029402
3.888889 0.091827 0.357106 0.029942
4.027778 0.091827 0.369860 0.030472
4.166667 0.091827 0.382614 0.030992
4.305556 0.091827 0.395368 0.031505
4.444444 0.091827 0.408122 0.032009
4.583333 0.091827 0.420875 0.032505
4.722222 0.091827 0.433629 0.032994
4.861111 0.091827 0.446383 0.033476
5.000000 0.091827 0.459137 0.033951
5.138889 0.091827 0.471891 0.034419
5.277778 0.091827 0.484644 0.034881
5.416667 0.091827 0.497398 0.035337
5.555556 0.091827 0.510152 0.035787
5.694444 0.091827 0.522906 0.036232
5.833333 0.091827 0.535660 0.036671
5.972222 0.091827 0.548413 0.037105

```

6.111111	0.091827	0.561167	0.037534
6.250000	0.091827	0.573921	0.037958
6.388889	0.091827	0.586675	0.038377
6.527778	0.091827	0.599429	0.038792
6.666667	0.091827	0.612182	0.039203
6.805556	0.091827	0.624936	0.039609
6.944444	0.091827	0.637690	0.040011
7.083333	0.091827	0.650444	0.040409
7.222222	0.091827	0.663198	0.040803
7.361111	0.091827	0.675951	0.054824
7.500000	0.091827	0.688705	0.073443
7.638889	0.091827	0.701459	0.084912
7.777778	0.091827	0.714213	0.094054
7.916667	0.091827	0.726967	0.101909
8.055556	0.091827	0.739720	0.108917
8.194444	0.091827	0.752474	0.115311
8.333333	0.091827	0.765228	0.121235
8.472222	0.091827	0.777982	0.126783
8.611111	0.091827	0.790736	0.132021
8.750000	0.091827	0.803489	0.136998
8.888889	0.091827	0.816243	0.141751
9.027778	0.091827	0.828997	0.146310
9.166667	0.091827	0.841751	0.150697
9.305556	0.091827	0.854505	0.154931
9.444444	0.091827	0.867258	0.159029
9.583333	0.091827	0.880012	0.163003
9.722222	0.091827	0.892766	0.166864
9.861111	0.091827	0.905520	0.170621
10.000000	0.091827	0.918274	0.174284
10.13889	0.091827	0.931027	0.193661
10.27778	0.091827	0.943781	0.203699
10.41667	0.091827	0.956535	0.212139
10.55556	0.091827	0.969289	0.219720
10.69444	0.091827	0.982043	0.226730
10.83333	0.091827	0.994796	0.233320
10.97222	0.091827	1.007550	0.239580
11.11111	0.091827	1.020304	0.245570
11.25000	0.091827	1.033058	0.251331
11.38889	0.091827	1.045812	0.256896
11.52778	0.091827	1.058565	0.262287
11.66667	0.091827	1.071319	0.267525
11.80556	0.091827	1.084073	0.272625
11.94444	0.091827	1.096827	0.277599
12.08333	0.091827	1.109581	0.664750
12.22222	0.091827	1.122334	1.924156
12.36111	0.091827	1.135088	3.490622
12.50000	0.091827	1.147842	4.935523

END FTABLE 1
END FTABLES

EXT SOURCES

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

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member-><--Mult-->Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***
<Name>	#	<Name> #	#<-factor->strg	<Name>	#	<Name>	tem strg	strg***
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
RCHRES	1	HYDR	RO 1 1	1	WDM	1000	FLOW	ENGL REPL
RCHRES	1	HYDR	STAGE 1 1	1	WDM	1001	STAG	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  16
  END MASS-LINK      16

END MASS-LINK

END RUN

```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Phone: (253) 514-8952 Fax: (253) 514-8954

Memorandum

To: Justin Holland, Prospect Development

File Number: 1310.0038

From: Jon Pickett, Soundview Consultants LLC

Date: May 13, 2022

Re: Stormwater Model Analysis

The Reserve – Adjacent to: 101st Street Court and Peacock Hill Avenue, Gig Harbor, WA 98332

Dear Mr. Holland,

Soundview Consultants LLC (SVC) is assisting Prospect Development (Applicant) with a wetland and fish and wildlife habitat assessment and environmental permitting for an approximately 9.62-acre property located adjacent to 101st Street Court Northwest and Peacock Hill Avenue in the City of Gig Harbor, Washington (Figure 1). The subject property consists of two parcels situated in the Southwest ¼ of Section 32, Township 22 North, Range 02 East, W.M. (Pierce County Tax Parcel Numbers 0222323134 and 0222323135).

The proposed residential development project utilizes the Western Washington Hydrology Model manual recommended by the Washington State Department of Ecology (Clear Creek Solutions, 2016). This tool models wetland hydrology fluctuation between pre-developed and post-developed conditions, with two criteria: 1) Total volume of water into a wetland during a single precipitation event should not be more than 20 percent higher or lower than the pre-project volumes, and 2) Total volume of water into a wetland on a monthly basis should not be more than 15 percent higher or lower than the pre-project volumes.

Stormwater from the new onsite impervious surfaces, including building roofs, sidewalks, landscaped areas, and roadways, will be routed to a below ground detention vault through routed catch basins and pipe networks. Treated stormwater will then be discharged, at a controlled flow rate, into the existing Wetland A on the eastern portion of the site via two dispersion trenches and an energy dissipator. Stormwater will be treated prior to discharge into Wetland A. The stormwater model indicates that the proposed discharge flows are projected to slightly exceed the pre-developed conditions.

Topography of the site naturally slopes moderately downward from west to east towards Stream Z. Despite the slight increase in hydrology when compared to the pre-developed site conditions, the natural recharge of Wetland A is not anticipated to be negatively affected. The wetland contains a Seasonally Saturated hydroperiod according to the definitions outlined in Cowardin et al. (1979). As such, the wetland maintains saturated substrate at or near the surface for extended periods throughout the growing season, but rarely contains surface water. Wetland A is also classified as a depressional wetland (Brinson, 1993); however, the majority of the western portion of Wetland A is sloped and

does not contain sufficient depressions to store water. The wetland, and upgradient upland areas, are relatively intact and contain dense, rigid vegetation that will help reduce velocity of surface flows entering Wetland A, and continuing east toward Stream Z. Such site characteristics allow much of the onsite hydrology to flow through Wetland A and drain into Stream Z. As no impacts to the natural topography are proposed, hydrology due to natural runoff to the stream is not anticipated to be negatively affected. Additionally, the buffers of the wetland will remain relatively intact with native vegetation and therefore, wetland hydrology is not anticipated to be significantly altered from a biological standpoint due to surface runoff. As such, the slight increase in water volume is not anticipated to negatively affect the existing state of the wetland or the hydrologic regime of the site.

Please do not hesitate to contact me with any questions or concerns you may have.

Sincerely,

A handwritten signature in dark ink, appearing to read "J. Pickett", written in a cursive style.

Jon Pickett
Associate Principal

References

- Brinson, M. M. 1993. *A hydrogeomorphic classification for wetlands*, Technical Report WRP-DE-4. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.
- Clear Creek Solutions. 2016. *Western Washington Hydrology Model 2012 User Manual*. February, 2016.
- CPH Consultants. 2022. Wetland Hydroperiod Analysis – The Reserve. Prepared April 29, 2022.
- Cowardin, L.M. V. Carter, F. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish & Wildlife Service. Washington D.C.

APPENDIX D

CONVEYANCE ANALYSIS

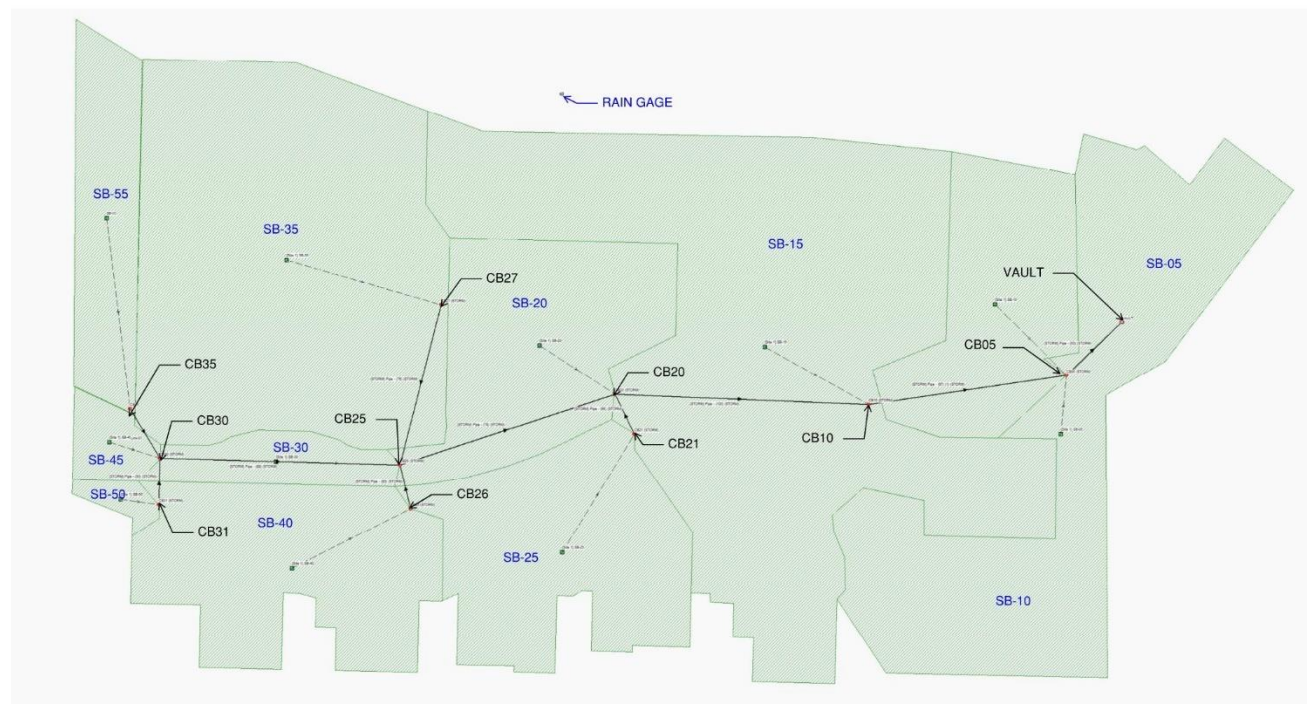
CONVEYANCE ANALYSIS

FOR
THE RESERVE
GIG HARBOR, WA

Conveyance Analysis Narrative:

The project proposes to collect on-site runoff from the proposed building roofs, landscape area, sidewalks, and roadway runoff from the developed project area. Stormwater from roof area is collected in gutters and conveyed through downspouts to the proposed roadway closed conveyance system. Runoff from landscape area, sidewalk and roadway runoff will sheet flow to catch basins and routed through the pipe networks to an underground detention vault, then to a water quality treatment facility prior to being discharged to a gabion energy dissipator and two dispersion trenches. The proposed dispersion trenches will disperse stormwater just west of the existing on-site wetland buffer. Per City of Gig Harbor site development standards, a backwater analysis of the proposed conveyance system was performed. To perform this task, AutoDesk Storm and Sanitary Analysis software (SSA) was used. SSA is a single-event model and uses the Santa Barbara Urban Hydrograph, SCS TR-55 for Time of Concentration and Kinematic Wave for routing. See Figure 1- Model Layout for a view of the storm drainage basins and catch basins.

Figure 1: SSA Model Layout



The model was used to analyze the 25-year, 24-hour, and 100-year, 24-hour events. Precipitation values were provided by the 2016 City of Gig Harbor Stormwater Management and Site Development Manual. A precipitation volume of 4.0 inches and 4.8 inches for the 25-year and 100-year design storms, respectively. All pipes have capacity for both storm events. All Catch basins have more than a minimum 0.5' of freeboard during the 25-year event and no catch basins overtop during the 100-year event. The following Tables 1-3 including sub-basin, pipes and catch basin input perimeters and SSA model layout results. Direct reports from the SSA model are also provided at the end of this report.

Table 1: Sub-Basin Land Use, Receiving CB and Sub-Basin Results

Basin ID	Basin Area (SF)	Receiving Catch Basin	Impervious Area Curve No.	Perv. Area Curve No.	% Impervious	Rainfall Distribution	25-Year Event				100-Year Event			
							Total Precip. (in)	Total Runoff (in)	Peak Runoff (cfs)	ToC (min)	Total Precip. (in)	Total Runoff (in)	Peak Runoff (cfs)	ToC (min)
SB-05	19,646	CB05	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.32	6	4.75	3.65	0.41	6
SB-10	8,756	CB05	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.14	6	4.75	3.65	0.18	6
SB-15	37,810	CB10	98.00	76.00	55.00	SCS Type IA 24-hr	3.96	2.82	0.59	6	4.75	3.54	0.75	6
SB-20	10,454	CB20	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.17	6	4.75	3.65	0.22	6
SB-25	11,108	CB21	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.18	6	4.75	3.65	0.23	6
SB-30	2,483	CB25	98.00	79.00	100.00	SCS Type IA 24-hr	3.96	3.73	0.05	6	4.75	4.52	0.06	6
SB-35	26,005	CB27	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.43	6	4.75	3.65	0.54	6
SB-40	10,934	CB26	98.00	79.00	55.00	SCS Type IA 24-hr	3.96	2.92	0.18	6	4.75	3.65	0.23	6
SB-45	1,350	CB30	98.00	79.00	100.00	SCS Type IA 24-hr	3.96	3.73	0.03	6	4.75	4.52	0.04	6
SB-50	610	CB31	98.00	79.00	100.00	SCS Type IA 24-hr	3.96	3.73	0.01	6	4.75	4.52	0.02	6
SB-55	4,806	CB30	98.00	79.00	100.00	SCS Type IA 24-hr	3.96	3.73	0.03	6	4.75	4.52	0.13	6

Table 2: Pipe Data and 25-year and 100-year Model Results

Pipe Data												25-Year Event						100-Year Event					
Pipe ID	Up Stream CB	Down Stream CB	Pipe Length (ft)	Inlet IE (ft)	Outlet IE (ft)	Total Drop (ft)	Pipe Slope (%)	Pipe Dia. (in)	Manning's Roughness	Entrance / Exit Loss	Design Flow Capacity (cfs)	Peak Flow (cfs)	Max. Velocity (ft/s)	Travel Time (min)	Max Flow/ Design Flow Ratio	Max Flow Depth/ Total Depth Ratio	Max Flow Depth (ft)	Peak Flow (cfs)	Max. Velocity (ft/s)	Travel Time (min)	Max Flow/ Design Flow Ratio	Max Flow Depth/ Total Depth Ratio	Max Flow Depth (ft)
Pipe - (100)	CB20	CB10	123.85	248.00	236.78	11.22	9.06	12	0.013	0.5	10.72	1.16	8.93	0.23	11%	22%	0.22	1.45	9.53	0.22	13%	25%	0.24
Pipe - (76)	CB27	CB25	80.30	264.96	264.15	0.81	1.01	12	0.013	0.5	3.57	0.43	3.06	0.44	12%	23%	0.23	0.54	3.28	0.41	15%	26%	0.26
Pipe - (78)	CB25	CB20	111.20	264.15	248.00	16.15	14.52	12	0.013	0.5	13.58	0.80	9.47	0.20	6%	17%	0.17	1.00	10.13	0.18	7%	18%	0.17
Pipe - (80)	CB26	CB25	21.98	265.68	264.15	1.53	6.96	12	0.013	0.5	9.40	0.18	4.63	0.08	2%	10%	0.10	0.23	4.84	0.08	2%	11%	0.11
Pipe - (88)	CB30	CB25	118.11	282.63	264.15	18.48	15.65	12	0.013	0.5	14.09	0.15	5.80	0.34	1%	7%	0.07	0.18	6.16	0.32	1%	8%	0.04
Pipe - (90)	CB31	CB30	22.54	282.86	282.64	0.23	1.00	12	0.013	0.5	3.56	0.01	1.06	0.35	0%	4%	0.04	0.02	1.12	0.34	0%	5%	0.05
Pipe - (93)	CB05	VAULT	38.08	230.00	223.00	7.00	18.38	12	0.013	0.5	15.28	2.21	13.84	0.05	14%	26%	0.26	2.78	14.74	0.04	18%	29%	0.28
Pipe - (95)	CB21	CB20	21.56	248.43	248.00	0.43	2.00	12	0.013	0.5	5.04	0.18	3.04	0.12	4%	13%	0.13	0.23	3.27	0.11	5%	15%	0.15
Pipe - (97) (1)	CB10	CB05	97.44	236.78	230.00	6.78	6.96	12	0.013	0.5	9.40	1.74	9.14	0.18	19%	29%	0.29	2.19	9.75	0.17	23%	33%	0.32
Link-01	CB35	CB30	29.15	285.73	282.63	3.10	10.63	12	0.013	0.5	11.62	0.10	4.57	0.11	1%	7%	0.07	0.12	4.83	0.10	1%	7%	

Table 3: Catch Basin Data and 25-year and 100-year Model Results

Catch Basin Data								25-Year Event					100-Year Event				
CB ID	CB Type	IE (ft)	Rim Elev. (ft)	CB Depth (ft)	Initial WTR Elev. (ft)	Surcharge Elev. (ft)	Min. Pipe Cover (in)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max. HGL Elev.	Max HGL Depth (ft)	Min. Free-board (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max. HGL Elev.	Max HGL Depth (ft)	Min. Free-board (ft)
CB05	TYPE 2-48"	230.00	233.07	3.07	230.00	233.07	24.89	2.21	0.47	230.29	0.29	2.78	2.78	0.59	230.33	0.33	2.75
CB10	TYPE 2-48"	236.78	241.84	5.06	236.78	241.84	48.68	1.74	0.59	237.07	0.29	4.77	2.19	0.75	237.11	0.33	4.73
CB20	TYPE 2-48"	248.00	253.00	5.00	248.00	253.00	47.98	1.16	0.17	248.22	0.22	4.78	1.45	0.22	248.25	0.25	4.75
CB21	TYPE 1	248.43	252.98	4.55	248.43	252.98	42.58	0.18	0.18	248.56	0.13	4.42	0.23	0.23	248.58	0.15	4.40
CB25	TYPE 2-48"	263.35	270.27	6.92	263.35	270.27	61.36	0.80	0.05	264.39	1.04	5.88	1.00	0.06	264.42	1.07	5.85
CB26	TYPE 1	265.68	269.68	4.00	265.68	269.68	35.98	0.18	0.18	265.78	0.10	3.90	0.23	0.23	265.79	0.11	3.89
CB27	TYPE 1	263.75	266.25	2.50	263.75	266.25	3.53	0.43	0.43	265.19	1.44	1.06	0.54	0.54	265.22	1.47	1.03
CB30	TYPE 1	282.63	285.79	3.16	282.63	285.79	25.86	0.15	0.03	282.70	0.07	3.09	0.18	0.04	282.71	0.08	3.08
CB31	TYPE 1	282.86	285.78	2.92	282.86	285.78	23.04	0.01	0.01	282.90	0.04	2.88	0.02	0.02	282.91	0.05	2.87
CB35	TYPE 1	285.73	287.86	2.13	285.73	287.86	13.56	0.10	0.10	285.80	0.07	2.06	0.12	0.12	285.80	0.07	2.06

APPENDIX E

GEOTECHNICAL REPORT

(PROVIDED SEPARATELY FROM THIS REPORT)

APPENDIX F

DOWNSTREAM ANALYSIS

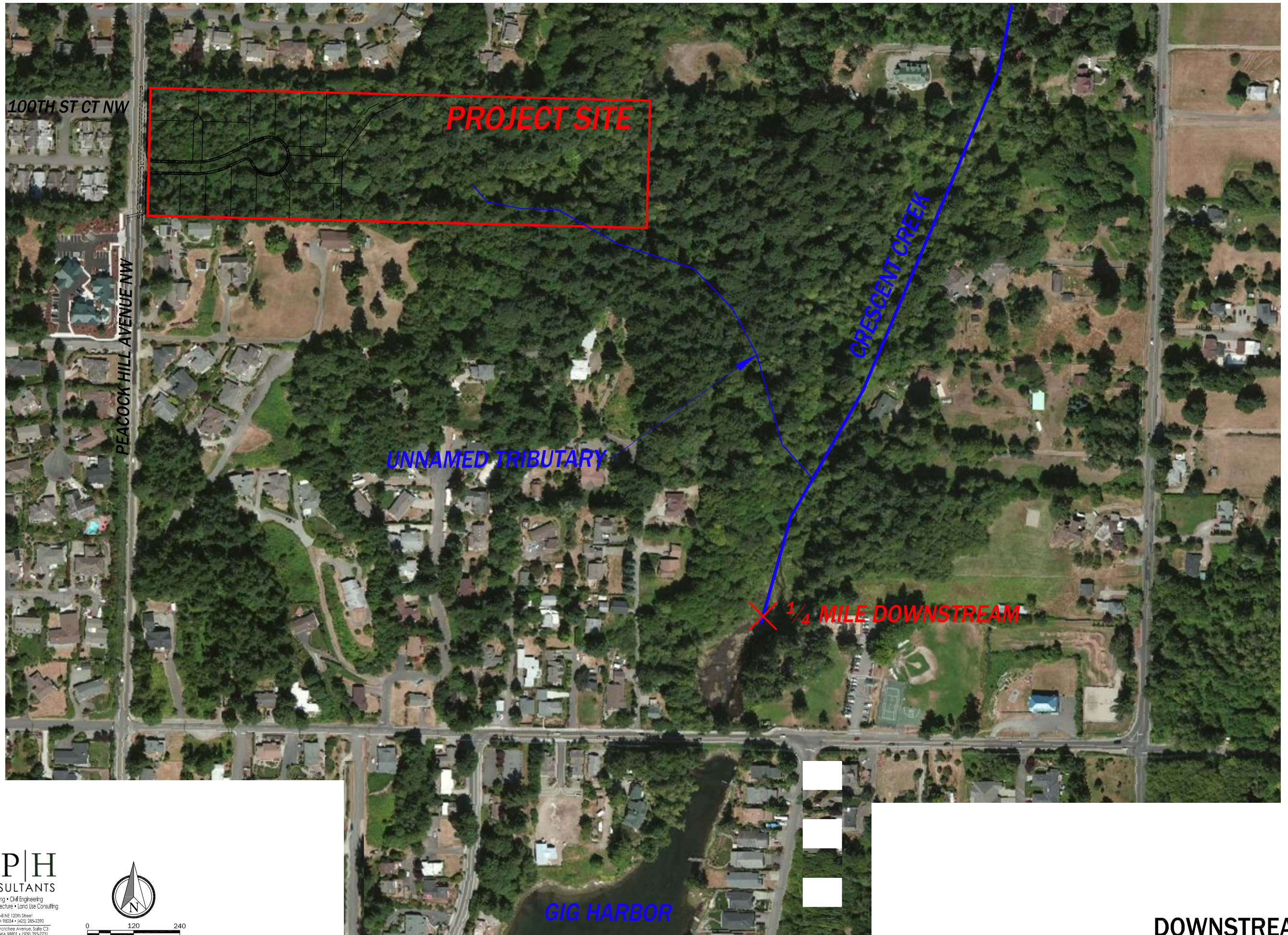




Photo #1: Looking down at on-site wetland.



Photo #2: Near western edge of on-site wetland, notice standing water towards bottom center of photo.



Photo #3: Minor flow underneath of fallen tree near beginning of stream on-site.



Photo #4: On-site stream near southeastern property corner.



Photo #5: Just south of property, neighbor appears to have created small pond.



Photo #6: Outlet from small pond on parcel south of project site.



Photo #7: Downstream approximately 300 feet from project site, stream flow has gradually increased with downstream distance.

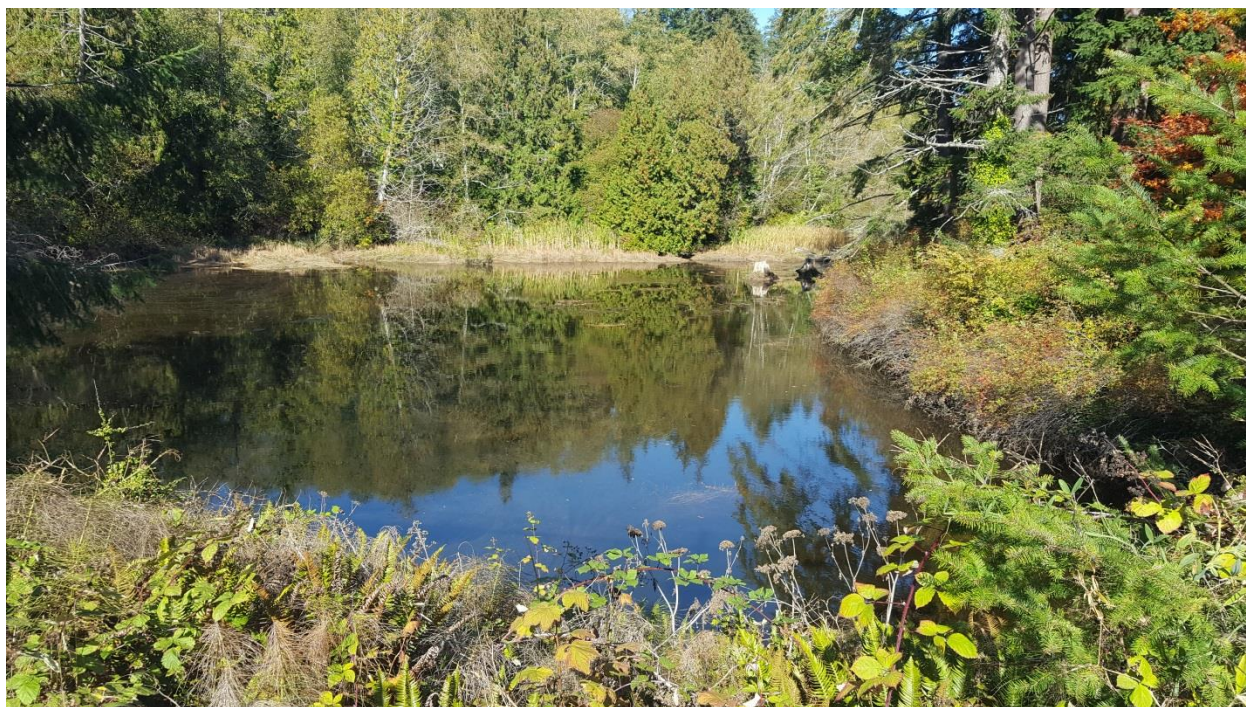


Photo #8: Looking north at pond supplied by Crescent Creek just west of Crescent Creek Park.



Photo #9: Looking south towards culvert underneath Vernhardson Street at south end of pond.



Photo #10: Looking south at Gig Harbor bay over Vernhardson Street. Crescent Creek discharges to bay through culvert underneath road.

APPENDIX G

ESTABLISHMENT OF MAINTENANCE COVENANT