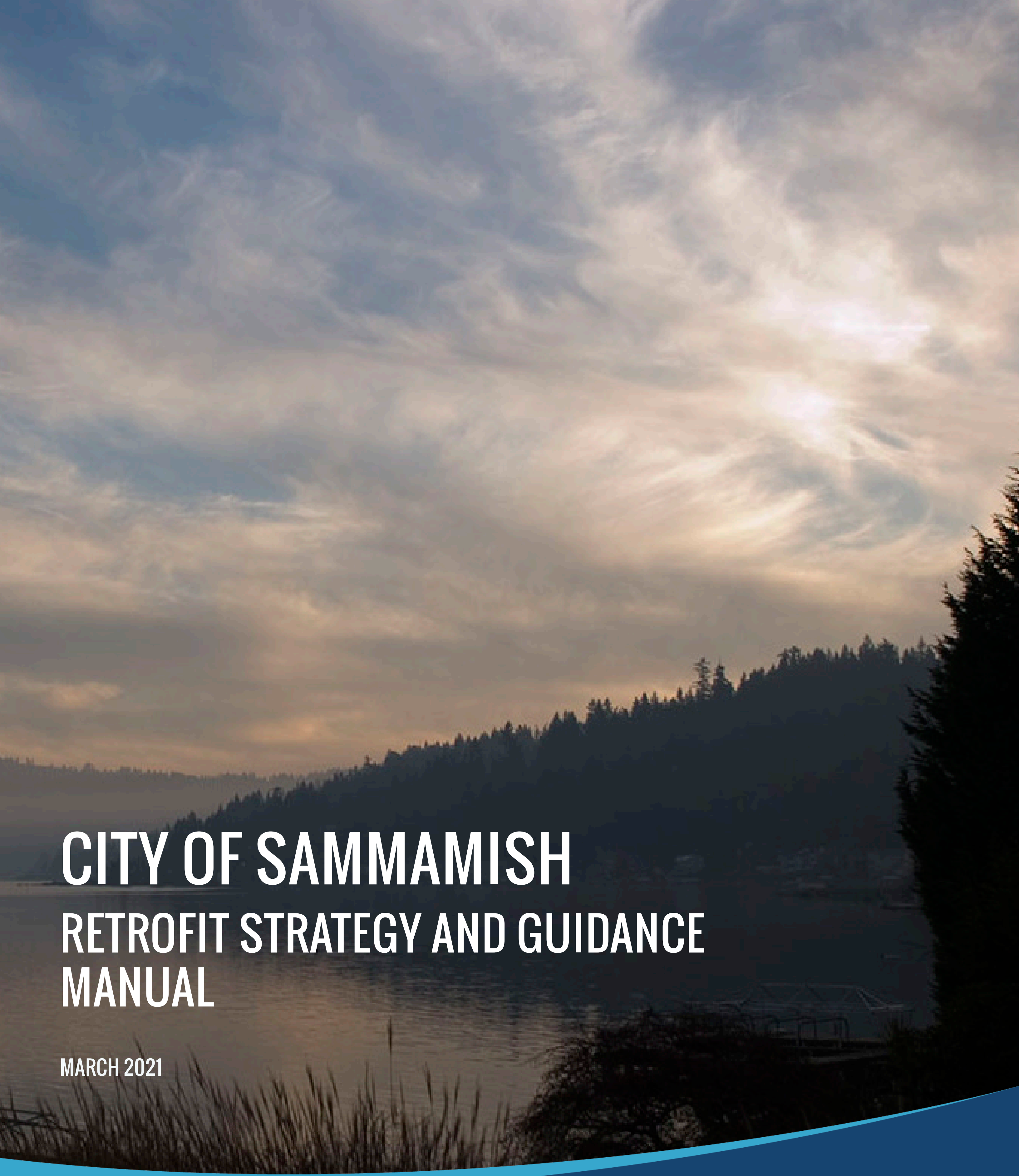

CITY OF SAMMAMISH

RETROFIT STRATEGY AND GUIDANCE MANUAL

MARCH 2021

City of Sammamish
Washington

PREPARED FOR:

PREPARED BY:

northwest hydraulic consultants

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INTRODUCTION

Urbanization of stream basins in western Washington has almost without exception been accompanied by a loss of stream-related beneficial uses such as anadromous fish resources. There are multiple causes for the loss, including significant alteration of hydrologic patterns, degraded water quality, and loss of riparian habitat. The Department of Ecology (Ecology) recognizes that past and current policies and stormwater planning efforts that focus only on new development and redevelopment have fallen short of protecting aquatic resources. The recent 2019 Department of Ecology Phase II Municipal Stormwater Permit recognizes the need to address degradation of the state's waters and legacy impacts caused by stormwater discharges from existing developed sites. For that reason, stormwater programs must include planning and developing policies that address receiving water needs, including stormwater facility retrofit provisions. In this context, "stormwater facility retrofits" include projects that modify existing treatment and/or flow control facilities or provide new flow control or treatment facilities/best management practices (BMPs) that address impacts from existing development.

As a Phase II permittee, the City of Sammamish (City) manages stormwater within the city limits, encompassing runoff from more than 24 square miles and including 30 miles of streams, numerous bogs, and five large lakes. The City's jurisdiction covers more than 400 publicly owned facilities (ponds, tanks, and vaults), parts of four major watersheds, 185 miles of stormwater pipes, and many more miles of roadside ditches and culverts. Rapid growth occurred on the Sammamish Plateau in the 1980s and 1990s, prior to the establishment of current stormwater regulations that are more protective of water quality and stream habitat. As a result, large areas of the City lack facilities capable of providing stormwater treatment to current standards.

This document provides City staff with a planning approach that emphasizes protection of and improvements to the quality of the bogs, lakes, and streams that receive stormwater runoff. It is focused on addressing impacts from the collective existing development, rather than on a single site, and helps to answer these two important questions:

How can we most strategically address existing stormwater problems from existing development?

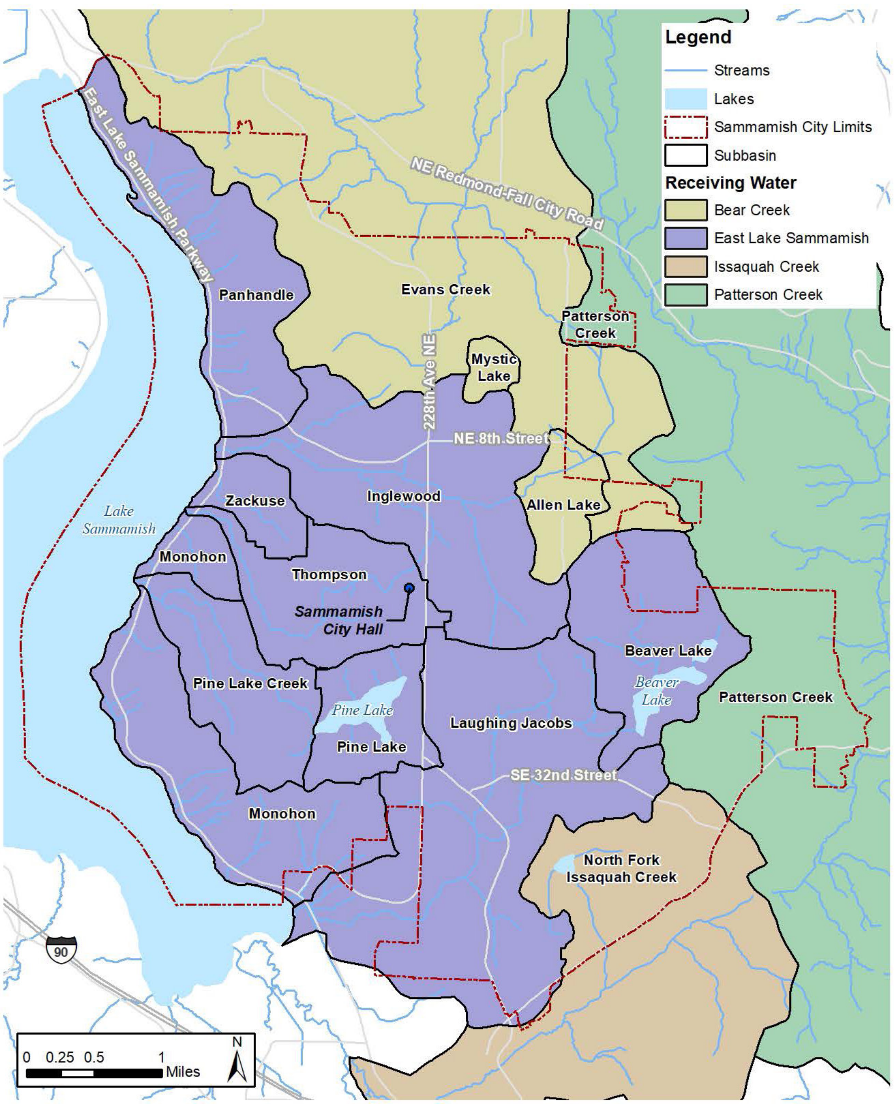
How can we most strategically address retrofit of existing treatment and/or flow control facilities?

This document provides a strategy and framework for analyzing and prioritizing the City's watersheds and identifying potential retrofit opportunity zones. This strategy focuses on three-step process that can be applied by stormwater planners and engineers to identify, evaluate and prioritize sub-watershed retrofit potential.

STEP ONE:
Assessment of Receiving Waters

Within the City of Sammamish are 14 drainage subbasins contributing to four watersheds. All 14 basins were part of the stormwater retrofit planning study. The first task of the assessment of receiving waters was to confirm the drainage basin boundaries. After review of topographic data, the GIS basin boundaries and the storm pipe network, the boundaries were updated where storm drainage or topographic data clearly indicated alternate drainage pathways. These adjustments are common where newer and more detailed drainage system information is compared against basins originally delineated from lower resolution topography. Figure 1 shows the 14 updated drainage basins and four receiving watersheds within the City of Sammamish.

FIGURE 1: CITY OF SAMMAMISH DRAINAGE BASINS



To begin an assessment of watershed health, the planning team compiled and reviewed available information to understand the likely condition of the receiving waters. Available information included landscape-scale data (land use and cover, road network, density, zoning, etc) to help explain and predict receiving water conditions, drainage complaints to identify existing problems within the drainage basins, and biological indicators to assess the aquatic health of the receiving waters. The sources included both regional-scale information and local watershed-specific information (e.g., Storm and Surface Water Comprehensive Plan, 2016; Ecology's 303(d) map, Puget Sound Stream Benthos website; and Puget Sound Characterization Project, among others).

The available data for the 14 drainage basins was reviewed and collated into a Receiving Water Inventory spreadsheet organized by receiving water basin. The basin data are rolled up and summarized in Table 1. The complete inventory is printed in Appendix A, Exhibit 1.

The City's GIS also contains data on existing stormwater facilities within the city, including the type of facility and the year it was built. Using this dataset, maps were produced showing the relative level of existing flow control and existing water quality treatment throughout the City. The estimated level of treatment was based upon the age of the facility and associated stormwater treatment requirements. If the facility was built before 1998 it was classified as providing negligible treatment (designated untreated in the following figures); if built between 1998 and 2005 the facility was classified as providing limited treatment; and if built in 2005 or later the storm facility effectiveness is considered significant. Figures 2 and 3 illustrate the presumed effectiveness of existing flow control and of existing water quality treatment.

TABLE 1: CITY OF SAMMAMISH RECEIVING WATER ASSESSMENT

CITY OF SAMMAMISH RECEIVING WATERS ASSESSMENT - COVER SHEET

4/1/2021

								Flow Control (%)**			Runoff Treatment (%)***			Biological Considerations		
Sub-Basin*	Watershed*	Drainage Complaints	Area in City (ac)	Impervious Area (ac)	Impervious Area (%)	Forested Area (ac)	Forested Area (%)	Significant	Limited	None	Significant	Limited	None	Kokanee	303(d) Level 4/5	B-IBI
Zackuse	East Lake Sammamish	11	253	68	27	91	36	18	73	9	18	0	82	X		
Panhandle	East Lake Sammamish	3	1078	266	25	368	34	7	48	45	2	31	67			
Inglewood	East Lake Sammamish	10	1718	517	30	430	25	59	30	11	57	25	18	X	X	Good
Thompson	East Lake Sammamish	1	776	157	20	256	33	54	6	40	54	5	41	X	X	Fair
Monohon	East Lake Sammamish	4	1262	245	19	556	44	7	33	60	5	23	72		X	Fair
Pine Lake	East Lake Sammamish	1	483	126	26	98	20	75	16	9	77	15	9			
Pine Lake Creek	East Lake Sammamish	2	714	112	16	282	40	22	31	47	22	8	70	X	X	Fair
Beaver Lake	East Lake Sammamish	4	728	123	17	275	38	72	1	27	72	1	27		X	
Laughing Jacobs	East Lake Sammamish	23	2138	607	28	468	22	47	30	23	47	15	38	X	X	Fair
Mystic Lake (wetland)	Bear Creek	2	93	39	42	13	14	30	70	0	30	70	0			
Allen Lake	Bear Creek	2	260	75	29	46	18	75	9	16	75	0	25		X	
Evans Creek	Bear Creek	9	1956	541	28	373	19	19	74	7	19	44	37		X	Fair
NF Issaquah Creek	Issaquah Creek	1	725	277	38	139	19	18	82	0	23	67	10		X	Fair
Patterson Creek	Patterson Creek	1	1066	351	33	197	18	80	20	0	80	20	0			Excellent

* Sub-Basin and Watershed designations consistent with City of Sammamish 2016 Storm and Surface Water Comprehensive Plan (Figure 3-1 Subbasins).

** Significant flow control is that which was constructed after the current flow duration standard became a requirement. Limited is that which was constructed after 1998 and prior to the current flow duration standard.

*** Significant runoff treatment is that which was constructed since 1998 (current treatment standards). Limited is that which was constructed prior to 1998.

FIGURE 2: EXISTING TREATMENT LEVELS OF FLOW CONTROL

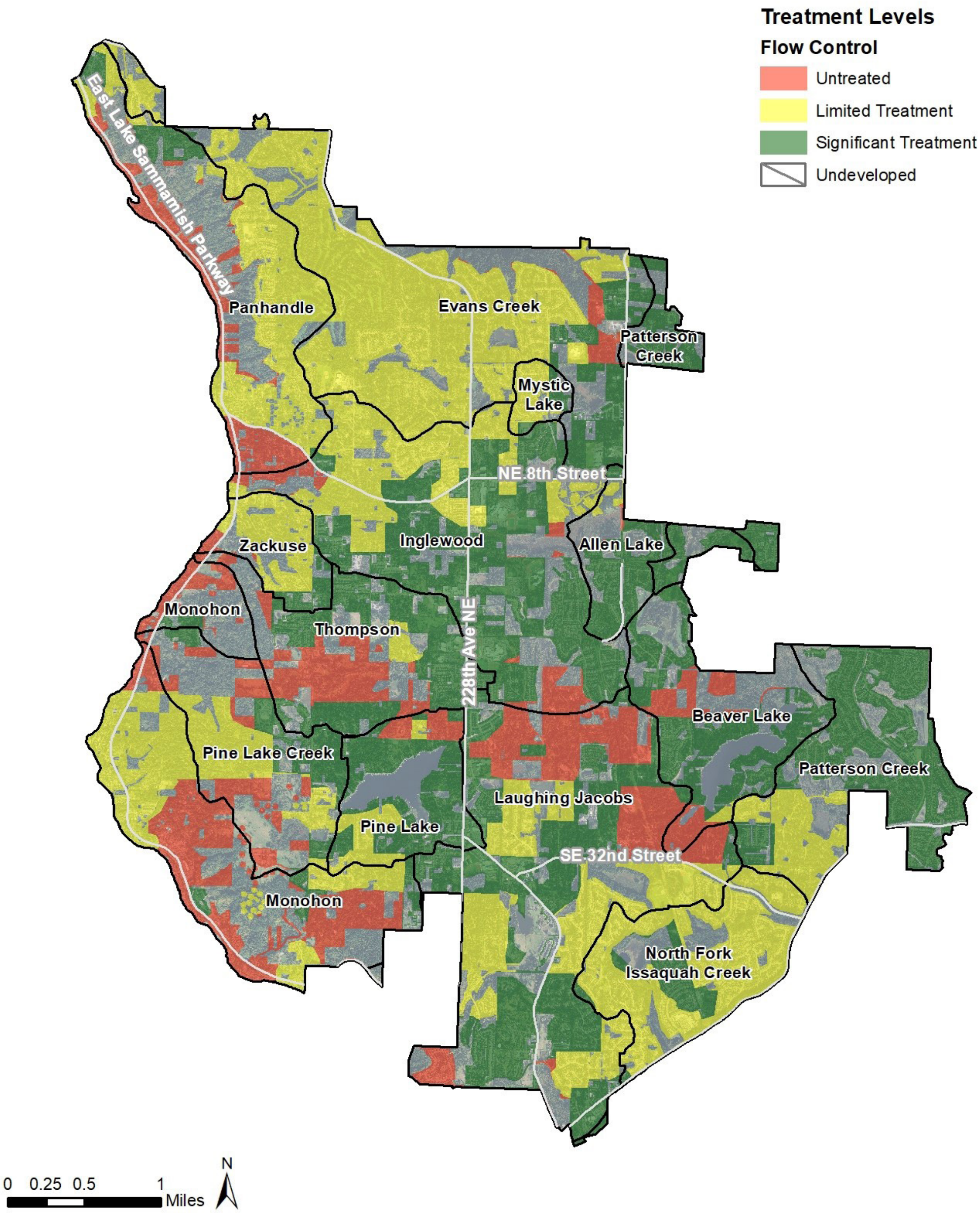
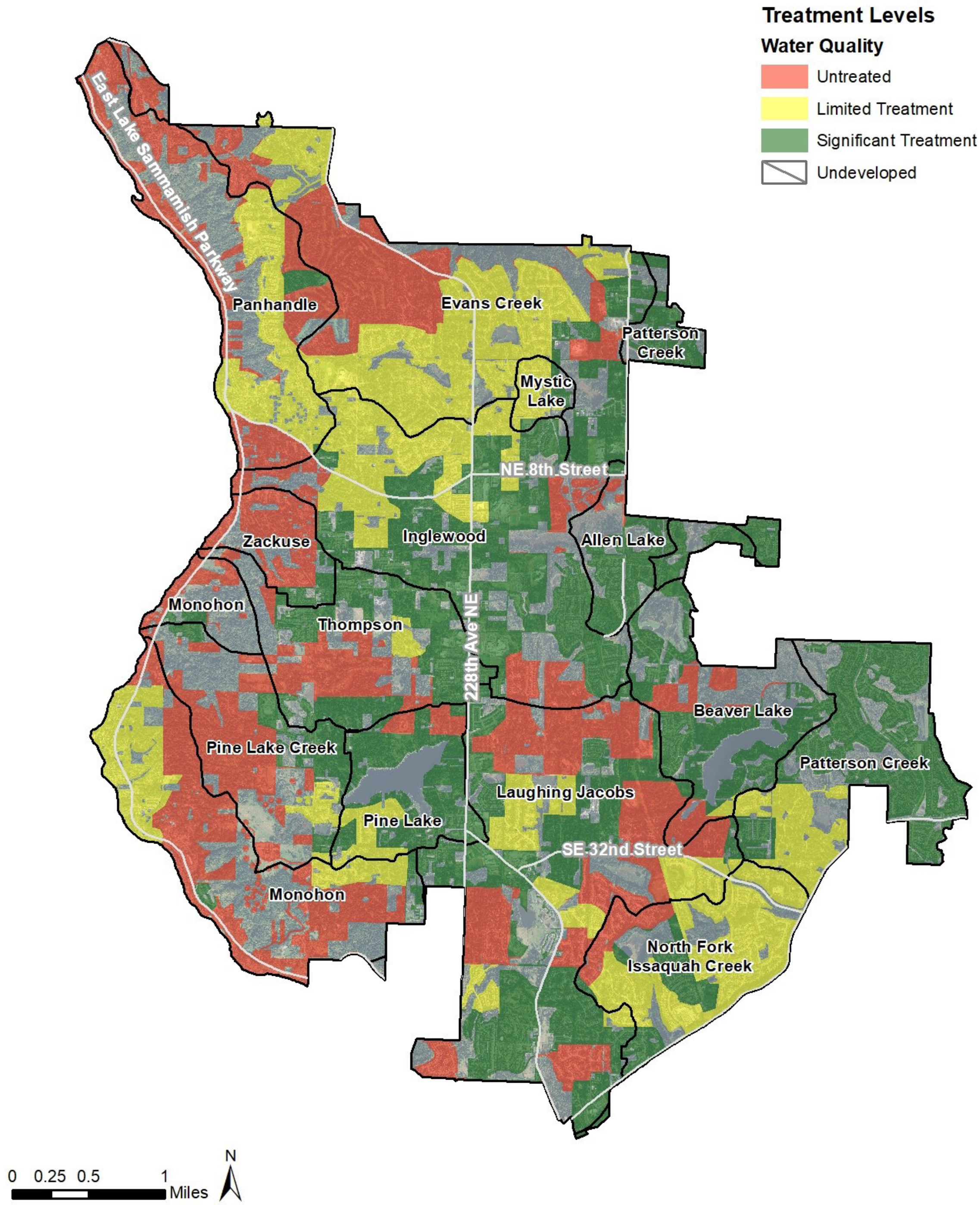


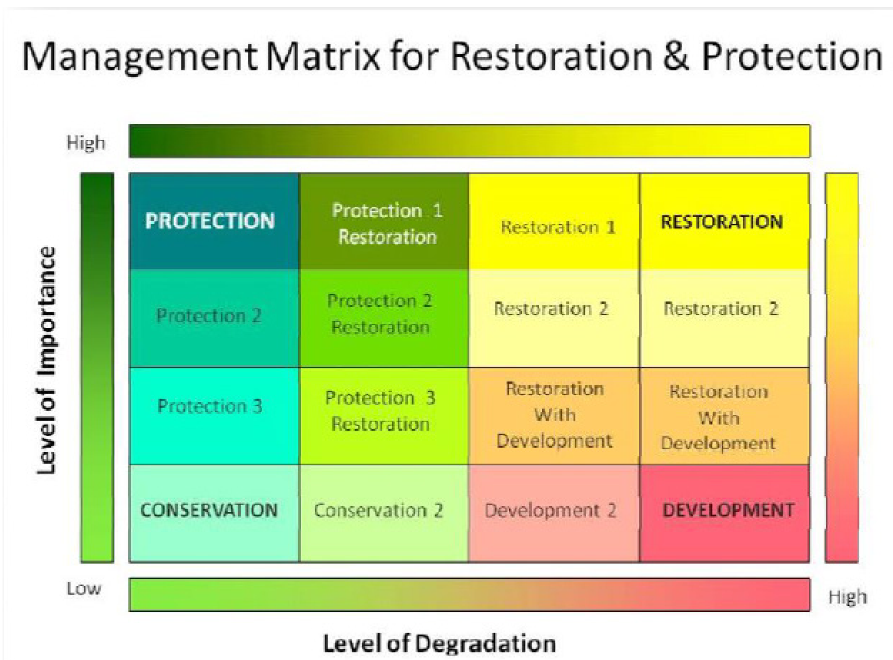
FIGURE 3: EXISTING WATER QUALITY TREATMENT LEVELS



STEP TWO:
Watershed Prioritization and Ranking

Consistent with Ecology guidance, the City is following a prioritization framework developed by Ecology as part of the Puget Sound Characterization study and documented in the Building Cities in the Rain watershed prioritization guidance (Dept. of Commerce, 2016). The framework (Figure 4) uses level of importance and level of degradation to define the types of actions appropriate for protection and/or restoration of beneficial uses.

FIGURE 4: PUGET SOUND CHARACTERIZATION STORMWATER MANAGEMENT FRAMEWORK (SOURCE: DEPT. OF COMMERCE, 2016)



The prioritization process consisted of three major tasks:

- Subbasin characterization and scoring. Use subbasin characteristics defined from the data to assign scores to metrics related to resource value or degradation.
- Subbasin ranking and prioritization.
- Stakeholder and public outreach.

TASK 1: SUBBASIN CHARACTERIZATION

A GIS-based screening process was used to characterize each subbasin in terms of its relative resource value (or importance for natural processes and aquatic species) and level of degradation from existing development and other human impacts.

Most of the GIS data used for subbasin characterization were provided by the City of Sammamish. These data sets included:

- Hydrography, including streams and wetlands
- Stormwater system mapping, including stormwater facilities and attributes
- Impervious surface mapping
- Forest cover mapping
- Zoning

City GIS data were supplemented by LiDAR topography, soils/surface geology, and aquifer recharge areas obtained from King County, Sammamish Plateau Water and Sewer District (SPWSD), and other public data sources. Most of the data were collected and summarized at the subbasin level for the earlier Receiving Water Assessment work (see Table 1).

The GIS data and other information collected as part of the Receiving Waters Assessment were used to rank the 14 subbasins in terms of 12 individual metrics related to resource value/importance or level of degradation. Metrics were calculated only for the portion of the subbasin within Sammamish city limits, since data outside of city limits was not consistently available. Values for each metric were assigned a score from zero to three, and scores were summed to provide a relative comparison of each subbasin on the “Importance” and “Degradation” axes.

RESOURCE VALUE/IMPORTANCE METRICS

These metrics represent basin conditions that preserve natural processes and support healthy streams and aquatic species. Higher scores indicate greater value. Ranges were developed based on experience and scientific understanding of impact thresholds (where available) and to distribute values for Sammamish subbasins over the range.

Forest Land Cover: Percent of subbasin area with forest land cover based on UW canopy cover study mapping (University of Washington, 2018). Forest cover is indicative of undisturbed (or less disturbed) landscape. Forested areas produce a hydrologic response with less surface runoff and higher baseflows—conditions that are correlated with stable stream channels and higher ecological function.

Wetlands: Presence and quality of wetlands in each subbasin based on the Washington Department of Ecology wetland rating system. Wetlands provide aquatic habitat, water quality benefits, and natural flow buffering.

Riparian Forest: Percent of riparian corridor (200-foot buffer on either side of stream) within each subbasin with forest land cover. Based on UW canopy cover study mapping (University of Washington, 2018). Riparian canopy cover provides nutrient inputs, wood recruitment, and shading critical to maintaining fish-friendly stream temperatures.

Potential Habitat: Total stream length in the basin used as proxy for potential aquatic habitat. Habitat assessments are available for some streams but not consistently throughout the city, so habitat quality is not included.

Fish Use: Scoring based on current and historic observed fish species. The endangered Lake Sammamish kokanee are a priority species for this area, so scoring emphasized kokanee presence or use.

Groundwater Recharge: Percent of subbasin area with outwash soils or designated critical aquifer recharge or wellhead protection areas. Based on surface geology data and critical areas data from City of Sammamish, SPWSD, and King County. Preservation of groundwater recharge is important to maintaining summer baseflows in streams.

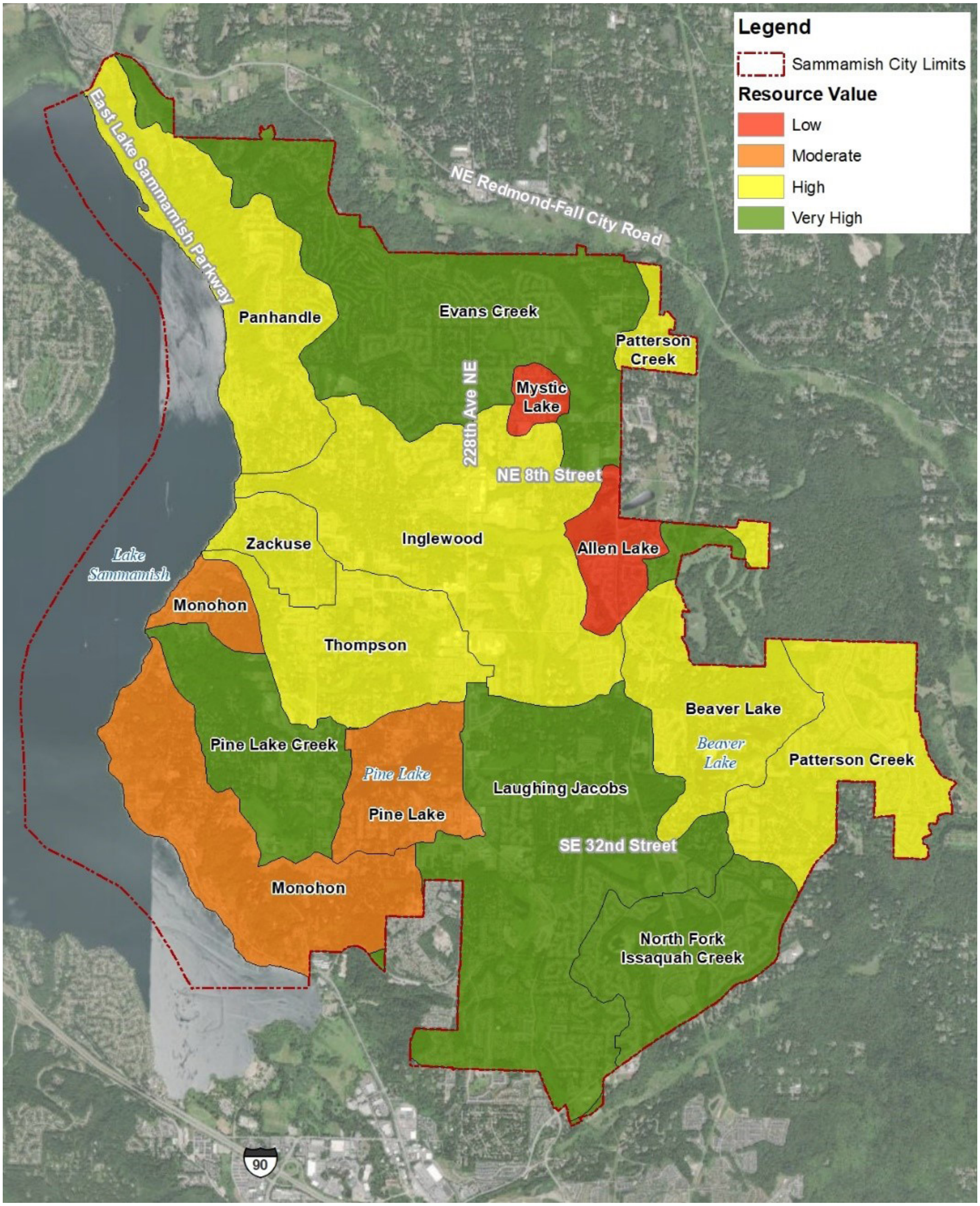
Table 2 lists the value scores for each metric by subbasin. The aggregate value score, determined from a weighted average of the individual scores, was used to assign a position on the Importance axis in the prioritization matrix. Only Fish Use was assigned a weight other than one; weight for the fish use score was doubled based on feedback received by the City from multiple community and stakeholder groups regarding the importance of Lake Sammamish kokanee to the area and the city. Figure 5 illustrates the relative resource value of the in-city portion of each subbasin. Subbasins shaded in green were calculated as having the highest relative value while the subbasins shaded in red were lowest.

TABLE 2: RESOURCE VALUE SCORING

Subbasin in City	Total Area (acres)	% in City	Riparian Forest	Potential Habitat	Fish Use‡	Forest Cover	Wetland Area	Ground-water Recharge	Aggregate Value Score
Allen Lake	307	85	1	0	0	1	1	2	**0.71**
Mystic Lake	93	100	0	0	0	1	1	3	**0.71**
Beaver Lake	939	78	2	2	1	2	2	2	**1.71**
Pine Lake	483	100	1	2	1	1	3	0	**1.29**
Evans Creek†	9,215	21	3	3	2	1	1	2	**2.00**
Patterson Creek†	13,155	8	2	1	2	1	2	2	**1.71**
North Fork Issaquah†	2,977	24	2	2	2	1	2	3	**2.00**
Laughing Jacobs	2,641	81	2	3	3	1	1	3	**2.29**
Inglewood	1,718	100	2	3	2	1	1	2	**1.86**
Thompson	776	100	3	2	3	2	1	0	**2.00**
Panhandle	1,078	100	3	3	0	2	1	1	**1.73**
Pine Lake Creek	714	100	3	3	2	2	2	0	**2.00**
Zackuse	253	100	3	1	3	2	0	1	**1.86**
Monohon	1,337	94	3	3	0	2	1	0	**1.29**

†Subbasin excluded from prioritization since less than 50% of watershed is within city limits.
‡Double weight applied to Fish Use metric.

FIGURE 5: RELATIVE VALUE/IMPORTANCE BY SUBBASIN



DEGRADATION METRICS

These six metrics represent basin conditions that disturb natural processes and are linked with negative impacts on streams and aquatic species. Higher scores indicate greater level of degradation. Ranges were developed based on experience and scientific understanding of impact thresholds (where available) and to distribute values for Sammamish subbasins over the range.

Impervious Surface: Percent of subbasin area with impervious land cover (excluding deck and dock areas). Higher runoff from impervious surfaces increases peak flows and stormflow volumes in streams, which leads to erosion and channel instability that disrupt habitat and stream biology.

Land Use: Dominant land use calculated as a weighted score based on percent of each category in the subbasin. Denser, higher traffic land uses generate increased stormwater runoff and pollutant loads. Land use categories were based on zoning adjusted for undeveloped areas.

Existing Flow Control Treatment: Relative effectiveness of existing flow control treatment based on facility age. This was calculated as a weighted score of previously mapped treatment effectiveness (Figure 2). Current stormwater regulations (including flow duration control) provide much higher level of protection to streams than earlier peak flow-based standards.

Existing Water Quality Treatment: Relative effectiveness of existing flow control treatment based on facility age. This was calculated as a weighted score of previously mapped treatment effectiveness (Figure 3). Current stormwater regulations require more water quality treatment than earlier standards.

Water Quality Impairment: Number of Level 4 or Level 5 303d listings for streams in the subbasin. Level 4 or 5 status on Ecology's 303d list indicates significant impairment for that water quality constituent, requiring mitigation actions.

Road Crossings: Number of road crossings per mile of stream in each subbasin, computed by intersecting street and stream networks. Road crossings disrupt a stream's riparian corridor and increase efficiency of runoff delivery to the stream, which increases peak flows. Culverts at many crossings may also be undersized and limit fish passage for certain species and life stages.

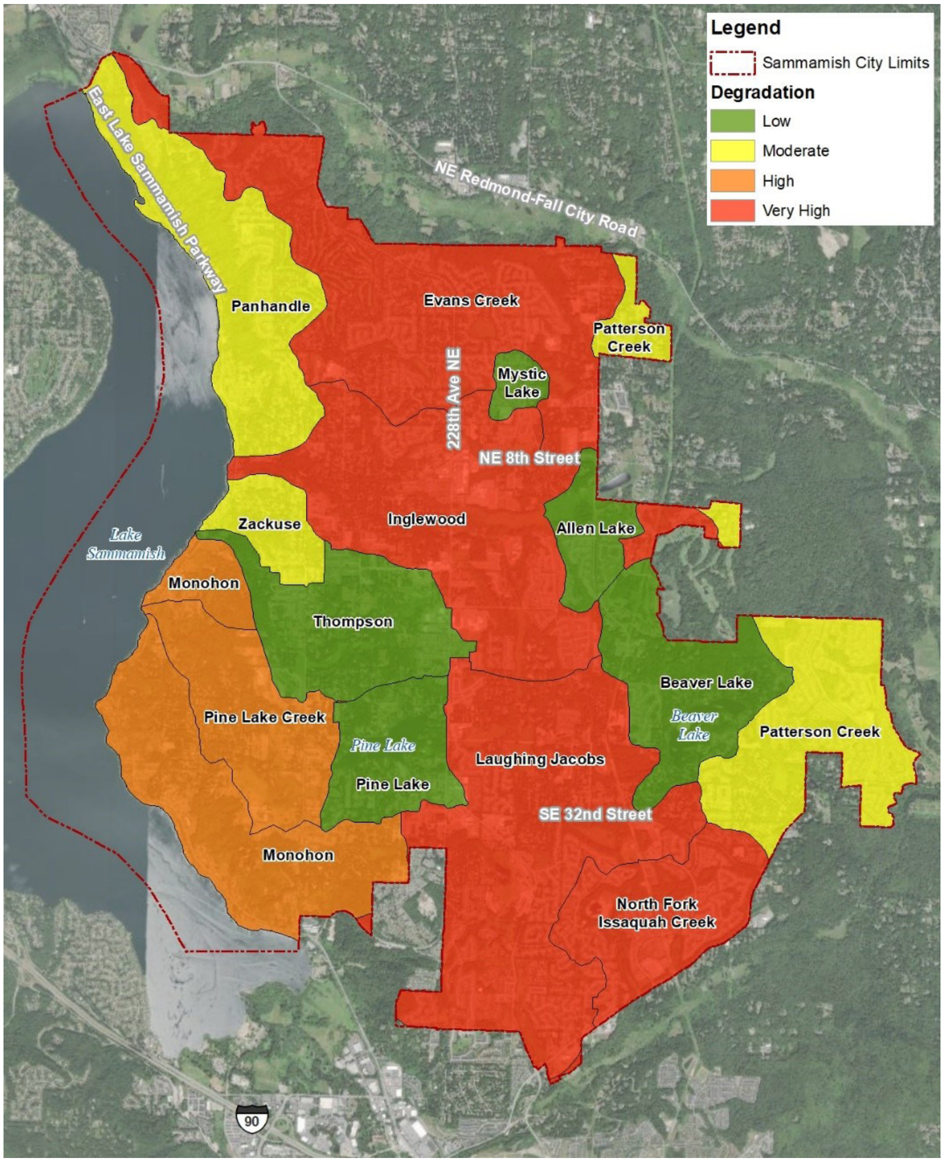
Table 3 lists the degradation scores for each metric by subbasin. The aggregate degradation score, determined from a weighted average of the individual scores, was used to assign a position on the Degradation axis in the prioritization matrix. All degradation metrics were weighted evenly, so the value is the arithmetic average of the individual scores. Figure 6 illustrates the relative level of degradation of the in-city portion of each subbasin. Subbasins shaded in green were calculated as having the lowest relative degradation while the subbasins shaded in red were highest.

TABLE 3: LEVEL OF DEGRADATION SCORING

Subbasin in City	Total Area (acres)	% in City	Impervious Surface	Land Use	Existing Flow Control	Existing WQ	WQ Impair-ment	Road xings	Aggregate Degradation Score
Allen Lake	307	85	1	1.3	0.69	0.73	1	1	**0.95**
Mystic Lake	93	100	2	1.84	1.46	1.46	0	0	**1.13**
Beaver Lake	939	78	1	1.15	0.86	0.86	1	2	**1.14**
Pine Lake	483	100	1	1.66	1.09	1.08	0	2	**1.14**
Evans Creek†	9,215	21	1	1.65	1.47	1.72	3	2	**1.81**
Patterson Creek†	13,155	8	2	1.47	0.91	0.91	0	3	**1.38**
North Fork Issaquah†	2,977	24	2	2.03	1.57	1.62	3	1	**1.87**
Laughing Jacobs	2,641	81	1	1.65	1.43	1.55	3	2	**1.77**
Inglewood	1,718	100	2	1.68	1.17	1.25	3	2	**1.85**
Thompson	776	100	1	1.30	1.25	1.25	1	1	**1.13**
Panhandle	1,078	100	1	1.49	1.53	1.75	0	3	**1.46**
Pine Lake Creek	714	100	1	0.99	1.23	1.44	3	2	**1.61**
Zackuse	253	100	1	1.59	1.46	2.04	0	2	**1.35**
Monohon	1,337	94	1	1.26	1.63	1.73	1	3	**1.60**

†Subbasin excluded from prioritization since less than 50% of watershed is within city limits.

FIGURE 6: RELATIVE DEGRADATION LEVEL BY SUBBASIN

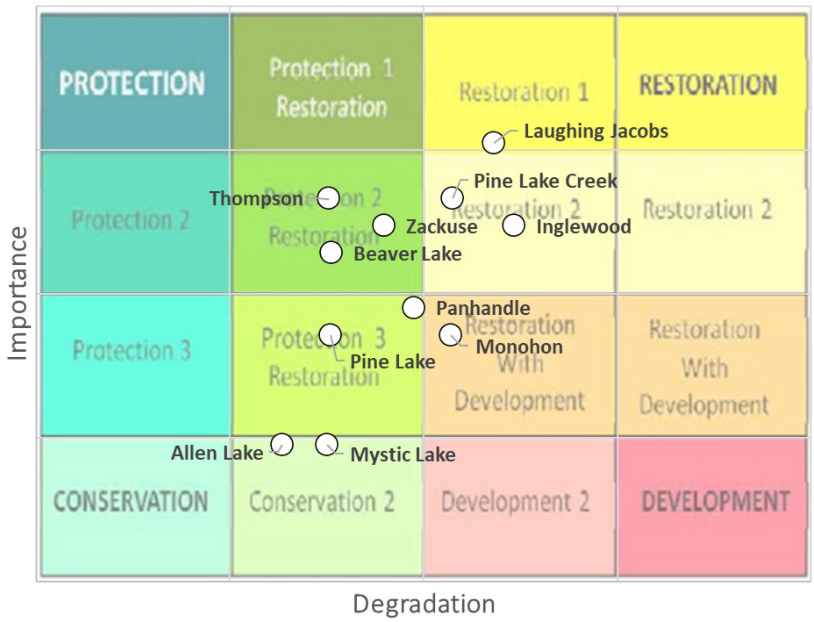


Draft results of the subbasin characterization and scoring were presented to local stakeholders and the Sammamish community as part of a public process through two virtual meetings. Comments and input from stakeholders, including City government, agencies, neighboring jurisdictions, and NGOs, were incorporated into the GIS analysis and score weighting before the process and results were presented to the general public.

TASK 2: SUBBASIN PRIORITIZATION

Subbasin degradation and value scores (from Table 3 and Table 2, respectively) were plotted on the management matrix as shown below in Figure 7. Since only a small portion of the Evans Creek, Patterson Creek, and North Fork Issaquah Creek basins are located within the boundaries of Sammamish, these subbasins were excluded from prioritization, consistent with Ecology guidelines. While the City may pursue stormwater management projects in these areas to provide local benefits, actions within City jurisdiction would be limited in ability to impact overall basin conditions.

FIGURE 7: SUBBASIN PRIORITIZATION MATRIX



The City wants to prioritize restoration and protection of its high value streams, particularly those with existing or potential kokanee habitat. Based on the prioritization matrix, the Laughing Jacobs subbasin would be the primary target, followed by Thompson (Ebright Creek), Pine Lake Creek, Zackuse, and Inglewood (George Davis Creek). The City is already in the process of developing a basin plan for Laughing Jacobs Creek and completed a plan for Zackuse Creek in 2019 (City of Sammamish, 2019). Therefore, the Inglewood, Thompson, and Pine Lake Creek subbasins were selected as the priority watersheds for further stormwater planning.

Documentation of the scoring criteria for each of the metrics utilized to reflect resource value (importance) and relative degradation is provided in Appendix A, Exhibit 2.

TASK 3: STAKEHOLDER AND PUBLIC OUTREACH

A public outreach plan was developed to solicit input from stakeholder groups and the residents of Sammamish. Two targeted meetings were held to inform stakeholders and city residents of the Stormwater Retrofit Strategy Project and to gather input on subbasin assessments and prioritization. Stormwater staffs from other municipalities, local tribes, and special interest watershed groups were consulted with and invited to provide input on known problems within the watershed, opportunities for partnerships, priority concerns, and any future plans for projects within the city. Another effective method of public outreach was a targeted survey questionnaire hosted on the City's webpage, Connect Sammamish.

The outreach activities are listed in Table 4 and meeting materials and notes are included in Appendix B, Exhibit 1.

TABLE 4: OUTREACH ACTIVITIES

ACTIVITY	DATE	COLLATORAL
Stakeholder Meeting	June 23, 2020	PowerPoint Presentation
Sammamish Connects Web Survey	June – Dec 2020	Survey Questionnaire
Frequently Asked Q & A, published on website	July, 2020	Responses to Questions from Stakeholder Meeting and Survey
City Official & Resident Meeting	July 14, 2020	PowerPoint Presentation

City of Sammamish Washington

Public Works Department

801 228th Avenue SE • Sammamish, WA 98075 • Phone: 425-295-0500 • Fax: 425-295-0600 • Web: www.sammamish.us

STORMWATER RETROFIT
PUBLIC SURVEY
May 2020

Background:

As the City of Sammamish matures new regulations trigger the need for additional and more enhanced stormwater projects, and the City must balance demands such as protection of watersheds, environment, and public safety with our two most limited resources: budget and staff time. Therefore, the City needs an objective, transparent, and consistent method for ranking and prioritizing potential drainage basins and stormwater retrofit projects.

Currently, City staff are developing a method by which to rank and prioritize drainage basins for future study, design and construction of stormwater retrofit projects. This process is directly informed by existing City goals and direction from State agencies. For example, the City's Comprehensive Plan includes specific goals to provide opportunities to retrofit existing stormwater facilities and enhance their effectiveness, use drainage basin planning to allocate resources to priority problems, promote the recovery of Lake Sammamish kokanee, and coordinate with neighboring jurisdictions to create regional stormwater solutions. These goals will be top of mind when developing criteria with which to rank potential retrofit projects.

Public input is critical to the prioritization process. As we develop this ranking method, we want to hear citizen feedback and incorporate your priorities into our framework. This survey will aid the City in ensuring all voices are heard and incorporated into the final prioritization criteria.

Stakeholder Questions:

1. This prioritization process will give higher priority to watersheds wherein stormwater management improvements from complementary projects have been made or plans are in place to accelerate environmental improvement. In order to capitalize on this efficiency, close coordination will be required with neighboring jurisdiction and state, federal, tribal, and NGOs to leverage our work.

   1a. Are you aware of any current or upcoming stormwater retrofit, habitat restoration, or stream protection projects located in the watersheds downstream of the City of Sammamish? If yes, please provide details.

   1b. Are you aware of any current or upcoming stormwater basin planning studies in watersheds adjacent to or adjoining the City of Sammamish? If yes, please provide details.

Sample of Community Survey

Example slides from public briefings

STEP THREE:
Evaluate Location-Specific Retrofit Concept Projects

The next step of a stormwater retrofit planning process is to develop specific actions for the priority subbasin(s). While the scope of this study did not include development of a basin-specific plan, it did provide for the development of a prioritization method and process to identify potential stormwater retrofits to reduce pollutants to receiving waters and to reduce stormwater flows when the receiving waters are small streams. This Stormwater Retrofit Prioritization method and planning process includes four major tasks: GIS-based parcel analysis to identify and screen potential retrofit candidate sites, field reconnaissance to evaluate the feasibility of the top sites, prioritization of the candidate sites, and conceptual design for the most promising retrofit sites.

TASK 1: GIS PARCEL ANALYSIS

The desktop GIS analysis method helps organize, map, and interpret watershed information to make better and quicker decisions. Existing GIS datasets form the basis of the potential site identification process. Table 5 shows the commonly available data sets used in the parcel-scale retrofit potential analysis.

TABLE 5: GIS DATA SETS

Land use/land cover	Existing stormwater facilities
Topography	Storm drain network
Surface water features	Aerial photos
Forest and wetland cover	Parcel size and jurisdictional boundaries
Soil type/surface geology	Subbasin boundaries

The purpose of the desktop GIS analysis is to identify parcels suitable for stormwater retrofit facilities. Four initial screening criteria were used to identify potential retrofit sites citywide:

- Parcels with existing stormwater facilities;
- Public parcels at least one acre in size
- Vacant parcels (less than 5% impervious surface) at least one acre in size
- Right-of-way segments with less than 5 percent average slope

After further consultation with city staff, the existing facility criterion was refined to include only existing stormwater facilities maintained by the city, thereby eliminating privately maintained stormwater facilities (mainly associated with commercial developments). Additionally, vacant parcels were eliminated if they were not publicly owned, and right-of-way segments were limited to roadways classified as collectors or local roads, based on traffic considerations. Undeveloped parcels with forest cover or wetlands were not considered because, in general, in their undisturbed state, these areas are performing at the highest possible level in supporting healthy aquatic ecosystems.

Because the GIS-based parcel analysis initially provides a large database of potential retrofit sites, further desktop screening is then used to identify a smaller set of the most promising retrofit sites. For each potential site, we classified several characteristics related to site suitability/potential effectiveness of stormwater retrofits:

- Public vs. private ownership
- Presence of existing facility
- Infiltration potential based on soils
- Level of existing flow and/or WQ treatment
- Presence of wetlands on site

The desktop analysis identified 47 sites in the Inglewood, Thompson, and Pine Lake subbasins that scored in the in the top tier of the nearly 1,200 potential sites citywide. The 47 sites included 29 existing facilities, a right-of-way segment and 16 vacant parcels.   After meeting with city staff, the list was further reduced to 19 existing facilities within the three priority subbasins and one known poorly functioning existing facility.

Figures 8 - 10 provide the location of the 20 retrofit sites and the study-specific unique identification number.

FIGURE 8: PREFERRED SITES

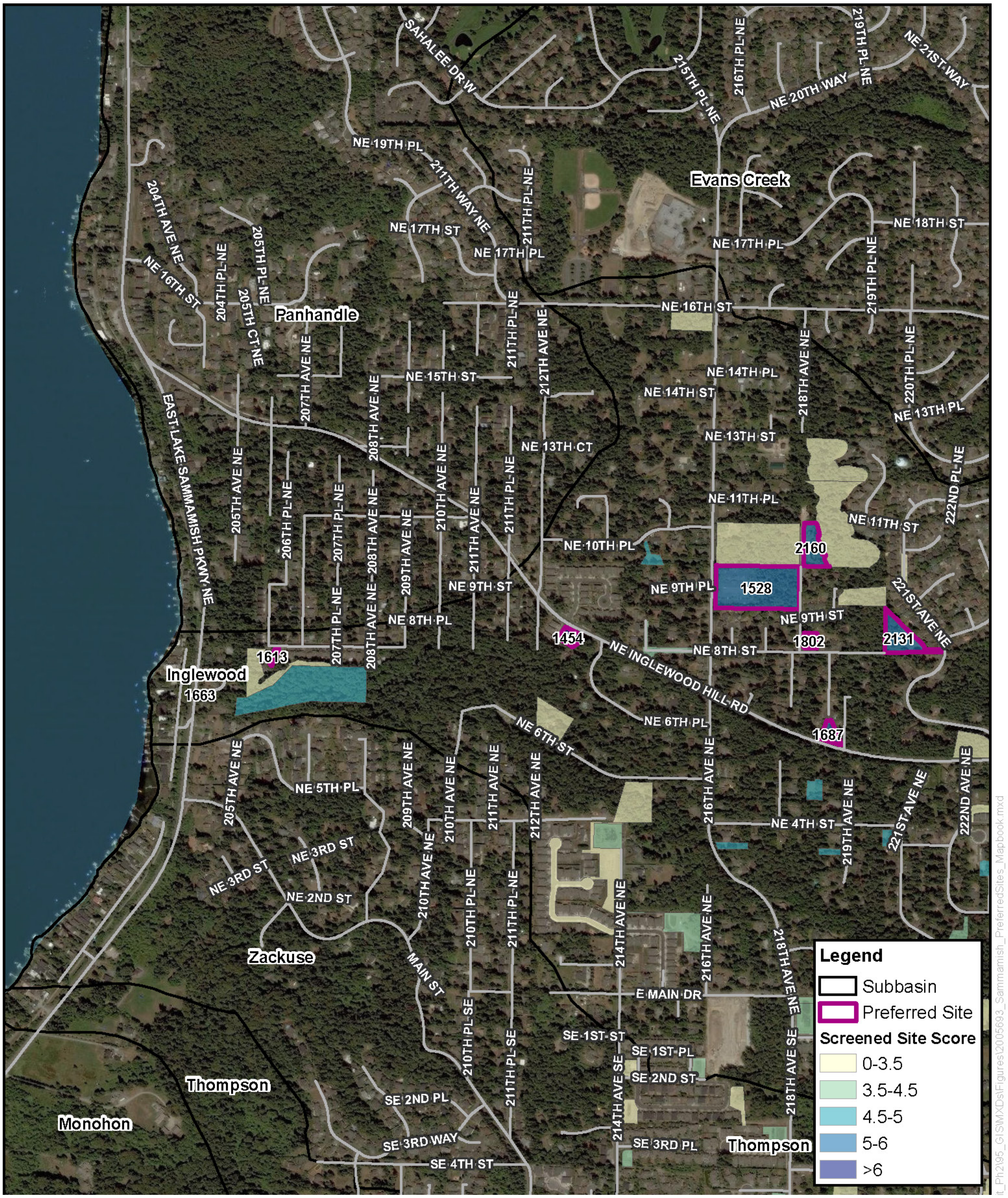


FIGURE 9: PREFERRED SITES

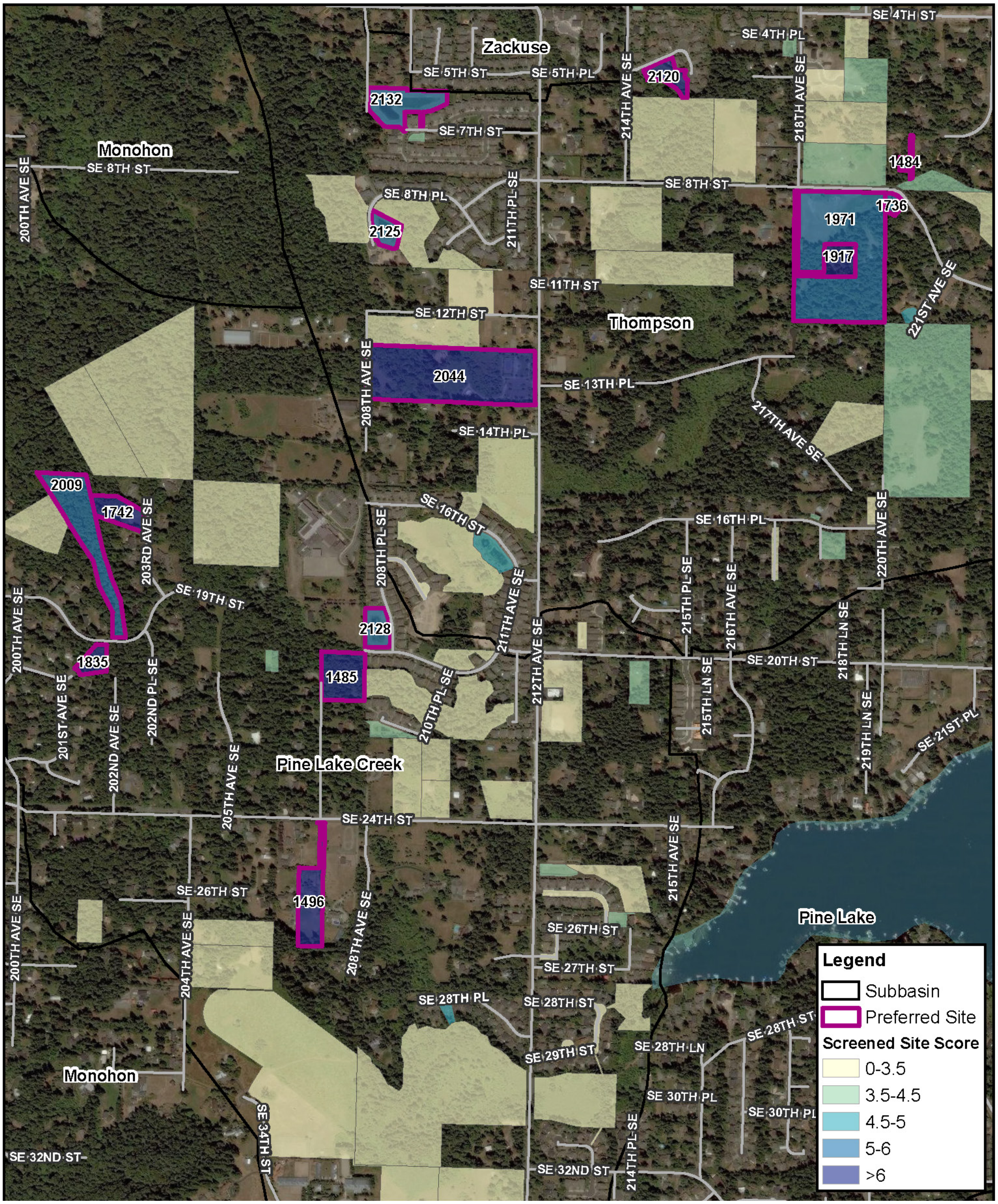
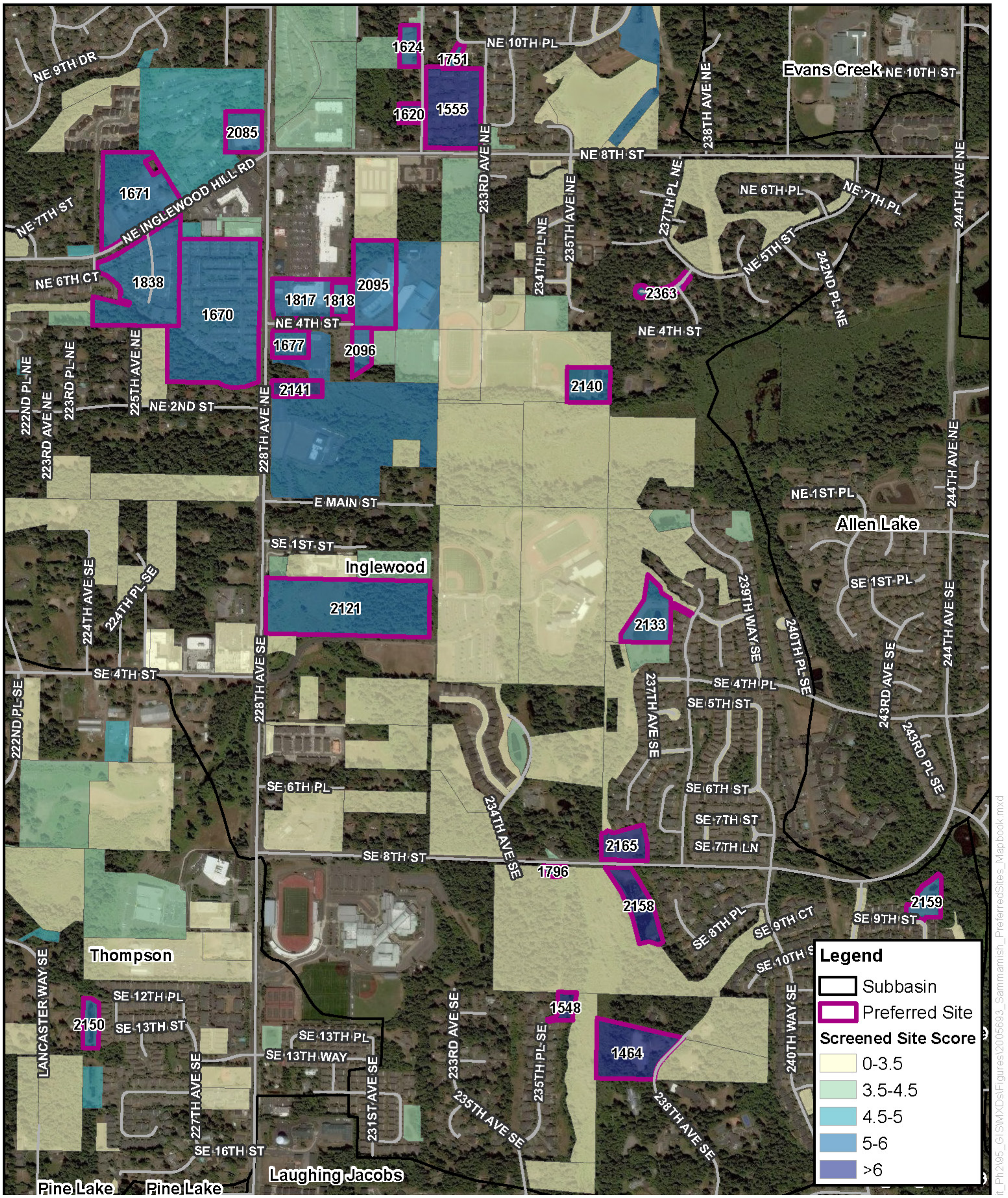


FIGURE 10: PREFERRED SITES



TASK 2: FEASIBILITY ASSESSMENT THROUGH FIELD RECONNAISSANCE

A team of experienced stormwater engineers visited the short-listed retrofit sites to evaluate each site based upon pre-established feasibility criteria. The engineers' site observations confirmed or corrected the drainage basin area tributary to the retrofit site, drainage flow patterns, potential high ground water, connectivity to the stream, land use within the drainage area, and identified existing uses and utilities that may impact the feasibility of implementing a stormwater project at the retrofit site. For the Sammamish Stormwater Retrofit project, the stormwater engineers collected the following information at each candidate retrofit site:

- Description of site;
- Site address or location;
- Approximate drainage area and contributing impervious cover;
- Existing drainage facility identification number from the City's GIS;
- Unique elements of the site;
- Utility conflicts;
- Construction and maintenance access;
- Presence of wetlands and other critical areas;
- Photos;
- Evidence of flooding or high groundwater.

When available, the Technical Information Report (TIR) was reviewed for each existing facility on the Top 20 retrofit candidate site list. The TIRs provided information on the existing level of flow control and runoff treatment, opportunity to increase the capacity of the facility, and the documented soils at the facility. Existing facilities mapped in outwash soils were particularly important under the assumption that designed infiltration could provide additional flow control. Our review of the TIRs confirmed these existing facilities do not have unused capacity. Generally the upstream tributary areas are fully developed to the maximum extent allowed by zoning and critical areas.

Expanding flow control capacity at existing facilities, whether through volume expansion or designed infiltration, is a high priority for retrofit efforts. In addition to enhancing performance compared to current flow control standards designed to protect streams, additional capacity will make facilities more resilient to projected climate change impacts. Modeling results (based on a 2015 future precipitation scenario) suggest that Sammamish storm runoff will increase by 5 to 10 percent over the next few decades, further taxing the under-sized facilities. (Documentation of the climate change modeling is provided as Appendix C)

Using the TIRs, as-built drawings and field notes from the site visits, a reconnaissance investigation report was completed for each site. Appendix D includes the Retrofit Reconnaissance Investigation (RRI) form completed for the Top 20 retrofit candidate site.

TASK 3: PRIORITIZATION METHOD AND PROCESS

The retrofit prioritization process looked at four major categories to evaluate and rank a potential retrofit site: Site Feasibility, Environmental Benefit, Public Stewardship, and Opportunity. Within each of these categories are criteria that were scored on a scale of 1 to 5, with 1 being the worst and 5 being the best. The 20 criteria used for the Sammamish Retrofit Site Prioritization are listed in Table 6.

TABLE 6: SITE FEASIBILITY CRITERIA

Site Feasibility	Environmental Benefit
Ease of Permitting	Infiltration Potential
Potential Utility or Site Constraints	Level of Existing Water Quality Treatment
Parcel Ownership	Level of Existing Flow Control
Sufficiency of Space	Upstream Impervious Area
Project Impact on Site Uses & Operations	Upstream Pollution Generating Hard Surfaces
Ease of Drainage Infrastructure Modification	Redevelopment Potential
Sufficient Head for Treatment/Flow Control Options	Priority Stormwater Basin
Public Stewardship	**Unique Opportunity**
Address Drainage Issue or safety concern	Joint Projects
Ease of Long-Term Maintenance/ Replacing an Aging Asset	Funding Partners/Grants
Demonstration, Education & Furthering Community Goals	Other/Bonus (Optional, not used)

The potential retrofit prioritization method generates an overall maximum score of 100. After completing the matrix, the total score and the average score (total score divided by number of criteria) for the site are calculated. Final selection of preferred sites is then based on ranking of site ratings, with some consideration of other factors. The Retrofit Rating Form for each potential site is included in Appendix C, Exhibit 3. The City of Sammamish Project Rating Form is also included in Appendix C, Exhibit 4; this document provides guidance on completing the rating form.

The preferred sites were ranked based on their overall score from the Stormwater Retrofit Form. Table 7 lists each site in order of the highest scoring site to the lowest scoring site.

TABLE 7: RETROFIT SITE SCORING

SAMMAMISH STORMWATER RETROFIT RATING SUMMARY

SITE FEASIBILITY RATING MATRIX

Rank	Retrofit Site #, Name, Sammamish Drainage Facility #	Feasibility Score	Points (n / 95)	City Comments
1	**Retrofit Site #3000 - SWC SE 20th Street & 228th Ave SE / Drainage Facility No: DS0011**	3.26	62	
2	**Retrofit Site #2131 - Demery Hill / Drainage Facility No. D91349**	3.21	61	
3	**Retrofit Site #1548 - Cedar Cove / Drainage Facility No. DS0092**	3.21	61	
4	Retrofit Site #2095 - Eastlake High School / Drainage Facility No. D98396	3.16	60	
5	Retrofit Site #2363 - Tree Farm / Drainage Facility No. N/a	3.16	60	
6	Retrofit Site #2096 - Eastlake HS / Drainage Facility No. D98397	3.05	58	
7	Retrofit Site #2085 - Sammamish Library - Boys & Girls Club / Drainage Facility No. D98417	2.95	56	
8	Retrofit Site #2141 - 228th Ave NE/SE / Drainage Facility No. DS0015 & D98903	2.89	55	
9	Retrofit Site #2125 - Chestnut Lane / Drainage Facility No. D93012	2.89	55	
10	Retrofit Site #2132 - Greenbriar / Drainage Facility No. DS0001 & DS0002	2.84	54	
11	Retrofit Site #2160 - Sammamish Heights Estates / Drainage Facility No. DS0008	2.84	54	
12	Retrofit Site #2133 - Greens at Beaver Crest / Drainage Facility No. D92745	2.79	53	
13	Retrofit Site #2165 - Three Willows / Drainage Facility No. D92610	2.79	53	
14	Retrofit Site #1454 - Benham Ridge / Drainage Facility No. DS0043	2.74	52	
15	Retrofit Site #2120 - Bellasera / Drainage Facility No. D92883	2.58	49	
16	Retrofit Site #2158 - Renaissance / Drainage Facility No. D92854	2.58	49	
17	Retrofit Site #2128 - The Crossings at Pine Lake / Drainage Facility No. D92928	2.53	48	
18	Retrofit Site #2150 - The Meadow at Redford Ranch / Drainage Facility No. D92668	2.47	47	
19	Retrofit Site #2159 - Renaissance / Drainage Facility No. D92855	2.47	47	
20	Retrofit Site #1464 - Single-Family Residence / Drainage Facility No. D91456	2.05	39	

Based upon these scores and the city’s expressed desire to pursue three examples of retrofit projects, the following sites were developed to a 10% concept design level:

- Retrofit Site #3000 - SWC SE 20th Street & 228th Ave SE / Drainage Facility No: DS0011
- Retrofit Site #2131 - Demery Hill / Drainage Facility No. D91349
- Retrofit Site #1548 - Cedar Cove / Drainage Facility No. DS0092

TASK 4: CONCEPTUAL DESIGN & SIZING TOOLS

The outcome of the above tasks identified high priority areas and stormwater retrofit opportunities that can be further developed in subsequent basin-specific planning efforts. Tools were developed to help identify suitable types of retrofit projects including a list of Best Management Practices (BMPs) and Infiltration Facility Sizing Curves. Finally conceptual retrofit designs for the top three existing facility sites were prepared.

BMP MENU

The BMP Menu of suitable retrofit options addressing flow control and/ or runoff treatment at an existing facility was reviewed with city staff. Potential retrofit BMPs include:

- Adding a wetpool to an existing detention pond.
- Increasing live storage at an existing pond.
- Enlarging an existing facility and acquiring additional property for expansion.
- New flow control facilities with and without infiltration in an underserved area.
- Right-of-way and transportation related BMPs.

The final BMP Menu of Preferred Retrofits provides pros, cons and typical sizing requirements for each BMP, and is located on the following page.

Sammamish Stormwater Retrofit - Best Management Practice (BMP) Menu

March 31, 2021

Facility / Condition		Retrofit BMP Options	Treatment Targeted: Flow Control: Detention	Treatment Targeted: Flow Control: Infiltration	Treatment Targeted: Water Quality	Pros*	Cons*	Retrofit BMP Feasibility Criteria**
Existing	Detention Pond	Expand existing facility.	✓	-	-	Inexpensive, low maintenance	Need surface space	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct wetpool facility.	-	-	✓	Inexpensive, low maintenance	Need surface space, permanent ponding	Need surface space
		Construct infiltration columns in bottom of existing facility.	-	✓	-	No added footprint	Potentially expensive, high maintenance, regulatory hurdles	Groundwater separation, soil infiltration suitability requirements
	Detention Tank	Expand existing facility.	✓	-	-	Underground, under traffic	Possible utility conflicts	Structural loading requirements, buoyancy with groundwater, rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct treatment facility in series with existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation	Potentially expensive	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Detention Vault	Expand existing facility.	✓	-	-	Underground, under traffic	Expensive	Structural loading requirements, buoyancy with groundwater, rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct treatment facility in series with existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation	Potentially expensive	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Infiltration Pond, Tank, or Vault	Expand existing facility.	-	✓	-	Inexpensive, low maintenance, tanks and vaults can be placed underground and under traffic areas	Need surface space for pond expansion, tanks and vaults are potentially expensive, infiltration facilities are high maintenance	Groundwater separation, soil infiltration suitability, structural loading, and buoyancy considerations/requirements
		Construct treatment facility upstream of existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation	Potentially expensive, infiltration facilities are high maintenance	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Combined Facility	See retrofit options for other flow control and water quality facilities that the combined facility is comprised of.	✓	✓	✓	See pros, cons, and feasibility for BMPs associated with retrofit of facilities that the combined facility is comprised of.		
	Wetpond	Construct detention facility in series with existing facility.	✓	-	-	Inexpensive, low maintenance	Need surface space	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Reduces downstream flows, low maintenance	Need surface space	Groundwater separation, soil infiltration suitability requirements
		Construct another treatment facility in series with existing one or expand existing facility.	-	-	✓	Ability to treat larger basin, similar maintenance	Potentially expensive, need surface space for wetpond expansion	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
Existing	Wetvault	Construct detention facility in series with existing facility.	✓	-	-	Potentially low maintenance	Potentially expensive, need surface space	rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Potentially low maintenance	Potentially expensive, need surface space	Groundwater separation, soil infiltration suitability requirements
		Construct another treatment facility in series with existing facility.	-	-	✓	Low impact installation	Potentially expensive	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Sand Filter or Stormwater Wetland	Construct detention facility in series with existing facility.	✓	-	-	Inexpensive, low maintenance	Need surface space	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Inexpensive, low maintenance	Need surface space	Groundwater separation, soil infiltration suitability requirements
		Construct another treatment facility in series with existing facility.	-	-	✓	Low impact installation	Potentially expensive	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Conveyance Swale/Ditch	Replace soil with bioretention soil mix (BSM) or proprietary filter soil.	-	✓	✓	Low impact installation, low cost	Limited to existing space	Overland flow, rule of thumb: bioretention bottom area ≈ 5% of area draining to it
	Catch Basins	Replace with StormFilter catch basin structures.	-	-	✓	Low impact installation	Potentially expensive, relatively small impact	Existing outlet pipe must have sufficient depth
		Replace with bioretention cell/planter.	-	-	✓	Low maintenance	Need space	Need space, overland flow, rule of thumb: bioretention bottom area ≈ 5% of area draining to it, existing outlet pipe must have sufficient depth
New	Untreated Right-of-Way	Install new BMPs for treatment and/or flow control: • Bioretention with infiltration • Bioretention without infiltration • Shallow infiltration trenches • Deep infiltration (UIC wells) • StormFilter structures	✓	✓	✓	Potential to make new facility a streetscape amenity	Limited space within right-of-way, regulatory hurdles for deep infiltration, infiltration facilities are high maintenance	Need surface space and sufficient depth
	Untreated, Vacant Parcel	Install new BMPs for treatment and/or flow control: • Detention facility • Infiltration facility • Treatment facility • Combined facility	✓	✓	✓	Low impact on existing infrastructure	Acquisition of parcel or rights to parcel use, costly to purchase parcel	Need surface space and sufficient depth

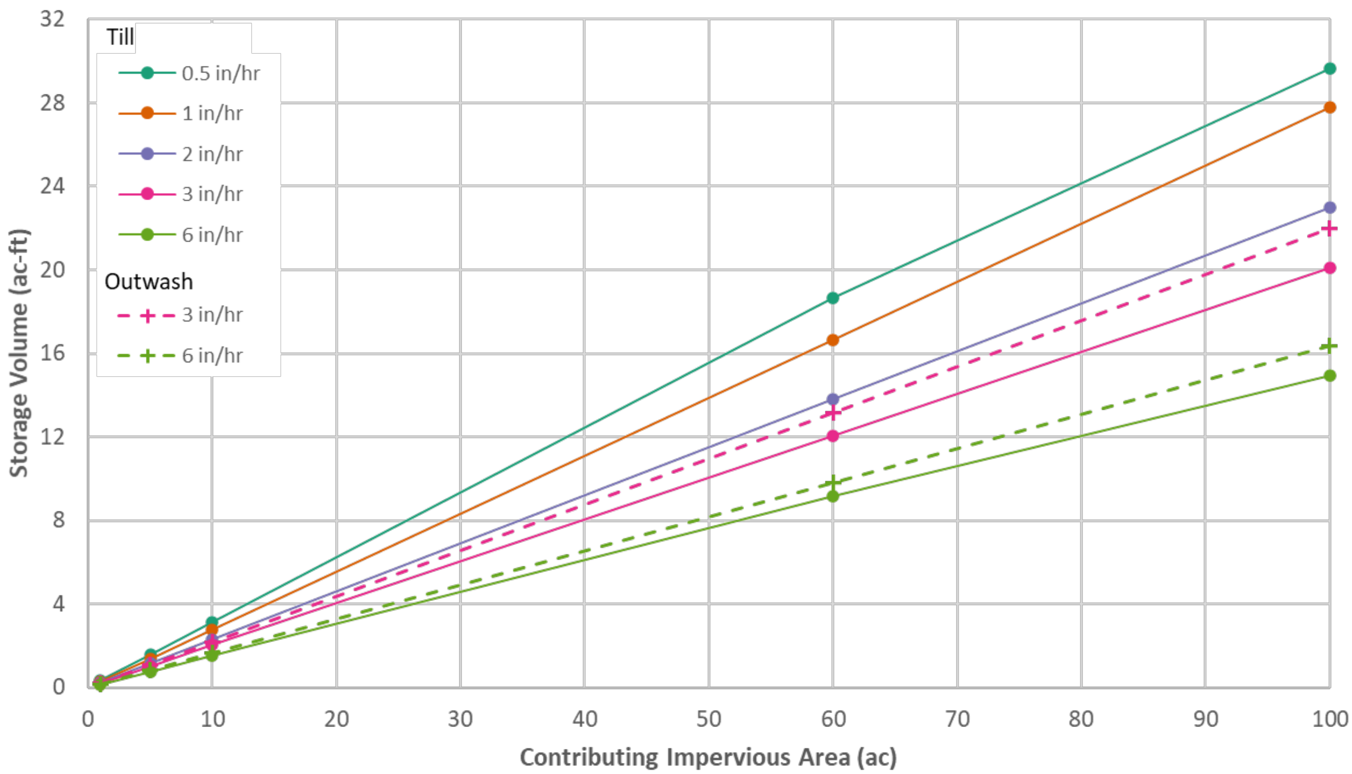
*Underground flow control facilities are considered expensive (e.g. $12 / cubic foot of storage for vaults or $10 / cubic foot for tanks. Above ground flow control facilities are considered inexpensive (e.g. $5 / cubic foot of storage for ponds). Proprietary treatment facilities are considered more expensive than non-proprietary; they cost roughly 50% more.

**Surface soils are considered suitable for infiltration if the design infiltration rate is 0.5 inches/hour or greater. Typical elevation difference between inlet and outlet (hydraulic drop) for treatment BMPs ranges from 1.5-3.5 feet.

SIZING CURVES

To support conceptual design of future facilities, a series of sizing curves (Figure 11) were developed to estimate the required volume for an infiltration facility meeting current flow control standards. These are intended to supplement existing “rules of thumb” for sizing detention facilities without infiltration. The family of curves, defined by rates of infiltration, was developed using the Western Washington Hydrology Model 2012 (WWHM2012), Ecology’s approved model for stormwater design in western Washington. Separate curves were developed for contributing areas with till-type soils versus outwash-type soils, as this affects the predevelopment (forested) flow condition that storage requirements are targeted to match. More infiltrative outwash soils require additional storage volume, even in an infiltration facility, because predevelopment runoff volumes are much lower.

FIGURE 11: INFILTRATION FACILITY SIZING CURVES



The model simulated runoff from varying sizes of contributing impervious area to a storage structure. The WWHM2012 Storage Vault element type was selected to represent the hypothetical storage since it is simpler to define than other facility types (e.g., detention pond). Within the vault, flow either infiltrates into native soil or, if volume exceeds infiltration capacity, is stored in the vault and released through a hypothetical outlet structure. The WWHM vault optimization tool, Auto Vault, was used to systematically adjust the vault size by modifying the footprint area and the outlet structure (an orifice and rectangular notch) to meet Ecology’s flow duration criteria. This optimization was repeated for a range of contributing areas and native soil infiltration rates to generate the series of curves. For these simulations, infiltration was assumed to be limited by native soil infiltration rates and to occur only through the storage vault bottom.

These sizing curves are intended for planning purposes only. Infiltration facility size needed to meet flow control requirements will depend on drainage area to the site, including pervious areas; distribution of soil types within the contributing area; and infiltration conditions at the vault site.

EXAMPLE CONCEPTUAL DESIGN

For the three highest scoring sites identified in Task 3 (Cedar Cove, Demery Hill and 228/20th), a conceptual design was prepared. Existing GIS data, topography, available geotechnical information and the base maps developed in the Parcel Analysis were used for the conceptual design. The retrofit strategy for flow control is to increase the facility's storage volume (by increasing the footprint, replacing side slopes with walls, deepening the facility) or to increase the use of infiltration if suitable soils are present. The general strategy for runoff treatment is to add an approved BMP such as a filter vault or bioretention. It is important to note retrofit projects are not required to meet the new and redevelopment criteria established in the Municipal Stormwater General Permits as Ecology recognizes constraints within the project retrofit site may control the size and capacity of the proposed Runoff Treatment.

The specific approach for each site is discussed below.

The Cedar Cove site in the Inglewood Drainage Basin was developed in 2001. Based on our site reconnaissance, the site did not present a substantial opportunity for a stormwater retrofit. The development upstream and immediately to the west did, however. This is the Claremont development, which was developed in 1992. Runoff from the development travels east, through Cedar Cove, undetained and untreated.

The upstream Claremont site presents an opportunity to improve the water quality of the runoff. This retrofit strategy does not meet the Lake Protection requirements presented in the 2016 *King County Surface Water Design Manual (KCSWDM)* but is a significant improvement to the existing site.

The *KCSWDM* indicates that a two-system treatment train is required to meet the Lake Protection standard. The first treatment system that is proposed is a grass-lined bioswale. This will be implemented in the existing drainage ditches that border the road to the maximum extent feasible. The next system is a proprietary media filter (Contech StormFilter). This system is not officially recognized in the *KCSWDM* but will provide an additional layer of treatment prior to leaving the site. Alternatively, the Ecology Manual lists several proprietary treatment devices that have approval for phosphorous removal and enhanced treatment and these devices could be used. (Documentation of the retrofit modeling is provided in Appendix E, Exhibit 1.)

<u>Grass-lined Bioswales:</u> Due to the site information required for sizing, calculations were not prepared for the bioswales. It is assumed that these will be two feet wide, which is the minimum, and replace the existing ditches. This will provide the maximum amount of treatment.

<u>Contech StormFilters</u>: The site was divided into five subbasins, which were approximately sized from record drawings and GIS contours. Each subbasin was assumed to be 60 percent impervious. The StormFilters are sized based on the water quality flowrate generated from a continuous runoff model. The WWHM2012 continuous model software provided this information for each subbasin, which is included in Appendix C. It was assumed that each facility had the required depth available. Existing site information should be confirmed, and the design should be refined as necessary.

It should be noted that not all subbasins will receive treatment from both systems. Based on assumed site grades and improvements, the bioswale is not feasible in every subbasin. Some existing catch basins and storm pipe may require replacement depending on their condition and depth.

Divisions 1 & 2 of the Demery Hill project, was developed in the mid-1980s in the Inglewood Drainage Basin. Based on our field reconnaissance and review of the record drawings, flow control is provided (42,000 CF) in a detention vault and runoff treatment is not provided. The existing concrete detention tank was sized using an older methodology (event-based model) and does not meet current standards. The retrofit strategy for this existing facility is to enlarge the detention vault and to add a proprietary media treatment vault on the outlet pipe from the detention vault. The outflow pipe heads west from the detention vault and connects to NE 8th Street. The storm pipe drops about 30 feet so adequate fall is available for the required drop through a treatment vault. The proposed vault expansion would add nearly 100,000 CF meeting approximately 59% of the volume required under current flow control standards. (Documentation of the retrofit modeling is provided in Appendix E, Exhibit 2.)

SE 20th St and 228th Ave SE Pond. In 2001 the City of Sammamish constructed improvements to 228th Ave SE between SE 24th and NE 8th. The stormwater runoff from the south end of this roadway project was treated in a combination detention/ wetpond at the southwest corner of SE 20th Street & 228th Ave SE. Pond outflows are intended to be further treated in a proprietary media filter vault. The wetpond and filter vault are considered a two-treatment train. The outlet control structure at this stormwater facility was not properly constructed. Consequently, increase peak flows have been observed downstream at the storm pipe outlet to Pine Lake.

The site reconnaissance indicated little room is available to increase the footprint of the pond. Rockeries comprises two sides of the pond, while earthen berms lie along the other two sides. The detention volume could be increased by converting the dead storage of the wetpond pond into live storage and lowering the pond outlet. Also taller retaining walls or berms around the pond perimeter would increase the storage in the facility. With these improvements the detention pond would then provide 63% of the required flow control treatment under current design requirements. A new treatment vault would be installed with a proprietary media approved by Ecology for enhanced treatment and phosphorous removal. (Documentation of the retrofit modeling is provided in Appendix E, Exhibit 3.)

CONCLUSION

Prioritization of watersheds and sub-basins for stormwater retrofits can target those areas with the most potential for reducing stormwater impacts and restoring beneficial uses in the watershed. In addition to providing environmental benefits, the prioritization method and process explained in this report has the following benefits:

- Public outreach informed elected officials and city residents of the environmental assets (Assess Receiving Water Conditions) in the City of Sammamish and the current condition of those assets.
- Stakeholders and residents were included in the prioritization process which will create support for future retrofit projects.
- Development of a prioritization method and process complies with requirements of the 2019 Western Washington Phase II Municipal Stormwater Permit.

REFERENCES

City of Sammamish. 2016. *Storm and Surface Water Comprehensive Plan*. October 2016.

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Commerce. 2016. *Building Cities in the Rain*. Washington Department of Commerce Publication 0006. September 2016.

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Ecology. 2019. *Stormwater Management Manual for Western Washington*. Washington Department of Ecology, Olympia, WA. Publication No. 19-10-021.

APPENDICES

APPENDIX A | SUBBASIN ASSESSMENT, PRIORITIZATION & RATING

EXHIBIT 1: Receiving Waters Assessment Inventory

EXHIBIT 2: Subbasin Scoring

APPENDIX B | PUBLIC OUTREACH

EXHIBIT 1: Stormwater Retrofit Stakeholder Questions. June 2020

EXHIBIT 2: City of Sammamish Stormwater Retrofit Strategy Stakeholder Presentation, June 23, 2020 and Public Briefing July 13, 2020.

EXHIBIT 3: Sammamish Stormwater Retrofit Strategy Stakeholder Presentation. Questions And Responses, June 23, 2020.

APPENDIX C | CLIMATE CHANGE ASSESSMENT

EXHIBIT 1: Memorandum by NHC, May 18, 2020

APPENDIX D | STORMWATER RETROFIT SITE FEASIBILITY

EXHIBIT 1: Retrofit Reconnaissance Field Guide

EXHIBIT 2: Retrofit Reconnaissance Investigation Forms (20 sites)

EXHIBIT 3: Retrofit Rating Forms (20 sites)

EXHIBIT 4: Sammamish Retrofit Rating Form Instructions

APPENDIX E | STORMWATER RETROFIT CONCEPTUAL DESIGN

EXHIBIT 1: Cedar Cove Stormwater Retrofit Conceptual Design

EXHIBIT 2: Demery Hill Division 1 & 2 Stormwater Retrofit Conceptual Design

EXHIBIT 3: SE 20th St & 228th SE Stormwater Retrofit Conceptual Design

APPENDIX A

ZACKUSE SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Zackuse Creek (mainstem & south tributary) 5 listed wetlands (none identified to contain Sphagnum Bog Ecosystem) Lake Sammamish
Drainage Complaints	Beavers - 0 Erosion - 5 Flooding - 2 Groundwater - 1 Monitoring & Maintenance - 3 Total = 11
Sub-basin area (within City limits)	253 acres (0.40 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	68 acres (27%)
Forested surface coverage (within City limits)	91 acres (36%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 18% Limited (prior to flow duration standard) - 73% None - 9% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 18% Limited (prior to 1998) - 0% None - 82%
Biological Considerations	Kokanee salmon expected to spawn in lower reaches of Zackuse Creek. Cutthroat trout expected to be found throughout Zackuse Creek. Habitat is suitable for coho salmon below 206th Ave NE. No waterbodies within sub-basin are identified as impaired on 303(d) list. Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 27% Residential MED - 73% Residential HI - 0% Commercial - 0% Town Center - 0%

PANHANDLE SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Several un-named streams 8.6 acres of wetlands No wetlands identified to contain Sphagnum Bog Ecosystem Lake Sammamish
Drainage Complaints	Beavers - 0 Erosion - 1 Flooding - 1 Groundwater - 0 Monitoring & Maintenance - 1 Total = 3
Sub-basin area (within City limits)	1078 acres (1.68 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	266 acres (25%)
Forested surface coverage (within City limits)	368 acres (34%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 7% Limited (prior to flow duration standard) - 48% None - 45% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 2% Limited (prior to 1998) - 31% None - 67%
Biological Considerations	Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	 Residential LO - 0% Residential MED - 100% Residential HI - 0% Commercial - 0% Town Center - 0%

INGLEWOOD SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	George Davis Creek Tributary 0145 136.5 acres of wetlands 1 wetland identified to contain Sphagnum Bog Ecosystem Lake Sammamish Illahe Lake
Drainage Complaints	Beavers - 0 Erosion - 1 Flooding - 6 Groundwater - 2 Monitoring & Maintenance - 1 Total = 10
Sub-basin area (within City limits)	1718 acres (2.68 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	517 acres (30%)
Forested surface coverage (within City limits)	430 acres (25%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 59% Limited (prior to flow duration standard) - 30% None - 11% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 57% Limited (prior to 1998) - 25% None - 18%
Biological Considerations	George Davis Creek is considered a primary kokanee spawning stream George Davis Creek is on the Category 5 303(d) list for bacteria George Davis Creek is on the Category 5 303(d) list for bioassessment George Davis Creek is on the Category 5 303(d) list for temp. George Davis Creek is on the Category 2 303(d) list for copper George Davis Creek is on the Category 2 303(d) list for DO George Davis Creek is on the Category 1 303(d) list for ammonia George Davis Creek has a good B-IBI score (66.1) Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 23% Residential MED - 56% Residential HI - 7% Commercial - 2% Town Center - 11%

THOMPSON SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Ebright Creek Ebright Creek Tributary Stream 49.8 acres of wetlands No wetlands identified to contain Sphagnum Bog Ecosystem Lake Sammamish
Drainage Complaints	Beavers - 0 Erosion - 0 Flooding - 1 Groundwater - 0 Monitoring & Maintenance - 0 Total = 1
Sub-basin area (within City limits)	776 acres (1.21 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	157 acres (20%)
Forested surface coverage (within City limits)	256 acres (33%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 54% Limited (prior to flow duration standard) - 6% None - 40% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 54% Limited (prior to 1998) - 5% None - 41%
Biological Considerations	Ebright Creek is considered a primary kokanee spawning stream Ebright Creek is on the Category 1 303(d) list for arsenic, selenium, ammonia, bacteria, and copper Ebright Creek is on the Category 2 303(d) list for DO and mercury Ebright Creek is on the Category 5 303(d) list for bioassessment Ebright Creek has a fair B-IBI score (53.3) Lake Sammamish is on the 303(d) list for several categories and parameters.
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	 Residential LO - 49% Residential MED - 37% Residential HI - 5% Commercial - 0% Town Center - 9%

MONOHON SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Many Springs Creek Tributary 0163 2 un-named streams 14.3 acres of wetlands 1 wetland identified to contain Sphagnum Bog Ecosystem Lake Sammamish
Drainage Complaints	Beavers - 0 Erosion - 2 Flooding - 0 Groundwater - 2 Monitoring & Maintenance - 0 Total = 4
Sub-basin area (within City limits)	1262 acres (1.97 square miles)
Sub-basin area (outside City limits)	75 acres (0.12 square miles)
Percent of Sub-Basin Within City Limits	94%
Impervious surface coverage (within City limits)	245 acres (19%)
Forested surface coverage (within City limits)	556 acres (44%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 7% Limited (prior to flow duration standard) - 33% None - 60% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 5% Limited (prior to 1998) - 23% None - 72%
Biological Considerations	An un-named creek is on the Category 5 303(d) list for bioassessment Many Springs Creek has a fair B-IBI score (55.5) Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 41% Residential MED - 58% Residential HI - 1% Commercial - 0% Town Center - 0%

PINE LAKE SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Pine Lake (wetland) Kanin Creek 155.4 acres of wetlands 1 wetland identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 0 Erosion - 0 Flooding - 1 Groundwater - 0 Monitoring & Maintenance - 0 Total = 1
Sub-basin area (within City limits)	483 acres (0.75 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	126 acres (26%)
Forested surface coverage (within City limits)	98 acres (20%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (2005-current) - 75% Limited (1998-2005) - 16% None - 9% Runoff treatment provided (% of sub-basin area): Significant (1998-current) - 77% Limited (Prior to 1998) - 15% None - 9%
Biological Considerations	Pine Lake is on the Category 2 303(d) list for bacteria Pine Lake is on the Category 1 303(d) list for P Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 0% Residential MED - 94% Residential HI - 3% Commercial - 3% Town Center - 0%

PINE LAKE CREEK SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Pine Lake Creek Kanin Creek 155.4 acres of wetlands 1 wetland identified to contain Sphagnum Bog Ecosystem Lake Sammamish
Drainage Complaints	Beavers - 1 Erosion - 1 Flooding - 0 Groundwater - 0 Monitoring & Maintenance - 0 Total = 2
Sub-basin area (within City limits)	714 acres (1.12 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	112 acres (16%)
Forested surface coverage (within City limits)	282 acres (40%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (2005-current) - 22% Limited (1998-2005) - 31% None - 47% Runoff treatment provided (% of sub-basin area): Significant (1998-current) - 22% Limited (Prior to 1998) - 8% None - 70%
Biological Considerations	Pine Lake Creek is considered a primary kokanee spawning stream Pine Lake Creek is on the Category 1 303(d) list for arsenic, selenium, ammonia, and copper Pine Lake Creek is on the Category 2 303(d) list for mercury Pine Lake Creek is on the Category 5 303(d) list for DO, temp., bioassessment, and bacteria Pine Lake Creek has a poor B-IBI score (31.8) Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 66% Residential MED - 34% Residential HI - 0% Commercial - 0% Town Center - 0%

BEAVER LAKE SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Beaver Lake Long Lake Un-named stream 132.7 acres of wetlands 1 wetland identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 2 Erosion - 0 Flooding - 2 Groundwater - 0 Monitoring & Maintenance - 0 Total = 4
Sub-basin area (within City limits)	728 acres (1.14 square miles)
Sub-basin area (outside City limits)	211 acres (0.33 square miles)
Percent of Sub-Basin Within City Limits	78%
Impervious surface coverage (within City limits)	123 acres (17%)
Forested surface coverage (within City limits)	275 acres (38%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 72% Limited (prior to flow duration standard) - 1% None - 27% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 72% Limited (prior to 1998) - 1% None - 27%
Biological Considerations	Beaver Lake is on the Category 5 303(d) list for P
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	 Residential LO - 14% Residential MED - 86% Residential HI - 0% Commercial - 0% Town Center - 0%

LAUGHING JACOBS SUB-BASIN

Watershed	East Lake Sammamish
Waterbodies	Laughing Jacobs Creek Several un-named streams 126.2 acres of wetlands 4 wetlands identified to contain Sphagnum Bog Ecosystem Laughing Jacobs Lake (wetland) Lake Sammamish
Drainage Complaints	Beavers - 8 Erosion - 1 Flooding - 4 Groundwater - 2 Monitoring & Maintenance - 8 Total = 23
Sub-basin area (within City limits)	2138 acres (3.34 square miles)
Sub-basin area (outside City limits)	503 acres (0.79 square miles)
Percent of Sub-Basin Within City Limits	81%
Impervious surface coverage (within City limits)	607 acres (28%)
Forested surface coverage (within City limits)	468 acres (22%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 47% Limited (prior to flow duration standard) - 30% None - 23% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 47% Limited (prior to 1998) - 15% None - 38%
Biological Considerations	Laughing Jacobs Lake is phosphorus sensitive Laughing Jacobs Creek is on the Category 1 303(d) list for ammonia Laughing Jacobs Creek is on the Category 5 303(d) list for bacteria, bioassessment, temp., and DO Laughing Jacobs Creek has a fair B-IBI score (40.4) Laughing Jacobs Creek is considered a primary kokanee spawning stream Lake Sammamish is on the 303(d) list for several categories and parameters
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 11% Residential MED - 86% Residential HI - 2% Commercial - 1% Town Center - 0%

MYSTIC LAKE SUB-BASIN

Watershed	Bear Creek
Waterbodies	Mystic Lake (wetland) 12.5 acres of wetlands No wetlands identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 0 Erosion - 0 Flooding - 0 Groundwater - 1 Monitoring & Maintenance - 1 Total = 2
Sub-basin area (within City limits)	93 acres (0.15 square miles)
Sub-basin area (outside City limits)	0 acres (0.00 square miles)
Percent of Sub-Basin Within City Limits	100%
Impervious surface coverage (within City limits)	39 acres (42%)
Forested surface coverage (within City limits)	13 acres (14%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 30% Limited (prior to flow duration standard) - 70% None - 0% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 30% Limited (prior to 1998) - 70% None - 0%
Biological Considerations	Mystic lake is classified as a wetland
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 1% Residential MED - 99% Residential HI - 0% Commercial - 0% Town Center - 0%

ALLEN LAKE SUB-BASIN

Watershed	Bear Creek
Waterbodies	Allen Lake (outside City limits) Several un-named streams 47.6 acres of wetlands No wetlands identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 1 Erosion - 0 Flooding - 0 Groundwater - 1 Monitoring & Maintenance - 0 Total = 2
Sub-basin area (within City limits)	260 acres (0.41 square miles)
Sub-basin area (outside City limits)	47 acres (0.07 square miles)
Percent of Sub-Basin Within City Limits	85%
Impervious surface coverage (within City limits)	75 acres (29%)
Forested surface coverage (within City limits)	46 acres (18%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 75% Limited (prior to flow duration standard) - 9% None - 16% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 75% Limited (prior to 1998) - 0% None - 25%
Biological Considerations	Allen Lake is on the Category 5 303(d) list for P
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	 Residential LO 40% Residential MED - 60% Residential HI - 0% Commercial - 0% Town Center - 0%

EVANS CREEK SUB-BASIN

Watershed	Bear Creek
Waterbodies	Evans Creek Several un-named streams 68.2 acres of wetlands 3 wetlands identified to contain Sphagnum Bog Ecosystem (one outside City limits)
Drainage Complaints	Beavers - 1 Erosion - 1 Flooding - 3 Groundwater - 1 Monitoring & Maintenance - 3 Total = 9
Sub-basin area (within City limits)	1956 acres (3.06 square miles)
Sub-basin area (outside City limits)	7259 acres (11.34 square miles)
Percent of Sub-Basin Within City Limits	21%
Impervious surface coverage (within City limits)	541 acres (28%)
Forested surface coverage (within City limits)	373 acres (19%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 19% Limited (prior to flow duration standard) - 74% None - 7% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 19% Limited (prior to 1998) - 44% None - 37%
Biological Considerations	Tributary 0111A is on the Category 4A 303(d) list for temp Tributary 0111A has a fair - good/fair B-IBI score (41.9) Tributary 0111E to Evans Creek is on the Category 5 303(d) list for bioassessment Tributary 0111E has a fair - good/fair B-IBI score (54.7) Evans Creek (outside City) is on the 303(d) list for several categories and parameters Evans Creek (outside City) has a poor B-IBI score (35.0)
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	 Residential LO - 11% Residential MED - 89% Residential HI - 0% Commercial - 0% Town Center - 0%

NORTH FORK ISSAQUAH CREEK SUB-BASIN

Watershed	Issaquah Creek
Waterbodies	Yellow Lake (wetland) North Fork Issaquah Creek Several un-named streams 45.9 acres of wetlands No wetlands identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 0 Erosion - 0 Flooding - 1 Groundwater - 0 Monitoring & Maintenance - 0 Total = 1
Sub-basin area (within City limits)	725 acres (1.13 square miles)
Sub-basin area (outside City limits)	2253 acres (3.52 square miles)
Percent of Sub-Basin Within City Limits	24%
Impervious surface coverage (within City limits)	277 acres (38%)
Forested surface coverage (within City limits)	139 acres (19%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 18% Limited (prior to flow duration standard) - 82% None - 0% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 23% Limited (prior to 1998) - 67% None - 10%
Biological Considerations	North For Issaquah Creek is on the Category 5 303(d) list for DO North For Issaquah Creek is on the Category 5 303(d) list for temp. North For Issaquah Creek is on the Category 4A 303(d) list for fecal coliform North Fork Issaquah Creek has a fair B-IBI score (43.0)
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 2% Residential MED - 79% Residential HI - 17% Commercial - 3% Town Center - 0%

PATTERSON CREEK SUB-BASIN

Watershed	Patterson Creek
Waterbodies	Tributary to Canyon Creek, which is tributary to Patterson Creek 40.2 acres of wetlands 2 wetlands identified to contain Sphagnum Bog Ecosystem
Drainage Complaints	Beavers - 1 Erosion - 0 Flooding - 0 Groundwater - 0 Monitoring & Maintenance - 0 Total = 1
Sub-basin area (within City limits)	1066 acres (1.67 square miles)
Sub-basin area (outside City limits)	12089 acres (18.89 square miles)
Percent of Sub-Basin Within City Limits	8%
Impervious surface coverage (within City limits)	351 acres (33%)
Forested surface coverage (within City limits)	197 acres (18%)
Water Quality Summary	Flow control provided (% of sub-basin area): Significant (since flow duration standard) - 80% Limited (prior to flow duration standard) - 20% None - 0% Runoff treatment provided (% of sub-basin area): Significant (1998 - current) - 80% Limited (prior to 1998) - 20% None - 0%
Biological Considerations	This sub-basin drains to Canyon Cr., which drains to Patterson Cr. Canyon Creek is on the Category 1 303(d) list for temperature Patterson Creek is on the Category 2 303(d) list for pH Patterson Creek is on the Category 4A 303(d) list for DO, temp, and bacteria Canyon Creek has an excellent B-IBI score (86.8) Patterson Creek (outside City) has a fair B-IBI score (49.4)
Zoning Designations Residential LO (R-1) Residential MED (R-4 & R-6) Residential HI (R-8, R-12, R-18) Commercial (NB, CB, O) Town Center (TC A thru TC E)	Residential LO - 21% Residential MED - 79% Residential HI - 0% Commercial - 0% Town Center - 0%

1 INTRODUCTION

As a condition of its NPDES Phase 2 municipal stormwater permit, the City of Sammamish (City) is required to perform a citywide watershed assessment, prioritize watersheds for retrofits and other stormwater management actions, and develop a Stormwater Management Action Plan (SMAP) for a priority watershed. This report documents the watershed prioritization process, building from information collected during the earlier receiving water assessment.

Consistent with Ecology guidance, the City is following a prioritization framework developed by Ecology as part of the Puget Sound Characterization study and documented in the *Building Cities in the Rain* watershed prioritization guidance (Dept. of Commerce, 2016). The framework (Figure 1) uses level of importance and level of degradation to define the types of actions appropriate for protection and/or restoration of beneficial uses.

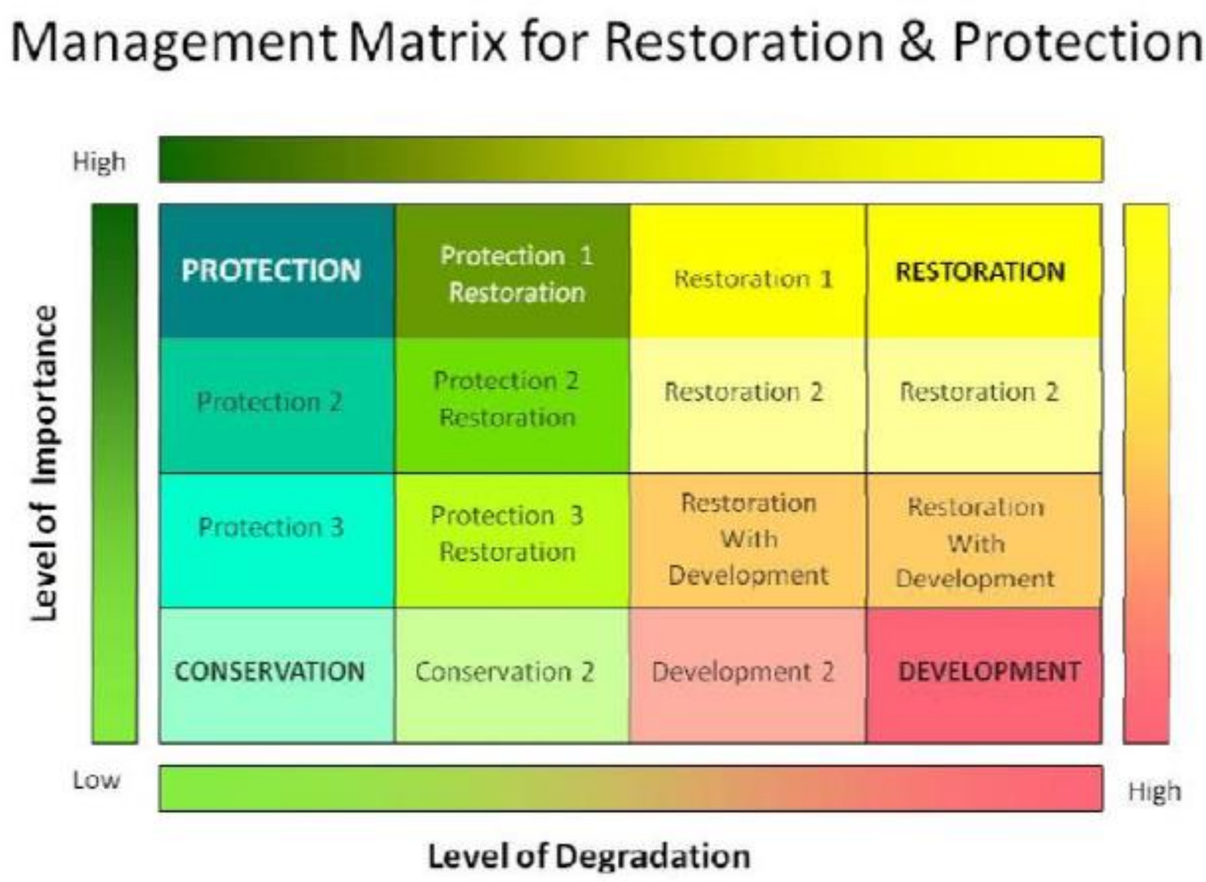


Figure 1. Puget Sound Characterization Stormwater Management Framework (Source: Dept. of Commerce, 2016)

The prioritization process consisted of two major tasks:

- Subbasin characterization and scoring. Use subbasin characteristics defined from the data to assign scores to metrics related to resource value or degradation.

- Figures Subbasin ranking and prioritization.

2 SUBBASIN CHARACTERIZATION

There are 14 planning subbasins, draining to four distinct receiving waters, within the City of Sammamish (Figure 2). A GIS-based screening process was used to characterize each subbasin in terms of its relative resource value (or importance for natural processes and aquatic species) and level of degradation from existing development and other human impacts.

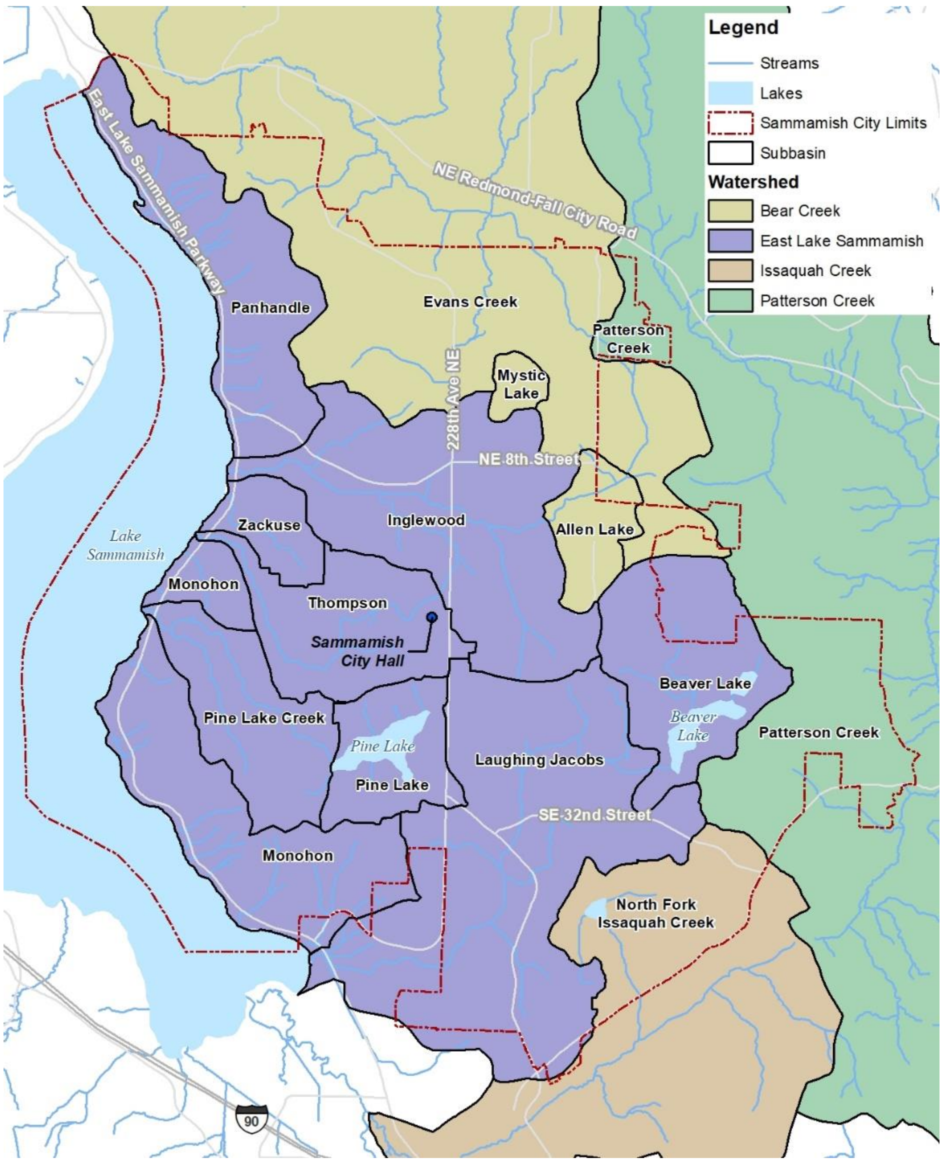


Figure 2. City of Sammamish Subbasins

Most of the GIS data used for subbasin characterization were provided by the City of Sammamish. These data sets included:

- Hydrography, including streams and wetlands

- Stormwater system mapping, including stormwater facilities and attributes
- Impervious surface mapping
- Forest cover mapping
- Zoning

City GIS data were supplemented by LiDAR topography, soils/surface geology, and aquifer recharge areas obtained from King County, Sammamish Plateau Water and Sewer District (SPWSD), and other public data sources. Most of the data were collected and summarized at the subbasin level for the earlier Receiving Water Assessment work. Also as part of the Receiving Water Assessment, the baseline data were used to develop supplemental datasets mapping existing land use and levels of stormwater treatment.

The GIS data and other information collected as part of the Receiving Waters Assessment were used to rank the 14 subbasins in terms of 12 individual metrics related to resource value/importance or level of degradation. Metrics were calculated only for the portion of the subbasin within Sammamish city limits, since data outside of city limits was not consistently available. Values for each metric were assigned a score from zero to three, and scores were summed to provide a relative comparison of each subbasin on the "Importance" and "Degradation" axes.

Resource Value/Importance Metrics

These metrics represent basin conditions that preserve natural processes and support healthy streams and aquatic species. Higher scores indicate greater value. Ranges were developed based on experience and scientific understanding of impact thresholds (where available) and to distribute values for Sammamish subbasins over the range.

Forest Land Cover: Percent of subbasin area with forest land cover based on UW canopy cover study mapping (University of Washington, 2018). Forest cover is indicative of undisturbed (or less disturbed) landscape. Forested areas produce a hydrologic response with less surface runoff and higher baseflows—conditions that are correlated with stable stream channels and higher ecological function.

Percent Forest Cover	Scoring
0 – 10%	0
10 % - 30%	1
30% - 50%	2
> 50%	3

Wetlands: Presence and quality of wetlands in subbasin based on the Washington Department of Ecology wetland rating system. Wetlands provide aquatic habitat, water quality benefits, and natural flow buffering.

Wetland Rating	Scoring
No wetlands	0
3 - 4	1
2	2
1	3

Riparian Forest: Percent of riparian corridor (200-foot buffer on either side of stream) within subbasin with forest land cover. Based on UW canopy cover study mapping (University of Washington, 2018). Riparian canopy cover provides nutrient inputs, wood recruitment, and shading critical to maintaining fish-friendly stream temperatures.

Percent Riparian Forest	Scoring
0 – 20%	0
20% - 40%	1
40 % - 60%	2
> 60%	3

Potential Habitat: Total stream length in the basin used as proxy for potential aquatic habitat. Habitat assessments are available for some streams but not consistently throughout the city, so habitat quality is not included.

Stream Length (km)	Scoring
0 - 1	0
1 - 2	1
2 - 6	2
> 6	3

Fish Use: Scoring based on current and historic observed fish species. The endangered Lake Sammamish kokanee are a priority species for this area, so scoring emphasizes kokanee.

Fish Use	Scoring
No Fish Use/Unknown	0
Other Fish Species	1
Historic Kokanee and/or Other Salmonids	2
Known Kokanee Use	3

Groundwater Recharge: Percent of subbasin area with outwash soils or designated critical aquifer recharge or wellhead protection areas. Based on surface geology data and critical areas data from City of Sammamish, SPWSD, and King County. Preservation of groundwater recharge is important to maintaining summer baseflows in streams.

Percent Recharge Area	Scoring
0 – 10%	0
10% - 30%	1
30% - 50%	2
> 50%	3

Table 1 lists the value scores for each metric by subbasin. The aggregate value score, determined from a weighted average of the individual scores, was used to assign a position on the Importance axis in the prioritization matrix. Only Fish Use was assigned a weight other than one; weight for the fish use score was doubled based on feedback received by the City from multiple community and stakeholder groups regarding the importance of Lake Sammamish kokanee to the area and the city. Figure 3 illustrates the relative resource value of the in-city portion of each subbasin. Subbasins shaded in green were calculated as having the highest relative value while the subbasins shaded in red were lowest.

Table 1. Resource Value Scoring

Subbasin	Total Area (acres)	% in City	Riparian Forest	Potential Habitat	Fish Use‡	Forest Cover	Wetland Area	Ground-water Recharge	Aggregate Value Score
Allen Lake	307	85	1	0	0	1	1	2	**0.71**
Mystic Lake	93	100	0	0	0	1	1	3	**0.71**
Beaver Lake	939	78	2	2	1	2	2	2	**1.71**
Pine Lake	483	100	1	2	1	1	3	0	**1.29**
Evans Creek†	9,215	21	3	3	2	1	1	2	**2.00**
Patterson Creek†	13,155	8	2	1	2	1	2	2	**1.71**
North Fork Issaquah†	2,977	24	2	2	2	1	2	3	**2.00**
Laughing Jacobs	2,641	81	2	3	3	1	1	3	**2.29**
Inglewood	1,718	100	2	3	2	1	1	2	**1.86**
Thompson	776	100	3	2	3	2	1	0	**2.00**
Panhandle	1,078	100	3	3	0	2	1	1	**1.73**
Pine Lake Creek	714	100	3	3	2	2	2	0	**2.00**
Zackuse	253	100	3	1	3	2	0	1	**1.86**
Monohon	1,337	94	3	3	0	2	1	0	**1.29**

†Subbasin excluded from prioritization since less than 50% of watershed is within city limits.
‡Double weight applied to Fish Use metric.

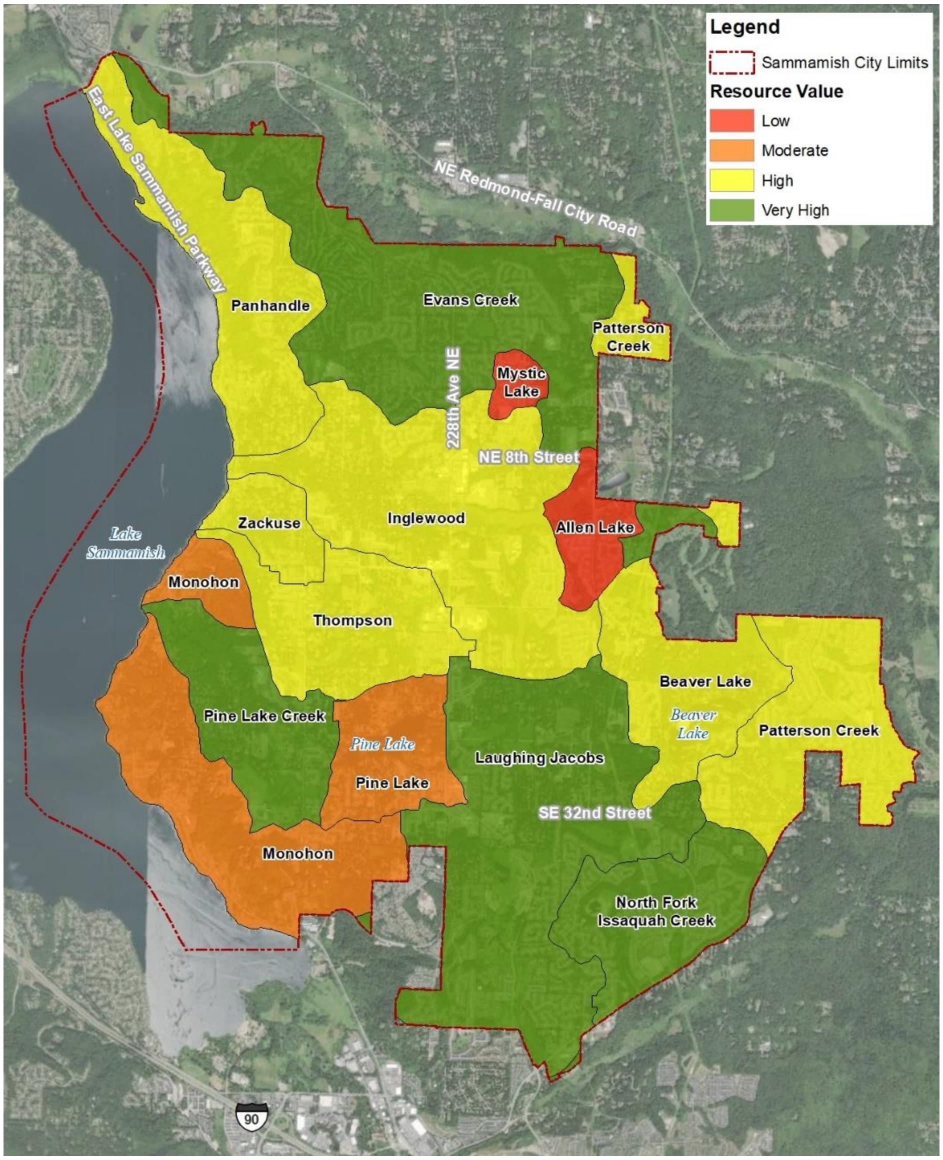


Figure 3. Relative Value/Importance by Subbasin

Degradation Metrics

These metrics represent basin conditions that disturb natural processes and are linked with negative impacts on streams and aquatic species. Higher scores indicate greater level of degradation. Ranges were developed based on experience and scientific understanding of impact thresholds (where available) and to distribute values for Sammamish subbasins over the range.

Impervious Surface: Percent of subbasin area with impervious land cover (excluding deck and dock areas). Higher runoff from impervious surfaces increases peak flows and stormflow volumes in streams, which leads to erosion and channel instability that disrupt habitat and stream biology.

Percent Impervious Surface	Scoring
0 – 10%	0
10% - 30%	1
30% - 50%	2
> 50%	3

Land Use: Dominant land use calculated as a weighted score based on percent of each category in the subbasin. Denser, higher traffic land uses generate increased stormwater runoff and pollutant loads. Land use categories were based on zoning adjusted for undeveloped areas.

Land Use Type	Scoring
Undeveloped	0
Residential – Low	1
Residential – Medium	2
Residential – High Commercial Town Center Roadways	3

Existing Flow Control Treatment: Relative effectiveness of existing flow control treatment based on facility age. Calculated as a weighted score of previously mapped treatment effectiveness. Current stormwater regulations (including flow duration control) provide much higher level of protection to streams than earlier peak flow-based standards.

Existing Flow Control	Scoring
Undeveloped	0
Significant (2005 or later)	1
Limited (1998-2005)	2
None (Pre-1998 or untreated)	3

Existing Water Quality Treatment: Relative effectiveness of existing flow control treatment based on facility age. Calculated as a weighted score of previously mapped treatment effectiveness. Current stormwater regulations require more water quality treatment than earlier standards.

Existing Water Quality	Scoring
Undeveloped	0
Significant (2005 or later)	1
Limited (1998-2005)	2
None (Pre-1998 or untreated)	3

Water Quality Impairment: Number of Level 4 or Level 5 303d listings for streams in the subbasin. Level 4 or 5 status on Ecology's 303d list indicates significant impairment for that water quality constituent, requiring mitigation actions.

303D Listings (Level 4 or 5)	Scoring
None	0
1	1
2	2
>2	3

Road Crossings: Number of road crossings per mile of stream in each subbasin, computed by intersecting street and stream networks. Road crossings disrupt a stream's riparian corridor and increase efficiency of runoff delivery to the stream, which increases peak flows. Culverts at many crossings may also be undersized and limit fish passage for certain species and life stages.

Road crossings per stream mile	Scoring
< 0	0
1 – 2	1
2 – 4	2
> 4	3

Table 2 lists the degradation scores for each metric by subbasin. The aggregate degradation score, determined from a weighted average of the individual scores, was used to assign a position on the Importance axis in the prioritization matrix. All degradation metrics were weighted evenly, so the value is the arithmetic average of the individual scores. Figure 4 illustrates the relative level of degradation of the in-city portion of each subbasin. Subbasins shaded in green were calculated as having the lowest relative degradation while the subbasins shaded in red were highest.

Table 2 Level of Degradation Scoring

Subbasin	Total Area (acres)	% in City	Impervious Surface	Land Use	Existing Flow Control	Existing WQ	WQ Impair-ment	Road xings	Aggregate Degradation Score
Allen Lake	307	85	1	1.3	0.69	0.73	1	1	0.95
Mystic Lake	93	100	2	1.84	1.46	1.46	0	0	1.13
Beaver Lake	939	78	1	1.15	0.86	0.86	1	2	1.14
Pine Lake	483	100	1	1.66	1.09	1.08	0	2	1.14
Evans Creek†	9,215	21	1	1.65	1.47	1.72	3	2	1.81
Patterson Creek†	13,155	8	2	1.47	0.91	0.91	0	3	1.38
North Fork Issaquah†	2,977	24	2	2.03	1.57	1.62	3	1	1.87
Laughing Jacobs	2,641	81	1	1.65	1.43	1.55	3	2	1.77
Inglewood	1,718	100	2	1.68	1.17	1.25	3	2	1.85
Thompson	776	100	1	1.30	1.25	1.25	1	1	1.13
Panhandle	1,078	100	1	1.49	1.53	1.75	0	3	1.46
Pine Lake Creek	714	100	1	0.99	1.23	1.44	3	2	1.61
Zackuse	253	100	1	1.59	1.46	2.04	0	2	1.35
Monohon	1,337	94	1	1.26	1.63	1.73	1	3	1.60

†Subbasin excluded from prioritization since less than 50% of watershed is within city limits.

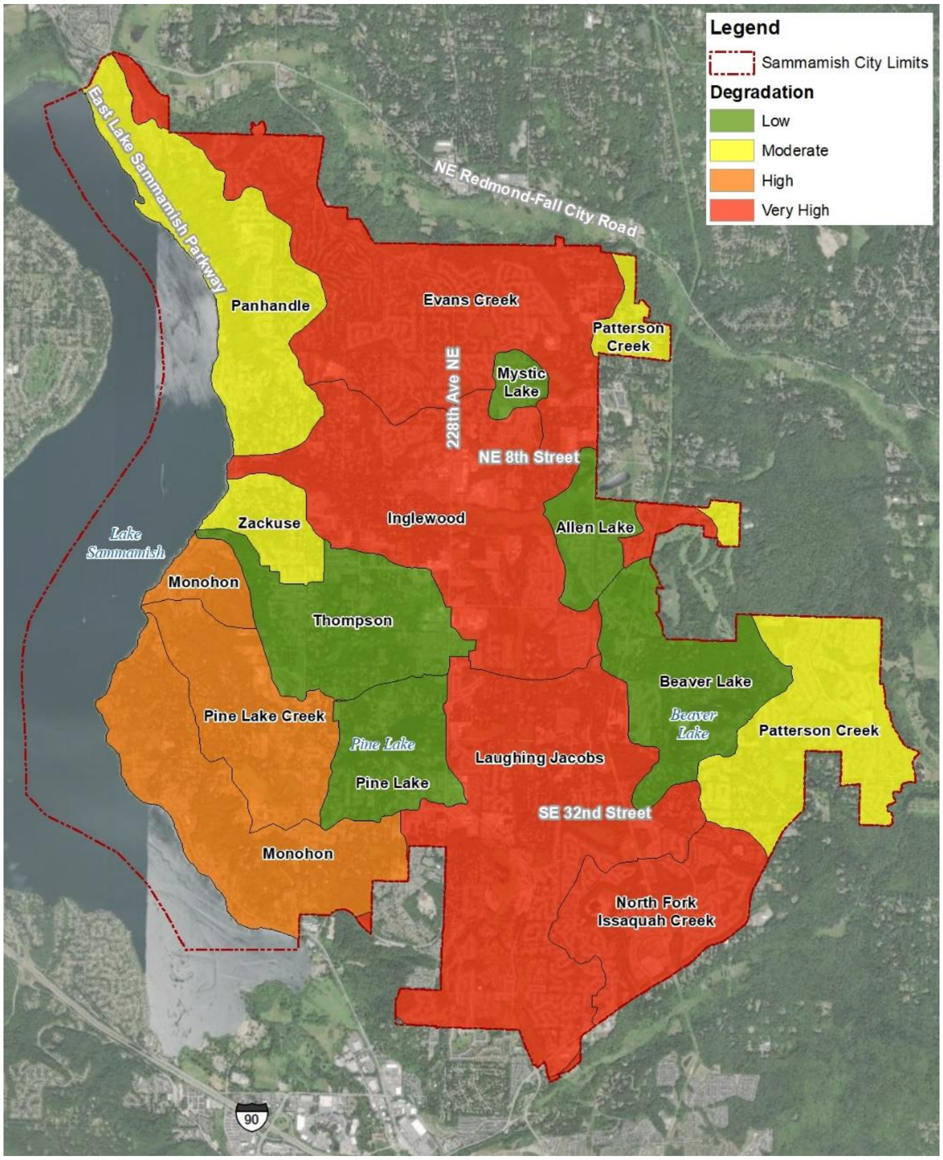


Figure 4. Relative Degradation Level by Subbasin

Draft results of the subbasin characterization and scoring were presented to local stakeholders and the Sammamish community as part of a public process through two virtual meetings. Comments and input from stakeholders, including City government, agencies, neighboring jurisdictions, and NGOs, were incorporated into the GIS analysis and score weighting before presenting the process and results to the general public.

3 SUBBASIN PRIORITIZATION

Subbasin degradation and value scores (from Table 2 and Table 1, respectively) were plotted on the management matrix as shown below in Figure 5. Since only a small portion of the Evans Creek, Patterson Creek, and North Fork Issaquah Creek basins are located within the boundaries of Sammamish, these subbasins were excluded from prioritization, consistent with Ecology guidelines. While the City may pursue stormwater management projects in these areas to provide local benefits, actions within City jurisdiction would be limited in ability to impact overall basin conditions.

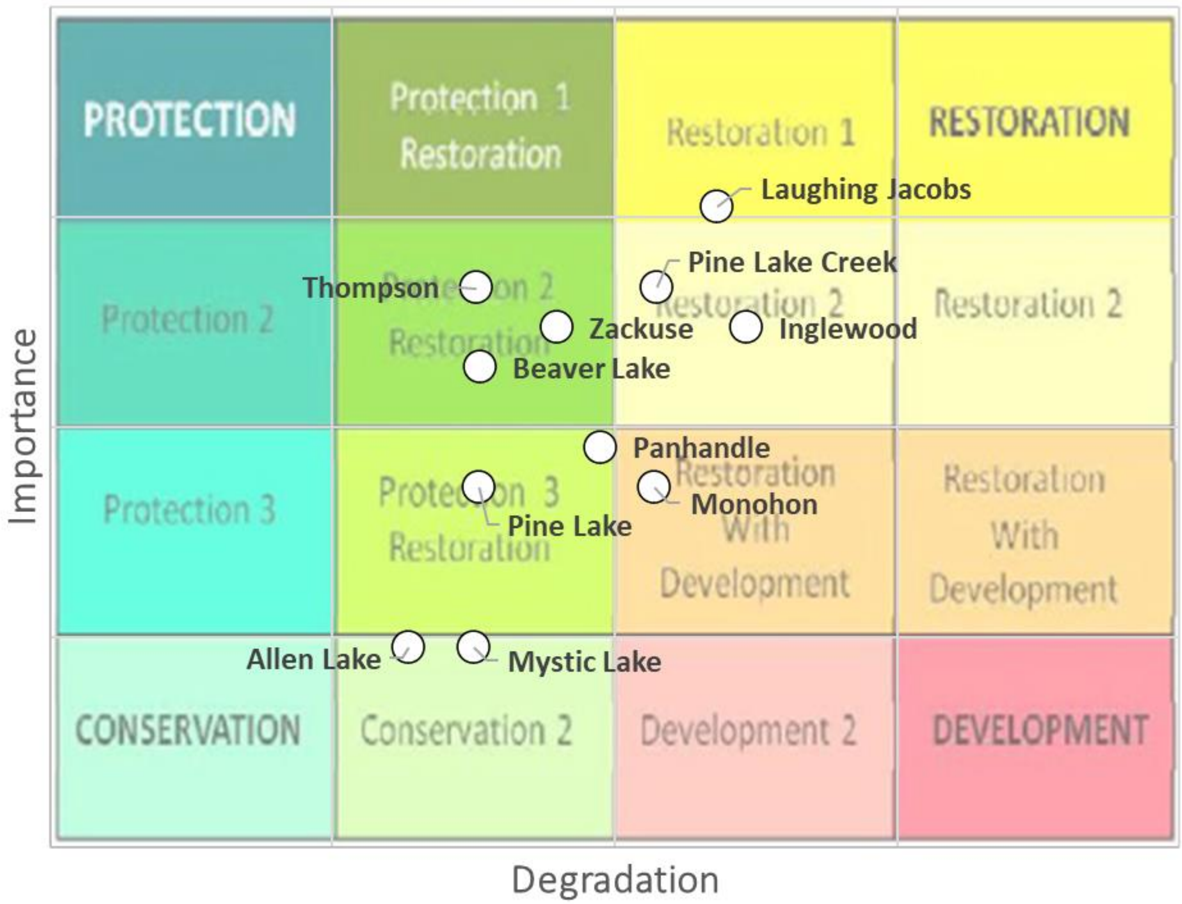


Figure 5. Subbasin Prioritization Matrix

The City wants to prioritize restoration and protection of its high value streams, particularly those with existing or potential kokanee habitat. Based on the prioritization matrix, the Laughing Jacobs subbasin would be the primary target, followed by Thompson (Ebright Creek), Pine Lake Creek, Zackuse, and Inglewood (George Davis Creek). The City is already in the process of developing a basin plan for Laughing Jacobs Creek and completed a plan for Zackuse Creek in 2019 (City of Sammamish, 2019). Therefore, the Inglewood, Thompson, and Pine Lake Creek subbasins were selected as the priority watersheds for further stormwater planning.

4 REFERENCES

City of Sammamish, 2019. Final Zackuse Basin Plan. Prepared by AltaTerra Consulting, June 2019.

Washington Department of Commerce, 2016. Building Cities in the Rain: Watershed Prioritization for Stormwater Retrofits. September 2016, 49 pp.

Washington Department of Ecology, 2019. Stormwater Management Action Planning Guidance, Publication 19-10-010. Washington State Department of Ecology, Water Quality Program. Olympia, Washington.

APPENDIX B

City of Sammamish Washington

Public Works Department

801 228th Avenue SE • Sammamish, WA 98075 • Phone: 425-295-0500 • Fax: 425-295-0600 • Web: www.sammamish.us

Note: This survey was first shared with project stakeholders at a meeting on 6/23/2020.

STORMWATER RETROFIT PUBLIC SURVEY

May 2020

Background:

As the City of Sammamish matures new regulations trigger the need for additional and more enhanced stormwater projects, and the City must balance demands such as protection of watersheds, environment, and public safety with our two most limited resources: budget and staff time. Therefore, the City needs an objective, transparent, and consistent method for ranking and prioritizing potential drainage basins and stormwater retrofit projects.

Currently, City staff are developing a method by which to rank and prioritize drainage basins for future study, design and construction of stormwater retrofit projects. This process is directly informed by existing City goals and direction from State agencies. For example, the City's Comprehensive Plan includes specific goals to provide opportunities to retrofit existing stormwater facilities and enhance their effectiveness, use drainage basin planning to allocate resources to priority problems, promote the recovery of Lake Sammamish kokanee, and coordinate with neighboring jurisdictions to create regional stormwater solutions. These goals will be top of mind when developing criteria with which to rank potential retrofit projects.

Public input is critical to the prioritization process. As we develop this ranking method, we want to hear citizen feedback and incorporate your priorities into our framework. This survey will aid the City in ensuring all voices are heard and incorporated into the final prioritization criteria.

General Public Questions:

1. Within the City of Sammamish, I am a: (check all that apply)
   - ☐ Resident
   - ☐ Property owner
   - ☐ Renter
   - ☐ Business owner or employee in Sammamish

2. Based on the stormwater sub-basin map, which sub-basin do you think you live, work, or own property in?
   - ☐ Evans Creek
   - ☐ Mystic Lake
   - ☐ Allen Lake
   - ☐ Panhandle
   - ☐ Inglewood

- ☐ Zackuse
- ☐ Thompson
- ☐ Monohon
- ☐ Pine Lake Creek
- ☐ Beaver Lake
- ☐ Laughing Jacobs
- ☐ Patterson Creek
- ☐ North Fork Issaquah Creek
- ☐ I don't know, and my property address is:

  ____

  ____

3. Which of the following types of waterbodies should be prioritized with regard to stormwater management?
   - ☐ Streams
   - ☐ Lakes
   - ☐ Wetland and sphagnum bog ecosystems
   - ☐ These waterbodies should be equally prioritized

4. In determining which stormwater retrofit projects get constructed, please rank the following in order of personal priority (1 being the highest priority):
   - ☐ Cost
   - ☐ Environmental benefit
   - ☐ Facility and maintenance improvements
   - ☐ Safety
   - ☐ Population benefited
   - ☐ Time-sensitive opportunities
   - ☐ Climate change effects

5. With regard to stormwater management, please rank the following objectives in order of priority (1 being the highest priority):
   - ☐ Control the rate of stormwater (i.e. prevent flooding and promote soil infiltration)
   - ☐ Remove pollutants from stormwater
   - ☐ Improve habitat for salmon, trout, and other aquatic species
   - ☐ Improve biological condition of streams
   - ☐ Address drainage problems (beavers, erosions, flooding, groundwater, etc.)
   - ☐ Provide treatment for a large amount of stormwater (i.e. focus on larger sub-basins)

6. Stormwater in the City flows to one of four watersheds. Which watershed should be prioritized for stormwater improvements? Refer to the sub-basin map for watershed boundaries.

   - ☐ Lake Sammamish
   - ☐ Bear Creek
   - ☐ Patterson Creek
   - ☐ Issaquah Creek
   - ☐ They should be equally prioritized

7. Which of the following is most important?
   - ☐ Construct new stormwater management facilities in sub-basins that have little or no treatment.
   - ☐ Retrofit or repair existing stormwater management facilities that do not meet current standards for treatment.

8. Please provide contact information if you would like City staff to contact you.
   Name:____________________________________
   Email Address:______________________________
   Phone Number:______________________________

9. Please tell us about any surface water or drainage issues in your neighborhood. Provide as much detail as possible, including location, time of year the problem occurs, and frequency of the problem.____
   ____
   ____
   ____
   ____

Stakeholder Questions:

1. Are you aware of any current or upcoming stormwater retrofit, or habitat restoration or stream protection projects located in the watersheds downstream of the City of Sammamish? If yes, please provide details.

2. Are you aware of any current or upcoming stormwater basin planning studies located in the vicinity of same watersheds as exist in the City of Sammamish? If yes, please provide details.

City of Sammamish Washington

Public Works Department

801 228th Avenue SE • Sammamish, WA 98075 • Phone: 425-295-0500 • Fax: 425-295-0600 • Web: www.sammamish.us

3. Are you aware of any current or upcoming transportation projects or infrastructure projects located in the same watersheds as exist in the City Sammamish? If yes, please provide details.

4. What basins or sub-basins near the City of Sammamish have been identified as a Stormwater Management Action Plan priority by your municipality, if applicable?

5. What steps can the City of Sammamish take to improve fish use and aquatic habitat in the receiving waters?

1

Welcome Stakeholders!

Meet the Team

Lisa Were
Project Manager
City of Sammamish

Doreen Gavin, PE, LEED AP
Principal
AHBL Inc.

Lucas Johnson, PE
Project Manager AHBL Inc.

Patty Dillon, PE
Principal
NHC Inc.

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

2

Agenda

Doreen Gavin, PE, LEED AP
AHBL, Inc.

- Meeting Goals
- What is Stormwater Retrofit Planning?
- What we know
- Basin Prioritization
- Soliciting Information
- Q&A

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

3

Meeting Goals

Doreen Gavin, PE, LEED AP
AHBL, Inc.

Increase our **knowledge** base

Transparency

Inform our prioritization process

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

4

What is SW Retrofit Planning?
Seeking Answers

Doreen Gavin, PE, LEED AP
AHBL, Inc.

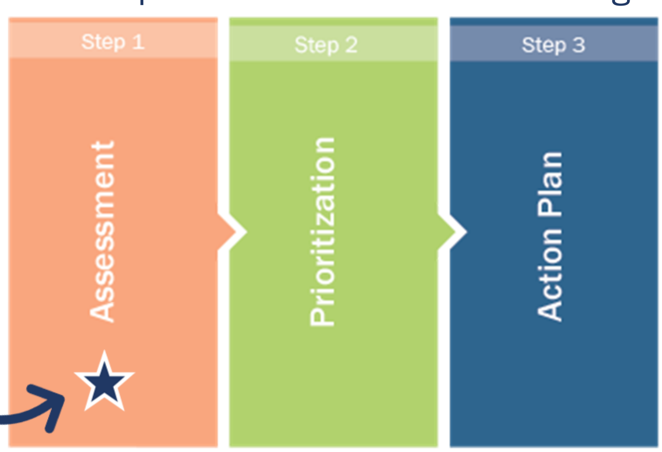
- Fix problems from existing development
- Retrofit existing treatment and flow control facilities
- Consider climate change and uncertainty
- Prioritize watersheds and sub-basins

5

What is SW Retrofit Planning?
The Process

Doreen Gavin, PE, LEED AP
AHBL, Inc.

Steps to Effective Retrofit Planning



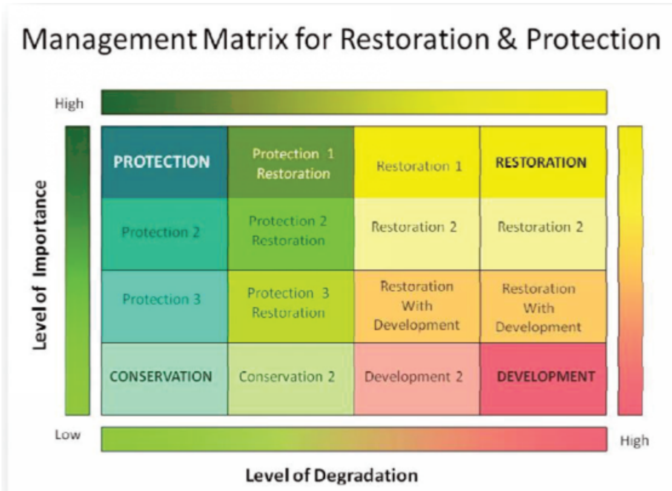
We are here.

GOAL:
Prioritize subbasins and watersheds and determine where to focus our efforts

6

What is SW Retrofit Planning?
Subbasin Prioritization

Doreen Gavin, PE, LEED AP
AHBL, Inc.



Higher priority to basins where:

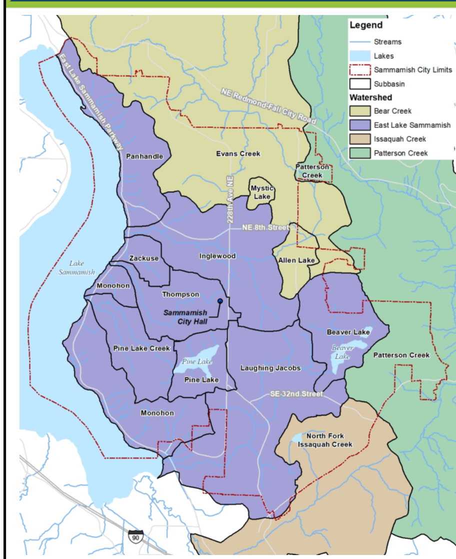
- Levels of impairment are low to moderate
- Municipality can exert greater influence
- Regional rehabilitation efforts are focused

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

7

Assessment - What We Know

Lucas Johnson, PE
AHBL, Inc.



Legend

- Streams
- Lakes
- Sammamish City Limits
- Subbasin

Watershed

- Bear Creek
- East Lake Sammamish
- Issaquah Creek
- Patterson Creek

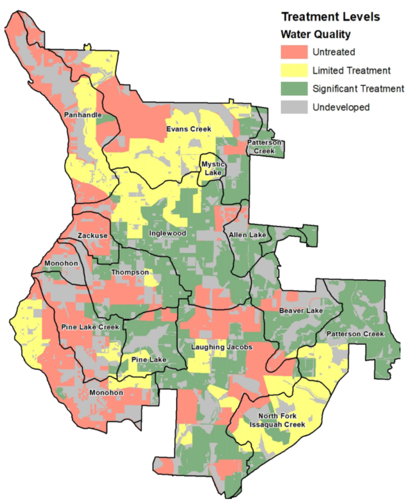
- 4 Watersheds
- 14 Sub-basins
- Several lakes, streams, wetlands and Sphagnum bogs
- Lake Sammamish is the main receiving water for most of the City

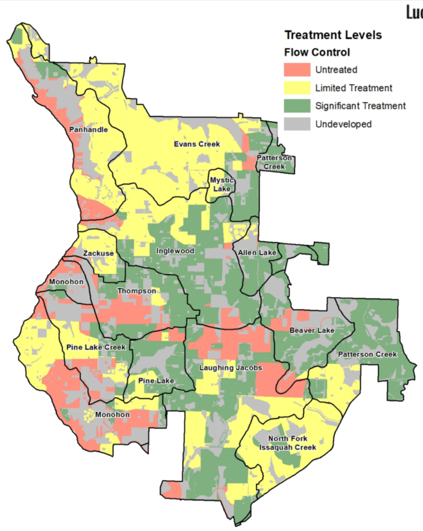
City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

8

Assessment - What We Know

Lucas Johnson, PE
AHBL, Inc.



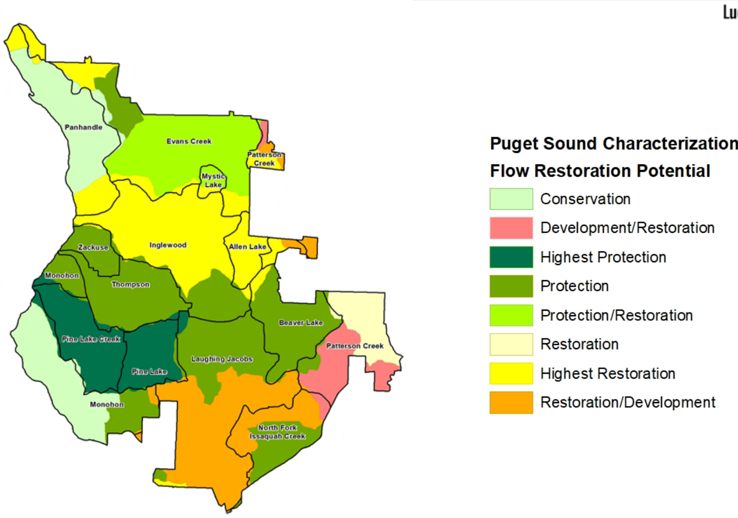


City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

9

Assessment - What We Know

Lucas Johnson, PE
AHBL, Inc.



City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

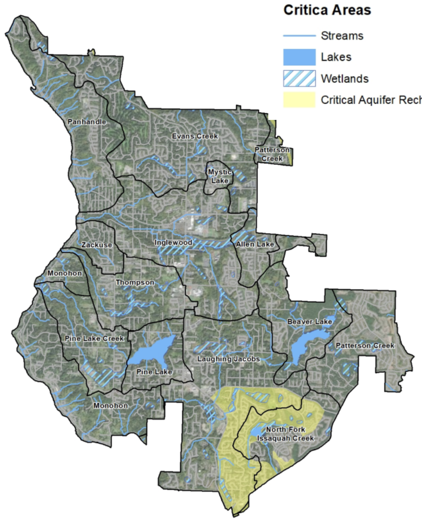
10

Assessment - What We Know

City of Sammamish Washington

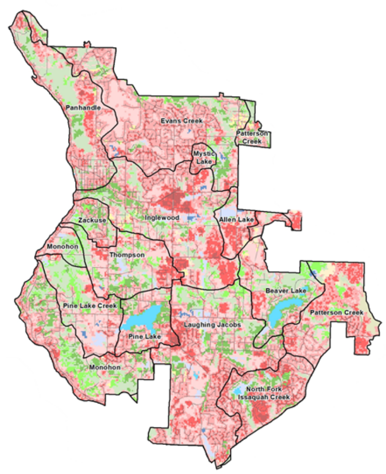
AHBL

Lucas Johnson, PE
AHBL, Inc.



Critica Areas

- Streams
- Lakes
- Wetlands
- Critical Aquifer Recharge



Land Cover

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Roads
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

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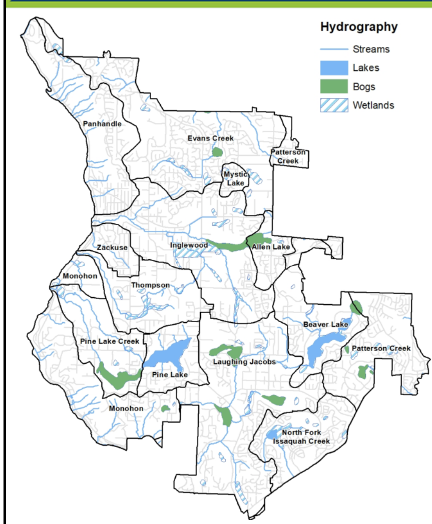
Assessment - What We Know

City of Sammamish Washington

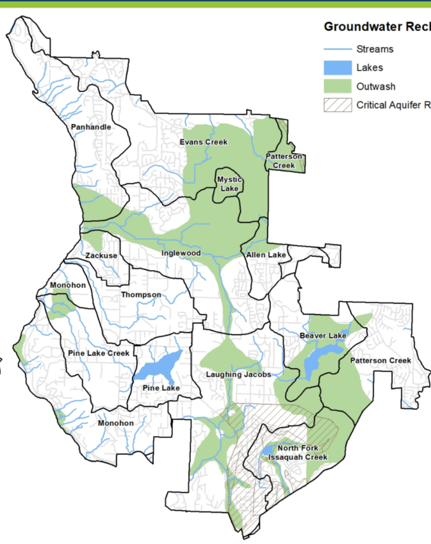
AHBL

Lucas Johnson, PE
AHBL, Inc.



Hydrography

- Streams
- Lakes
- Bogs
- Wetlands



Groundwater Recharge

- Streams
- Lakes
- Outwash
- Critical Aquifer Recharge

- Outwash Soils are priority area for the ability to infiltrate stormwater
- Fish bearing streams
- Several streams are habitat for Kokanee salmon

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

12

What is SW Retrofit Planning?
Prioritization Factors

Patty Dillon, PE
NHC, Inc.

Value/Importance	Degradation
Forest Cover	Impervious Cover
Wetlands	Land Use
Groundwater Recharge	Road Crossings
Riparian Canopy	Flow Control Treatment
Fish Use*	Water Quality Treatment
Habitat*	Water Quality Impairment

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

13

What is SW Retrofit Planning?
Prioritization Factors

Patty Dillon, PE
NHC, Inc.

- Where are you at in your process?
- What factors are important to you?
- How would you rank resources?
- Are we missing anything?

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

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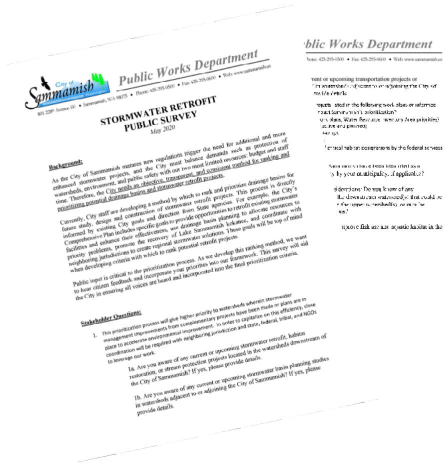
Soliciting Information
Stakeholder Survey

Lucas Johnson, PE
AHBL, Inc.



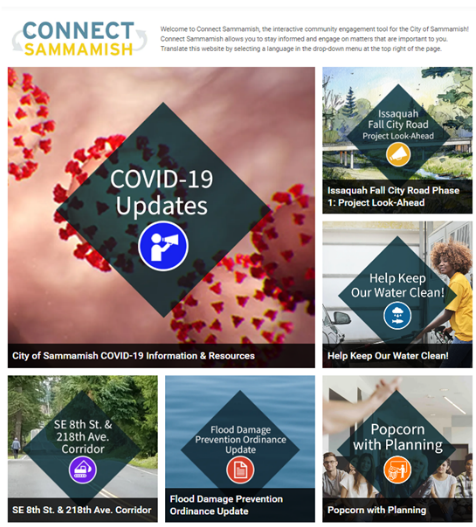
- We want to incorporate your feedback and priorities into our process.
- What upcoming stormwater projects are you aware of?
- Are you aware of any upcoming stormwater basin planning studies?
- What sub-basins near Sammamish have been identified as a priority by your municipality?
- Please help us by answering these questions and others on our survey.

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

15

More Information

Lucas Johnson, PE
AHBL, Inc.



- Visit Connect Sammamish:
  connect.sammamish.us
- Contact the City:
  Lisa Werre
  lwerre@Sammamish.us
  425.295.0573

City of Sammamish Stormwater Retrofit Strategy Stakeholder Meeting | June 23, 2020

16

What is SW Retrofit Planning?
The Process

City of Sammamish Washington AHBL

Doreen Gavin, PE, LEED AP
AHBL, Inc.

Questions?

17

Sammamish Stormwater Retrofit Strategy – Stakeholder Presentation
June 23, 2020

Questions and Responses:

1) Are you considering the age of (stormwater) infrastructure?

The age of the flow control or runoff facility is used to determine the levels of flow control and runoff treatment provided by existing facilities. If a facility was constructed before 1998, it is classified as providing limited treatment and/or flow control. The 1998 KCSWDM introduced the current flow duration standard for flow control. If a facility was built after 1998 it is classified as providing significant flow control and/or runoff treatment

2) Looking through criteria, future conditions and zoning buildout isn't shown. How are you aligning future buildout in the conversation?

Evaluation of a future buildout scenario is not a requirement of the NPDES Phase II watershed planning. In previous experience with detailed modeling of future buildout conditions, we have consistently seen that buildout with stormwater treatment meeting current standards is not further degrading flow and water quality conditions compared to existing. So existing conditions provide a reasonable "worst case" scenario. The plan for the selected subbasin may consider land use management actions or zoning changes to meet preservation or restoration goals.

3) Have we considered climate change in the modeling?

The scope of this study considered climate change in general. Existing hydrologic models of existing and future climate scenarios, developed for King County, were used to estimate increases in storm runoff (peak hourly and daily flows) for Sammamish watersheds.

4) Can you talk more about how you are accounting for receiving water conditions 303d listings?

The Receiving Water Assessment will include all 303d listings. Level 4 and 5 303d listings will be used as one indication of degradation within the basin.

5) Have you looked at how much of the undeveloped land will be developed in the future?

No, a future conditions analysis is beyond the scope of this study.

6) How are you addressing basins with undersized stormwater systems, such as those along the East Lake Sammamish Parkway?

One factor that may be considered as we identify Priority Basin(s) is known existing drainage issues such as undersized stormwater systems. Existing drainage issues may be considered as an indicator of degradation within the basin. Addressing existing drainage issues may also provide a future opportunity to improve flow control and/ or runoff treatment retrofit projects. However, the current study does not include the design of stormwater retrofit or infrastructure projects.

7) A comment was made encouraging mindfulness of Kokanee Salmon.

Kokanee Salmon habitat is one indicator of the resource value of a receiving water and will be considered in the prioritization of basins for future retrofit projects and management actions. We are including Zackuse, George Davis (Inglewood subbasin), Ebright (Thompson subbasin), Pine Lake and Laughing Jacobs creeks as including Kokanee habitat.

8) A comment was made regarding areas between SE 33rd and Inglewood Hill. Trail design in that stretch is nearing 100%.

While this study does not include the design of stormwater retrofit or infrastructure projects, we appreciate the comment and the opportunity for the city to further coordinate future projects.

APPENDIX C

SAMMAMISH RETROFIT STRATEGY AND GUIDANCE MANUAL

12787 Gateway Drive South | Seattle, WA 98168 | 206.241.6000 | www.nhcweb.com

nhc
northwest hydraulic consultants

MEMORANDUM

To:	Lisa Werre	Date: 5/18/2020
Company:	City of Sammamish	NHC Ref. No. 2005693
Cc:	Lucas Johnson, AHBL	
From:	Patty Dillon, P.E. and Alison Lunde	
Re:	**Sammamish Retrofit Strategy – Climate Change Assessment**	

1 INTRODUCTION

The Sammamish Stormwater Retrofit Strategy project will develop receiving water basin assessments and establish a process to rank subbasins within the City of Sammamish (City) for protection and restoration of aquatic resources. This will steer future efforts to identify stormwater retrofits with high potential to benefit receiving waters. As part of this effort, existing hydrologic models (developed in previous work for King County) were used to compare stormwater runoff and peak flows between existing and future climate scenarios. This memo describes the methods and results of the climate change assessment.

2 BACKGROUND (HSPF MODEL)

As part of the design for its Willowmoor Floodplain Restoration project north of Lake Sammamish, King County conducted hydrologic modeling for the entire Lake Sammamish basin. The effort included existing conditions modeling, as well as development and simulation of a future hydrology scenario based on global climate model (GCM) projections. The future hydrology scenario (documented in NHC, 2015) was developed by applying statistical analysis to downscaled GCM precipitation scenarios to ultimately develop hourly future climate time series for 19 local precipitation gages used as hydrologic model inputs. For this analysis, the future precipitation scenarios were run with the most recent available model updates (King County, 2019), and flow outputs were generated for seven subbasins within the City.

It should be noted that existing conditions models were calibrated to larger creek basins (Evans, Bear and Issaquah) but not to the smaller Sammamish streams. Based on our understanding of plateau hydrology, modeled storm peaks are believed to be significantly higher than actual conditions on many Sammamish streams. Reported flows (particularly at shorter durations) should not be assumed to represent design peaks without further investigation; however, <u>differences</u> between the two scenarios due to changes in precipitation are generally consistent across the regional modeling and across durations and are thus considered valid estimates of projected impact of climate change.

3 RESULTS

This analysis compared HSPF model flow outputs for seven Sammamish subbasins for existing and future hydrologic conditions. Frequency analysis was performed at 15-minute and 24-hour durations to assess potential impacts on conveyance capacity and detention storage, respectively. Table 1 shows the frequency analysis results, and Table 2 lists the percent increase—from existing to future hydrology—in 25- and 100-year flows at each location. For the 25-year storm event, future flows were 5 to 6 percent higher than existing at both durations. The future hydrology impacts were slightly higher and more variable at the 100-year event, with future flows between 4 and 9 percent higher than existing. In general, the model predicts a 5 to 10 difference from current to future storm events for either timestep.

Table 1. Simulated Flow Frequency Comparisons

Location (Subbasin-Creek)	15-min Simulated Peak Flow (cfs)†				24-hour Simulated Peak Flow (cfs)†			
	25-year		100-year		25-year		100-year	
	Exist	Future	Exist	Future	Exist	Future	Exist	Future
Beaver Lake	195	207	291	306	49.3	52.3	61.4	66.8
Laughing Jacobs Creek	589	626	887	931	169	178	211	227
Pine Lake	124	131	167	174	31.2	32.8	38.5	41.3
Pine Lake Creek	343	363	478	509	80.6	84.9	99.5	106
Thompson-Ebright Creek	156	165	229	242	30.4	31.9	37.9	39.9
Zackuse Creek	146	155	233	246	23.6	24.8	29.4	30.9
Inglewood-George Davis Creek	495	526	741	787	109	115	136	143
† Peak flows may be high compared to actual conditions. Not intended for design.								

Table 2. Storm Flow Increases under Future Hydrology

Location (Subbasin-Creek)	15-min Percent Difference		24-hour Percent Difference	
	25-year (%)	100-year (%)	25-year (%)	100-year (%)
Beaver Lake	6%	5%	6%	9%
Laughing Jacobs Creek	6%	5%	6%	8%
Pine Lake	5%	4%	5%	7%
Pine Lake Creek	6%	6%	5%	6%
Thompson-Ebright Creek	6%	6%	5%	5%
Zackuse Creek	6%	6%	5%	5%
Inglewood-George Davis Creek	6%	6%	5%	5%

4 CONCLUSION

Increases in precipitation, particularly storm magnitudes, associated with climate change may affect the ability of existing stormwater facilities to meet design functionality. The hydrologic model results suggest that climate change variability could increase stormwater runoff peaks and flow volumes by 5 to 10 percent, depending on the location and storm intensity. This suggests that design of proposed retrofits or new facilities should consider additional conveyance and/or detention capacity to accommodate increased stormwater runoff under future hydrologic conditions.

5 REFERENCES

King County (2019). Willowmoor Floodplain Restoration Project: Hydrologic Modeling Technical Memorandum, prepared by Northwest Hydraulic Consultants for King County, Seattle, Washington. January 2019.

Northwest Hydraulic Consultants (2015). Willowmoor Hydrology: Model Calibration and Future Hydrology. Memorandum to Craig Garric and John Engel, King County. January 21, 2015.

DISCLAIMER

This document has been prepared by Northwest Hydraulic Consultants Inc. in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of the City of Sammamish and their authorized representatives for specific application to the Sammamish Stormwater Retrofit project in King County, Washington. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from Northwest Hydraulic Consultants Inc. No other warranty, expressed or implied, is made. Northwest Hydraulic Consultants Inc. and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than the City of Sammamish.

APPENDIX D

THIS RRI FIELD GUIDE TEMPLATE SHOULD BE COMPLETED WITH LOCAL DATA

Unique Site ID Nomenclature Guidance

Unique Site ID = City of Sammamish Drainage Facility Number (NHC Specific Site Number)

Ownership

Public:	Parcel is owned by a public organization, such as a school district, or governmental body. - If public, define jurisdiction level.
Private	Parcel is owned by a private owner or company.
Unknown	Parcel ownership is not known.
Sammamish	Parcel is owned by the City of Sammamish.

Delineating Drainage Area and Estimating Current Impervious Cover

Simple Pipe – Drainage Area Ratios	
Pipe Diameter (inches)	**Drainage Area (approx. acres)**
6	0.1 to 1
12	1 to 2
24	2 to 5
36	5 to 25
48	25 to 100
60	100 to 200

Land Use / Impervious Cover Relationships	
Land Use Category	**Impervious Cover (%)**
1.0 DU/GA	15
1.5 DU/GA	20
2.0 DU/GA	25
2.5 DU/GA	30
3.0 DU/GA	34
4.0 DU/GA	42
5.0 DU/GA	48
6.0 DU/GA	52
7.0 DU/GA	56
Multifamily Residential	Calculate
Light Industrial	Calculate
Commercial	Calculate

DU = Dwelling Unit
GA = Gross Acre

Retrofitting Objectives

Core Retrofitting Objectives:	
Designated Pollutant(s) of Concern:	
Type of Storage Needed:	

Sammamish Stormwater Retrofit - Best Management Practice (BMP) Menu

November 9, 2020

Facility / Condition		Retrofit BMP Options	Treatment Targeted			Pros*	Cons*	Retrofit BMP Feasibility Criteria**
			Flow Control		Water Quality			
			Detention	Infiltration				
Existing	Detention Pond	Expand existing facility.	✓	-	-	Inexpensive, low maintenance.	Need surface space.	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct wetpool facility.	-	-	✓	Inexpensive, low maintenance.	Need surface space, permanent ponding.	Need surface space.
		Construct infiltration columns in bottom of existing facility.	-	✓	-	No added footprint.	Potentially expensive, high maintenance, regulatory hurdles.	Groundwater separation, soil infiltration suitability requirements.
	Detention Tank	Expand existing facility.	✓	-	-	Underground, under traffic.	Possible utility conflicts.	Structural loading requirements, buoyancy with groundwater, rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct treatment facility in series with existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation.	Potentially expensive.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.
	Detention Vault	Expand existing facility.	✓	-	-	Underground, under traffic.	Expensive.	Structural loading requirements, buoyancy with groundwater, rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct treatment facility in series with existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation.	Potentially expensive.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.

Sammamish Stormwater Retrofit - Best Management Practice (BMP) Menu

November 9, 2020

Facility / Condition		Retrofit BMP Options	Treatment Targeted			Pros*	Cons*	Retrofit BMP Feasibility Criteria**
			Flow Control		Water Quality			
			Detention	Infiltration				
Existing	Infiltration Pond, Tank, or Vault	Expand existing facility.	-	✓	-	Inexpensive, low maintenance, tanks and vaults can be placed underground and under traffic areas.	Need surface space for pond expansion, tanks and vaults are potentially expensive, infiltration facilities are high maintenance.	Groundwater separation, soil infiltration suitability, structural loading, and buoyancy considerations/ requirements.
		Construct treatment facility upstream of existing facility. See "new" facility BMP options below.	-	-	✓	Low impact installation.	Potentially expensive, infiltration facilities are high maintenance.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.
	Combined Facility	See retrofit options for other flow control and water quality facilities that the combined facility comprises.	✓	✓	✓	See pros, cons, and feasibility for BMPs associated with retrofit of facilities that the combined facility comprises.		
	Wetpond	Construct detention facility in series with existing facility.	✓	-	-	Inexpensive, low maintenance.	Need surface space.	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Reduces downstream flows, low maintenance.	Need surface space.	Groundwater separation, soil infiltration suitability requirements.
		Construct another treatment facility in series with existing one or expand existing facility.	-	-	✓	Ability to treat larger basin, similar maintenance.	Potentially expensive, need surface space for wetpond expansion.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.

Sammamish Stormwater Retrofit - Best Management Practice (BMP) Menu

November 9, 2020

Facility / Condition		Retrofit BMP Options	Treatment Targeted: Flow Control: Detention	Treatment Targeted: Flow Control: Infiltration	Treatment Targeted: Water Quality	Pros*	Cons*	Retrofit BMP Feasibility Criteria**
Existing	Wetvault	Construct detention facility in series with existing facility.	✓	-	-	Potentially low maintenance.	Potentially expensive, need surface space.	Rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Potentially low maintenance.	Potentially expensive, need surface space.	Groundwater separation, soil infiltration suitability requirements.
		Construct another treatment facility in series with existing facility.	-	-	✓	Low impact installation.	Potentially expensive.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.
	Sand Filter or Stormwater Wetland	Construct detention facility in series with existing facility.	✓	-	-	Inexpensive, low maintenance.	Need surface space.	Need surface space, rule of thumb: 20,000 cubic yards of storage per tributary acre.
		Construct infiltration facility downstream from existing treatment facility.	-	✓	-	Inexpensive, low maintenance.	Need surface space.	Groundwater separation, soil infiltration suitability requirements.
		Construct another treatment facility in series with existing facility.	-	-	✓	Low impact installation.	Potentially expensive.	Overland flow, elevation difference between inlet and outlet, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.
	Conveyance Swale/Ditch	Replace soil with bioretention soil mix (BSM) or proprietary filter soil.	-	✓	✓	Low impact installation, low cost.	Limited to existing space.	Overland flow, rule of thumb: bioretention bottom area ≈ 5% of area draining to it.

Sammamish Stormwater Retrofit - Best Management Practice (BMP) Menu

November 9, 2020

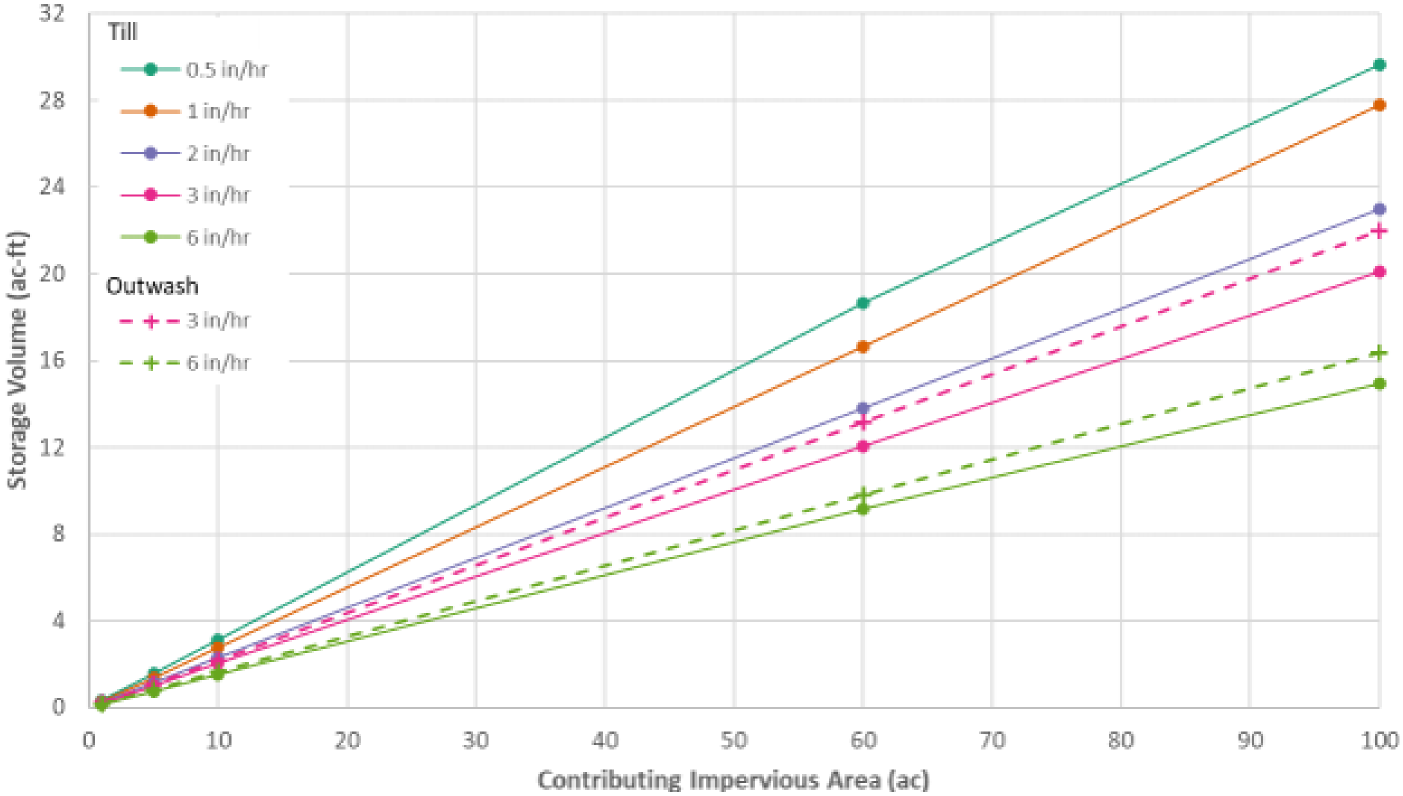
Facility / Condition		Retrofit BMP Options	Treatment Targeted: Flow Control – Detention	Treatment Targeted: Flow Control – Infiltration	Treatment Targeted: Water Quality	Pros*	Cons*	Retrofit BMP Feasibility Criteria**
Existing	Catch Basins	Replace with StormFilter catch basin structures.	-	-	✓	Low impact installation.	Potentially expensive, relatively small impact.	Existing outlet pipe must have sufficient depth.
Existing	Catch Basins	Replace with bioretention cell/planter.	-	-	✓	Low maintenance.	Need space.	Need space, overland flow, rule of thumb: bioretention bottom area ≈ 5% of area draining to it, existing outlet pipe must have sufficient depth.
New	Untreated Right-of-Way	Install new BMPs for treatment and/or flow control: • Bioretention with infiltration • Bioretention without infiltration • Shallow infiltration trenches • Deep infiltration (UIC wells) • StormFilter structures	✓	✓	✓	Potential to make new facility a streetscape amenity.	Limited space within right-of-way, regulatory hurdles for deep infiltration, infiltration facilities are high maintenance.	Need surface space and sufficient depth.
New	Untreated, Vacant Parcel	Install new BMPs for treatment and/or flow control: • Detention facility • Infiltration facility • Treatment facility • Combined facility	✓	✓	✓	Low impact on existing infrastructure.	Acquisition of parcel or rights to parcel use, costly to purchase parcel.	Need surface space and sufficient depth.

* *Underground flow control facilities are considered expensive (e.g., $12/cubic foot of storage for vaults or $10/cubic foot of storage for tanks. Aboveground flow control facilities are considered inexpensive (e.g., $5/cubic foot of storage for ponds). Proprietary treatment facilities are considered more expensive than non-proprietary; they cost roughly 50% more.*

** *Surface soils are considered suitable for infiltration if the design infiltration rate is 0.5 inch/hour or greater. Typical elevation difference between inlet and outlet (hydraulic drop) for treatment BMPs ranges from 1.5 to 3.5 feet.*

Computing the Retrofit Storage Volume

To calculate ***flow control target volume***, use the following curve:



Computing Available Retrofit Storage

For ponds and wetlands, use the following simplified equation to estimate available storage:

$$V_{av} = 2/3 * d * SA$$

Where: V_{av} = Available storage at the site (acre-feet)
SA = Surface area of the facility (acres)
d = Estimated maximum depth (feet)
2/3 = Average volume factor

For other stormwater treatment options, available storage can be estimated based on the typical surface area or depth requirements of different stormwater treatment options:

Drainage Area – Surface Area Requirements		
Stormwater Treatment Option	**% of Contributing Drainage Area**	**Average Depth (feet)**
Detention Ponds	1 to 3%	6
Wet Ponds	2 to 4%	6
Constructed Wetland	3 to 5%	2
Bioretention	5 to 10%	1 to 2
Sand Filters	0 to 5%	2

Minimum Setbacks

Minimum Distance…*	To Be Maintained From…
5 to 10 feet	Tract / Property Line
10 feet	Building Foundation
100 feet	Septic System Fields
100 feet	Private Well
1,200 feet	Public Water Supply Well
400 feet	Surface Drinking Water Source
200 feet	Surface Water
Do no submerge	Sewer Line
10 feet	Dry Utilities
15 feet	Overhead Wires
10 feet	Road (Seepage)

** Confirm that these common setbacks are consistent with local regulations.*

Final Feasibility Questions

#1. Is site candidate for further investigation?

Yes - Parcel presents significant opportunity to improve flow control and/or water quality of the tributary basin.

No - Parcel is newly developed to existing standards, does not have opportunities to capture additional upstream area, or is otherwise unfeasible for potential retrofit.

Maybe - Parcel presents opportunities to retrofit but faces potential conflict or is not seen as a high opportunity site.

#2. Is site candidate for early action projects?

Yes - Parcel retrofit would address a significant safety issue, maintenance problem, or be combined with adjacent planned project(s). Early action may be necessary to capitalize on adjacent projects.

No - Existing parcel does not present safety or maintenance issues and parcel retrofit is not included with adjacent projects if any.

Maybe - Parcel retrofit may seek to improve safety or maintenance problems. Adjacent projects may occur and include retrofit but are not priority.

#3. If no, is site candidate for other restoration project(s)?

Yes - Parcel is adjacent to streams, wetlands, or potential fish passage culverts, which could be improved through retrofit development.

No - Parcel does not possess adjacent opportunities for restoration.

Maybe - Parcel has adjacent streams, wetlands, or fish passage culverts, but it is unsure if retrofit of the parcel would improve these facilities.

Unique Site ID: DS0043 (1454)	**Subwatershed:** Inglewood	**Watershed:** East Lake Sammamish
Date: 11/2/2020	**Assessed By:** SN	

Site Description

Name:	Benham Ridge / Drainage Facility No. DS0043
Address:	21253 NE Inglewood Hill Road
Location Notes:	Not able to access pond. Ownership has not been turned over to the City yet.

Ownership:	☐ Public	☒ Private	☐ Unknown	☐ Sammamish
If Public, Government Jurisdiction:	☐ Local	☐ State	☐ DOT	☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond	☐ Conveyance System	☐ Vacant Parcel	☒ Wetpond	☐ Wet Vault
☐ Outfall	☐ ROW	☒ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈ 4.30 AC

Imperviousness ≈ 53 %

Impervious Area ≈ 2.26 AC

Notes:
Roof areas and patios infiltrate at individual infiltration trenches per lot. Remainder of developed area [ROW, landscaping, driveway - 4.3 AC] infiltrates in infiltration pond.

Drainage Area Land Use:

☒ Residential	☐ Institutional
☒ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Wetpond water quality treatment with infiltration pond for flow control. Basic wetpond used for water quality prior to infiltration.

Existing Treatment Provided: ☐ Detention ☒ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2013

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:

- Retaining walls on western and norther sides of pond.
- Ecology block wall separates water quality cell from infiltration pond
- No visible problems noted.

Approximate existing head available:
±1.75 ft between CB#3 and connection to pond. [Page 14 of As-builts]

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control

☒ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
2009 KCSWDM 18,246 CF Live Storage per TIR 11,320 CF WQ Storage per TIR	29,566 CF (Live Storage + WQ)

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM

☐ Proprietary Media Filter ☒ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

- Add low-head water quality device between CB#3 and pond.
- Expand full pond area to infiltration (Assumed 4 in/hr)
- Route additional area off NE Inglewood Hill Road to pond.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional

☐ Industrial ☒ Transport-Related ☐ Park

☐ Undeveloped ☐ Other: ____

Possible conflicts due to adjacent land use? ☐ Yes ☐ No

If yes, describe:

Access:

☒ No Constraints

Constrained due to:

☐ Slope ☐ Space

☐ Utilities ☐ Tree Impacts

☐ Structures ☐ Property Ownership

☐ Other:

Conflicts with Existing Utilities:

☐ None

☐ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☒	Gas
☐	☒	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many? ____

Approx. DBH: ____

Other Factors:

Soils:

Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: Everett Gravelly Sandy Loam (EvC)

Comments:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes
Potential Flow Control and Water Quality Facilities Expand detention / infiltration volume. Expand tributary area from NE Inglewood Hill Road. Steep slopes upstream and downstream may limit expansion of infiltration.

Follow-up Needed to Complete Field Concept	
☒ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
Pond appears to be built to full flow control and water quality standards. Limited opportunity for facility expansion. Project currently not owned by the City of Sammamish under M&D.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☐ No	☒ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	D91456 (1464)	**Subwatershed:**	Inglewood	**Watershed:**	Lake Sammamish
Date:	11/2/2020	**Assessed By:**	TM		

Site Description

Name:	1305 235TH Ave SE / Drainage Facility No. D91456
Address:	1305 238th Ave SE
Location Notes:	Site was a developed single-family residence with equestrian facilities.

Ownership: ☒ Public ☐ Private ☐ Unknown ☐ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☐ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 215,186 sf

Imperviousness ≈ 15.6 %

Impervious Area ≈ 33,548

Notes:
Approximate impervious area determined from aerial map.

Drainage Area Land Use:

☒ Residential
- ☐ SFH (< 1 ac lots)
- ☒ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☐ Yes ☒ No ☐ Possible

If Yes, Describe:

Existing Treatment Provided: ☐ Detention ☐ Infiltration ☐ Water Quality ☒ None ☐ Unknown

Year of Construction, if known:

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The site is developed as a single-family residence with equestrian facilities. A City storm system did not exist, and the site appeared to discharge stormwater to the west via sheet flow, to a creek/wetland tributary to George Davis Creek.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☐ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
None	

Proposed Treatment Option:

☐ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☒ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Based on the site's location, surrounding elevations, and existing slopes, retrofitting this site would provide little to no benefit. There is no upstream tributary area that could be routed through a retrofit facility. A majority of the site is currently pervious and sheet flows into native vegetation to the west.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: ______

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:

☒ Slope ☐ Space
☐ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many? ______
Approx. DBH: ______

Other Factors:

Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: ______
Comments:
No record information provided.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D91456 (1464)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☐ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
Based on the site's location, surrounding elevations, and existing slopes, retrofitting this site would provide little to no benefit. There is no upstream tributary area that could be routed through a retrofit facility. A majority of the site is currently pervious and sheet flows into native vegetation to the west.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	DS0092 (1548)	**Subwatershed:**	Inglewood	**Watershed:**	Lake Sammamish
Date:	11/2/2020	**Assessed By:**	TM		

Site Description

Name:	Cedar Cove / Drainage Facility No. DS0092
Address:	235th Pl SE, KC Parcel 1441600310
Location Notes:	Access road from cul-de-sac at end of 235th Pl SE

Ownership:	☐ Public	☐ Private	☐ Unknown	☒ Sammamish
If Public, Government Jurisdiction:	☐ Local	☐ State	☐ DOT	☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond	☒ Conveyance System	☐ Vacant Parcel	☐ Wetpond	☐ Wet Vault
☐ Outfall	☒ ROW	☐ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈ 30.5 ac

Imperviousness ≈ 40 %

Impervious Area ≈ 12.2

Notes:
Assumed 40% for residential plats. Verify impervious area.

Drainage Area Land Use:

☒ Residential	☐ Institutional
☒ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Combination detention/water quality facility (wetpond) with control structure. Control structure outlets to swale seeded with "wetland mixture" and level spreader. Discharges to wetland.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2001 (KCRTS)

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing development slopes down from west to east. Lots within Cedar Cove development drain to conveyance system in 235th Pl SE. This system consists of 12- and 18-inch concrete pipe that convey to the pond in the northeast corner of the development. No visible drainage problems were observed at the time of the visit.

The development to the west (uphill), Claremont (1988), has a conveyance system consisting of a series of swales and 18" ductile iron pipe that convey runoff east, directly to the wetland through level spreaders.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1990 KCSWDM (KCRTS) Level 1 Flow Control	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Add proprietary media filters upstream of the existing pond and convert the combination detention/water quality facility to a detention only facility to gain storage volume. In order to meet the Sensitive Lake Treatment requirement, the system would need a treatment system designed in accordance with the 2016 KCSWDM. The existing facility provides roughly 50% of current flow control storage volume.

Add detention to the development to the west (Claremont) by either conveying to the existing pond or adding/replacing existing pipes with larger detention pipes. Add treatment to the development to the west (Claremont) by proprietary media filters or bioswales. Appears no detention is provided. Full FC would require approx. 135,000 CF.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: wetland

Possible conflicts due to adjacent land use? ☒ Yes ☐ No

If yes, describe:
Might impact wetland buffer

Access:

☐ No Constraints

Constrained due to:

☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☒ Other: wetland

Conflicts with Existing Utilities:

☒ None
☐ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?

Approx. DBH:

Other Factors:

Soils:

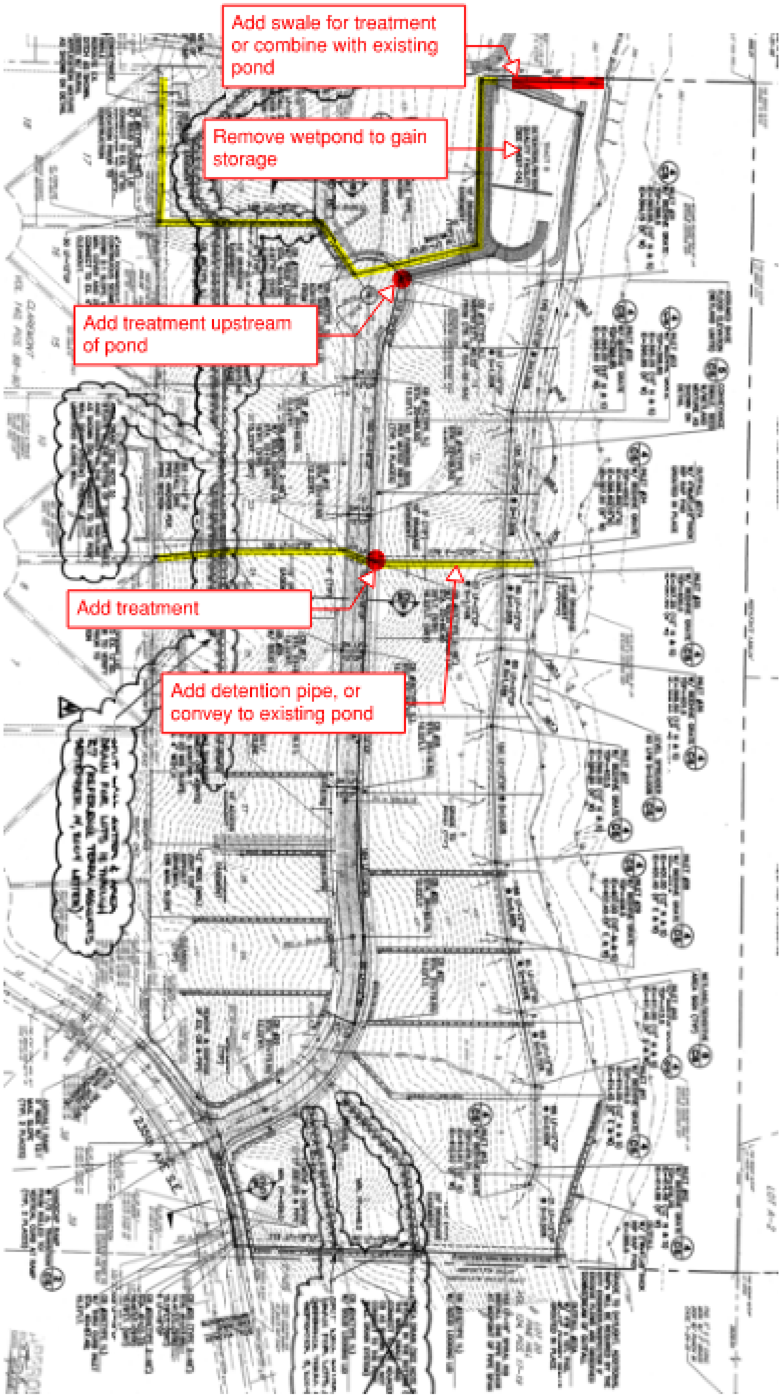
Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☒ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☒ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Evidence of high water table (gleying, saturation):	☒ Yes	☐ No

Soil Classification: Alderwood (till)

Comments:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: DS0092 (1548)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☒ Yes	☐ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	D98417 (2085)	**Subwatershed:**	Inglewood	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name:	Sammamish Library - Boys & Girls Club / Drainage Facility No. D98417
Address:	825 228th Avenue NE
Location Notes:	Facility at SE corner of property

Ownership:	☒ Public	☐ Private	☐ Unknown	☒ Sammamish
If Public, Government Jurisdiction:	☒ Local	☐ State	☐ DOT	☐ Other:

Proposed Retrofit Location: At existing infiltration system
Storage

☐ Pond	☐ Conveyance System	☐ Vacant Parcel	☐ Wetpond	☐ Wet Vault
☐ Outfall	☐ ROW	☒ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈ 1.85 AC
Imperviousness ≈ 70 %
Impervious Area ≈ 1.29 AC

Notes:
Confirm impervious area

Drainage Area Land Use:

☐ Residential	☒ Institutional
☒ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Underground infiltration pipe system, 6'Ø perforated pipe. Emergency outlet to City storm sewer.

Existing Treatment Provided: ☐ Detention ☒ Infiltration ☐ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1997

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Parking lots drain to catch basins connecting to the conveyance system routing to the infiltration system.
Fire lane and landscape areas are collected and route to swales which connect to the infiltration system.
Building roof discharge collected and routed to infiltration system.
Stormfilter treatment vault prior to fire lane and swale discharge to infiltration

Approximate existing head available:
None Available

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☐ Flow Control
☒ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
80 lf 6"Ø infiltration pipe = ±2261 CF	

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☒ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Sammamish geological maps indicate outwash soils may be present for expanded infiltration footprint. Expand underground infiltration system south into right-of-way or west into parcel open space. Approximately 11,500 SF surface area available. Invert elevation ±11.10 below existing grade.
Additional flow could be taken from 228th Avenue NE or NE Inglewood Hill Road.
Several adjacent residential developments upstream can be connected. Confirm routing.

Site Constraints

Adjacent Land Use:

☒ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☒ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: ____

Possible conflicts due to adjacent land use? ☐ Yes ☐ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:
☐ Slope ☐ Space
☒ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☒ Probable	☐ Not Probable

How many? ____
Approx. DBH: ____

Other Factors:

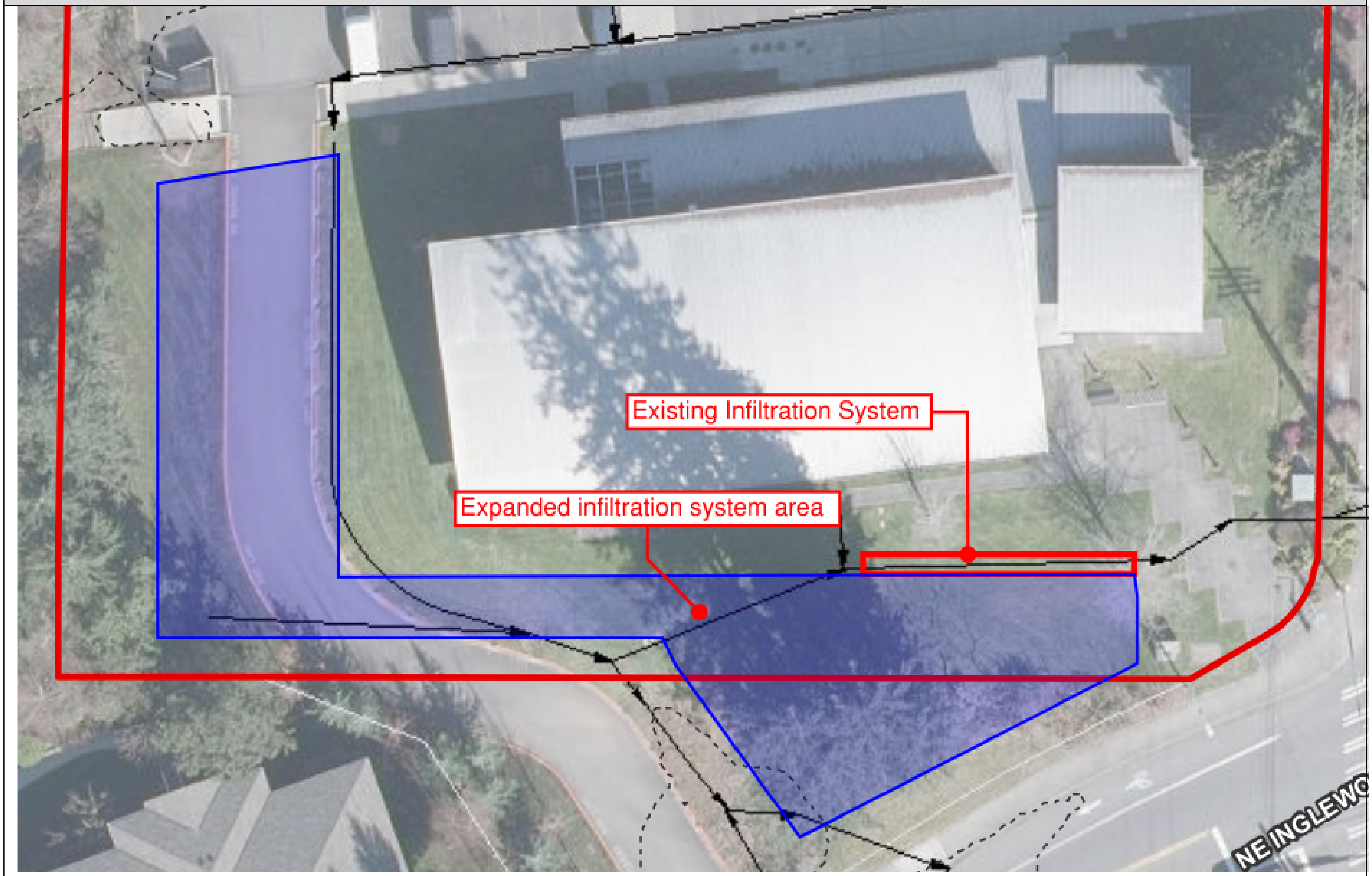
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: ____
Comments:
No TIR Available

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

- Expand underground infiltration system into right-of-way to the south or into landscape area to the west of existing building.
- ±11,500 SF available surface area.

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☒ Confirm drainage area impervious cover
☐ Confirm volume computations
☐ Confirm concept sketch
☒ Obtain existing stormwater practice as-builts
☐ Obtain site as-builts
☐ Obtain detailed topography
☒ Obtain utility mapping
☐ Confirm storm drain invert elevations
☒ Confirm soil types

☐ Other:

Initial Feasibility and Construction Considerations

Confirm infiltration soil types and depths.
Confirm utilities within right-of-way.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☐ No	☒ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D98396 (2095)	**Subwatershed:** Inglewood	**Watershed:** Lake Sammamish
Date: 11/2/2020	**Assessed By:** TM	

Site Description

Name:	Eastlake High School / Drainage Facility No. D98396
Address:	NE 4th Street, KC Parcel 3425069029
Location Notes:	Detention pond is located in the NW corner of the school

Ownership:	☒ Public	☐ Private	☐ Unknown	☐ Sammamish
If Public, Government Jurisdiction:	☒ Local	☒ State	☐ DOT	☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond	☒ Conveyance System	☐ Vacant Parcel	☐ Wetpond	☐ Wet Vault
☐ Outfall	☐ ROW	☐ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈ 9.2 ac

Imperviousness ≈ 75 %

Impervious Area ≈ 6.9 ac

Notes:
Confirm impervious area.

Drainage Area Land Use:

☐ Residential	☒ Institutional
☐ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Existing system includes a 36” detention pipe system with flow restrictor catch basin that outlets to a biofiltration/wetpond. The wetpond flows to a detention cell, which outlets to a bioswale. The bioswale discharges to a wetland.

This system is publicly owned and privately maintained by the school.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1992

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The contributing area includes runoff from roof, non-pollution generating hard surfaces, and pollution generating hard surfaces. The storm system consists of a series of 6- to 12-inch storm pipes, which convey water to a 36-inch detention pipe. No visible drainage problems were apparent during the site visit. The facility appeared to be undermaintained.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☒ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1990 KCSWDM (KCRTS)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☒ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

The storage volume of the pond could be increased by adding walls to up to 25% of the perimeter. It appears that there may be a pocket of outwash soils in the area, based on Sammamish geological maps, which could provide infiltration opportunity. Additional pollution-generating area from the neighboring property could be routed to the pond.

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: __________

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many? __________
Approx. DBH: __________

Other Factors:

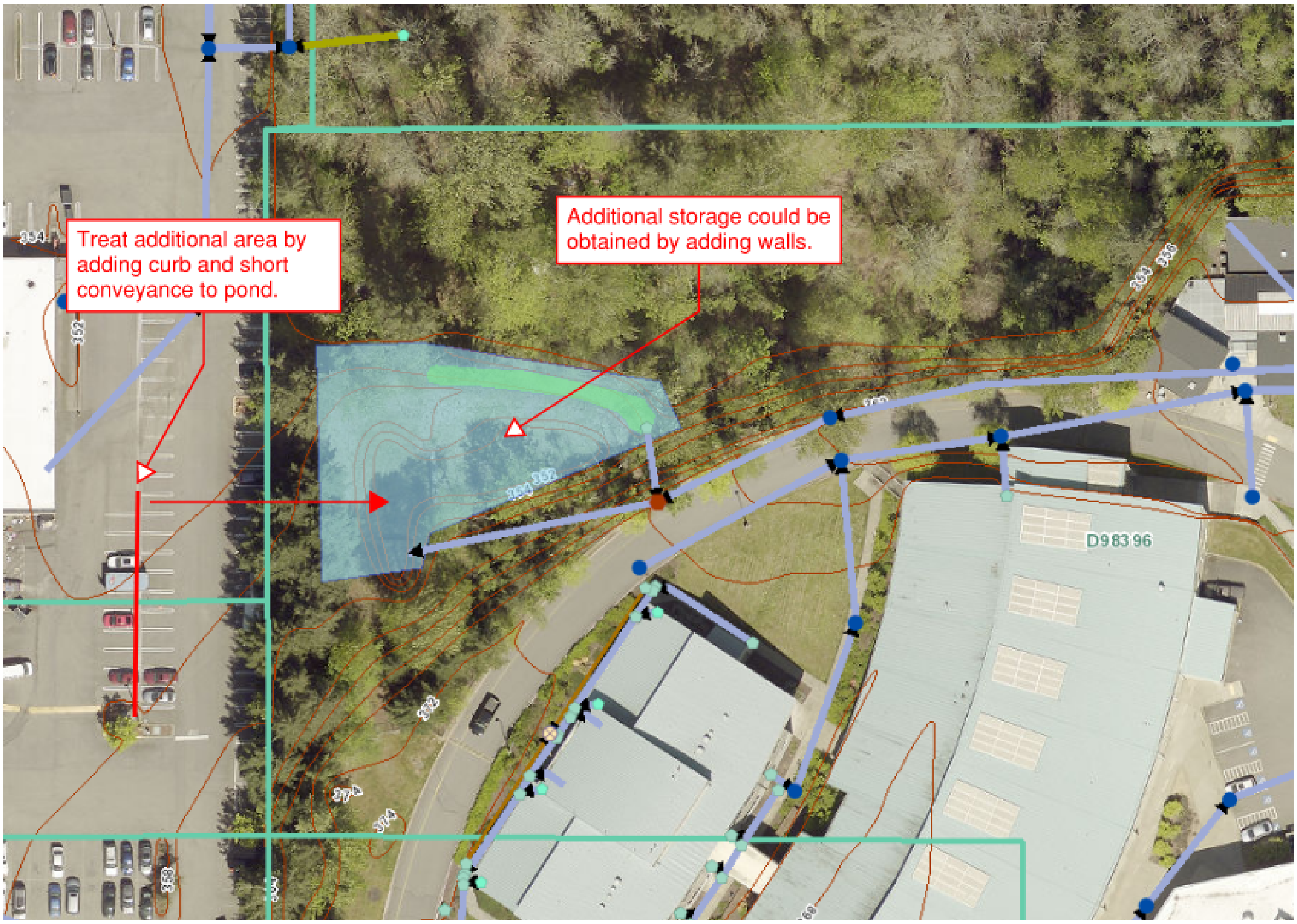
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: __________
Comments:
No TIR available.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID: D98397 (2096)	**Subwatershed:** Inglewood	**Watershed:** Lake Sammamish
Date: 11/2/2020	**Assessed By:** TM	

Site Description

Name: Eastlake HS / Drainage Facility No. D98397

Address: NE 4th Street, KC Parcel 3425069074

Location Notes: Vault and pond located south of Eastlake HS parking lot

Ownership: ☒ Public ☐ Private ☐ Unknown ☐ Sammamish

If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☐ Pond ☒ Conveyance System ☐ Vacant Parcel ☒ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☒ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 2.3 ac

Imperviousness ≈ 100 %

Impervious Area ≈ 2.3 ac

Notes:
Confirm drainage area. It appears that the vault and pond receive runoff only from the parking lot.

Drainage Area Land Use:

☐ Residential
- ☐ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☒ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
The existing system consists of a storage vault, wetpond, and bioswale.

The system is publicly owned and maintained by the school district.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1991

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The contributing area for this system primarily comprises of the parking lot. Runoff generally sheet flows to the south and is conveyed to the storage vault. From here, runoff is conveyed to the wetpond, and discharges through the bioswale to George Davis Creek. No visible drainage problems were apparent during the visit. The facility appeared to be undermaintained.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control

☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1990 KCSWDM (KCRTS)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☒ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM

☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

It appears that additional runoff from the parking lot is bypassing treatment and detention and discharging directly to a small portion of the bioswale. This could be rerouted to the existing vault, or new vault for pre-settlement. The capacity of the pond could be expanded by adding walls to no more than 25% of the perimeter. Additionally, proprietary media filters could be added to the parking lot for additional treatment.

Site Constraints

Adjacent Land Use:

☐ Residential ☐ Commercial ☒ Institutional

☐ Industrial ☐ Transport-Related ☐ Park

☐ Undeveloped ☒ Other: Wetland, George David Creek

Possible conflicts due to adjacent land use? ☐ Yes ☐ No

If yes, describe:

Access:

☒ No Constraints

Constrained due to:

☐ Slope ☐ Space

☐ Utilities ☐ Tree Impacts

☐ Structures ☐ Property Ownership

☐ Other:

Conflicts with Existing Utilities:

☐ None

☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?

Approx. DBH:

Other Factors:

Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

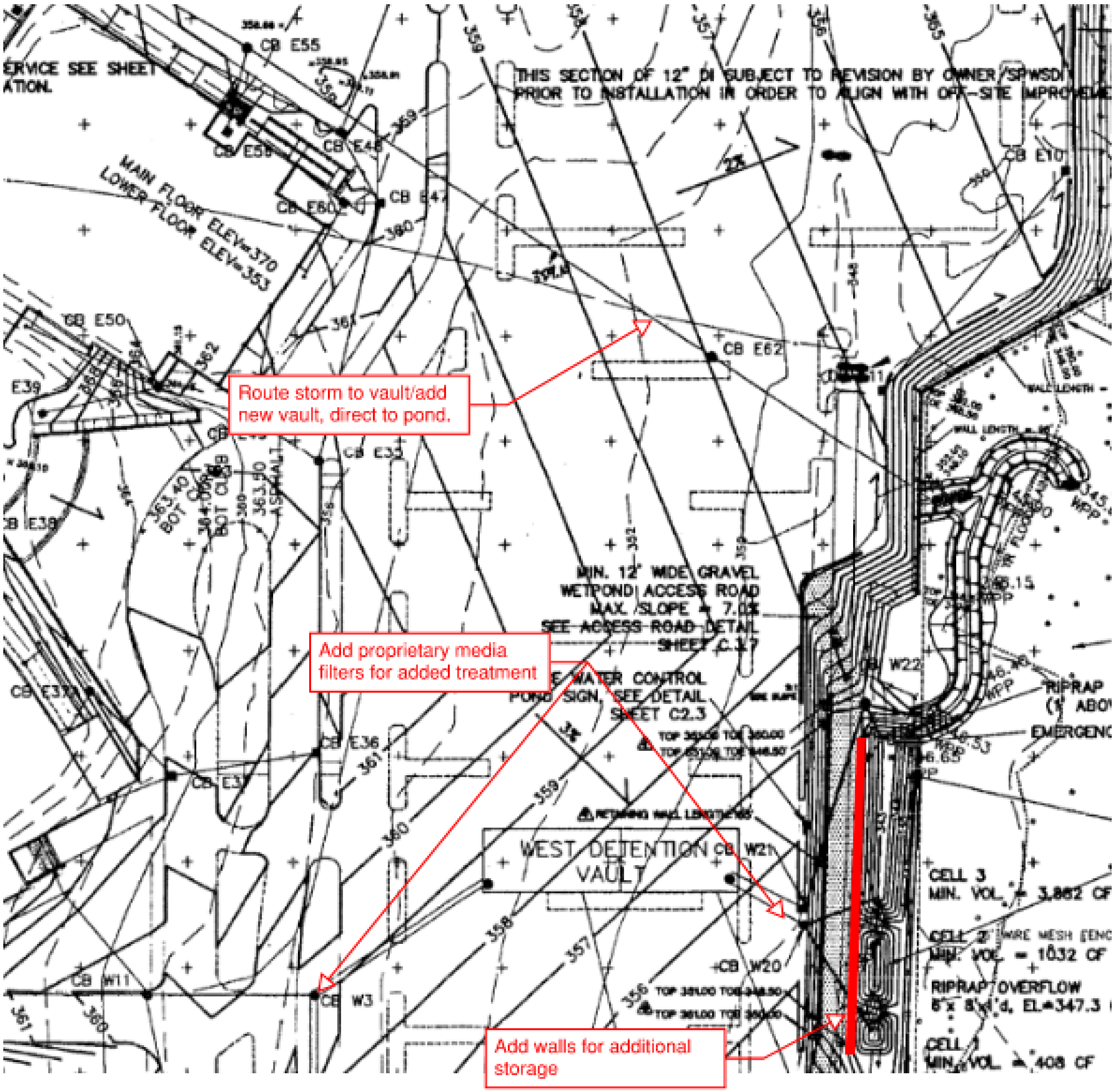
Soil Classification:

Comments:

TIR not provided

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☒ Obtain utility mapping
☒ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID:	D92883 (2120)	**Subwatershed:**	Thompson	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name:	Bellasera / Drainage Facility No. D92883
Address:	505 SE 5th Place
Location Notes:	Trapezoidal pond between 215th Ct SE, SE 5th Pl, and adjacent residence.

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault

☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault

☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 9.03 AC

Imperviousness ≈ 30 %

Impervious Area ≈ 3.07 AC

Notes:
±2.5 DU/GA. Confirm impervious area.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Existing tributary area consists of 17 residences. Assumed roof drainage collected and combined with road drainage to discharge to the detention pond. Flow from 214th Avenue SE is routed through a flow splitter and into the detention pond. Existing detention pond is a two cell pond which discharges to the adjacent wetland to the south via a drywell structure.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☐ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: Addendum Dates on Plans call out design changes during 2000. As-builts done in 2006

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing detention pond is somewhat overgrown. No visible conveyance issues noticed. Conveyance connects from residential parcels, SE 5th Place, 215th Court SE, and flow splitter on 214th Ave SE. A rockery retaining wall exists around the northern edge of the pond. A berm separates the pond from the wetland to the south.

Approximate existing head available:
± 5' from 214th Ave SE
±2.5' from SE 5th Place conveyance
No head available at 215th Court SE.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control

☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
91,827 CF Detention 30,276 CF Water Quality	2000 SF x 6' Live Storage Depth = 12,000 CF Added

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM

☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Install detention vault under adjacent park to north of pond. Route additional flow from existing flow splitter to added detention. Proposed vault approximately 2000 SF footprint at 6' depth. Maximum depth of system 15' below existing grade. Connect pond to existing pond via piping and connect to SE 5th Place conveyance.
Confirm existing wetland discharge is maintained.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional

☐ Industrial ☐ Transport-Related ☐ Park

☐ Undeveloped ☒ Other: Wetland

Possible conflicts due to adjacent land use? ☐ Yes ☒ No

If yes, describe:

Access:

☐ No Constraints

Constrained due to:

☒ Slope ☐ Space

☐ Utilities ☐ Tree Impacts

☒ Structures ☐ Property Ownership

☐ Other:

Conflicts with Existing Utilities:

☐ None

☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?

Approx. DBH:

Other Factors:

Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

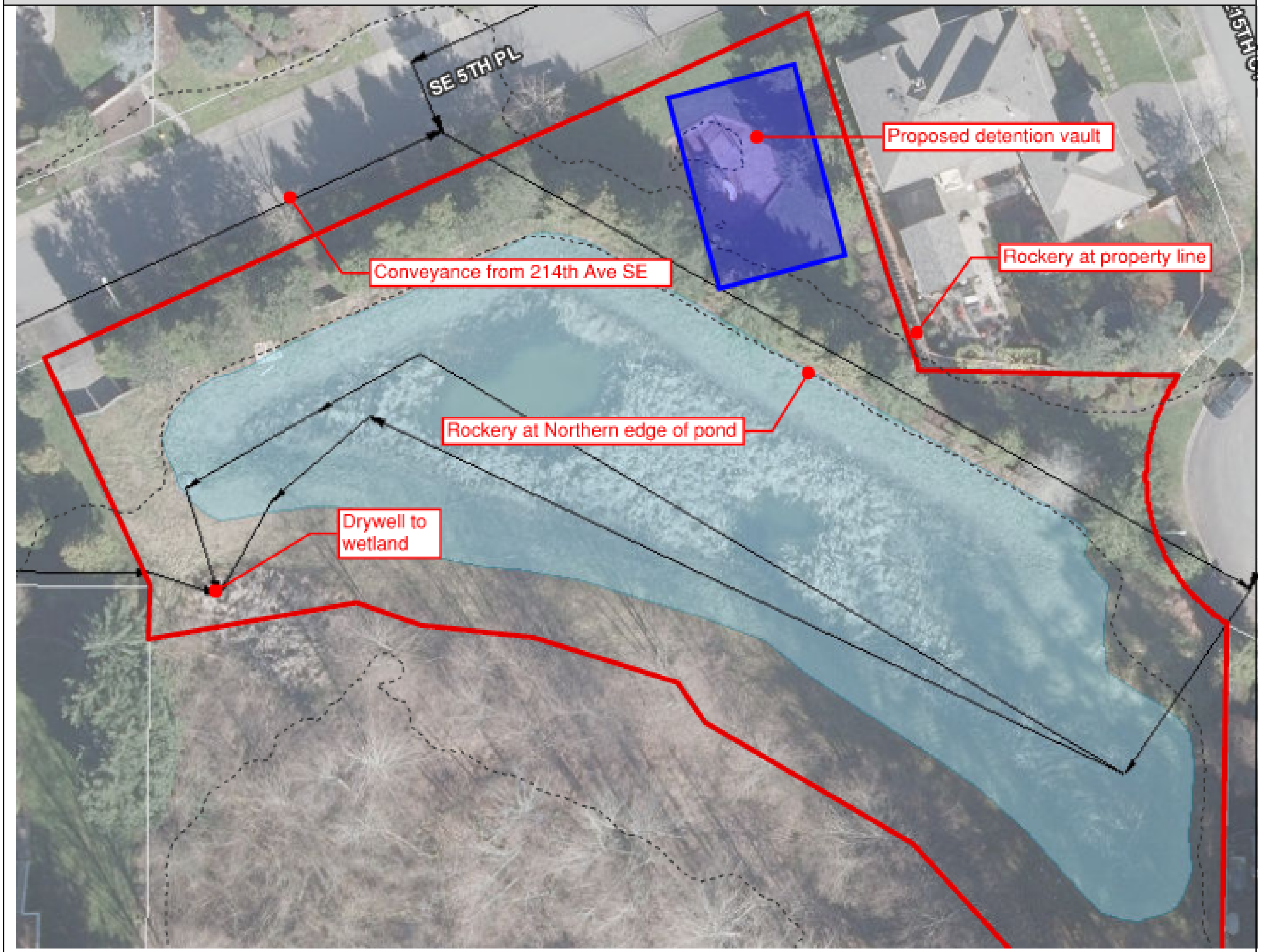
Soil Classification:

Comments:

No TIR available.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

 Unique Site ID: D92883 (2120)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☒ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☐ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
Rockery walls surrounding northern edge of pond and adjacent properties present constructability concerns for shoring. Pond cannot be expanded deeper due to likely high groundwater at wetland. Park / playground will need to be rebuilt on top of proposed vault.

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	D93012 (2125)	**Subwatershed:**	Thompson	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name:	Chestnut Lane / Drainage Facility No. D93012
Address:	20911 SE 8th Place
Location Notes:	Triangular parcel between SE 8th Place, row of residences, and wetland

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 18.15 AC
Imperviousness ≈ 37 %
Impervious Area ≈ 6.8 AC

Notes:
Roof and pervious drainage routes to wetlands. Wetland 1 outlets to detention pond. Roadway drains to pond.

Drainage Area Land Use:

☐ Residential
- ☐ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Per TIR, system designed to meet 1998 KCSWDM – Level 2 standards. Roof and pervious drainage is discharged from lots to existing wetlands on-site. Wetland 1 [6.41 AC] discharges to the detention pond. Houses not draining to the wetland and roadways are routed to the detention pond. Pond discharges to Ebright Creek.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2006

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing pond is well maintained. Existing site drainage routes through roadway and wetland. No visible problems observed on-site. Water quality is maintained through a dead-storage wetpool facility (±69,170 CF).

Approximate existing head available:
±41’ available between pond bottom and outfall to Ebright Creek.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
Live Storage = 181,406 CF Dead Storage = 69,170 CF	

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Install walls on 25% of pond boundary. Expand and deepen detention pond for greater live storage depth.
Route additional flow for 212th Ave SE to pond.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: Wetland

Possible conflicts due to adjacent land use? ☒ Yes ☐ No
If yes, describe: Potential wetland impact

Access:

☒ No Constraints
Constrained due to:

☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☒ Probable	☐ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

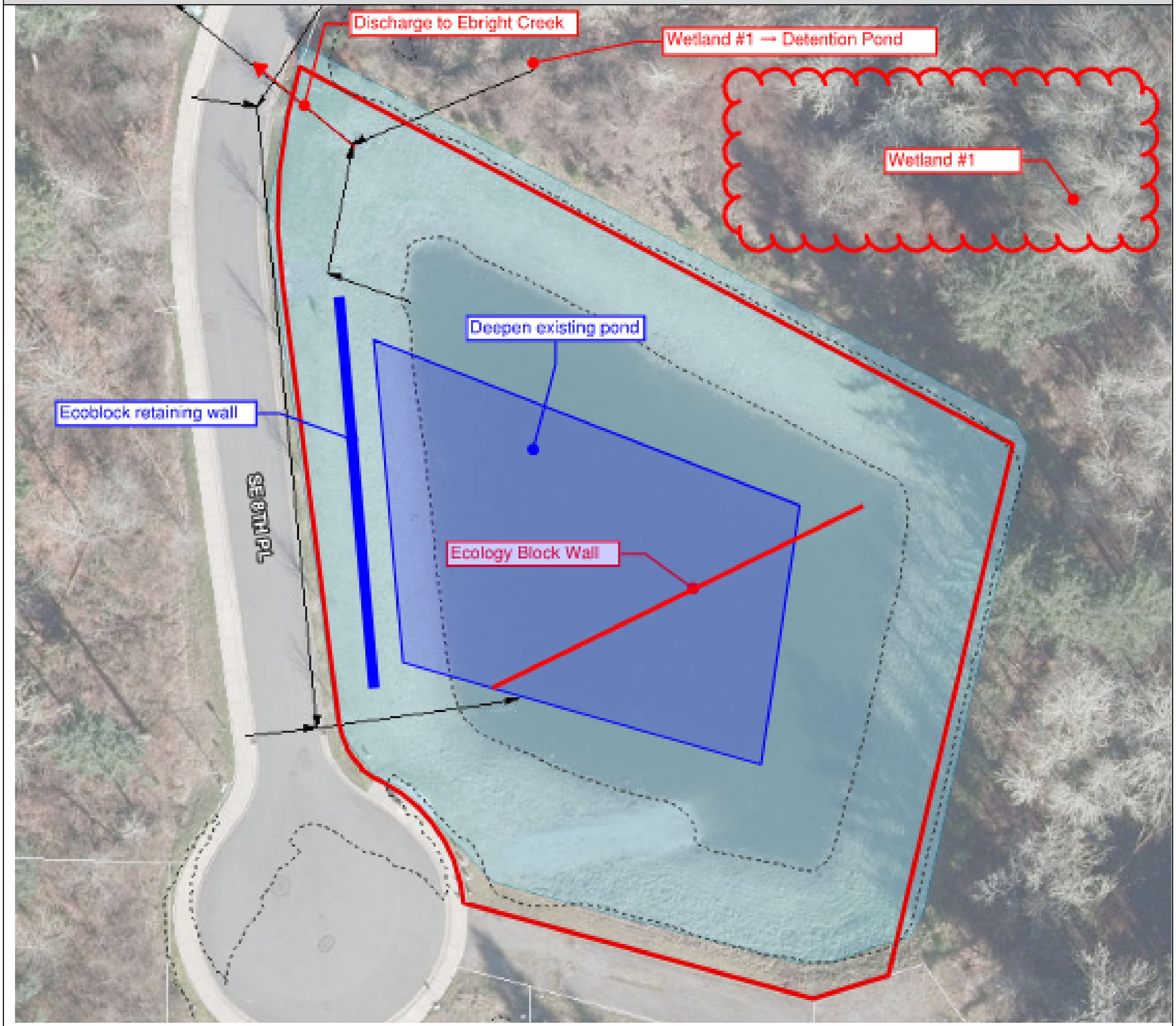
Soils:

Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: Class C – Till [1-10%]
Comments:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D93012 (2125)

Design or Delivery Notes
Expand existing facility footprint and depth.

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☐ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
- Install wall on western side of pond for crane access from roadway - Verify wetland volumes are maintained by discharge from Wetland #1 to Pond. - A fence is recommended to be installed around this facility.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

 Unique Site ID: D93012 (2125)

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID: D92928 (2128)	**Subwatershed:** Pine Lake Creek	**Watershed:** East Lake Sammamish
Date: 11/2/2020	**Assessed By:** SN	

Site Description

Name: The Crossings at Pine Lake / Drainage Facility No. D92928

Address: 20767 SE 20th Street

Location Notes: Tract between SE 20th Street and 208th Place SE

Ownership:	☐ Public	☐ Private	☐ Unknown	☒ Sammamish
If Public, Government Jurisdiction:	☐ Local	☐ State	☐ DOT	☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond	☐ Conveyance System	☐ Vacant Parcel	☐ Wetpond	☐ Wet Vault
☐ Outfall	☐ ROW	☐ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈ 14.78 AC

Imperviousness ≈ 70% %

Impervious Area ≈ 10.34

Notes:
Tract B per As-Builts

Drainage Area Land Use:

☒ Residential	☐ Institutional
☒ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Flow Control per 1998 KCSWDM – Level 2. Water Quality meets 1998 KCSWDM and Sammamish Lake Protection requirements. 179,129 CF live storage provided.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☐ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: No construction date indicated. Plans dated 2002

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing site is a single cell wetpond with baffle wall. Facility appears well maintained and no visible problems were noticed while on-site. Pond discharges under SE 20th Street and out to Pine Lake Creek.

Approximate existing head available:
Bottom of live storage: 346.83 – Pine Creek Invert: 340 = 6.83 feet available.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control

☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	Retrofit Computations (Storage)
179,129 CF Live Storage 62,702 CF Wetpool Storage 1998 KCSWDM – KCRTS Level 2 +10%	

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM

☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Install walls on 25% of pond perimeter and deepen pond per available head. Available depth up to 6.3ft. Expand pond surface area for expanded pond footprint with walls. Revise downstream conveyance per deeper pond.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional

☐ Industrial ☐ Transport-Related ☐ Park

☐ Undeveloped ☐ Other: ____________

Possible conflicts due to adjacent land use? ☒ Yes ☐ No

If yes, describe: Outlet pipe is installed closely between two houses

Access:

☐ No Constraints

Constrained due to:

☐ Slope ☒ Space

☐ Utilities ☐ Tree Impacts

☒ Structures ☒ Property Ownership

☐ Other:

Conflicts with Existing Utilities:

☐ None

☒ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☒ Probable	☐ Not Probable
Impacts to Specimen Trees	☒ Probable	☐ Not Probable

How many? ____________

Approx. DBH: ____________

Other Factors:

Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: ____________

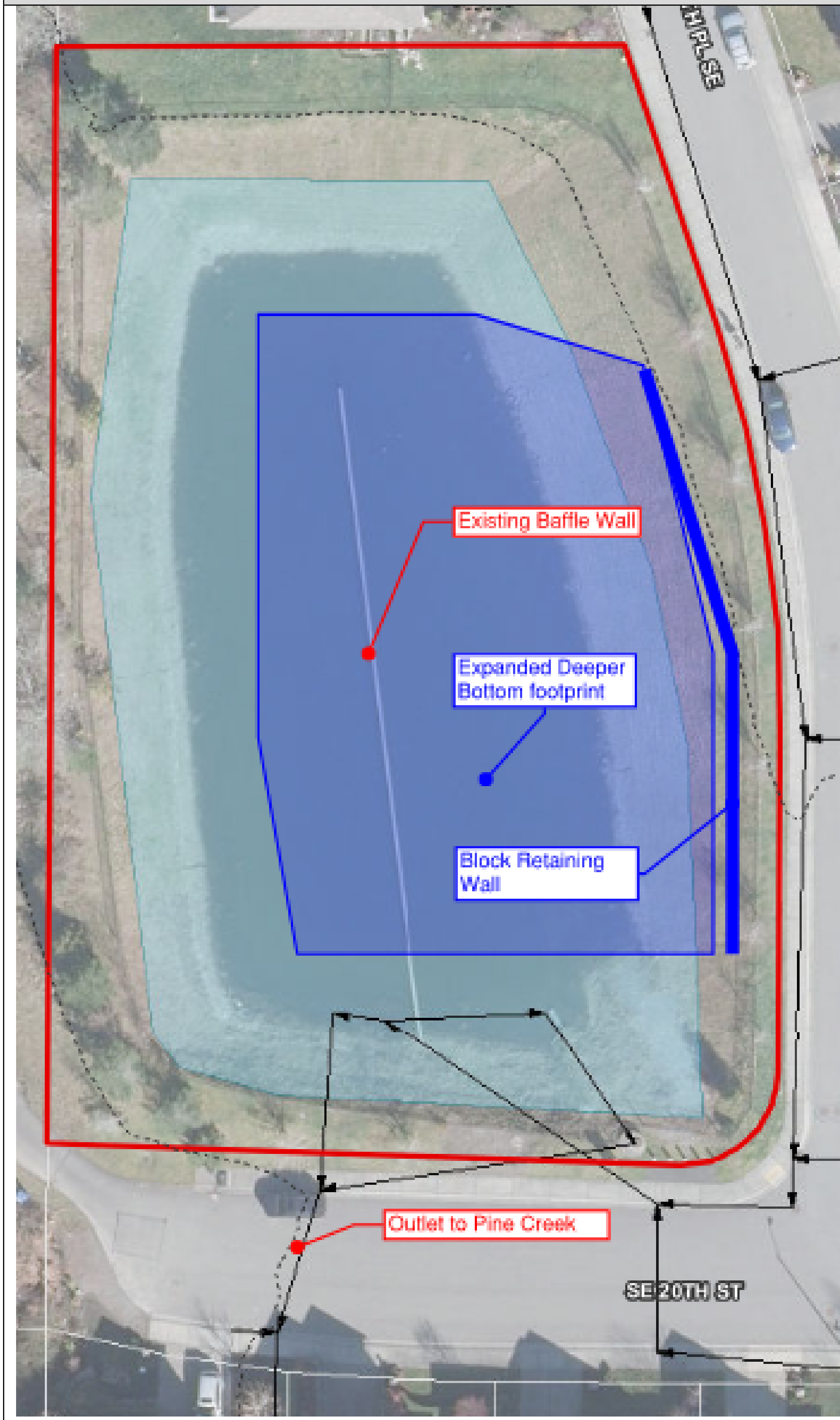
Comments:

Class C, Alderwood Till (AgB, AgC, AgD)

Area not known for outwash soils per City of Sammamish

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D92928 (2128)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
Outlet to Pine Creek may be difficult to replace due to proximity of adjacent structures. Wall should be constructed on a side adjacent to SE 20th Street or 208th Place SE ease of crane use. Verify that water quality treatment is provided. The TIR indicates no treatment but provides wetpool volume.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☐ No	☒ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D91349 (2131)	**Subwatershed:** Inglewood	**Watershed:** East Lake Sammamish
Date: 11/2/2020	**Assessed By:** SN	

Site Description

Name: Demery Hill / Drainage Facility No. D91349

Address: 757 222nd Place NE

Location Notes: Underground Vault at North East corner of parcel

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☐ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☒ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 5.30 AC

Imperviousness ≈ 60 %

Impervious Area ≈ 3.18 AC

Notes:
No TIR Available.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
42,120 CF underground concrete stormwater vault with control structure. No water quality provided.

Existing Treatment Provided: ☐ Detention ☐ Infiltration ☐ Water Quality ☒ None ☐ Unknown

Year of Construction, if known: 1985

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing site is mostly undeveloped forest space. The detention vault takes up a small portion of the site. Site drainage exists mainly in the east corner of the site. Conveyance runs down the southern property line. No visible problems notices while on-site. On-site sheet flow flows west towards the adjacent forest. Downstream conveyance appears to head towards NE 8th Street.

Approximate existing head available:
No upstream head available. Downstream head +30’ available. Please verify.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
±42,120 CF per Asbuilts Pre-1990 KCSWDM / 1979 KC Manual	±58,000 CF (18,000 CF per Impervious Acre)

Proposed Treatment Option:

☒ Expanded Detention ☒ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Excavate and remove existing underground detention vault. Construct larger / deeper vault to current flow control and water quality standards. Maintain existing incoming and outgoing conveyance. Rebuild control structure.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☒ Undeveloped ☐ Other:

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:
☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

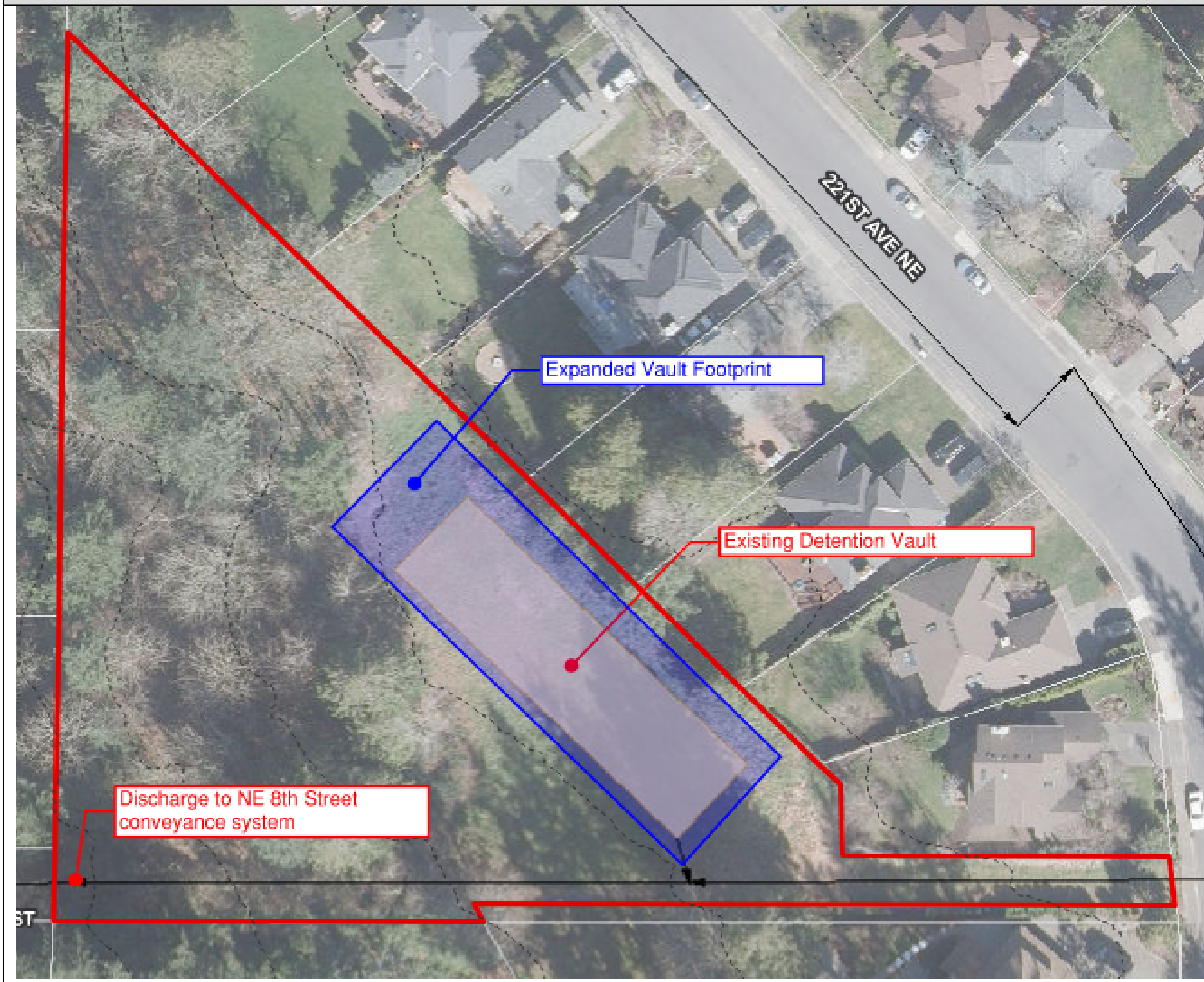
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:
Comments:
No TIR Available

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

 Unique Site ID: D91349 (2131)

Design or Delivery Notes

Per City of Sammamish geologic information, outwash soils may be present. Confirm soil types and use infiltration ponds where feasible.
Forested space on-site slopes between 1-10%.

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☐ Confirm drainage area impervious cover
☐ Confirm volume computations
☐ Confirm concept sketch
☒ Obtain existing stormwater practice as-builts
☐ Obtain site as-builts
☒ Obtain detailed topography
☐ Obtain utility mapping
☒ Confirm storm drain invert elevations
☒ Confirm soil types
☐ Other:

Initial Feasibility and Construction Considerations

Existing site access is relatively constricted. A temporary construction easement would likely be suggested through the neighboring cleared backyard.

Is site candidate for further investigation?	☒ Yes	☐ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	DS0001 / DS0002 (2132)	**Subwatershed:**	Thompson	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name: Greenbriar / Drainage Facility No. DS0001 & DS0002

Address: 20904 SE 6th Place

Location Notes: Pond is behind row of houses at Northwest corner of property. Pond is being used as a park.

Ownership: ☐ Public ☐ Private ☐ Unknown ☐ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 17.88 AC

Imperviousness ≈ 56 %

Impervious Area ≈ 10.09 AC

Notes:
Basin areas per TIR

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Combined wet detention pond sized to meet lake protection standards and KCSWDM. Wetpond discharges through stormfilter and then to infiltration vault. Existing infiltration vault is precast concrete and has a sand bottom.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2016

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing storm pond has a gravel walking path around the berm and appears to have been converted to a park. Existing site drainage routes from rooftops to roadway conveyance system which discharges to the stormwater pond. Stormwater then routes through two wet pond cells in the combined wet detention pond. Stormwater then discharges to a stormfilter vault for pretreatment prior to reaching the infiltration vault. A portion of the offsite flow is routed to the detention pond as well. The park above the infiltration vault was not draining and was a deep mud. Downstream discharge of overflow is Ebright Creek.

Approximate existing head available:
No head available upstream
6.71 feet available downstream of infiltration vault.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
84,311 CF Wetpool Volume 309,367 CF Detention Volume 7.94 In/Hr Infiltration Rate 1998 KCSWDM	

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Walls could be installed to expand detention footprint. Per City of Sammamish geologic studies, outwash soils are not likely in this area, however the opportunity to infiltrate is available given the use of the infiltration vault. Pond could be converted to infiltration if soil types are feasible under the facility.
Conveyance can be increased from 212th Ave SE

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

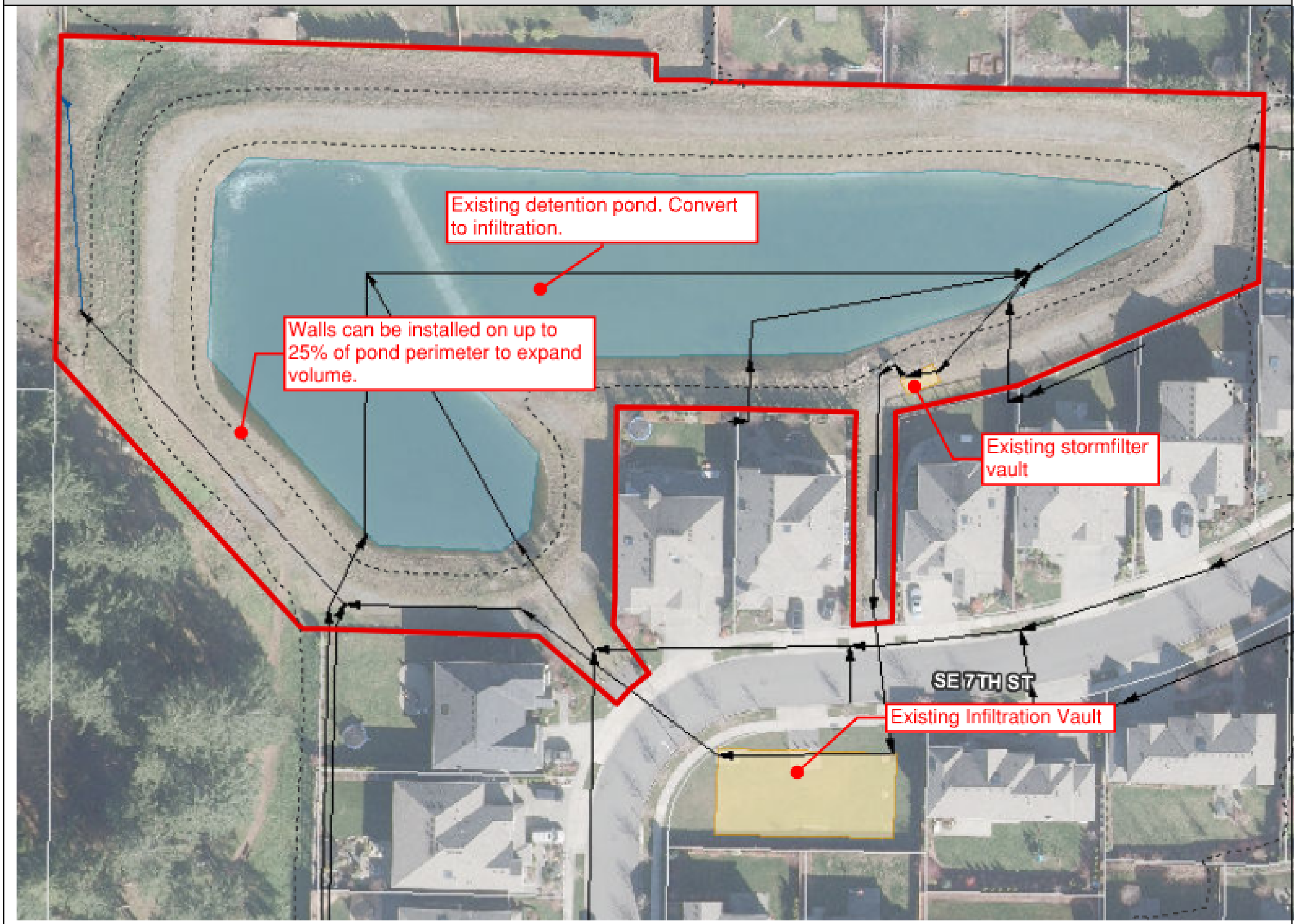
Soils:

Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:
Comments:
Alderwood Gravelly, Sandy Loam (AgC)

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Site appears to be sufficiently built-out to current flow control and water quality standards. If infiltration of the detention pond is not feasible, options to expand this facility are limited. Initial design cites 7.94 In/hr infiltration rate, however conservative rate adjustments should be considered as well as installation of additional measures to protect infiltration soils from sediment. Groundwater seepage could also be considered to migrate flow toward ravine slopes to the south.

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	D92745 (2133)	**Subwatershed:**	Inglewood	**Watershed:**	Lake Sammamish
Date:	11/2/2020	**Assessed By:**	TM		

Site Description

Name:	Greens at Beaver Crest / Drainage Facility No. D92745
Address:	SE 2nd Place, KC parcels
Location Notes:	Intersection of SE 2nd Place and 238th Ave SE

Ownership:	☐ Public	☐ Private	☐ Unknown	☒ Sammamish
If Public, Government Jurisdiction:	☐ Local	☐ State	☐ DOT	☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond	☐ Conveyance System	☐ Vacant Parcel	☒ Wetpond	☐ Wet Vault
☐ Outfall	☐ ROW	☐ Infiltration	☐ Tank	☐ Vault
☐ Other:				

Drainage Area to Proposed Retrofit

Drainage Area ≈	39.4 ac
Imperviousness ≈	54.7 %
Impervious Area ≈	21.6 ac

Notes:
Areas taken from page 133 of Greens at Beaver Crest TIR

Drainage Area Land Use:

☒ Residential	☐ Institutional
☒ SFH (< 1 ac lots)	☐ Industrial
☐ SFH (> 1 ac lots)	☐ Transport-Related
☐ Townhouses	☐ Park
☐ Multi-Family	☐ Undeveloped
☐ Commercial	☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
The Greens at Beaver Crest modified the pond (G34), which was modeled after the 1990 KCSWDM for the Three Willows development. The wetpond was updated to the 1998 KCSWDM, and additional volume was obtained by removing a cell. The pond receives runoff from The Greens at Beaver Crest, The Three Willows, and Bordeaux at Beaver Crest sites.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1997

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The existing site generally flows from east to west towards the pond. The conveyance system consists of 12- to 24-inch storm pipes and catch basins. No apparent drainage problems were visible during the visit. The pond outlets to George Davis Creek.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:
☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1990 KCSWDM (SBUH)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:
☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:
Expand detention by adding walls and removing cells. Increase treatment by adding proprietary media filters upstream of the pond. Add a bioswale with level spreader downstream of the pond for additional treatment and a less concentrated discharge.

Site Constraints

Adjacent Land Use:
☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: George Davis Creek
Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:
☐ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:
☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:
Other Factors:

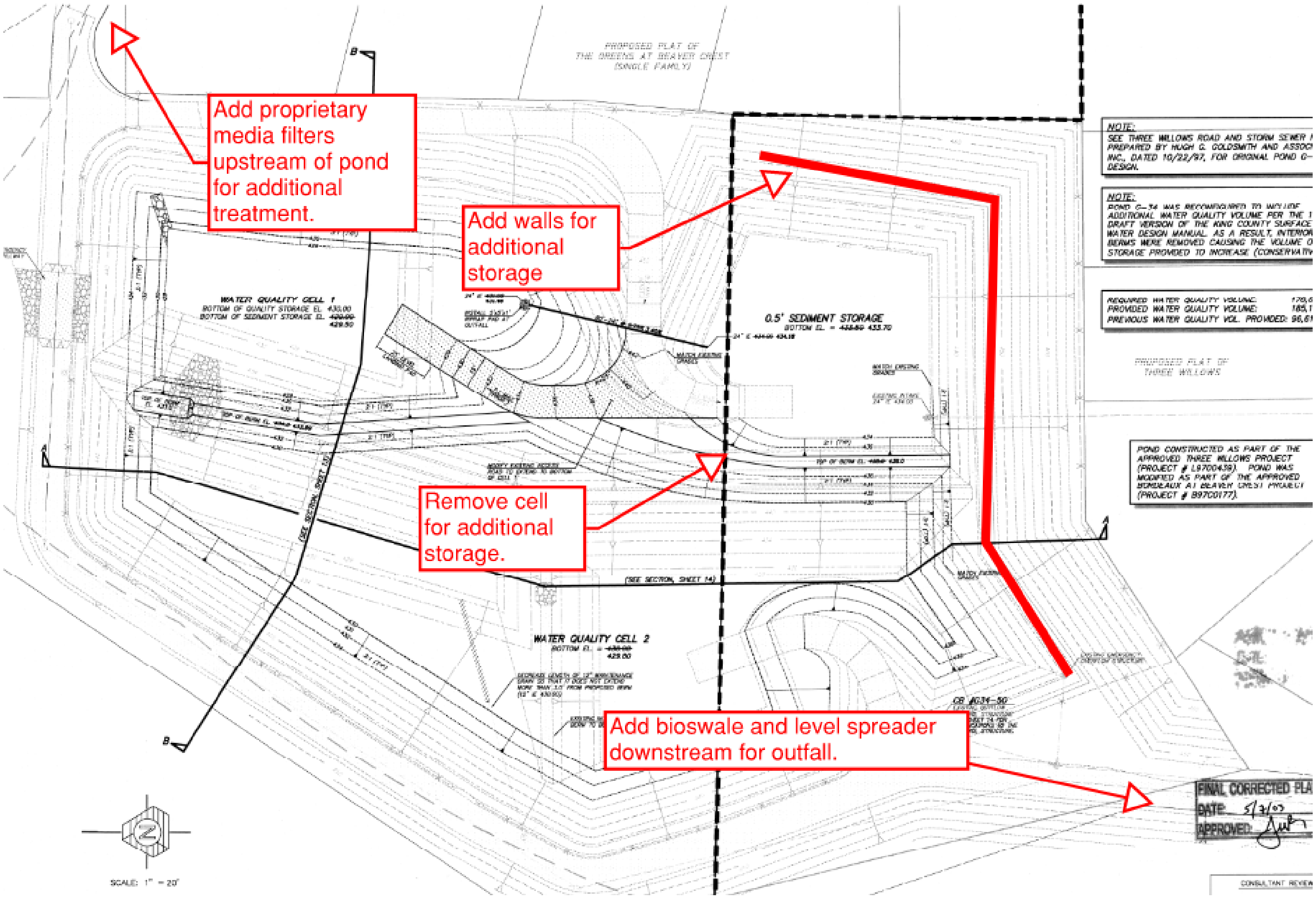
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: Till
Comments:
Confirm soils

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

 Unique Site ID: D92745 (2133)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

- ☐ Confirm property ownership
- ☒ Confirm drainage area
- ☒ Confirm drainage area impervious cover
- ☒ Confirm volume computations
- ☐ Confirm concept sketch
- ☐ Other:
- ☐ Obtain existing stormwater practice as-builts
- ☐ Obtain site as-builts
- ☐ Obtain detailed topography
- ☒ Obtain utility mapping
- ☐ Confirm storm drain invert elevations
- ☒ Confirm soil types

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID:	D98903 (2141)	**Subwatershed:**	Inglewood	**Watershed:**	Lake Sammamish
Date:	11/2/2020	**Assessed By:**	TM		

Site Description

Name:	228th Ave NE/SE, KC Parcel 3425069053 / Drainage Facility No. DS0015 & D98903
Address:	228th Ave NE/SE
Location Notes:	East side of 288th Ave NE, across from intersection of 228th Ave SE and NE 2nd Street

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☒ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 14.2 ac

Imperviousness ≈ 45 %

Impervious Area ≈ 6.4 ac

Notes:
Drainage area obtained from TIR

Drainage Area Land Use:

☐ Residential
- ☐ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☐ Institutional
☐ Industrial
☒ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Existing system includes two detention ponds, bioswale, and a constructed wetland. According to the TIR, the north pond and bioswale exist on the north side of SE 4th Street, just east of 228th Ave. It was unclear where the bioswale was located.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2002

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The conveyance system consists of 12-inch pipes that collect runoff primarily from 228th Ave NE. Additional runoff is also collected from various pervious areas along the tributary basin. No visible drainage problems were observed during the site visit. The site appeared to be maintained.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1998 KCSWDM (KCRTS)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☒ Wet Pond ☒ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Capacity could be increased by adding walls to the ponds. It appears that there is a site immediately to the south (KC Parcel 3425069017) that appears to drain to a vault. It does not appear that this pond provides any treatment. This could be obtained by converting the pond to a wetpool, adding a bioswale, and/or proprietary media filters along 228th Ave NE.

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☒ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: George Davis Creek

Possible conflicts due to adjacent land use? ☒ Yes ☐ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:
☐ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

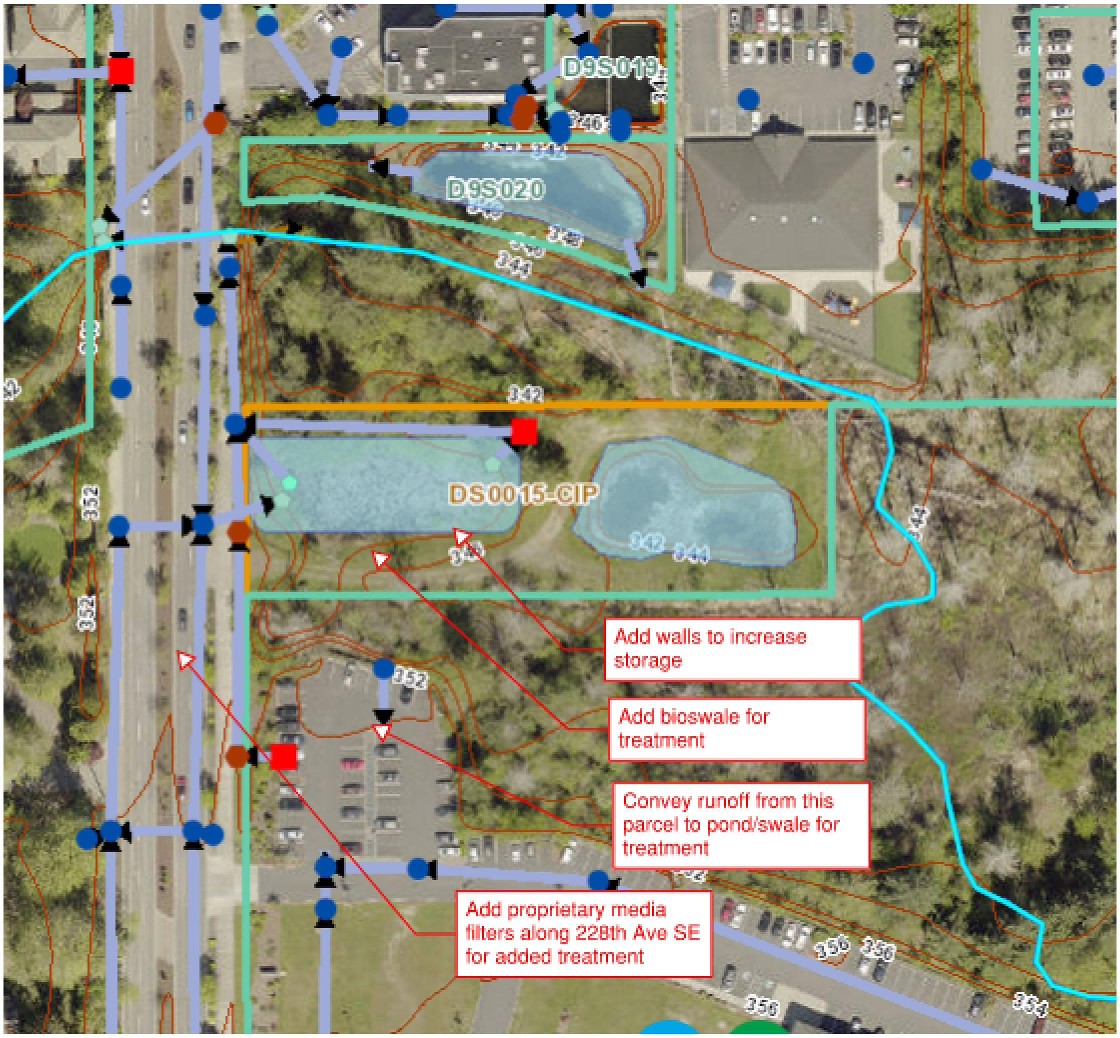
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:
Comments:
No Geotech report referenced in TIR

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☒ Confirm drainage area impervious cover
☒ Confirm volume computations
☒ Confirm concept sketch
☒ Obtain existing stormwater practice as-builts
☒ Obtain site as-builts
☐ Obtain detailed topography
☐ Obtain utility mapping
☐ Confirm storm drain invert elevations
☐ Confirm soil types
☐ Other:

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☐ No	☒ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☐ No	☒ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation

RRI

Unique Site ID:	D92668 (2150)	**Subwatershed:**	Thompson	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name:	The Meadow at Redford Ranch / Drainage Facility No. D92668
Address:	1205 225th Place SE
Location Notes:	Behind western row of homes. Access at north west corner of site.

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 13.22 AC

Imperviousness ≈ .63 %

Impervious Area ≈ 8.29

Notes:

Areas per TIR
4 AC @ 85% Imp. [Multifamily]
9 AC @ 52% Imp. [SFR 6 DU/Ac]
0.19 AC @ 100% Imp. [228th Ave SE Offsite]

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:

Designed in accordance to 1998 KCSWDM.
Two cell wetpool detention facility.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2002

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:

Existing site drains east to west. Roof drainage connects to in-street conveyance and outlets to the detention pond. No onsite conveyance issues were observed on-site. Existing detention pond is a two cell wetpond. Pond discharges to outlet of existing wetland and flows west towards Lancaster Way SE.

Approximate existing head available:

Upstream Head Available:9.51’
Downstream Head Available: 11.79’

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:
☐ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
69,733 CF Water Quality Volume 86,564 CF Detention Volume	

Proposed Treatment Option:
☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Downstream discharge is significantly deeper than pond. Pond could be expanded deeper to provide more live storage volume for the facility. Some sheet flow from 228th Avenue SE seems to be tributary to the system however it does not appear that additional flow can be captures off of 228th Avenue SE.

Site Constraints

Adjacent Land Use:
☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: Wetland (North)
Possible conflicts due to adjacent land use? ☐ Yes ☐ No
If yes, describe:

Access:
☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:
☐ None
☒ Unknown

Yes	**Possible**	
☐	☒	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many? ____
Approx. DBH: ____
Other Factors:

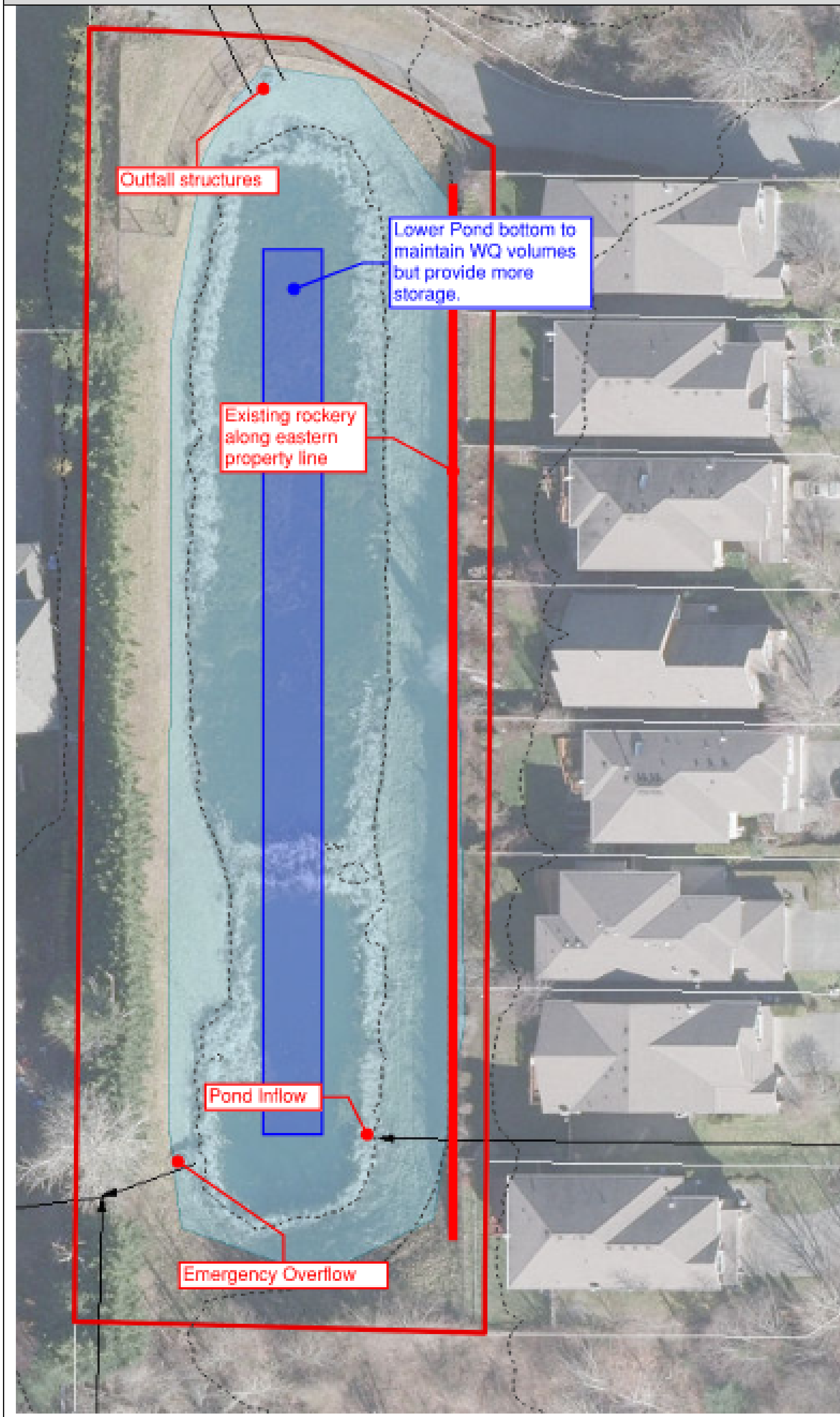
Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:
Comments:
Type C – Alderwood Till

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☐ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID: D92854 (2158)	**Subwatershed:** Inglewood	**Watershed:** Lake Sammamish
Date: 11/2/2020	**Assessed By:** TM	

Site Description

Name: Renaissance / Drainage Facility No. D92854

Address: SE 8th Street, KC Parcel 7215722030

Location Notes: Northwest corner of the Renaissance development

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☒ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☒ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 42.2 ac

Imperviousness ≈ 40 %

Impervious Area ≈ 16.9 ac

Notes:
Assumed 40% impervious for residential. Confirm drainage basin and impervious surface.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
The existing development contains a three celled wetpond with control structure. The pond outfalls to a bioswale and wetland.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2001

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The site is developed with single-family residences and drains to the northwest corner of the basin. The conveyance system consists of a series of catch basins and 12- to 30-inch CPEP. The existing pond contains a wall along the south and west sides. No visible problems existing at the time of the visit.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1998 KCSWDM (KCRTS) Level 1 Flow Control	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Additional storage volume could be obtained by removing the cells and converting the pond to a detention pond, with no dead storage. Install proprietary media storage upstream of the pond, including tributary area in SE 8th Street.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: Wetland, road

Possible conflicts due to adjacent land use? ☒ Yes ☐ No

If yes, describe:
Rockery, wall, wetland, and road prevent pond expansion.

Access:

☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☒ None
☐ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

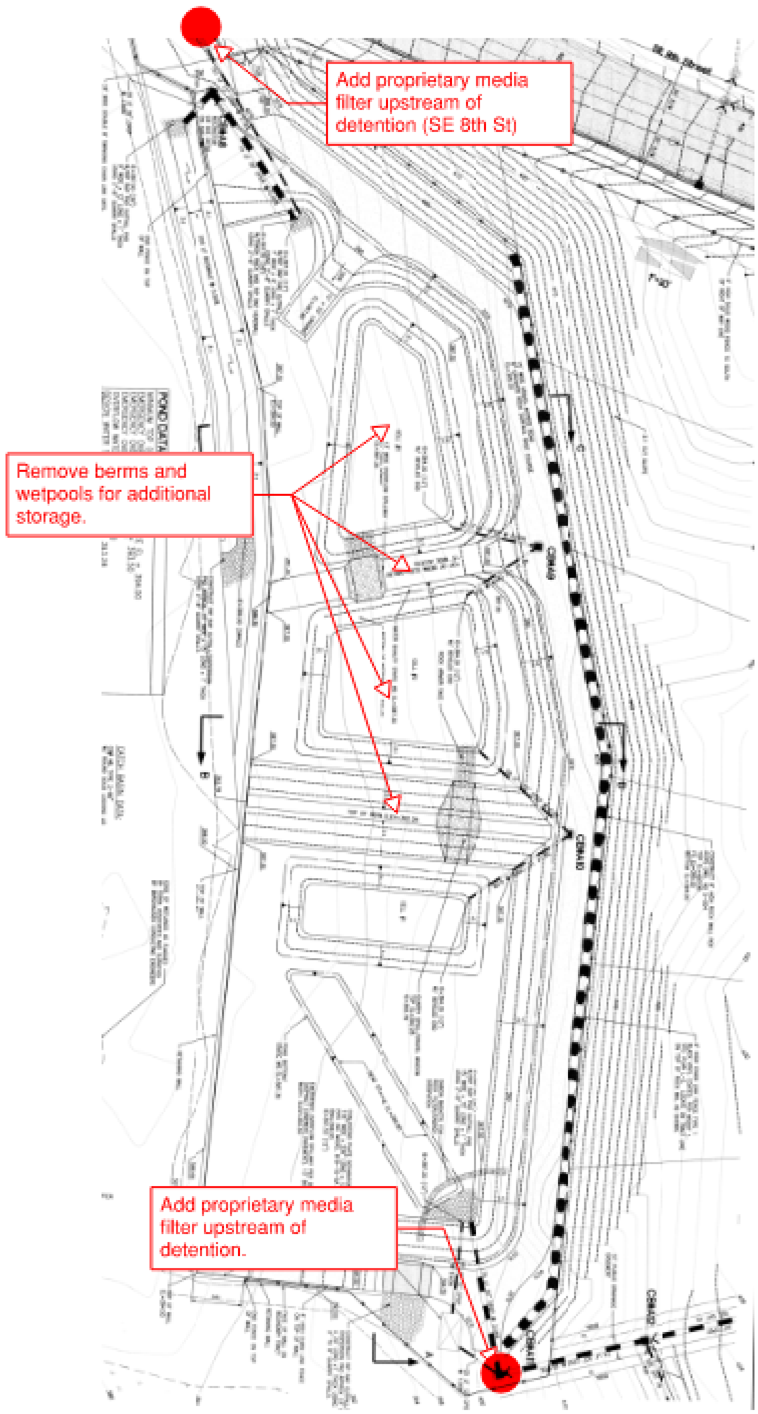
Soils:

Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☒ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☒ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: Alderwood (till)
Comments:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D92854 (2158)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☒ Confirm drainage area impervious cover
☒ Confirm volume computations
☐ Confirm concept sketch
☐ Obtain existing stormwater practice as-builts
☐ Obtain site as-builts
☐ Obtain detailed topography
☐ Obtain utility mapping
☒ Confirm storm drain invert elevations
☐ Confirm soil types
☐ Other:

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	D92855 (2159)	**Subwatershed:**	Inglewood	**Watershed:**	Lake Sammamish
Date:	11/2/2020	**Assessed By:**	TM		

Site Description

Name:	Renaissance / Drainage Facility No. D92855
Address:	SE 9th Street, KC Parcel 721572-2040
Location Notes:	Northeast corner of Renaissance development

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☒ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault

☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault

☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 10.3 ac

Imperviousness ≈ 40 %

Impervious Area ≈ 4.1 ac

Notes:
Assumed 40% impervious for residential. Confirm impervious coverage.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☐ Institutional

☐ Industrial

☐ Transport-Related

☐ Park

☐ Undeveloped

☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Existing parcels drain to a bioswale before entering a three-cell wetpond. Stormwater discharges through a control structure and to a wetland.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2002

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing developed parcels drain through a series of catch basins and storm pipes to the bioswale. The storm pipes consist of 12- and 18-inch CPEP. No visible problems were observed during the visit. In general, the contributing parcels drain to the northeast corner and wetland.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☒ Other: Dispersal trench

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1998 KCSWDM (KCRTS)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☒ Other: Dispersal trench

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Expand the pond by removing the cells and adding walls. It appears that additional drainage area at 244th Ct SE could be rerouted to the expanded pond. Currently, this area is released through a swale, and is not treated or controlled. Convert the pond outlet to a dispersal trench, instead of a concentrated outlet, to minimize impact to wetland. The bioswale would need to remain in order to meet the Sensitive Lake Treatment requirement, along with an additional treatment facility in accordance with the 2016 KCSWDM (unless the site can infiltrate).

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: wetland

Possible conflicts due to adjacent land use? ☒ Yes ☐ No

If yes, describe:
Constrained by residential properties and wetland buffer

Access:

☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☒ None
☐ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☒ Probable	☐ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many? ______
Approx. DBH: ______

Other Factors:

Soils:

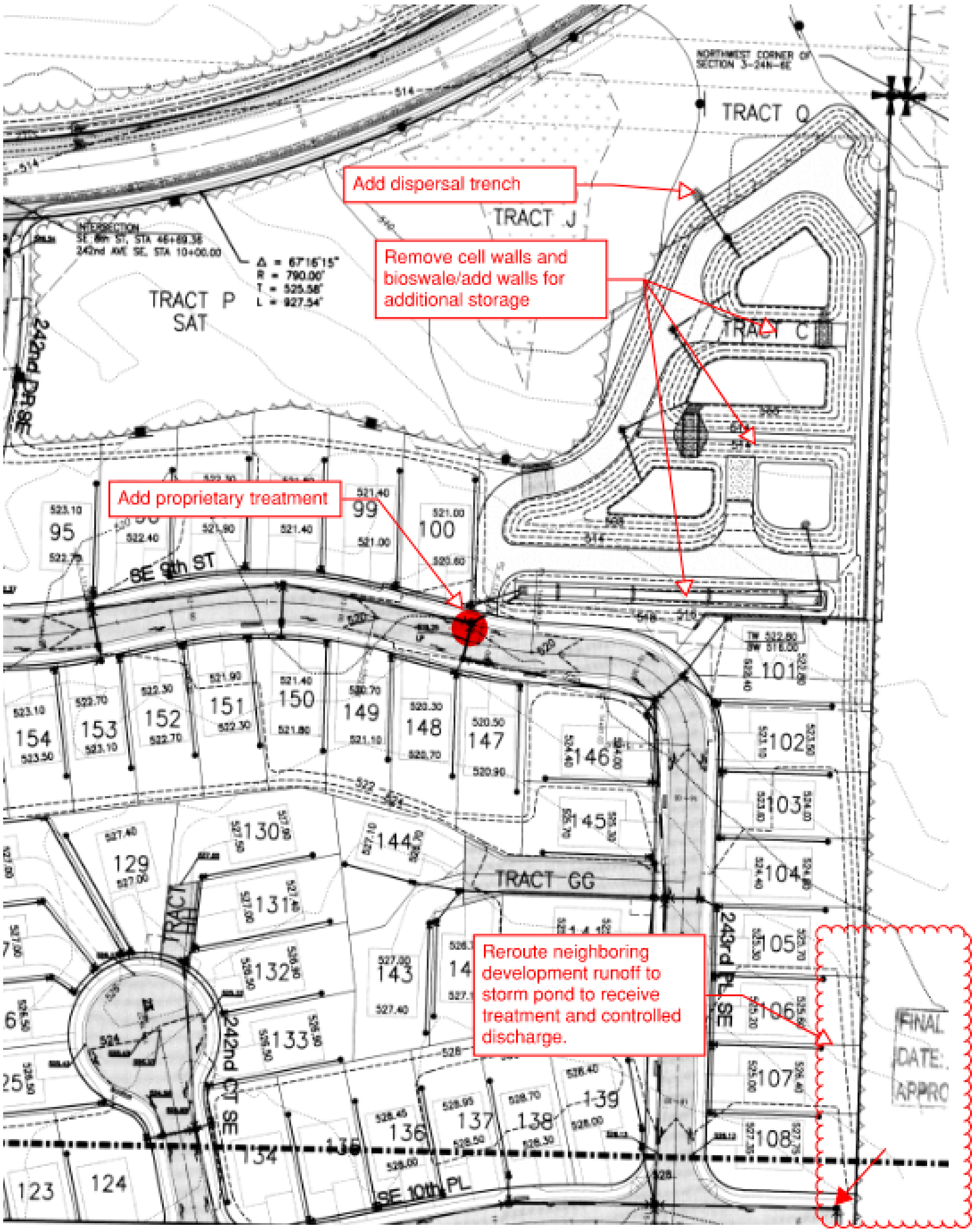
Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: ______

Comments:
TIR not available

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D92855 (2159)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☐ Obtain utility mapping
☐ Confirm concept sketch	☒ Confirm storm drain invert elevations
	☐ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations
Would need to coordinate with neighboring development ownership.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☐ No	☒ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID:	DS0008 (2160)	**Subwatershed:**	Inglewood	**Watershed:**	East Lake Sammamish
Date:	11/2/2020	**Assessed By:**	SN		

Site Description

Name: Sammamish Heights Estates / Drainage Facility No. DS0008

Address: 930 218th Ave NE

Location Notes: To the north of cul-de-sac, adjacent to driveway.

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ ±3.33 AC

Imperviousness ≈ 34 %

Impervious Area ≈ 1.13

Notes:
No TIR Provided.
Assumed 34% Impervious (3 DU/GA)

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☒ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Pond appears to be a two-cell wetpool detention pond facility.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 2000

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
Existing pond is overgrown and on the downstream edge of a steep forest critical area. Pond is surrounded on both sides by cast-in-place concrete walls. Pond is a two-cell wetpool detention pond. Existing flow comes from residential properties above the adjacent hillside to the east.

Approximate existing head available:
Upstream head available: ±150 feet
Downstream head available: ±10.5 feet

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☐ Water Quality ☐ Channel Protection ☒ Flow Control

☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
Wetpond Volume: 18,200 CF Detention Volume: 39,000 CF	

Proposed Treatment Option:

☒ Expanded Detention ☒ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM

☐ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Expand existing walls deeper and deepen pond per available downstream head. Install sand filter or other proprietary water quality device to reduce turbidity generated from adjacent steep slopes.

Pond is located within an area known by City of Sammamish geologic analysis to potentially have outwash soils. Infiltration should be considered if outwash soils are present.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional

☐ Industrial ☐ Transport-Related ☐ Park

☒ Undeveloped ☐ Other:

Possible conflicts due to adjacent land use? ☒ Yes ☐ No

If yes, describe:

Steep slope sensitive forest area

Access:

☐ No Constraints

Constrained due to:

☐ Slope ☒ Space

☐ Utilities ☐ Tree Impacts

☐ Structures ☐ Property Ownership

☐ Other:

Conflicts with Existing Utilities:

☐ None

☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☒ Probable	☐ Not Probable
Impacts to Specimen Trees	☐ Probable	☐ Not Probable

How many?

Approx. DBH:

Other Factors:

Soils:

Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

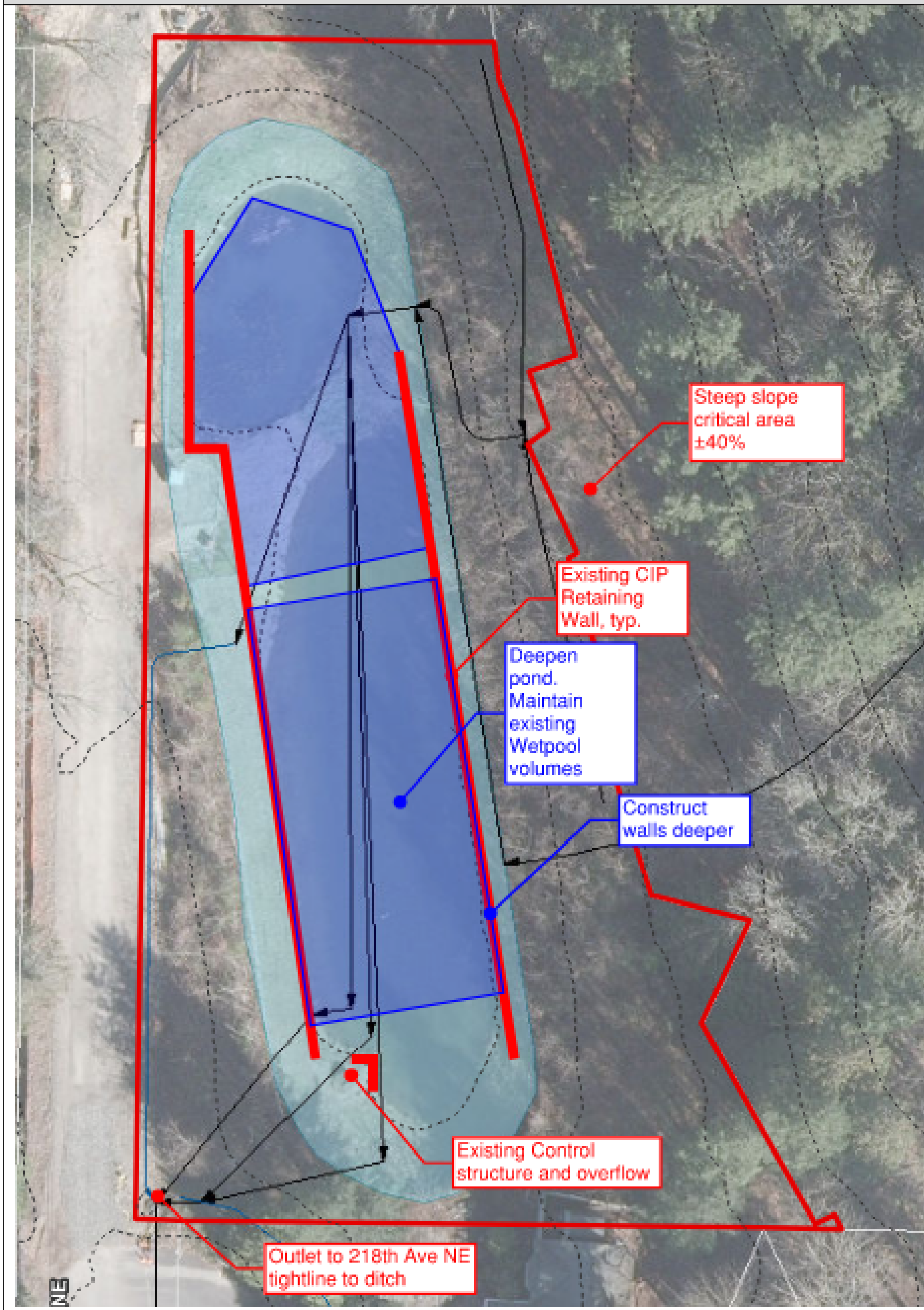
Soil Classification:

Comments:

No TIR Available.
Outwash potentially present.

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: DS0008 (2160)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership	☒ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☐ Confirm drainage area impervious cover	☐ Obtain detailed topography
☐ Confirm volume computations	☒ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Site is very narrow. The limiting pond depth for a proposed retrofit will likely be vehicle access to the bottom of the facility.
Minimal space to turn around at the entrance to the pond for vehicles. Wider construction access would likely be needed.

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: D92610 (2165)	**Subwatershed:** Inglewood	**Watershed:** Lake Sammamish
Date: 11/2/2020	**Assessed By:** TM	

Site Description

Name: Three Willows / Drainage Facility No. D92610

Address: SE 8th Street, KC parcel 8635751580

Location Notes:

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☒ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 19.0 ac

Imperviousness ≈ 40 %

Impervious Area ≈ 7.6 ac

Notes:
40% impervious assumed for residential. Confirm drainage area and impervious coverage.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
The existing stormwater system consists of a two cell wetpond with detention. This pond outlets to a bioswale and to George Davis Creek.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1996

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The existing site drainage consists of a series of 12- and 18-inch pipes and catch basin structures. Contributing area includes portions of the Three Willows development, SE 8th Street, and Renaissance developments.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☒ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1990 KCSWDM (SBUH)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Additional storage capacity could be obtained in the pond by adding walls to 25% of the perimeter. Proprietary media filters could be added upstream of the pond for enhanced treatment. A flow spreader could be added to the outlet to reduce the impacts of concentrated flow. In order to meet the Sensitive Lake Treatment requirement, a two-facility treatment system would need to be implemented based on available space, in accordance with the 2016 KCSWDM.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: George Davis Creek

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:
☒ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☒ Probable	☐ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

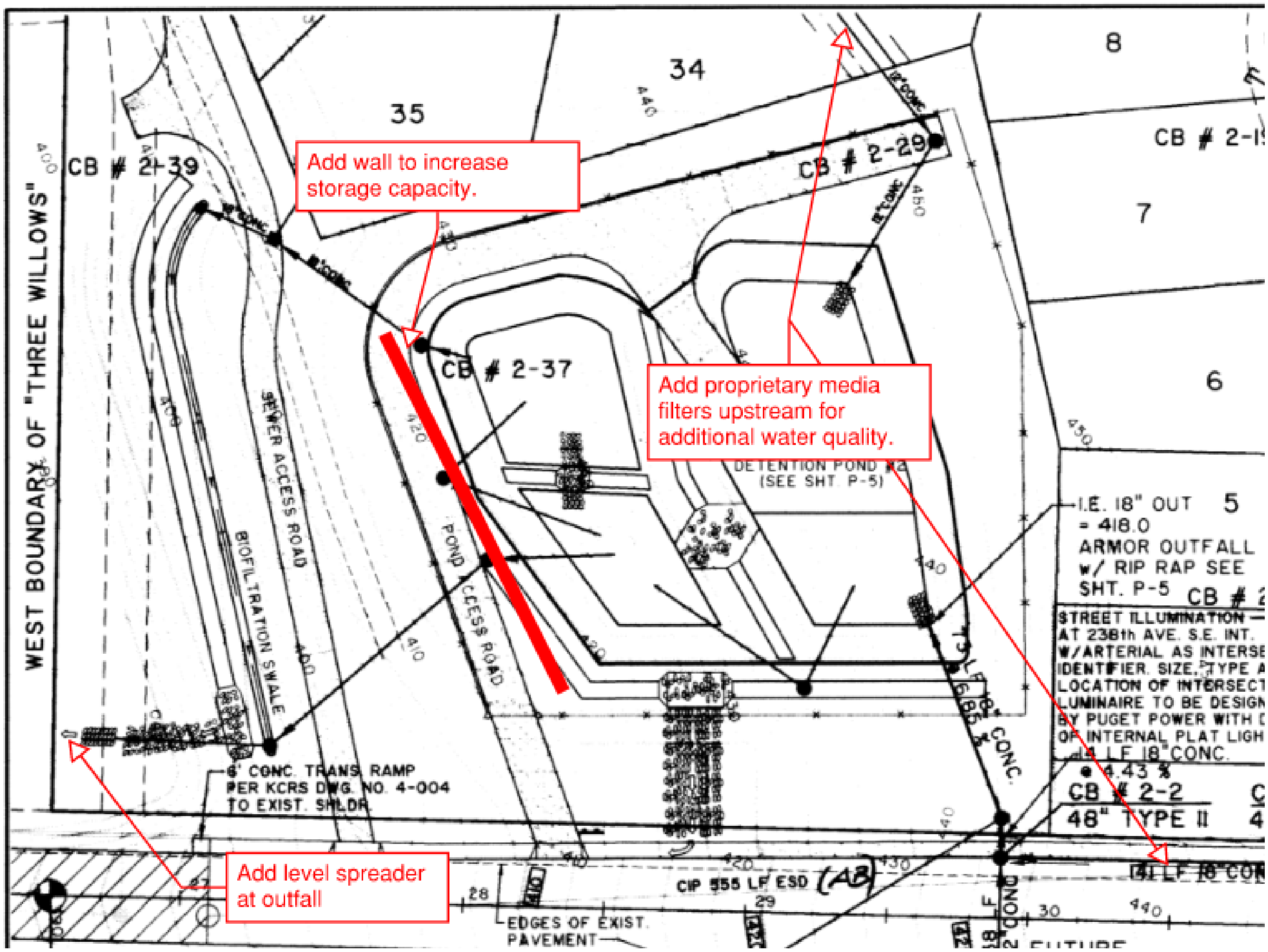
Soils:

Prior Geotechnical Analysis:	☒ Yes	☐ No
Soil auger test holes:	☒ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☒ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification: Till
Comments:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☒ Confirm drainage area impervious cover
☐ Confirm volume computations
☐ Confirm concept sketch
☐ Obtain existing stormwater practice as-builts
☐ Obtain site as-builts
☐ Obtain detailed topography
☐ Obtain utility mapping
☐ Confirm storm drain invert elevations
☐ Confirm soil types
☐ Other:

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☐ Yes	☒ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Retrofit Reconnaissance Investigation **RRI**

Unique Site ID: N/A (2363)	**Subwatershed:** Inglewood/Allen Lake	**Watershed:** Lake Sammamish
Date: 11/2/2020	**Assessed By:** TM	

Site Description

Name: Tree Farm / Drainage Facility No. N/a

Address: NE 8th Street and NE 5th Street

Location Notes:

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☒ Conveyance System ☐ Vacant Parcel ☐ Wetpond ☐ Wet Vault
☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault
☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ 74.4 ac

Imperviousness ≈ 40 %

Impervious Area ≈ 29.8

Notes:
Entire Tree Farm development was analyzed assuming 40% impervious for residential. Confirm impervious coverage.

Drainage Area Land Use:

☒ Residential
- ☒ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial
☐ Institutional
☐ Industrial
☐ Transport-Related
☐ Park
☐ Undeveloped
☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:
Existing development contains two detention ponds that outlet to George Davis Creek.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☐ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: 1980

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:
The existing site generally drains from north to south, with a series of drainage ditches and culverts throughout the development. The network either drains to one of two detention ponds, or discharges directly to George Davis Creek. No visible problems were observed at the time of the visit.

Approximate existing head available:

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☒ Channel Protection ☒ Flow Control
☒ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
1979 KC Storm Drainage Control Manual (Colorado Urban Hydrograph Method)	2016 KCSWDM Level 3 Flow Control Sensitive Lake Treatment Area

Proposed Treatment Option:

☒ Expanded Detention ☐ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☐ Proprietary Media Filter ☒ Infiltration ☒ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Sammamish geology map indicates pockets of outwash in this area, which generally coincide with soils observed at bottom of detention ponds. The storm ditches appeared to be bare. Planting them or converting to bioswales would increase treatment and decrease turbidity. According to the Sammamish storm GIS, some ditches discharge directly to George Davis Creek. Adding detention/infiltration (if feasible) and treatment could positively impact the creek. Providing infiltration would reduce the required treatment level to basic.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☒ Other: creek

Possible conflicts due to adjacent land use? ☐ Yes ☒ No
If yes, describe:

Access:

☒ No Constraints
Constrained due to:
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	**Possible**	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

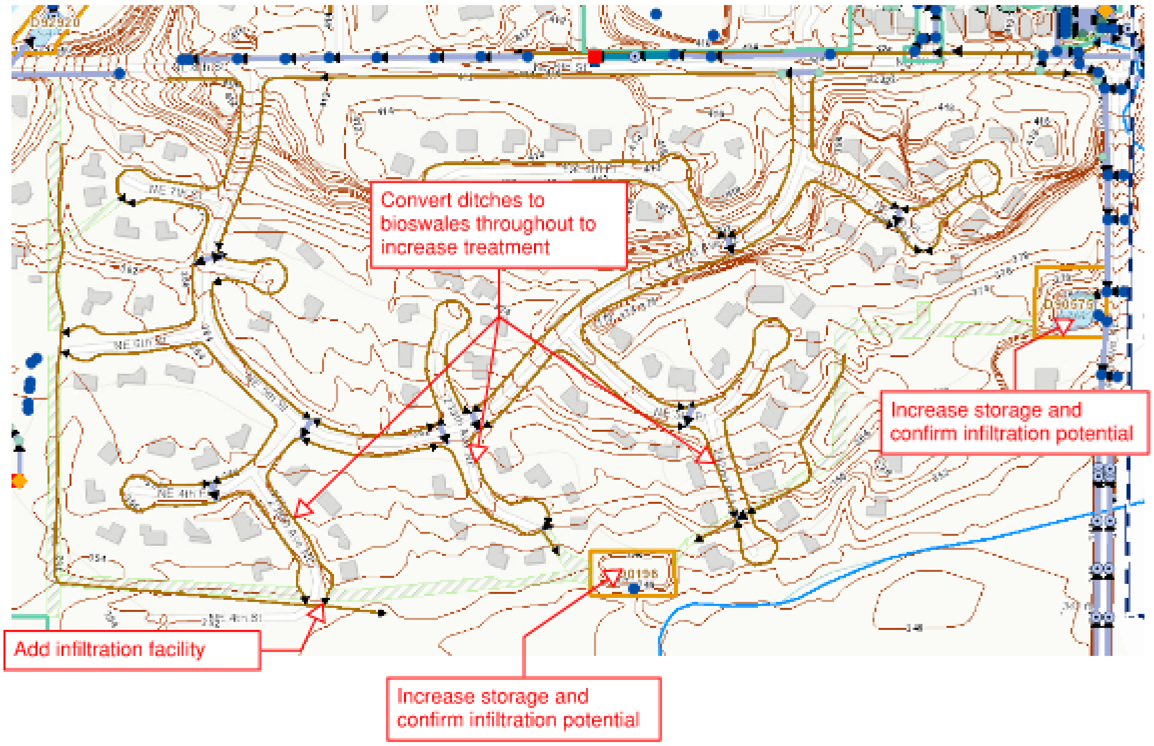
Soils:

Prior Geotechnical Analysis:	☐ Yes	☒ No
Soil auger test holes:	☐ Yes	☒ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:
Comments:
Confirm soil type for infiltration potential

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: N/A (2363)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept	
☐ Confirm property ownership	☐ Obtain existing stormwater practice as-builts
☒ Confirm drainage area	☐ Obtain site as-builts
☒ Confirm drainage area impervious cover	☐ Obtain detailed topography
☒ Confirm volume computations	☐ Obtain utility mapping
☐ Confirm concept sketch	☐ Confirm storm drain invert elevations
	☒ Confirm soil types
☐ Other:	

Initial Feasibility and Construction Considerations

Is site candidate for further investigation?	☒ Yes	☐ No	☐ Maybe
Is site candidate for early action project(s)?	☐ Yes	☒ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☐ No	☒ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: DS0011 (3000)	**Subwatershed:** Pine Lake	**Watershed:** East Lake Sammamish
Date: 11/2/2020	**Assessed By:** SN	

Site Description

Name: SWC SE 20th Street & 228th Ave SE / Drainage Facility No: DS0011

Address: SWC SE 20th Street & 228th Ave SE

Location Notes: Pond fenced in at the above address

Ownership: ☐ Public ☐ Private ☐ Unknown ☒ Sammamish

If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Proposed Retrofit Location:
Storage

☒ Pond ☐ Conveyance System ☐ Vacant Parcel ☒ Wetpond ☐ Wet Vault

☐ Outfall ☐ ROW ☐ Infiltration ☐ Tank ☐ Vault

☐ Other:

Drainage Area to Proposed Retrofit

Drainage Area ≈ ±1.25

Imperviousness ≈ 100 %

Impervious Area ≈ 1.25

Notes:

No TIR provided.
Accepts road and sidewalk drainage off of 228th Ave SE

Drainage Area Land Use:

☐ Residential
- ☐ SFH (< 1 ac lots)
- ☐ SFH (> 1 ac lots)
- ☐ Townhouses
- ☐ Multi-Family

☐ Commercial

☐ Institutional

☐ Industrial

☒ Transport-Related

☐ Park

☐ Undeveloped

☐ Other:

Existing Stormwater Management

Existing Stormwater Practice: ☒ Yes ☐ No ☐ Possible

If Yes, Describe:

Existing single cell wetpond detention facility. Stormfilter vault at control structure discharge point. Discharge and emergency overflow both outlet to Pine Lake.

Existing Treatment Provided: ☒ Detention ☐ Infiltration ☒ Water Quality ☐ None ☐ Unknown

Year of Construction, if known: Prior to 2002

Describe existing site conditions, including existing site drainage, conveyance, visible problems, etc.:

Pond does not appear to function as designed. The overflow structure for the pond is approximately 1.5’ lower than the invert elevation to the control structure. Additionally, the control structure rim appears to be raised higher than adjacent top of berm elevations. Shear gate is removed from control structure. It’s likely that this pond only operates in overflow condition while out-falling to Pine Lake. This bypasses the water quality device and increases turbidity at the outlet.

Approximate existing head available:

Downstream Head Available: 10 feet +

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Proposed Retrofit

Purpose of Retrofit / Treatment Targeted:

☒ Water Quality ☐ Channel Protection ☐ Flow Control
☐ Infiltration ☐ Repair ☐ Other:

Existing Facility Computations (Storage)	**Retrofit Computations (Storage)**
Unable to determine, no as-builts provided.	

Proposed Treatment Option:

☒ Expanded Detention ☒ Wet Pond ☐ Constructed Wetland ☐ Bioretention/BSM
☒ Proprietary Media Filter ☐ Infiltration ☐ Swale ☐ Other:

Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance:

Reconstruct emergency outfall structure and control structure to properly drain pond as designed. Build-up berm to proper height to allow detention volume to develop.

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:

Possible conflicts due to adjacent land use? ☐ Yes ☐ No
If yes, describe:

Access:

☐ No Constraints
Constrained due to:
☐ Slope ☒ Space
☒ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☒ Other: Overhead Electric

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☐	Gas
☐	☒	Cable
☐	☐	Electric
☐	☒	Electric to Streetlights
☒	☐	Overhead Wires
☐	☐	Other:

Potential Permitting Factors:

Dam Safety Permits Necessary	☐ Probable	☒ Not Probable
Impacts to Wetlands	☐ Probable	☒ Not Probable
Impacts to a Stream	☐ Probable	☒ Not Probable
Floodplain Fill	☐ Probable	☒ Not Probable
Impacts to Forests	☐ Probable	☒ Not Probable
Impacts to Specimen Trees	☐ Probable	☒ Not Probable

How many?
Approx. DBH:

Other Factors:

Soils:

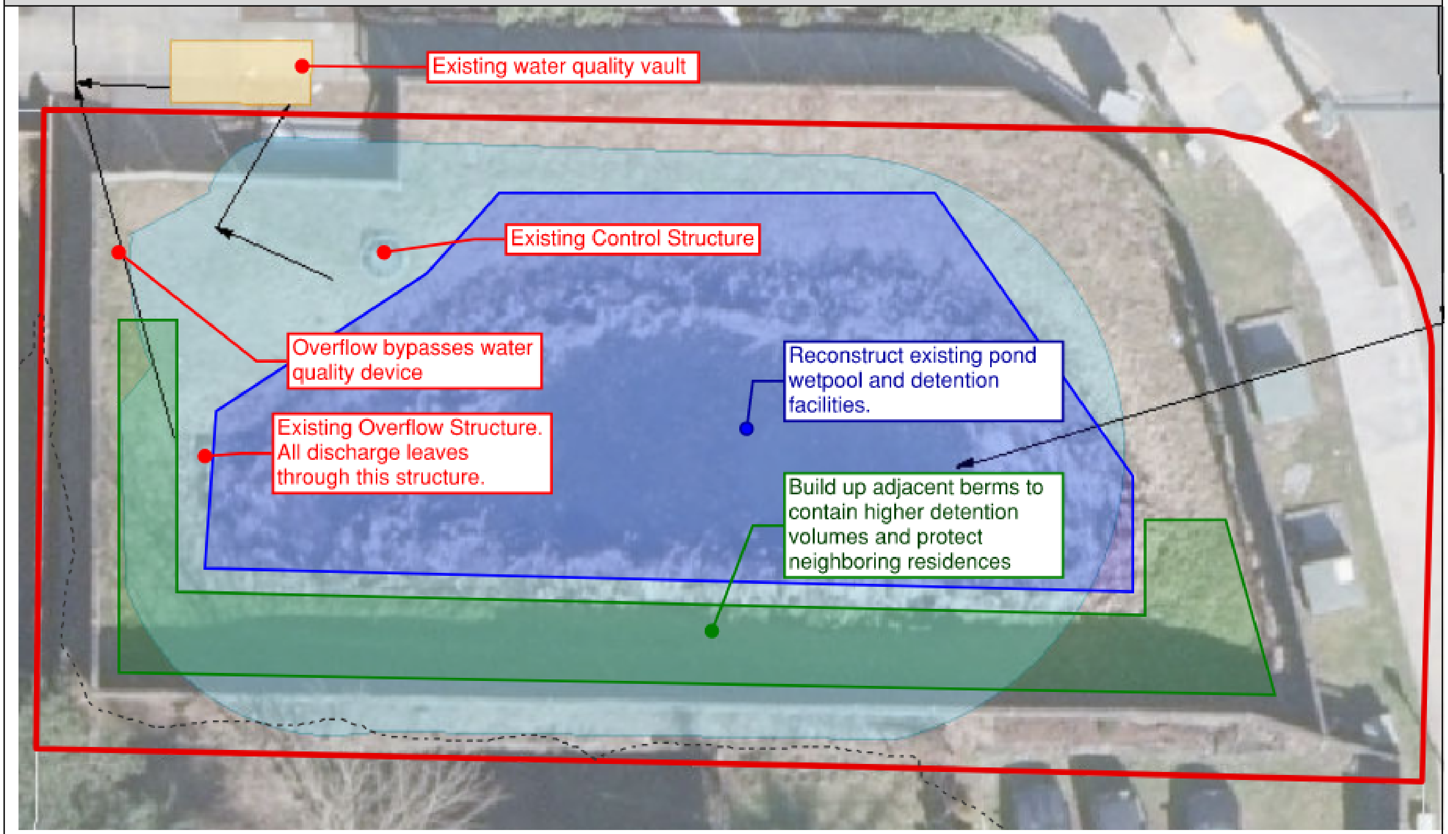
Prior Geotechnical Analysis:	☐ Yes	☐ No
Soil auger test holes:	☐ Yes	☐ No
Evidence of poor infiltration (clays, fines):	☐ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Evidence of high water table (gleying, saturation):	☐ Yes	☐ No

Soil Classification:

Comments:
No TIR Provided

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Sketch



Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

Unique Site ID: DS0011 (3000)

Design or Delivery Notes

Follow-up Needed to Complete Field Concept

☐ Confirm property ownership
☒ Confirm drainage area
☐ Confirm drainage area impervious cover
☐ Confirm volume computations
☐ Confirm concept sketch
☒ Obtain existing stormwater practice as-builts
☒ Obtain site as-builts
☐ Obtain detailed topography
☒ Obtain utility mapping
☒ Confirm storm drain invert elevations
☐ Confirm soil types
☐ Other:

Initial Feasibility and Construction Considerations

- Tight access and overhead utilities in right-of-way adjacent to project.
- Proximity to busy 20th Street / 228th Ave intersection.

Is site candidate for further investigation?	☒ Yes	☐ No	☐ Maybe
Is site candidate for early action project(s)?	☒ Yes	☐ No	☐ Maybe
If no, is site candidate for other restoration project(s)?	☐ Yes	☒ No	☐ Maybe
If yes, type(s):			

Refer to the Sammamish Retrofit Reconnaissance Field Guide located in Appendix B.

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #1454 - Benham Ridge / Drainage Facility No. DS0043

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 21253 NE Inglewood Hill Road

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	2.74	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	52.00	95 = HIGHEST

PROJECT DESCRIPTION

Excavate and remove existing underground detention vault. Construct larger / deeper vault to current flow control and water quality standards. Maintain existing incoming and outgoing conveyance. Rebuild control structure.

NOTE: GRAY BOX = DATA INPUT | x | PINK BOX=CALCULATED VALUE | x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					
	F1.2	Potential Utility or Site Constraints			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.	x						
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified					x		
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)	x						
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)					x		
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.74	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education	x						
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #1464 - Single-Family Residence / Drainage Facility No. D91456

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 1305 235TH Ave SE

Date: 11/10/2020

PROJECT DESCRIPTION

Based on the site's location, surrounding elevations, and existing slopes, retrofitting this site would provide little to no benefit.

FEASIBILITY AVERAGE RATING (1-5):	2.05	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	39.00	95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT | x | PINK BOX=CALCULATED VALUE | x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					
	F1.2	Potential Utility or Site Constraints			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)			x				
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)					x		
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)					x		
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.05	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset					x		
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #1548 - Cedar Cove / Drainage Facility No. DS0092

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 235th Pl SE, KC Parcel 1441600310

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	3.21	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	61.00	95 = HIGHEST
NOTE: GRAY BOX = DATA INPUT	x	PINK BOX=CALCULATED VALUE: x.x

PROJECT DESCRIPTION

Add proprietary media filters upstream of the ex pond and convert the combination detention/water quality facility to a detention only facility to gain storage volume. Currently Cedar Cove provides roughly 50% of full FC. Add detention to the development to the west (Claremont) by either conveying to the existing pond or adding/replacing existing pipes with larger detention pipes. Add treatment to the development to the west (Claremont) by proprietary media filters or bioswales. Calremont has not WQ or FC. Approx 136,800 CF reqd for ful FC.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints	x						
	F1.3	Parcel Ownership (City =5, Other Public=4, Institution =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)		x					
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)			x				
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1	x						
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	3.21	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners			x				

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2085 - Sammamish Library - Boys & Girls Club / Drainage Facility No. D98417

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 825 228th Avenue NE

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	**2.95**	**5=HIGHEST; 1=LOWEST FEASIBILITY**
PROJECT SCORE (0-95)	**56.00**	**95 = HIGHEST**

PROJECT DESCRIPTION

Sammamish geological maps indicate outwash soils may be present for expanded infiltration footprint. Expand underground infiltration system south into right-of-way or west into parcel open space. Approximately 11,500 SF surface area available. Invert elevation ±11.10 below existing grade.

NOTE: GRAY BOX = DATA INPUT x **PINK BOX=CALCULATED VALUE** x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints				x			
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.				x			
	F1.5	Project Impact on Site Uses & Operations (Long-term)				x			
	F1.6	Drainage Infrastructure Can be Reasonably Modified					x		
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)	x						
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.95	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education	x						
Opportunity	F4.1	Opportunity to Combine with another project	x						
	F4.2	Opportunity to Receive Grant or other funding partners			x				

SAMMAMISH STORMWATER RETROFIT RATING FORM

SUMMARY

PROJECT: Retrofit Site #2095 - Eastlake High School / Drainage Facility No. D98396

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: NE 4th Street, KC Parcel 3425069029

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 3.16 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 60.00 — 95 = HIGHEST

PROJECT DESCRIPTION

The storage volume of the pond could be increased by adding walls to up to 25% of the perimeter. It appears that there may be a pocket of outwash soils in the area, based on Sammamish geological maps, which could provide infiltration opportunity. Additional pollution-generating area from the neighboring property could be routed to the pond.

NOTE: GRAY BOX = DATA INPUT: x — PINK BOX=CALCULATED VALUE: x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					
	F1.2	Potential Utility or Site Constraints		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Institution =3, → multiple private owners =1)			x				
	F1.4	Sufficiency of Space Given Setback Requirements, etc.		x					
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)			x				
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)			x				
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)			x				Designed to 1990 KCSWDM
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1			x				
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1			x				
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	3.16	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education			x				
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2096 - Eastlake HS / Drainage Facility No. D98397

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: NE 4th Street, KC Parcel 3425069074

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 3.05 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 58.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — **PINK BOX=CALCULATED VALUE** x.x

PROJECT DESCRIPTION

It appears that additional runoff from the parking lot is bypassing treatment and detention could be rerouted to the existing vault, or new vault for pre-settlement. The capacity of the pond could be expanded by adding walls. Additionally, proprietary media filters could be added to the parking lot for additional treatment.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					
	F1.2	Potential Utility or Site Constraints		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Institution =3, → multiple private owners =1)			x				
	F1.4	Sufficiency of Space Given Setback Requirements, etc.	x						
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)x					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)			x				
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin							
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	3.05	
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education	x						Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2120 - Bellasera / Drainage Facility No. D92883

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 505 SE 5th Place

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.58 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95): 49.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — PINK BOX=CALCULATED VALUE x.x

PROJECT DESCRIPTION

Install detention vault under adjacent park to north of pond. Route additional flow from existing flow splitter to added detention.
Proposed vault approximately 2000 SF footprint at 6' depth. Maximum depth of system 15' below existing grade.
Connect pond to existing pond via piping and connect to SE 5th Place conveyance.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints			x				
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)		x					
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.58	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2125 - Chestnut Lane / Drainage Facility No. D93012

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 20911 SE 8th Place

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.89 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95): 55.00 — 95 = HIGHEST

PROJECT DESCRIPTION

Install walls on 25% of pond boundary. Expand and deepen detention pond for greater live storage depth.
Route additional flow for 212th Ave SE to pond.

NOTE: GRAY BOX = DATA INPUT x — PINK BOX=CALCULATED VALUE x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints	x						1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.	x						
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)				x			
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.89	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2128 - The Crossings at Pine Lake / Drainage Facility No. D92928

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 20767 SE 20th Street

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	**2.53**	**5=HIGHEST; 1=LOWEST FEASIBILITY**
PROJECT SCORE (0-95)	**48.00**	**95 = HIGHEST**

PROJECT DESCRIPTION

Install walls on 25% of pond perimeter and deepen pond per available head. Available depth up to 6.3ft. Expand pond surface area for expanded pond footprint with walls. Revise downstream conveyance per deeper pond.

NOTE: GRAY BOX = DATA INPUT x **PINK BOX=CALCULATED VALUE** x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints	x						1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.		x					
	F1.5	Project Impact on Site Uses & Operations (Long-term)			x				
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)					x		
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.53	
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

SUMMARY

PROJECT: Retrofit Site #2131 - Demery Hill / Drainage Facility No. D91349

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 757 222nd Place NE

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	3.21	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	61.00	95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x | **PINK BOX=CALCULATED VALUE** x.x

PROJECT DESCRIPTION

Excavate and remove existing underground detention vault. Develop entire parcel as detention pond to current flow control and water quality standards. Maintain existing incoming and outgoing conveyance. Rebuild control structure.A pond can be constructed in the cleared site area. For larger pond footprints, tree clearing will be required.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints			x				
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.		x					
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)			x				
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)	x						
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	3.21	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2132 - Greenbriar / Drainage Facility No. DS0001 & DS0002

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 20904 SE 6th Place

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.84 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 54.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — PINK BOX=CALCULATED VALUE x.x

PROJECT DESCRIPTION

Walls could be installed to expand detention footprint. Per City of Sammamish geologic studies, outwash soils are not likely in this area, however the opportunity to infiltrate is available given the use of the infiltration vault. Pond could be converted to infiltration if soil types are feasible under the facility.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints			x				
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)		x					
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)	x						
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.84	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2133 - Greens at Beaver Crest / Drainage Facility No. D92745

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: SE 2nd Place

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.79 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 53.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — **PINK BOX=CALCULATED VALUE** x.x

PROJECT DESCRIPTION

Expand detention by adding walls and removing cells. Increase treatment by adding proprietary media filters upstream of the pond. Add a bioswale with level spreader downstream of the pond for additional treatment and a less concentrated discharge.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)			x				
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)			x				
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)				x			
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.79	
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2141 - 228th Ave NE/SE / Drainage Facility No. DS0015 & D98903

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 228th Ave NE/SE / KC Parcel: 3425069053

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	2.89	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	55.00	95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT | X | PINK BOX=CALCULATED VALUE | X.X

PROJECT DESCRIPTION

Capacity could be increased by adding walls to the ponds. It appears that there is a site immediately to the south that appears to drain to a vault. It does not appear that this pond provides any treatment. This could be obtained by converting the pond to a wetpool, adding a bioswale, and/or proprietary media filters along 228th Ave NE.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints	x						
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.	x						
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)		x					
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern			x			2.89	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education			x				
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2150 - The Meadow at Redford Ranch / Drainage Facility No. D92668

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 1205 225th Place SE

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.47 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 47.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — **PINK BOX=CALCULATED VALUE** x.x

PROJECT DESCRIPTION

Downstream discharge is significantly deeper than pond. Pond could be expanded deeper to provide more live storage volume for the facility. Some sheet flow from 228th Avenue SE seems to be tributary to the system however it does not appear that additional flow can be captures off of 228th Avenue SE.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints			x				
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.				x			
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)					x		
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.47	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2158 - Renaissance / Drainage Facility No. D92854

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: SE 8th Street, KC Parcel 7215722030; Northwest corner of the Renaissance development

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.58 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 49.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT X — **PINK BOX=CALCULATED VALUE** X.X

PROJECT DESCRIPTION

Additional storage volume could be obtained by removing the cells and converting the pond to a detention pond, with no dead storage. Install proprietary media storage upstream of the pond, including tributary area in SE 8th Street.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints	x						
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)			x				
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		Site provides nearly full FC
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)			x				
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)				x			
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.58	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education			x				
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

SUMMARY

PROJECT: Retrofit Site #2159 - Renaissance / Drainage Facility No. D92855

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: Northeast corner of Renaissance development; SE 9th Street, KC Parcel 721572-2040

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 2.47 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95): 47.00 — 95 = HIGHEST

PROJECT DESCRIPTION

Expand the pond by removing the cells and adding walls. It appears that additional drainage area at 244th Ct SE could be rerouted to the expanded pond. Currently, this area is released through a swale, and is not treated or controlled.

NOTE: GRAY BOX = DATA INPUT x | **PINK BOX=CALCULATED VALUE** x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints	x						1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		Designed to nearly full FC
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)				x			
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.47	
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education					x		Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

Site # 2159: Renaissance / Drainage Facility No. D92855:

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2160 - Sammamish Heights Estates / Drainage Facility No. DS0008

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: 930 218th Ave NE

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	2.84	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	54.00	95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x | PINK BOX=CALCULATED VALUE x.x

PROJECT DESCRIPTION

Expand existing walls deeper and deepen pond per available downstream head. Install sand filter or other proprietary water quality device to reduce turbidity generated from adjacent steep slopes. Infiltration should be considered if outwash soils are present.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.2	Potential Utility or Site Constraints	x						
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)	x						
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)			x				
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)					x		
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)					x		
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1					x		
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)					x		
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.84	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset	x						
	F3.3	Demonstration/ Community Visibility/ Education					x		
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

PROJECT: Retrofit Site #2165 - Three Willows / Drainage Facility No. D92610

SUMMARY

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: SE 8th Street, KC parcel 8635751580

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5):	2.79	5=HIGHEST; 1=LOWEST FEASIBILITY
PROJECT SCORE (0-95)	53.00	95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT | x | PINK BOX=CALCULATED VALUE | x.x

PROJECT DESCRIPTION

Additional storage capacity could be obtained in the pond by adding walls to 25% of the perimeter. Proprietary media filters could be added upstream of the pond for enhanced treatment. A flow spreader could be added to the outlet to reduce the impacts of concentrated flow.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints	x						1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)				x			
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)			x				
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						Designed to 1990 KCSWDM with SBUH
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)			x				
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1			x				
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)				x			
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin	x						
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	2.79	Give Project a Score of 1 to 5 based on best overall judgment of all factors.
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education			x				
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING FORM

SUMMARY

PROJECT: Retrofit Site #2363 - Tree Farm / Drainage Facility No. N/a

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location:

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 3.16 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 60.00 — 95 = HIGHEST

NOTE: GRAY BOX = DATA INPUT x — **PINK BOX=CALCULATED VALUE** x.x

PROJECT DESCRIPTION

Sammamish geology map indicates pockets of outwash in this area, which generally coincide with soils observed at bottom of detention ponds. According to the Sammamish storm GIS, some ditches discharge directly to George Davis Creek. Adding detention/infiltration (if feasible) and treatment could positively impact the creek.

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

		FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)		x					
	F1.2	Potential Utility or Site Constraints	x						1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)			x				
	F1.6	Drainage Infrastructure Can be Reasonably Modified			x				
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)			x				
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						designed to 1979 KC Manual
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)	x						
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1	x						
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)			x				
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin					x		Appears to drain to Allen Lake
Safety	F3.1	Address/ Correct a drainage issue or safety concern					x	3.16	
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education					x		Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project					x		
	F4.2	Opportunity to Receive Grant or other funding partners			x				

SAMMAMISH STORMWATER RETROFIT RATING FORM

SUMMARY

PROJECT: Retrofit Site #3000 - SWC SE 20th Street & 228th Ave SE / Drainage Facility No: DS0011

THIS FORM SHOULD BE USED WITH IN CONJUNCTION WITH THE SAMMAMISH STORMWATER RETROFIT PROJECT RATING FORM INSTRUCTIONS AND WORKSHEETS DOCUMENT TO SCORE PROJECTS FOR PLACEMENT ON THE CAPITAL FACILITIES PLAN.

Location: SWC SE 20th Street & 228th Ave SE

Date: 11/10/2020

FEASIBILITY AVERAGE RATING (1-5): 3.26 — 5=HIGHEST; 1=LOWEST FEASIBILITY

PROJECT SCORE (0-95) 62.00 — 95 = HIGHEST

PROJECT DESCRIPTION

Reconstruct emergency outfall structure and control structure to properly drain pond as designed. Build-up berm to proper height to allow detention volume to develop.

NOTE: GRAY BOX = DATA INPUT x — **PINK BOX=CALCULATED VALUE** x.x

PREPARE FEASIBILITY ANALYSIS PRIOR TO RANKING SITE FOR FEASIBILITY

SITE FEASIBILITY RATING (1 TO 5)

Category	No.	FEASIBILITY CRITERIA - RATE CRITERIA 1 TO 5	5 (Best)	4	3	2	1 (Worst)	RANK	NOTES & INSTRUCTIONS
Site Feasibility	F1.1	Ease of Permitting & Environmental Permits (City only=5, multiple jurisdiction permits → 1)			x				
	F1.2	Potential Utility or Site Constraints			x				1 = WORST, 5 BEST Assess each criteria and check applicable box. If not applicable, leave blank.
	F1.3	Parcel Ownership (City =5, Other Public=4, Homeowner Tract =3, → multiple private owners =1)	x						
	F1.4	Sufficiency of Space Given Setback Requirements, etc.			x				
	F1.5	Project Impact on Site Uses & Operations (Long-term)			x				
	F1.6	Drainage Infrastructure Can be Reasonably Modified	x						
	F1.7	Sufficient Head for Treatment/Flow Control Options (yes = 5, neutral = 3, no =1)	x						
Environmental Benefit	F2.1	Infiltration Potential (High = 5, Low = 1)					x		
	F2.2	Ex Level of Flow Control (5 = none, 3 = moderate, 1 = significant)	x						Pond not performing as designed
	F2.3	Ex Level of Water Quality Treatment (5 = none, 3 = moderate, 1 = significant)	x						Pond not performing as designed
	F2.4	Potential Area Tributary to Retrofit Site (20+ acres = 5, 20-10 ac. = 4, 10-5 ac. = 3, 5-1 ac. = 2, < 1 ac. =1				x			
	F2.5	Upstream PGIS (5= high PGIS, high use, + no treatment, 4= high PGIS + limited treatment, 3= moderate PGIS + partial treatment), 2 = moderate PGIS + full treatment, 1 = low PGIS + full treatment)	x						treatment is bypassed
	F2.6	Redevelopment Potential (Likely = 5, Neutral = 3, Unlikely =1					x		
	F2.7	Priority Stormwater Basin (5 = site within priority basin & fish use, 3 = drains to fish use receiving waters but not a priority basin; 1 = site does not drain to fish use receiving waters or a priority basin			x				
Safety	F3.1	Address/ Correct a drainage issue or safety concern	x					3.26	
	F3.2	Ease of maintenance long term/ Replace aging asset			x				
	F3.3	Demonstration/ Community Visibility/ Education					x		Give Project a Score of 1 to 5 based on best overall judgment of all factors.
Opportunity	F4.1	Opportunity to Combine with another project			x				
	F4.2	Opportunity to Receive Grant or other funding partners					x		

SAMMAMISH STORMWATER RETROFIT RATING SUMMARY

SITE FEASIBILITY RATING MATRIX

Rank	Retrofit Site #, Name, Sammamish Drainage Facility #	Feasibility Score	Points (n / 95)	City Comments
1	**Retrofit Site #3000 - SWC SE 20th Street & 228th Ave SE / Drainage Facility No: DS0011**	3.26	62	
2	**Retrofit Site #2131 - Demery Hill / Drainage Facility No. D91349**	3.21	61	
3	**Retrofit Site #1548 - Cedar Cove / Drainage Facility No. DS0092**	3.21	61	
4	Retrofit Site #2095 - Eastlake High School / Drainage Facility No. D98396	3.16	60	
5	Retrofit Site #2363 - Tree Farm / Drainage Facility No. N/a	3.16	60	
6	Retrofit Site #2096 - Eastlake HS / Drainage Facility No. D98397	3.05	58	
7	Retrofit Site #2085 - Sammamish Library - Boys & Girls Club / Drainage Facility No. D98417	2.95	56	
8	Retrofit Site #2141 - 228th Ave NE/SE / Drainage Facility No. DS0015 & D98903	2.89	55	
9	Retrofit Site #2125 - Chestnut Lane / Drainage Facility No. D93012	2.89	55	
10	Retrofit Site #2132 - Greenbriar / Drainage Facility No. DS0001 & DS0002	2.84	54	
11	Retrofit Site #2160 - Sammamish Heights Estates / Drainage Facility No. DS0008	2.84	54	
12	Retrofit Site #2133 - Greens at Beaver Crest / Drainage Facility No. D92745	2.79	53	
13	Retrofit Site #2165 - Three Willows / Drainage Facility No. D92610	2.79	53	
14	Retrofit Site #1454 - Benham Ridge / Drainage Facility No. DS0043	2.74	52	
15	Retrofit Site #2120 - Bellasera / Drainage Facility No. D92883	2.58	49	
16	Retrofit Site #2158 - Renaissance / Drainage Facility No. D92854	2.58	49	
17	Retrofit Site #2128 - The Crossings at Pine Lake / Drainage Facility No. D92928	2.53	48	
18	Retrofit Site #2150 - The Meadow at Redford Ranch / Drainage Facility No. D92668	2.47	47	
19	Retrofit Site #2159 - Renaissance / Drainage Facility No. D92855	2.47	47	
20	Retrofit Site #1464 - Single-Family Residence / Drainage Facility No. D91456	2.05	39	

CITY OF SAMMAMISH RETROFIT RATING FORM INSTRUCTIONS

The retrofit rating process looks at 4 criteria to evaluate and rank a project: Site Feasibility, Environmental Benefit, Public Stewardship, and Opportunity.

The potential retrofit rating matrix generates a site feasibility average rating of 1 to 5 based on rating each of 19 criteria on a scale of 1 to 5, with 1 being the worst and 5 being the best. A checkmark is made in the evaluation matrix for each criterion based on the score for that criteria. After completing the matrix, the average rating for the site is calculated by averaging the score for each criterion. A project score of 0-95 is also provided. This is a total of each of the feasibility points. The feasibility average rating can be determined by dividing the project score by the number of rating criteria (19). For example, a site receiving "5" for all feasibility criteria would receive a total of 95 points in the project score and an average feasibility rating of 5.

Final selection of preferred sites is then based on ranking of site ratings, with some consideration of outside factors.

Site Feasibility Rating

The first step in the project rating process is to evaluate each project site based on feasibility criteria. This is accomplished by a person with a good level of understanding of the site and the type of project, and a site reconnaissance report.

The site reconnaissance report includes the following:

- An evaluation of alternative Best Management Practices (BMPs) that might be suitable for the site.
- An assessment of permitting requirements.
- Identification of existing utilities and their potential impact on the project.
- Determination whether water quality, flow control, or a combination of these can be accomplished at the site.

Prior to completing this section, a project feasibility analysis should be completed. The feasibility analysis should provide information to score each of the following feasibility criteria, as well as alternative methods of providing runoff treatment, flow control, and habitat enhancements at the project location.

#	Criteria	Score (1 to 5)
F1.1	**Ease of Permitting & Number of Environmental Permits**	

Guidance

Different projects will have different permitting requirements. The number of permits required, permitting agency, and anticipated difficulty in obtaining permits should be factored into the project feasibility. Also consider the number and type of special studies that might be required to obtain permits, such as habitat plans, geotechnical reports, etc. Permits that may be required include:

1. Hydraulic Project Approval – for work below the ordinary high water mark of streams, lakes, and

salt water.

2. Critical Areas Review – For work within or near certain critical areas, including wetlands, streams, shorelines, steep slopes, geologically sensitive areas, and critical habitats.
3. Public Works (Right-of-Way) Permit – Issued by City of Sammamish for work in the right-of-way. May require WSDOT permit if road is a state highway.
4. Construction and/or Grading Permit – Issued by City of Sammamish, requirements vary by amount of grading.
5. SEPA Compliance – At a minimum, a SEPA Checklist will be required.
6. Army Corps of Engineers Permit – For work within wetlands and waterways designated as navigable or associated with navigable waters.
7. Mechanical, Electrical, Plumbing, or Building permits – Issued by City of Sammamish for projects with mechanical equipment or structures, including retaining walls and vaults.
8. UIC Certification and/or Permitting – Issued by Ecology for certain infiltration projects that meet the criteria for requiring compliance with Ecology Underground Injection Control Requirements.
9. Construction NPDES Permit – Issued by Ecology for projects disturbing greater than 1-acre of land.
10. Shorelines Permit – Issued by City of Sammamish; may require Ecology approval for projects meeting certain requirements and located within designated shorelines.

Scoring Guide

- Project is small and requires no permits or only requires standard permits issued by City of Sammamish and does not trigger SEPA. → **Score = 5**

- Project requires City of Sammamish permits and SEPA and none of the permits requires a board review process. → **Score = 4**

- Project meets one of the above criteria, but also requires one permit from an outside agency such as Ecology, Army Corps of Engineers, or WDFW. → **Score = 3**

- Project requires special permits requiring a board review process or requires more than one permit from an outside agency. → **Score = 2**

- Multiple permits required local and outside agencies or permitting process anticipated to be difficult and lengthy and may not be successful. → **Score = 1**

#	Criteria	Score (1 to 5)
F1.2	**Potential Utility or Site Constraints**	

Guidance

Existing utilities and other site constraints can make a stormwater retrofit project difficult and more expensive. Projects in urbanized areas are more likely to face these types of constraints; however, utility service in more rural areas can also be a constraint. A site visit should be conducted, and a utility locate considered to identify the location of utilities in the project vicinity. Some examples of utility conflicts and site constraints to consider include:

1. Existing Sanitary Sewer or Water Mains.

2. Side sewer and water service lines (these are more easily relocated).
3. Electrical power lines (underground and overhead) and power service lines such as roadway lighting and landscape lighting.
4. Other franchise utility lines such as cable, gas, and phone. Locating these utility lines can frequently be difficult.
5. Existing fencing, structures, roads, gates, etc.
6. Existing drainfields, septic tanks, underground tanks, or structures.
7. Existing or abandoned water wells for drinking or irrigation.
8. Location of existing buildings and other structures and the type/location of foundations for those structures.
9. History of waste disposal or hazardous/dangerous waste handling or spillage at the location.

Scoring Guide

- No, or only minor utility, structure, or other site constraints exist in the project location. → **Score = 5**

- Minor utility, utility, structure, or site constraints exist, but are easily accommodated or relocated. → **Score = 4**

- Special construction practices and precautions will be required to avoid utility or structure impacts. → **Score = 3**

- Significant utility relocation of sewer or water mains or electrical power will be required to accommodate the project. → **Score = 2**

- Major utility conflicts exist that would require major efforts to accommodate construction or require relocating several utilities and service lines or result in loss of a significant structure or the site has a history of waste disposal that may require cleanup action. → **Score = 1**

#	Criteria	Score (1 to 5)
F1.3	**Parcel Ownership**	

Guidance

The feasibility of a stormwater retrofit project can be affected by the existing ownership of the property where the project is proposed. Ideally, City of Sammamish would already have ownership of the property, or it would be located within City right-of-way. Other considerations include:

1. Property is owned by another governmental organization such as a school district, state or federal agency, or local government agency (port district, water utility, etc.).
2. Property is privately owned, but ownership is with a large organization such as a land trust, institution, or other large organization.
3. Property is privately owned by a homeowners association.
4. Property is privately owned by a single individual property owner.
5. Property is privately owned by multiple individuals. This can be the most difficult since multiple individual have to agree to any use of the property.

Scoring Guide

- Project is located on property owned by City of Sammamish or within Stormwater Tract or an easement that City of Sammamish already has with the property owner. → **Score = 5**
- Project is located on property owned by another government organization with a high likelihood that they would cooperate in the use of the site. → **Score = 4**
- Project is located on property owned by a large institutional private property owner. → **Score = 3**
- Property is privately owned by a single owner. → **Score 2**
- Property is owned by multiple individual private property owners.
→ **Score = 1**

#	Criteria	Score (1 to 5)
F1.4	**Sufficiency of Space Given Setback Requirements, etc.**	

Guidance

To evaluate this criterion, an idea of what type of BMP would be installed is necessary. For some BMPs such as infiltration, certain setback criteria must be met such as setbacks to property lines, structures, drinking water wells, steep slopes, etc. Also important is a rough estimate of the area required to install the BMP and still meet minimal treatment and flow control requirements for the project.

Scoring Guide

- Based on the type of BMP proposed, the site appears to have adequate space to provide for full treatment and/or flow control and meet all setback requirements. → **Score = 5**
- Site can meet all setback requirements, but may be limited in area to meet full flow control or treatment requirements, while still meeting a minimum level to support the project.
→ **Score = 4**
- Site constraints limit ability to meet full flow control and/or treatment, or limit type of BMPs allowed based on setback criteria, or special reports are required such as geotechnical or hydrogeologic (for depth to water table). → **Score = 3**
- Site has limited area and will severely constrain types and size of BMPs, but a project is still feasible. → **Score = 2**
- Site constraints may make project not feasible, or will require extensive specialty reports to determine feasibility. → **Score = 1**

#	Criteria	Score (1 to 5)
F1.5	**Project Impact on Site Uses & Operations (Long-Term)**	

Guidance

Some stormwater retrofit locations may be associated with commercial or industrial operations or may be in areas that are designated to recreational use such as parks, trails or open spaces. This criterion rates the long-term impact of the project on the current site use and operations.

Scoring Guide

- Project is located in an area where no potential impact to site use or operations is anticipated. **→ Score = 5**

- Project is located in an area where there are site uses and operations that might be impacted but it is anticipated that little or no impact will occur **→ Score = 4**

- Project is located in an area where there are site uses and operations that might be impacted but impact occurs only during construction with minimal long-term impact. **→ Score = 3**

- Project is located in an area where there are site uses and operations that might be impacted and impacts will occur both during construction and long-term, but can be mitigated or managed. **→ Score = 2**

- Project will significantly impact site uses and operations during construction and long-term. **→ Score = 1**

#	Criteria	Score (1 to 5)
F1.6	**Drainage Infrastructure Can be Reasonably Modified**	

Guidance

Where stormwater is already collected in piping systems and other conveyances it becomes important whether the existing system can be reasonably modified to route flows to new BMPs for treatment and flow control without major system modification. Examples of circumstances that can cause problems include:

1. Deep burial conveyance piping – e.g., greater than 8 feet.
2. Existing infrastructure that is fragile and may be damaged by new connections.
3. System lacks structures or has long runs of pipe between existing structures.
4. Existing ponds or other treatment devices have been encroached upon by structures, roads, etc. and leave little room for expansion or improvement.

Scoring Guide

- Existing facilities and conveyance systems are easily modified to accommodate the project. **→ Score = 5**

- Existing facilities and conveyance systems have limitations that may impact ability to implement the project. → **Score = 3**

- Existing facilities and conveyance systems have multiple limitations that will impact ability to implement the project. → **Score = 1**

#	Criteria	Score (1 to 5)
F1.7	**Sufficient Head for Treatment/Flow Control Options**	

Guidance

Many BMPs that might be used for a retrofit require some change in grade to function properly. A detention pond needs to have a change in grade that allows the discharge pipe to be at an elevation near the bottom of the pond, typically a grade change of 5 to 10 feet is necessary. Even proprietary BMPs such as storm filters will require some grade change to function – typically at least 2.3 feet from grate elevation to outlet elevation. Bioretention that uses an underdrain may also require a grade change to allow for infiltrated runoff to be conveyed to an outlet conveyance system. Grade change is also necessary to facilitate conveying stormwater runoff from the area from which stormwater is collected to get it to the BMP. The location of the BMP in relation to site contours should be evaluated in scoring this criterion.

Alternatively, in some instances, site grades may be too steep to allow use of certain BMPs. Swales typically need between 1% and 4% slopes to function for water quality treatment. Bioretention and infiltration is typically not feasible on slopes exceeding 10%.

Scoring Guide

- Site grades allow for conveyance of runoff to the BMP and grades in the vicinity of the BMP allow for proper functioning. → **Score = 5**

- Site and BMP location grades create limits on type, size, and location of BMPs and conveyance systems. → **Score = 3**

- Site and BMP location grades create severe limitations on conveyance and BMP design or may make a retrofit impractical without major re-grading. → **Score = 1**

Environmental Benefit Rating

The **F2** criteria are somewhat different from many others on the list as they score primarily for opportunity at each site, rather than strictly feasibility. These criteria were identified by the City of Sammamish as factors considered in priority basin selection.

#	Criteria	Score (1 to 5)
F2.1	**Infiltration Potential**	

Guidance

On-site or infiltration-based stormwater BMPs (often referred to as low impact development (LID) or green stormwater infrastructure) are required to the maximum extent feasible by Ecology stormwater regulations. Minimum Requirement 5 of the Ecology stormwater management manual requires implementation of LID BMPs where feasible, and infiltration can significantly reduce detention volume required to meet flow control standards (Minimum Requirement 7). This criterion is scored based on infiltration suitability of the parcel.

Scoring Guide

- Site has high potential for concentrated or dispersed surface infiltration. → **Score = 5**
- Site has high potential for dispersed surface infiltration. → **Score = 4**
- Site has moderate surface infiltration potential and/or may be suitable for vertical drains (deep infiltration). → **Score = 3**
- Site has low surface infiltration potential. → **Score = 2**
- Site is not suitable for infiltration. → **Score = 1**

#	Criteria	Score (1 to 5)
F2.2	**Level of Existing Flow Control for Stormwater**	

Guidance

A retrofit project may be identified for an area that already receives some level of flow control. The level of existing flow control may be based on an old standard that is not considered adequate under current standards.

The feasibility of a retrofit project should be considered in part on whether the area currently receives significant, limited, or no flow control and to what standard it is provided. The City of Sammamish Treatment Map (Flow Control) provides a general indication of the levels of treatment throughout the city.

Scoring Guide

- Retrofit site area has little or no existing flow control. If flow control facilities are present, they were not designed with a continuous model (pre 1990). **→ Score = 5**

- Retrofit site area has some existing flow control but is not a system designed with a continuous runoff model (pre 1998 KCSWDM) or is no longer functioning. **→ Score = 3**

- Project site provides significant flow control designed with a continuous model (1998 KCSWDM or more current standards. **→ Score = 1**

#	Criteria	Score (1 to 5)
F2.3	**Level of Existing Water Quality Treatment for Stormwater**	

Guidance

A retrofit project may be identified for an area that already receives some level of runoff treatment or flow control. The level of existing treatment and flow control may be based on an old standard that is not considered adequate under current standards or the treatment may be inadvertent as a result of conveyance systems that provide treatment, but were not designed to provide treatment, such as grass-lined channels or sheet flow across vegetated surfaces.

The feasibility of a retrofit project should be considered in part on whether the area currently receives significant, some, or no treatment or flow control and to what standards it is provided.

Scoring Guide

- Retrofit site area has little or no existing runoff treatment. If water quality facilities are present, they provide minor treatment (pre 1990). **→ Score = 5**

- Retrofit site area has some existing runoff treatment (pre 1998 KCSWDM) or is no longer functioning. **→ Score = 3**

- Project site provides significant runoff treatment and is designed in conjunction with a flow control facility designed with a continuous model (1998 KCSWDM or more current standards.) **→ Score = 1**

#	Criteria	Score (1 to 5)
F2.4	**Upstream Impervious Surface**	

Guidance

Impervious surface is the primary indicator of the runoff generating potential of an area. Watersheds with greater than 25% impervious surface are typically urban in nature and impacts to streams within the watershed are virtually guaranteed. Projects that treat areas with a higher percentage of impervious surfaces are likely to be more beneficial than those that treat areas with less impervious surface.

Scoring Guide

Scores are based on estimated impervious area tributary to the retrofit site. Category thresholds were determined based on distribution in Sammamish and may not be appropriate to transfer to other basins. Commercial areas are assumed to be 80% impervious, multi-family areas are assumed to be 60% impervious and residential developments are assumed to be 40% impervious. The impervious tributary area is the weighted area based on the assumed percentage per each type of developed area.

- Upstream area has more than 50 acres of impervious surface. → **Score = 5**
- Upstream area has 20-50 acres of impervious area. → **Score = 4**
- Upstream area has 10-20 acres of impervious area. → **Score = 3**
- Upstream area has 5-10 acres of impervious area. → **Score = 2**
- Upstream area has less than 5 acres of impervious area. → **Score = 1**

#	Criteria	Score (1 to 5)
F2.5	**Upstream PGIS**	

Guidance

Areas within Sammamish developed prior to 1998 do not have significant stormwater treatment facilities, and the amount of untreated (or under-treated) upstream pollution-generating impervious surface (PGIS) is an indicator of need for and potential benefit of water quality retrofits at a site. This criterion is intended to identify "water quality hot spots" that are tributary to the project site and present opportunity for significant water quality benefit.

Scoring Guide

Scores are based on estimated PGIS tributary to the retrofit site. Consideration was also given to presence and extent of upstream water quality treatment.

- Upstream area has high PGIS area, meets the threshold for a high use site, and has little or no water quality treatment. → **Score = 5**
- Upstream area has high PGIS area and some basic water quality treatment. → **Score = 4**
- Upstream area has moderate PGIS area with at least partial enhanced, sensitive lake protection or sphagnum bog protection. → **Score = 3 or 4**
- Upstream area has low PGIS area or all PGIS area goes through water quality treatment meeting current standards for Enhanced Treatment, Sensitive Lake Protection or Sphagnum Bog Protection. → **Score = 1**

#	Criteria	Score (1 to 5)
F2.6	**Redevelopment Potential**	

Guidance

Older commercial/industrial areas within Sammamish are expected to redevelop over the next several decades. While redevelopment projects will be required the meet current stormwater regulations for the project area, redevelopment projects also offer opportunities to reconfigure the site and possibly include retrofit stormwater facilities that could not be incorporated into the current layout. Examples of this potential include redevelopment of a city park that would allow for stormwater facilities to be constructed below the park.

Scoring Guide

- Redevelopment is planned for the site or identified in 6-year CIP. → **Score = 5**
- Site is publicly owned and there are no current plans for redevelopment. → **Score = 3**
- Site is privately owned and there are no current plans for redevelopment. → **Score = 1**

#	Criteria	Score (1 to 5)
F2.7	**Priority Stormwater Basin**	

Guidance

The City of Sammamish has identified three high priority stormwater retrofit basins within the city: Inglewood, Pike Lake, and Thompson Basins. Development of retrofit projects within priority basins will have more positive impact on the receiving waters than development in other basins. Additionally, projects which drain to receiving waters with fish use are also a priority to protect the resource habitat.

Scoring Guide

- Retrofit Site is located in a priority stormwater retrofit basin and the site drains to waters with significant fish use. → **Score = 5**
- Retrofit Site is not located in a priority basin but drains to receiving waters with fish use. → **Score = 3**
- Retrofit Site is not located in a priority stormwater basin and does not drain to receiving waters with fish use. → **Score = 1**

Public Stewardship Rating

#	Criteria	Score (1 to 5)
F3.1	Address/Correct Drainage Issue or Safety Concern	

Guidance

A stormwater retrofit project may correct a known drainage issue or address a public safety concern. The City of Sammamish CIP Matrix provides guidance for scoring this criteria.

Scoring Guide

SAFETY RISK ASSESSMENT	Safety Impact		
Drainage Issue Frequency	Minor	Moderate	Major
Already Occurring, with Annual Frequency	3	5	5
Has Occurred Periodically in Last 5 Years	2	4	5
Almost Certain to Occur within Next 5 Years	2	3	4
Unlikely to Occur Within the Next 5 Years	1	2	4

#	Criteria	Score (1 to 5)
F3.2	Ease of Long-Term Maintenance/ Replace an Aging Asset	

Guidance

Long term maintenance is an important factor in evaluating a retrofit project site. In some instances, the jurisdiction has preferred BMPs due to ease of maintenance. A stormwater retrofit project may also replace an aging asset or improve a drainage facility with a higher than normal maintenance requirement.

Scoring Guide

- Project site will require limited or moderate maintenance (1 x per year) and will replace/improve an aging or troublesome asset. → **Score = 5**
- Project will require moderate maintenance (up to 2 x per year). → **Score = 3**
- Proposed retrofit would require frequent maintenance and propriety materials which the city does not stock, etc. → **Score = 1**

#	Criteria	Score (1 to 5)
F3.3	Demonstration/Education/Further Community Goal	

Guidance

A stormwater retrofit project provides an opportunity demonstrate stewardship of resources and educate the students and citizens of Sammamish.

Scoring Guide

- Project site is highly visible from public areas or located at a public site and facilities are above ground providing an excellent opportunity to demonstrate environmental stewardship through stormwater management. → **Score = 5**
- Project site is visible within the surrounding neighborhood but is not easily observed. → **Score = 3**
- Project site is not visible from public areas and offers limited opportunity for education. → **Score = 1**

Unique Opportunity

This factor recognizes the time sensitive nature of opportunity through partnerships and funding.

#	Criteria	Score (1 to 5)
F4.1	**Opportunity for Joint City Projects**	

Guidance

A stormwater retrofit project may be combined with another project and the other project provides an opportunity that may not occur again.

Scoring Guide

- Project site is within the area of a planned city project such as public facility, drainage improvement or roadway CIP and the opportunity will not be available later. → **Score = 5**
- Project site is located in an area where another jurisdiction plans a project and the project timeline makes the retrofit project more desirable to occur prior or in conjunction with the other project. → **Score = 3**
- Project site is not located within the area of an anticipated project. → **Score = 1**

#	Criteria	Score (1 to 5)
F4.1	**Opportunity for Funding Partners/ Grants**	

Guidance

A stormwater retrofit project may be combined with another project and the other project provides funding that in part would lower the cost of the retrofit project. Ecology grant funding may also be available for stormwater retrofit projects.

Scoring Guide

- Retrofit project has a high likelihood of receiving grant funding and may take advantage of funding designated for another project. → **Score = 5**
- Retrofit project has a moderate likelihood of receiving grant funding or the retrofit project may take advantage of funding designated for another project. → **Score = 3**
- Project site is not likely to receive grant funding or benefit from another project's funding. → **Score = 1**

APPENDIX E

PROJECT MEMO

TO:	Lisa Were, Project Manager City of Sammamish Public Works Department	**DATE:**	March 8, 2021
FROM:	Trevor McDonald Tacoma - (253) 383-2422	**PROJECT NO.:** **PROJECT NAME:**	2190816.10 Sammamish Stormwater Retrofit
SUBJECT:	Cedar Cove – DS0092		

This memo describes the stormwater retrofit strategy for the Cedar Cove (DS0092) site.

The Cedar Cove site was developed in 2001. Based on our site reconnaissance, the site did not present a substantial opportunity for a stormwater retrofit. The development upstream and immediately to the west did, however. This is the Claremont development, which was developed in 1992. Runoff from the development travels east, through Cedar Cove, undetained and untreated.

The site presents an opportunity to improve the water quality of the runoff. This retrofit strategy does not meet the Lake Protection requirements presented in the 2016 *King County Surface Water Design Manual (KCSWDM)* but is a significant improvement to the existing site.

The *KCSWDM* indicates that a two-system treatment train is required to meet the Lake Protection standard. The first treatment system that is proposed is a grass-lined bioswale. This will be implemented in the existing drainage ditches that border the road to the maximum extent feasible. The next system is a proprietary media filter (Contech StormFilter). This system is not officially recognized in the *KCSWDM but* will provide an additional layer of treatment prior to leaving the site.

<u>Grass-lined Bioswales</u>: Due to the site information required for sizing, calculations were not prepared for the bioswales. It is assumed that these will be two feet wide, which is the minimum, and replace the existing ditches. This will provide the maximum amount of treatment.

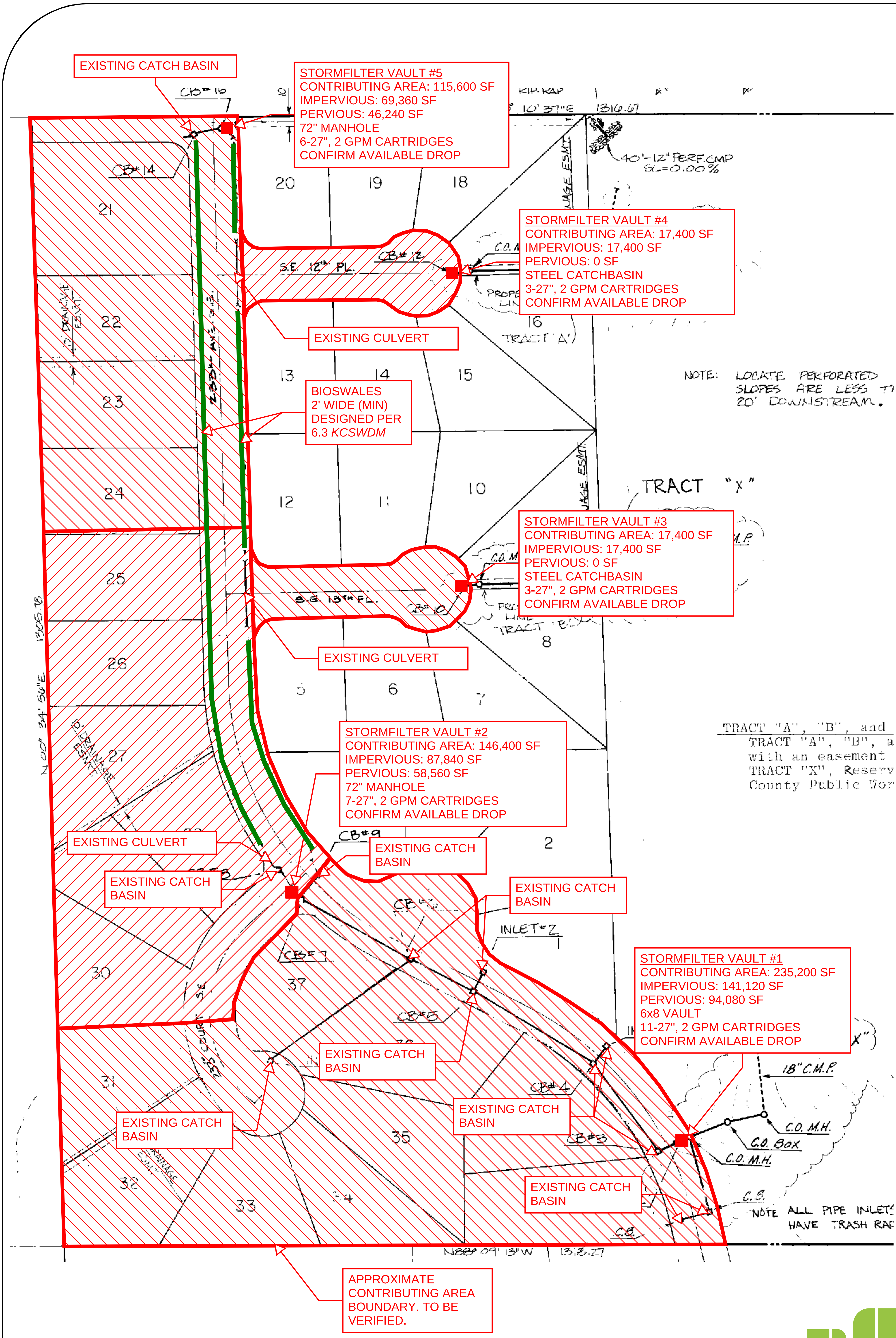
<u>Contech StormFilters</u>: The site was divided into five subbasins, which were approximately sized from record drawings and GIS contours. Each subbasin was assumed to be 60 percent impervious. The StormFilters are sized based on the water quality flowrate generated from a continuous runoff model. The WWHM2012 software provided this information for each subbasin, which is attached to this document. It was assumed that each facility had the required depth available. Existing site information should be confirmed, and the design should be refined as necessary.

It should be noted that not all subbasins will receive treatment from both systems. Based on assumed site grades and improvements, the bioswale is not feasible in every subbasin. Some existing catch basins and storm pipe may require replacement depending on their condition and depth.

TM/

c: Doreen Gavin, AHBL
Lucas Johnson, AHBL

Q:\2019\2190816\10_CIV\NON_CAD\SITE RECON\1548\10 Percent Design\Narrative.docx



EX A

SAMMAMISH STORMWATER RETROFIT PLANNING

SCALE: 1" = 100'

SITE ID: DS0092

DEVELOPMENT NAME: CEDAR COVE

ADDRESS: 235TH PL SE

AHBL

AHBL PROJECT NO: 2190816.10

\\AHBL.COM\DATA\PROJECTS\2019\2190816\10_CIV\CAD_2190816-11X17 EXHIBIT

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	StormFilter_Vault_1
Site Name:	
Site Address:	
City:	
Report Date:	3/8/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

StormFilter #1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	5.4
Pervious Total	5.4
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.4

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

StormFilter #1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	2.16
Pervious Total	2.16
Impervious Land Use	acre
ROADS FLAT	3.24
Impervious Total	3.24
Basin Total	5.4

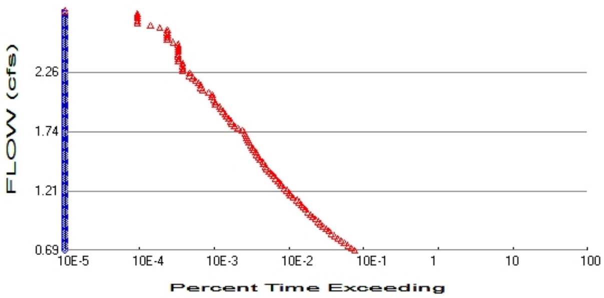
Element Flows To:

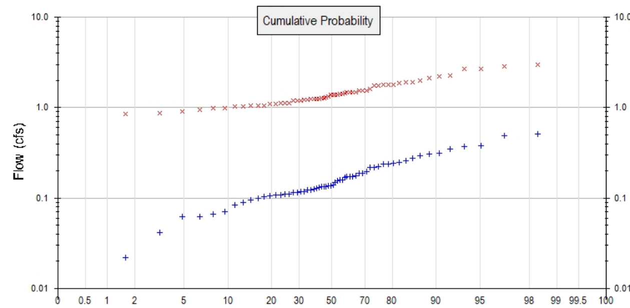
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 5.4
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.16
Total Impervious Area: 3.24

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.158765
5 year	0.249346
10 year	0.30068
25 year	0.355064
50 year	0.388717
100 year	0.41734

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	1.376346
5 year	1.798156
10 year	2.092283
25 year	2.481669
50 year	2.785077
100 year	3.100245

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

Year	**Predeveloped**	**Mitigated**
1949	0.156	1.913
1950	0.194	1.779
1951	0.350	1.189
1952	0.110	0.913
1953	0.089	0.987
1954	0.137	1.121
1955	0.218	1.238
1956	0.174	1.227
1957	0.140	1.478
1958	0.158	1.102

1959	0.135	1.048
1960	0.236	1.236
1961	0.133	1.237
1962	0.083	0.992
1963	0.114	1.198
1964	0.150	1.110
1965	0.107	1.544
1966	0.103	0.952
1967	0.216	1.741
1968	0.135	1.903
1969	0.132	1.402
1970	0.109	1.285
1971	0.116	1.535
1972	0.260	1.763
1973	0.118	0.859
1974	0.128	1.445
1975	0.174	1.495
1976	0.126	1.116
1977	0.015	1.064
1978	0.110	1.344
1979	0.067	1.799
1980	0.247	2.011
1981	0.099	1.415
1982	0.190	2.115
1983	0.170	1.559
1984	0.105	1.036
1985	0.062	1.423
1986	0.275	1.204
1987	0.243	1.792
1988	0.096	1.045
1989	0.063	1.307
1990	0.509	3.013
1991	0.306	2.266
1992	0.118	1.027
1993	0.123	0.848
1994	0.041	0.872
1995	0.177	1.242
1996	0.372	1.478
1997	0.311	1.393
1998	0.070	1.269
1999	0.292	2.883
2000	0.123	1.379
2001	0.022	1.383
2002	0.135	1.890
2003	0.172	1.469
2004	0.222	2.665
2005	0.159	1.226
2006	0.188	1.112
2007	0.378	2.700
2008	0.487	2.224
2009	0.239	1.603

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.5089	3.0134
2	0.4873	2.8828
3	0.3778	2.7000

4	0.3720	2.6646
5	0.3496	2.2658
6	0.3110	2.2236
7	0.3064	2.1147
8	0.2916	2.0105
9	0.2752	1.9133
10	0.2604	1.9032
11	0.2467	1.8900
12	0.2434	1.7988
13	0.2393	1.7916
14	0.2364	1.7788
15	0.2222	1.7625
16	0.2182	1.7409
17	0.2159	1.6026
18	0.1945	1.5593
19	0.1897	1.5445
20	0.1880	1.5349
21	0.1765	1.4953
22	0.1739	1.4785
23	0.1736	1.4777
24	0.1716	1.4693
25	0.1700	1.4447
26	0.1594	1.4225
27	0.1578	1.4154
28	0.1560	1.4019
29	0.1500	1.3925
30	0.1401	1.3830
31	0.1368	1.3788
32	0.1354	1.3438
33	0.1347	1.3073
34	0.1345	1.2853
35	0.1334	1.2694
36	0.1317	1.2417
37	0.1284	1.2378
38	0.1257	1.2371
39	0.1231	1.2364
40	0.1228	1.2271
41	0.1183	1.2262
42	0.1182	1.2036
43	0.1162	1.1979
44	0.1139	1.1886
45	0.1103	1.1209
46	0.1102	1.1163
47	0.1086	1.1124
48	0.1074	1.1104
49	0.1050	1.1025
50	0.1032	1.0636
51	0.0986	1.0479
52	0.0961	1.0453
53	0.0891	1.0360
54	0.0830	1.0268
55	0.0703	0.9922
56	0.0667	0.9872
57	0.0627	0.9522
58	0.0623	0.9130
59	0.0414	0.8723
60	0.0220	0.8589
61	0.0150	0.8485

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0794	0	1628	n/a	Fail
0.0825	0	1469	n/a	Fail
0.0856	0	1315	n/a	Fail
0.0888	0	1178	n/a	Fail
0.0919	0	1069	n/a	Fail
0.0950	0	972	n/a	Fail
0.0981	0	872	n/a	Fail
0.1013	0	787	n/a	Fail
0.1044	0	735	n/a	Fail
0.1075	0	671	n/a	Fail
0.1106	0	610	n/a	Fail
0.1138	0	562	n/a	Fail
0.1169	0	526	n/a	Fail
0.1200	0	482	n/a	Fail
0.1231	0	441	n/a	Fail
0.1263	0	410	n/a	Fail
0.1294	0	381	n/a	Fail
0.1325	0	354	n/a	Fail
0.1356	0	331	n/a	Fail
0.1387	0	311	n/a	Fail
0.1419	0	292	n/a	Fail
0.1450	0	271	n/a	Fail
0.1481	0	244	n/a	Fail
0.1512	0	225	n/a	Fail
0.1544	0	216	n/a	Fail
0.1575	0	202	n/a	Fail
0.1606	0	184	n/a	Fail
0.1637	0	170	n/a	Fail
0.1669	0	164	n/a	Fail
0.1700	0	153	n/a	Fail
0.1731	0	143	n/a	Fail
0.1762	0	134	n/a	Fail
0.1794	0	124	n/a	Fail
0.1825	0	116	n/a	Fail
0.1856	0	107	n/a	Fail
0.1887	0	104	n/a	Fail
0.1919	0	98	n/a	Fail
0.1950	0	95	n/a	Fail
0.1981	0	87	n/a	Fail
0.2012	0	83	n/a	Fail
0.2044	0	79	n/a	Fail
0.2075	0	77	n/a	Fail
0.2106	0	71	n/a	Fail
0.2137	0	69	n/a	Fail
0.2169	0	65	n/a	Fail
0.2200	0	62	n/a	Fail
0.2231	0	60	n/a	Fail
0.2262	0	58	n/a	Fail
0.2294	0	57	n/a	Fail
0.2325	0	55	n/a	Fail
0.2356	0	51	n/a	Fail
0.2387	0	44	n/a	Fail
0.2419	0	40	n/a	Fail

0.2450	0	37	n/a	Fail
0.2481	0	36	n/a	Fail
0.2512	0	33	n/a	Fail
0.2544	0	31	n/a	Fail
0.2575	0	30	n/a	Fail
0.2606	0	28	n/a	Fail
0.2637	0	26	n/a	Fail
0.2669	0	25	n/a	Fail
0.2700	0	22	n/a	Fail
0.2731	0	22	n/a	Fail
0.2762	0	21	n/a	Fail
0.2794	0	20	n/a	Fail
0.2825	0	20	n/a	Fail
0.2856	0	18	n/a	Fail
0.2887	0	15	n/a	Fail
0.2919	0	14	n/a	Fail
0.2950	0	14	n/a	Fail
0.2981	0	13	n/a	Fail
0.3012	0	12	n/a	Fail
0.3044	0	11	n/a	Fail
0.3075	0	10	n/a	Fail
0.3106	0	10	n/a	Fail
0.3137	0	8	n/a	Fail
0.3169	0	8	n/a	Fail
0.3200	0	8	n/a	Fail
0.3231	0	8	n/a	Fail
0.3262	0	7	n/a	Fail
0.3293	0	7	n/a	Fail
0.3325	0	7	n/a	Fail
0.3356	0	7	n/a	Fail
0.3387	0	7	n/a	Fail
0.3418	0	7	n/a	Fail
0.3450	0	7	n/a	Fail
0.3481	0	7	n/a	Fail
0.3512	0	6	n/a	Fail
0.3543	0	5	n/a	Fail
0.3575	0	5	n/a	Fail
0.3606	0	5	n/a	Fail
0.3637	0	5	n/a	Fail
0.3668	0	5	n/a	Fail
0.3700	0	4	n/a	Fail
0.3731	0	3	n/a	Fail
0.3762	0	2	n/a	Fail
0.3793	0	2	n/a	Fail
0.3825	0	2	n/a	Fail
0.3856	0	2	n/a	Fail
0.3887	0	2	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.4613 acre-feet
On-line facility target flow:	0.5174 cfs.
Adjusted for 15 min:	0.5174 cfs.
Off-line facility target flow:	0.2899 cfs.
Adjusted for 15 min:	0.2899 cfs.

0.5174 CFS = 232.2 GPM

232.2 GPM / 22.5 = 11 27", 2 GPM Cartridges

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

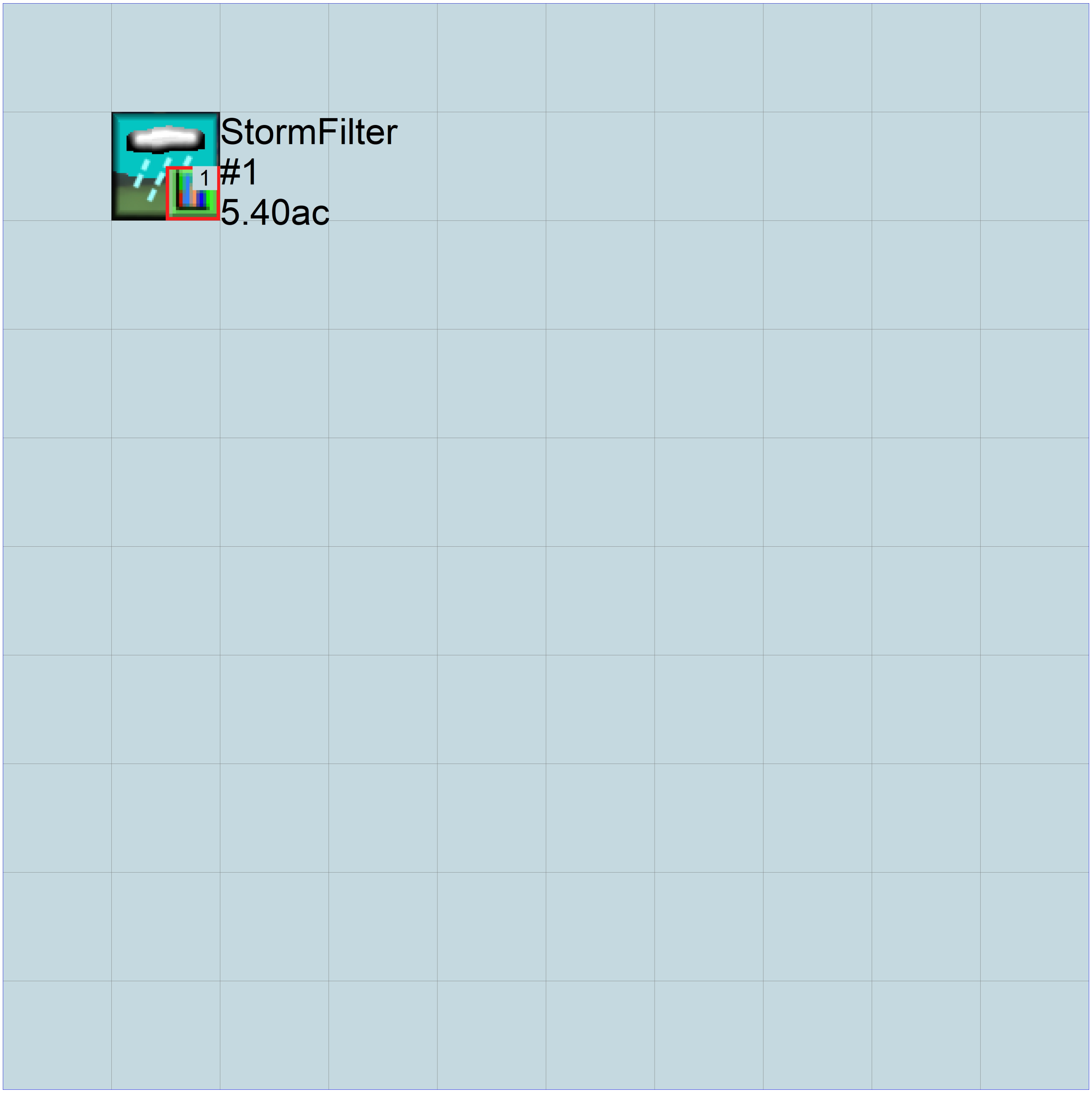
PERLND Changes

No PERLND changes have been made.

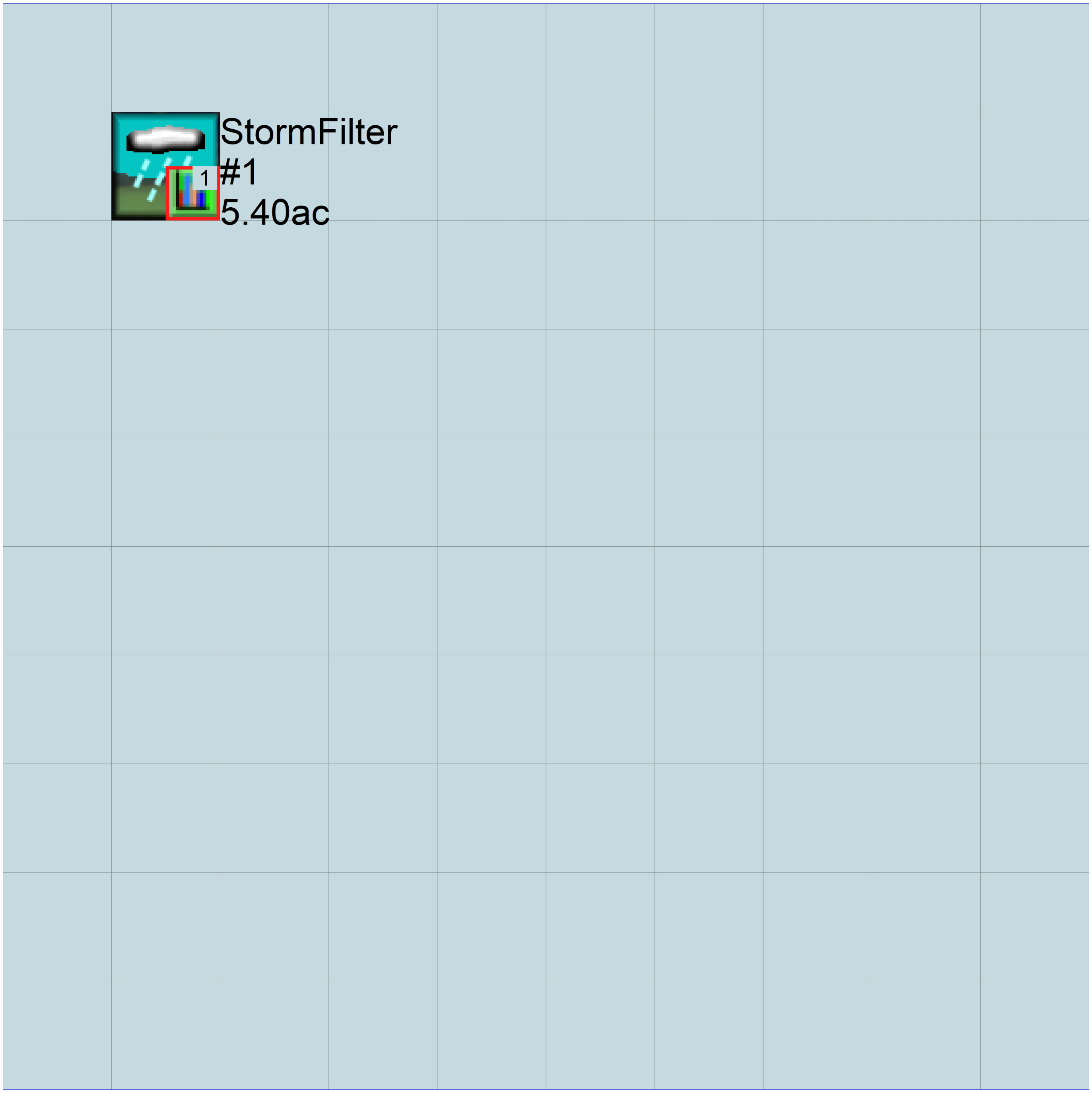
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	StormFilter_Vault_2
Site Name:	
Site Address:	
City:	
Report Date:	3/8/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

STORMFILTER VAULT #2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	3.36
Pervious Total	3.36
Impervious Land Use	acre
Impervious Total	0
Basin Total	3.36

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

STORMFILTER VAULT #2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	1.35
Pervious Total	1.35
Impervious Land Use	acre
ROADS FLAT	2.01
Impervious Total	2.01
Basin Total	3.36

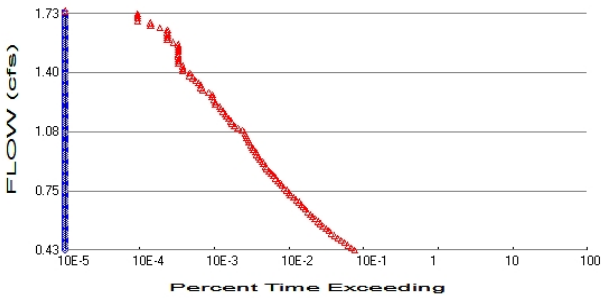
Element Flows To:

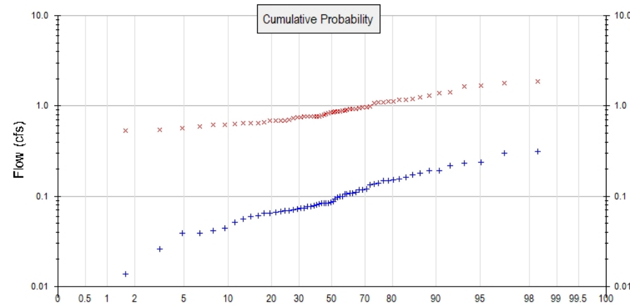
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 3.36
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.35
Total Impervious Area: 2.01

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.098787
5 year	0.155149
10 year	0.18709
25 year	0.220929
50 year	0.241868
100 year	0.259678

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.854537
5 year	1.116735
10 year	1.299605
25 year	1.54174
50 year	1.730439
100 year	1.926473

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

Year	**Predeveloped**	**Mitigated**
1949	0.097	1.188
1950	0.121	1.104
1951	0.218	0.738
1952	0.069	0.566
1953	0.055	0.613
1954	0.085	0.696
1955	0.136	0.768
1956	0.108	0.762
1957	0.087	0.918
1958	0.098	0.684

1959	0.084	0.650
1960	0.147	0.768
1961	0.083	0.768
1962	0.052	0.616
1963	0.071	0.744
1964	0.093	0.689
1965	0.067	0.959
1966	0.064	0.591
1967	0.134	1.082
1968	0.084	1.182
1969	0.082	0.871
1970	0.068	0.798
1971	0.072	0.953
1972	0.162	1.095
1973	0.074	0.533
1974	0.080	0.897
1975	0.108	0.929
1976	0.078	0.693
1977	0.009	0.660
1978	0.069	0.834
1979	0.041	1.116
1980	0.154	1.249
1981	0.061	0.879
1982	0.118	1.314
1983	0.106	0.968
1984	0.065	0.643
1985	0.039	0.883
1986	0.171	0.748
1987	0.151	1.112
1988	0.060	0.648
1989	0.039	0.811
1990	0.317	1.873
1991	0.191	1.408
1992	0.074	0.637
1993	0.077	0.527
1994	0.026	0.541
1995	0.110	0.771
1996	0.231	0.918
1997	0.193	0.865
1998	0.044	0.788
1999	0.181	1.790
2000	0.076	0.856
2001	0.014	0.858
2002	0.084	1.174
2003	0.107	0.913
2004	0.138	1.655
2005	0.099	0.762
2006	0.117	0.691
2007	0.235	1.679
2008	0.303	1.382
2009	0.149	0.994

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.3167	1.8732
2	0.3032	1.7904
3	0.2351	1.6785

4	0.2315	1.6548
5	0.2175	1.4080
6	0.1935	1.3817
7	0.1907	1.3136
8	0.1815	1.2493
9	0.1712	1.1884
10	0.1620	1.1815
11	0.1535	1.1740
12	0.1515	1.1161
13	0.1489	1.1118
14	0.1471	1.1038
15	0.1383	1.0950
16	0.1358	1.0819
17	0.1343	0.9942
18	0.1210	0.9677
19	0.1180	0.9592
20	0.1170	0.9529
21	0.1098	0.9287
22	0.1082	0.9184
23	0.1080	0.9177
24	0.1068	0.9127
25	0.1058	0.8971
26	0.0992	0.8831
27	0.0982	0.8786
28	0.0970	0.8707
29	0.0933	0.8649
30	0.0872	0.8582
31	0.0851	0.8561
32	0.0842	0.8341
33	0.0838	0.8110
34	0.0837	0.7980
35	0.0830	0.7878
36	0.0820	0.7708
37	0.0799	0.7683
38	0.0782	0.7681
39	0.0766	0.7680
40	0.0764	0.7617
41	0.0736	0.7615
42	0.0735	0.7475
43	0.0723	0.7438
44	0.0709	0.7382
45	0.0686	0.6959
46	0.0686	0.6932
47	0.0676	0.6910
48	0.0668	0.6893
49	0.0653	0.6843
50	0.0642	0.6604
51	0.0614	0.6501
52	0.0598	0.6485
53	0.0554	0.6432
54	0.0516	0.6374
55	0.0438	0.6158
56	0.0415	0.6125
57	0.0390	0.5910
58	0.0388	0.5665
59	0.0257	0.5411
60	0.0137	0.5328
61	0.0093	0.5266

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0494	0	1629	n/a	Fail
0.0513	0	1470	n/a	Fail
0.0533	0	1316	n/a	Fail
0.0552	0	1183	n/a	Fail
0.0572	0	1072	n/a	Fail
0.0591	0	971	n/a	Fail
0.0611	0	872	n/a	Fail
0.0630	0	787	n/a	Fail
0.0649	0	734	n/a	Fail
0.0669	0	669	n/a	Fail
0.0688	0	610	n/a	Fail
0.0708	0	561	n/a	Fail
0.0727	0	526	n/a	Fail
0.0747	0	481	n/a	Fail
0.0766	0	441	n/a	Fail
0.0786	0	410	n/a	Fail
0.0805	0	382	n/a	Fail
0.0824	0	354	n/a	Fail
0.0844	0	330	n/a	Fail
0.0863	0	311	n/a	Fail
0.0883	0	293	n/a	Fail
0.0902	0	270	n/a	Fail
0.0922	0	245	n/a	Fail
0.0941	0	225	n/a	Fail
0.0961	0	215	n/a	Fail
0.0980	0	202	n/a	Fail
0.0999	0	184	n/a	Fail
0.1019	0	171	n/a	Fail
0.1038	0	164	n/a	Fail
0.1058	0	151	n/a	Fail
0.1077	0	142	n/a	Fail
0.1097	0	134	n/a	Fail
0.1116	0	124	n/a	Fail
0.1136	0	116	n/a	Fail
0.1155	0	107	n/a	Fail
0.1174	0	105	n/a	Fail
0.1194	0	98	n/a	Fail
0.1213	0	94	n/a	Fail
0.1233	0	87	n/a	Fail
0.1252	0	83	n/a	Fail
0.1272	0	79	n/a	Fail
0.1291	0	77	n/a	Fail
0.1310	0	71	n/a	Fail
0.1330	0	69	n/a	Fail
0.1349	0	65	n/a	Fail
0.1369	0	62	n/a	Fail
0.1388	0	61	n/a	Fail
0.1408	0	58	n/a	Fail
0.1427	0	57	n/a	Fail
0.1447	0	55	n/a	Fail
0.1466	0	51	n/a	Fail
0.1485	0	44	n/a	Fail
0.1505	0	40	n/a	Fail

0.1524	0	37	n/a	Fail
0.1544	0	36	n/a	Fail
0.1563	0	33	n/a	Fail
0.1583	0	31	n/a	Fail
0.1602	0	30	n/a	Fail
0.1622	0	28	n/a	Fail
0.1641	0	26	n/a	Fail
0.1660	0	25	n/a	Fail
0.1680	0	22	n/a	Fail
0.1699	0	22	n/a	Fail
0.1719	0	21	n/a	Fail
0.1738	0	20	n/a	Fail
0.1758	0	20	n/a	Fail
0.1777	0	18	n/a	Fail
0.1797	0	15	n/a	Fail
0.1816	0	14	n/a	Fail
0.1835	0	14	n/a	Fail
0.1855	0	13	n/a	Fail
0.1874	0	12	n/a	Fail
0.1894	0	11	n/a	Fail
0.1913	0	10	n/a	Fail
0.1933	0	10	n/a	Fail
0.1952	0	8	n/a	Fail
0.1972	0	8	n/a	Fail
0.1991	0	8	n/a	Fail
0.2010	0	7	n/a	Fail
0.2030	0	7	n/a	Fail
0.2049	0	7	n/a	Fail
0.2069	0	7	n/a	Fail
0.2088	0	7	n/a	Fail
0.2108	0	7	n/a	Fail
0.2127	0	7	n/a	Fail
0.2146	0	7	n/a	Fail
0.2166	0	7	n/a	Fail
0.2185	0	6	n/a	Fail
0.2205	0	5	n/a	Fail
0.2224	0	5	n/a	Fail
0.2244	0	5	n/a	Fail
0.2263	0	5	n/a	Fail
0.2283	0	5	n/a	Fail
0.2302	0	4	n/a	Fail
0.2321	0	3	n/a	Fail
0.2341	0	3	n/a	Fail
0.2360	0	2	n/a	Fail
0.2380	0	2	n/a	Fail
0.2399	0	2	n/a	Fail
0.2419	0	2	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2864 acre-feet
On-line facility target flow:	0.3211 cfs.
Adjusted for 15 min:	0.3211 cfs.
Off-line facility target flow:	0.1798 cfs.
Adjusted for 15 min:	0.1798 cfs.

0.3211 CFS = 144.1 GPM

144.1 GPM / 22.5 = 7 27", 2 GPM Cartridges

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

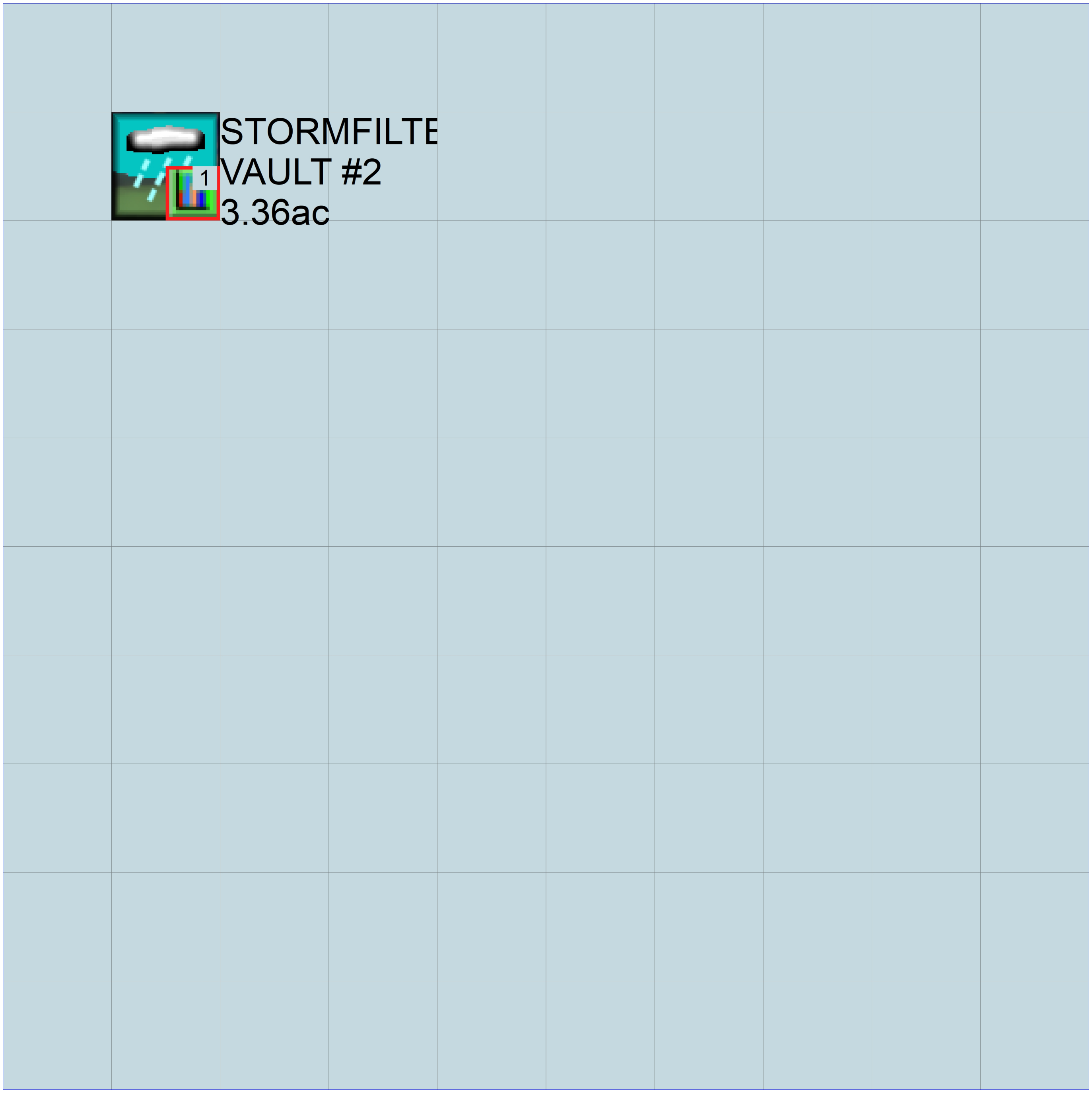
PERLND Changes

No PERLND changes have been made.

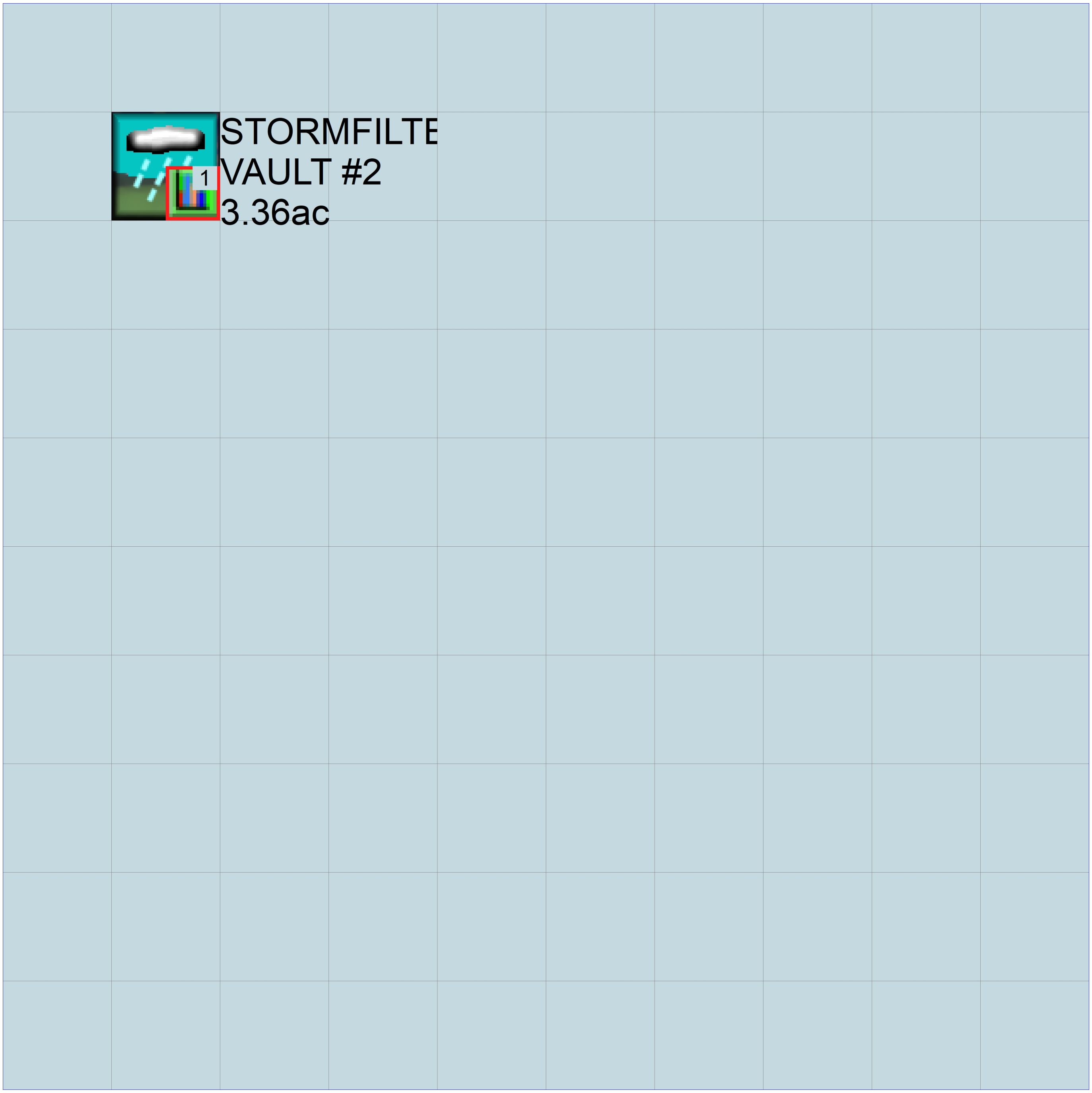
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

General Model Information

Project Name:	StormFilter_Vault_3
Site Name:	
Site Address:	
City:	
Report Date:	3/8/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

STORMFILTER VAULT #3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.4
Pervious Total	0.4
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.4

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

STORMFILTER VAULT #3

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.4
Impervious Total	0.4
Basin Total	0.4

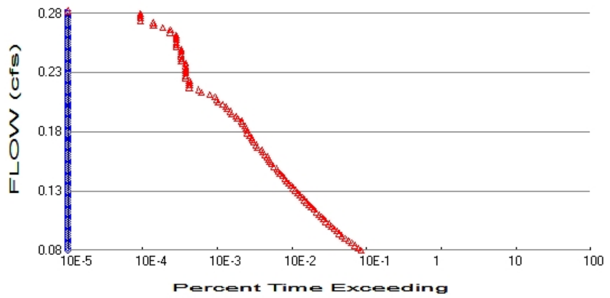
Element Flows To:

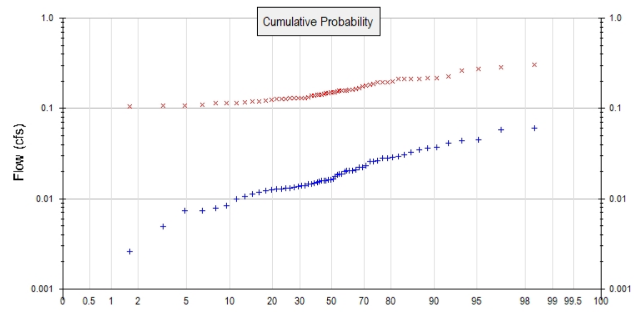
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.4
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.4

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.018817
5 year	0.029552
10 year	0.035636
25 year	0.042082
50 year	0.04607
100 year	0.049462

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.152506
5 year	0.192633
10 year	0.219896
25 year	0.25526
50 year	0.282328
100 year	0.310052

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.018	0.198
1950	0.023	0.213
1951	0.041	0.123
1952	0.013	0.110
1953	0.011	0.119
1954	0.016	0.124
1955	0.026	0.141
1956	0.021	0.138
1957	0.017	0.157
1958	0.019	0.127

1959	0.016	0.129
1960	0.028	0.127
1961	0.016	0.134
1962	0.010	0.117
1963	0.014	0.130
1964	0.018	0.127
1965	0.013	0.162
1966	0.012	0.108
1967	0.026	0.186
1968	0.016	0.212
1969	0.016	0.147
1970	0.013	0.142
1971	0.014	0.169
1972	0.031	0.175
1973	0.014	0.106
1974	0.015	0.155
1975	0.021	0.178
1976	0.015	0.120
1977	0.002	0.130
1978	0.013	0.159
1979	0.008	0.217
1980	0.029	0.195
1981	0.012	0.159
1982	0.022	0.225
1983	0.020	0.183
1984	0.012	0.115
1985	0.007	0.159
1986	0.033	0.138
1987	0.029	0.213
1988	0.011	0.129
1989	0.007	0.161
1990	0.060	0.272
1991	0.036	0.217
1992	0.014	0.114
1993	0.015	0.099
1994	0.005	0.108
1995	0.021	0.141
1996	0.044	0.150
1997	0.037	0.146
1998	0.008	0.148
1999	0.035	0.303
2000	0.015	0.151
2001	0.003	0.166
2002	0.016	0.193
2003	0.020	0.150
2004	0.026	0.283
2005	0.019	0.129
2006	0.022	0.114
2007	0.045	0.265
2008	0.058	0.213
2009	0.028	0.197

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0603	0.3028
2	0.0578	0.2833
3	0.0448	0.2718

4	0.0441	0.2648
5	0.0414	0.2247
6	0.0369	0.2172
7	0.0363	0.2171
8	0.0346	0.2134
9	0.0326	0.2133
10	0.0309	0.2126
11	0.0292	0.2118
12	0.0288	0.1975
13	0.0284	0.1971
14	0.0280	0.1948
15	0.0263	0.1932
16	0.0259	0.1863
17	0.0256	0.1829
18	0.0230	0.1781
19	0.0225	0.1749
20	0.0223	0.1694
21	0.0209	0.1656
22	0.0206	0.1617
23	0.0206	0.1613
24	0.0203	0.1594
25	0.0202	0.1590
26	0.0189	0.1586
27	0.0187	0.1570
28	0.0185	0.1546
29	0.0178	0.1507
30	0.0166	0.1504
31	0.0162	0.1501
32	0.0160	0.1480
33	0.0160	0.1472
34	0.0159	0.1460
35	0.0158	0.1421
36	0.0156	0.1413
37	0.0152	0.1406
38	0.0149	0.1384
39	0.0146	0.1378
40	0.0145	0.1341
41	0.0140	0.1298
42	0.0140	0.1297
43	0.0138	0.1295
44	0.0135	0.1292
45	0.0131	0.1290
46	0.0131	0.1273
47	0.0129	0.1268
48	0.0127	0.1267
49	0.0124	0.1240
50	0.0122	0.1234
51	0.0117	0.1197
52	0.0114	0.1185
53	0.0106	0.1168
54	0.0098	0.1154
55	0.0083	0.1144
56	0.0079	0.1143
57	0.0074	0.1098
58	0.0074	0.1081
59	0.0049	0.1077
60	0.0026	0.1059
61	0.0018	0.0990

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0094	0	1801	n/a	Fail
0.0098	0	1636	n/a	Fail
0.0101	0	1472	n/a	Fail
0.0105	0	1343	n/a	Fail
0.0109	0	1226	n/a	Fail
0.0113	0	1101	n/a	Fail
0.0116	0	1002	n/a	Fail
0.0120	0	920	n/a	Fail
0.0124	0	852	n/a	Fail
0.0127	0	789	n/a	Fail
0.0131	0	725	n/a	Fail
0.0135	0	665	n/a	Fail
0.0139	0	610	n/a	Fail
0.0142	0	571	n/a	Fail
0.0146	0	533	n/a	Fail
0.0150	0	490	n/a	Fail
0.0153	0	451	n/a	Fail
0.0157	0	420	n/a	Fail
0.0161	0	389	n/a	Fail
0.0164	0	364	n/a	Fail
0.0168	0	339	n/a	Fail
0.0172	0	317	n/a	Fail
0.0176	0	296	n/a	Fail
0.0179	0	272	n/a	Fail
0.0183	0	256	n/a	Fail
0.0187	0	239	n/a	Fail
0.0190	0	222	n/a	Fail
0.0194	0	208	n/a	Fail
0.0198	0	193	n/a	Fail
0.0201	0	181	n/a	Fail
0.0205	0	171	n/a	Fail
0.0209	0	161	n/a	Fail
0.0213	0	148	n/a	Fail
0.0216	0	139	n/a	Fail
0.0220	0	135	n/a	Fail
0.0224	0	122	n/a	Fail
0.0227	0	113	n/a	Fail
0.0231	0	108	n/a	Fail
0.0235	0	105	n/a	Fail
0.0239	0	100	n/a	Fail
0.0242	0	92	n/a	Fail
0.0246	0	87	n/a	Fail
0.0250	0	84	n/a	Fail
0.0253	0	73	n/a	Fail
0.0257	0	71	n/a	Fail
0.0261	0	65	n/a	Fail
0.0264	0	63	n/a	Fail
0.0268	0	62	n/a	Fail
0.0272	0	58	n/a	Fail
0.0276	0	54	n/a	Fail
0.0279	0	54	n/a	Fail
0.0283	0	52	n/a	Fail
0.0287	0	50	n/a	Fail

0.0290	0	46	n/a	Fail
0.0294	0	45	n/a	Fail
0.0298	0	40	n/a	Fail
0.0301	0	38	n/a	Fail
0.0305	0	33	n/a	Fail
0.0309	0	32	n/a	Fail
0.0313	0	29	n/a	Fail
0.0316	0	28	n/a	Fail
0.0320	0	25	n/a	Fail
0.0324	0	22	n/a	Fail
0.0327	0	21	n/a	Fail
0.0331	0	20	n/a	Fail
0.0335	0	17	n/a	Fail
0.0338	0	13	n/a	Fail
0.0342	0	12	n/a	Fail
0.0346	0	9	n/a	Fail
0.0350	0	9	n/a	Fail
0.0353	0	9	n/a	Fail
0.0357	0	9	n/a	Fail
0.0361	0	8	n/a	Fail
0.0364	0	8	n/a	Fail
0.0368	0	8	n/a	Fail
0.0372	0	8	n/a	Fail
0.0376	0	8	n/a	Fail
0.0379	0	8	n/a	Fail
0.0383	0	8	n/a	Fail
0.0387	0	7	n/a	Fail
0.0390	0	7	n/a	Fail
0.0394	0	7	n/a	Fail
0.0398	0	7	n/a	Fail
0.0401	0	7	n/a	Fail
0.0405	0	7	n/a	Fail
0.0409	0	6	n/a	Fail
0.0413	0	6	n/a	Fail
0.0416	0	6	n/a	Fail
0.0420	0	6	n/a	Fail
0.0424	0	6	n/a	Fail
0.0427	0	6	n/a	Fail
0.0431	0	5	n/a	Fail
0.0435	0	5	n/a	Fail
0.0438	0	4	n/a	Fail
0.0442	0	3	n/a	Fail
0.0446	0	3	n/a	Fail
0.0450	0	2	n/a	Fail
0.0453	0	2	n/a	Fail
0.0457	0	2	n/a	Fail
0.0461	0	2	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0491 acre-feet
On-line facility target flow:	0.0649 cfs.
Adjusted for 15 min:	0.0649 cfs.
Off-line facility target flow:	0.0367 cfs.
Adjusted for 15 min:	0.0367 cfs.

0.0649 CFS = 29.1 GPM

29.1 GPM / 11.25 = 3 27", 1 GPM Cartridges

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

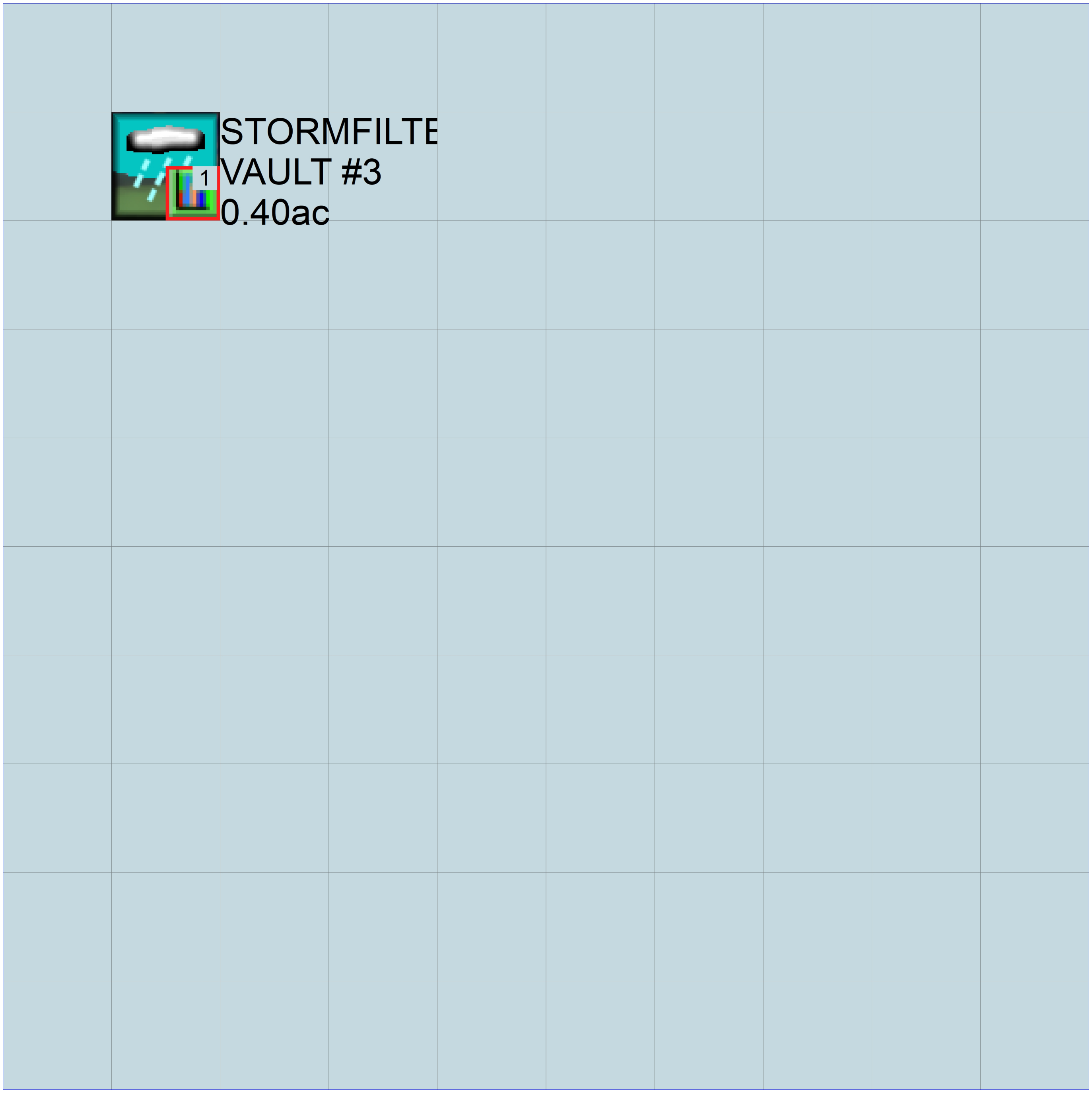
PERLND Changes

No PERLND changes have been made.

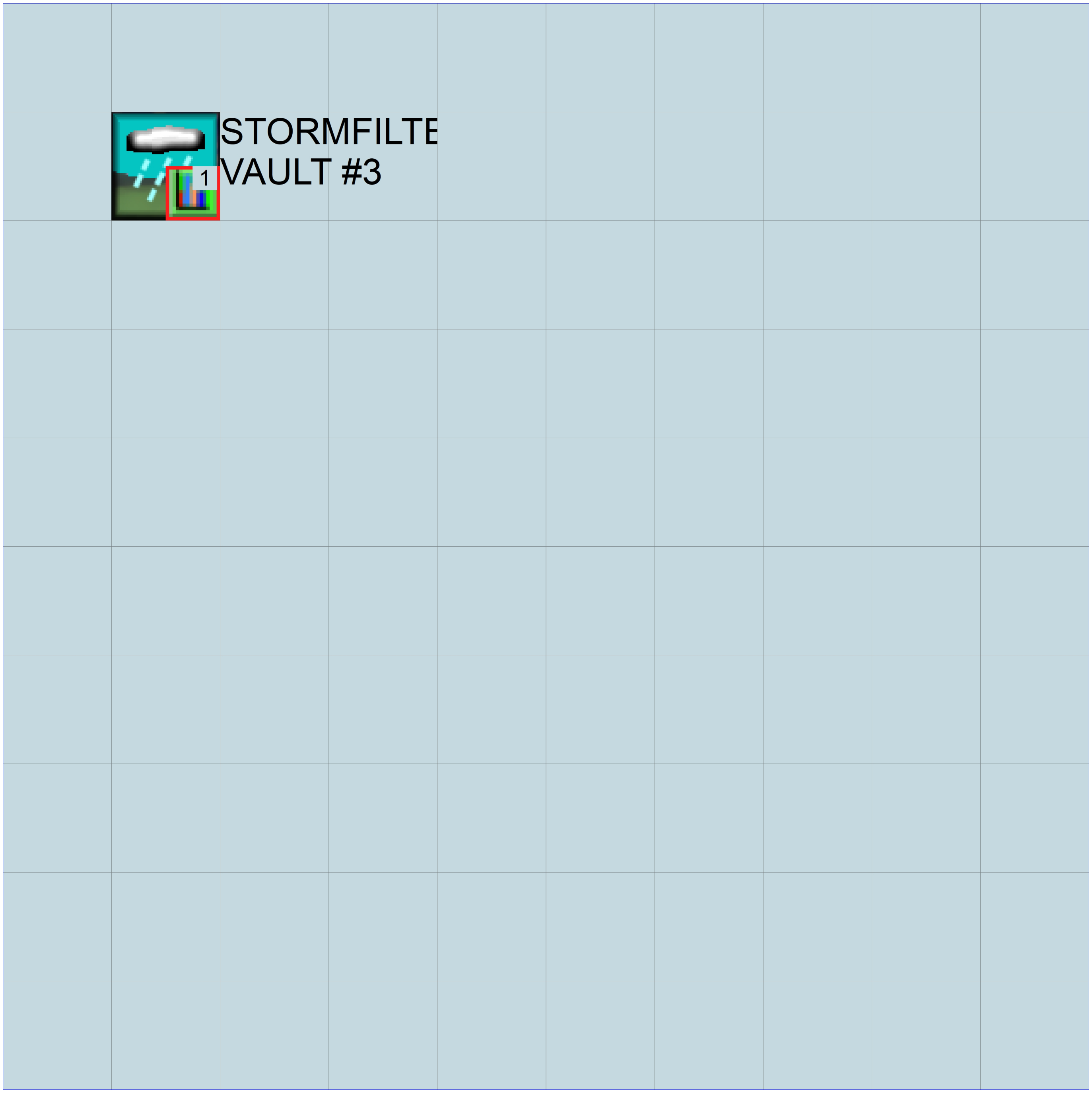
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   StormFilter_Vault_3.wdm
MESSU      25   MitStormFilter_Vault_3.MES
           27   MitStormFilter_Vault_3.L61
           28   MitStormFilter_Vault_3.L62
           30   POCStormFilter_Vault_31.dat
END FILES

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

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

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

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

```
  END PWAT-PARM1

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

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

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

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
  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    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->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
STORMFILTER VAULT #3***
IMPLND   1                         0.4     COPY   501     15

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

```
END EXT SOURCES

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	StormFilter_Vault_4
Site Name:	
Site Address:	
City:	
Report Date:	3/8/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

STORMFILTER VAULT #4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.4
Pervious Total	0.4
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.4

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

STORMFILTER VAULT #4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.4
Impervious Total	0.4
Basin Total	0.4

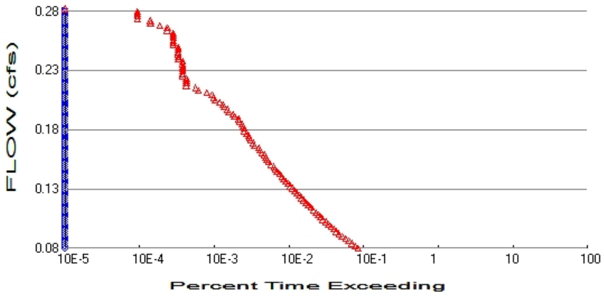
Element Flows To:

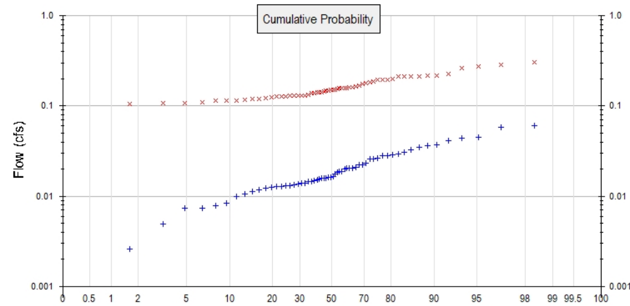
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.4
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.4

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.018817
5 year	0.029552
10 year	0.035636
25 year	0.042082
50 year	0.04607
100 year	0.049462

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.152506
5 year	0.192633
10 year	0.219896
25 year	0.25526
50 year	0.282328
100 year	0.310052

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

Year	**Predeveloped**	**Mitigated**
1949	0.018	0.198
1950	0.023	0.213
1951	0.041	0.123
1952	0.013	0.110
1953	0.011	0.119
1954	0.016	0.124
1955	0.026	0.141
1956	0.021	0.138
1957	0.017	0.157
1958	0.019	0.127

1959	0.016	0.129
1960	0.028	0.127
1961	0.016	0.134
1962	0.010	0.117
1963	0.014	0.130
1964	0.018	0.127
1965	0.013	0.162
1966	0.012	0.108
1967	0.026	0.186
1968	0.016	0.212
1969	0.016	0.147
1970	0.013	0.142
1971	0.014	0.169
1972	0.031	0.175
1973	0.014	0.106
1974	0.015	0.155
1975	0.021	0.178
1976	0.015	0.120
1977	0.002	0.130
1978	0.013	0.159
1979	0.008	0.217
1980	0.029	0.195
1981	0.012	0.159
1982	0.022	0.225
1983	0.020	0.183
1984	0.012	0.115
1985	0.007	0.159
1986	0.033	0.138
1987	0.029	0.213
1988	0.011	0.129
1989	0.007	0.161
1990	0.060	0.272
1991	0.036	0.217
1992	0.014	0.114
1993	0.015	0.099
1994	0.005	0.108
1995	0.021	0.141
1996	0.044	0.150
1997	0.037	0.146
1998	0.008	0.148
1999	0.035	0.303
2000	0.015	0.151
2001	0.003	0.166
2002	0.016	0.193
2003	0.020	0.150
2004	0.026	0.283
2005	0.019	0.129
2006	0.022	0.114
2007	0.045	0.265
2008	0.058	0.213
2009	0.028	0.197

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0603	0.3028
2	0.0578	0.2833
3	0.0448	0.2718

4	0.0441	0.2648
5	0.0414	0.2247
6	0.0369	0.2172
7	0.0363	0.2171
8	0.0346	0.2134
9	0.0326	0.2133
10	0.0309	0.2126
11	0.0292	0.2118
12	0.0288	0.1975
13	0.0284	0.1971
14	0.0280	0.1948
15	0.0263	0.1932
16	0.0259	0.1863
17	0.0256	0.1829
18	0.0230	0.1781
19	0.0225	0.1749
20	0.0223	0.1694
21	0.0209	0.1656
22	0.0206	0.1617
23	0.0206	0.1613
24	0.0203	0.1594
25	0.0202	0.1590
26	0.0189	0.1586
27	0.0187	0.1570
28	0.0185	0.1546
29	0.0178	0.1507
30	0.0166	0.1504
31	0.0162	0.1501
32	0.0160	0.1480
33	0.0160	0.1472
34	0.0159	0.1460
35	0.0158	0.1421
36	0.0156	0.1413
37	0.0152	0.1406
38	0.0149	0.1384
39	0.0146	0.1378
40	0.0145	0.1341
41	0.0140	0.1298
42	0.0140	0.1297
43	0.0138	0.1295
44	0.0135	0.1292
45	0.0131	0.1290
46	0.0131	0.1273
47	0.0129	0.1268
48	0.0127	0.1267
49	0.0124	0.1240
50	0.0122	0.1234
51	0.0117	0.1197
52	0.0114	0.1185
53	0.0106	0.1168
54	0.0098	0.1154
55	0.0083	0.1144
56	0.0079	0.1143
57	0.0074	0.1098
58	0.0074	0.1081
59	0.0049	0.1077
60	0.0026	0.1059
61	0.0018	0.0990

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0094	0	1801	n/a	Fail
0.0098	0	1636	n/a	Fail
0.0101	0	1472	n/a	Fail
0.0105	0	1343	n/a	Fail
0.0109	0	1226	n/a	Fail
0.0113	0	1101	n/a	Fail
0.0116	0	1002	n/a	Fail
0.0120	0	920	n/a	Fail
0.0124	0	852	n/a	Fail
0.0127	0	789	n/a	Fail
0.0131	0	725	n/a	Fail
0.0135	0	665	n/a	Fail
0.0139	0	610	n/a	Fail
0.0142	0	571	n/a	Fail
0.0146	0	533	n/a	Fail
0.0150	0	490	n/a	Fail
0.0153	0	451	n/a	Fail
0.0157	0	420	n/a	Fail
0.0161	0	389	n/a	Fail
0.0164	0	364	n/a	Fail
0.0168	0	339	n/a	Fail
0.0172	0	317	n/a	Fail
0.0176	0	296	n/a	Fail
0.0179	0	272	n/a	Fail
0.0183	0	256	n/a	Fail
0.0187	0	239	n/a	Fail
0.0190	0	222	n/a	Fail
0.0194	0	208	n/a	Fail
0.0198	0	193	n/a	Fail
0.0201	0	181	n/a	Fail
0.0205	0	171	n/a	Fail
0.0209	0	161	n/a	Fail
0.0213	0	148	n/a	Fail
0.0216	0	139	n/a	Fail
0.0220	0	135	n/a	Fail
0.0224	0	122	n/a	Fail
0.0227	0	113	n/a	Fail
0.0231	0	108	n/a	Fail
0.0235	0	105	n/a	Fail
0.0239	0	100	n/a	Fail
0.0242	0	92	n/a	Fail
0.0246	0	87	n/a	Fail
0.0250	0	84	n/a	Fail
0.0253	0	73	n/a	Fail
0.0257	0	71	n/a	Fail
0.0261	0	65	n/a	Fail
0.0264	0	63	n/a	Fail
0.0268	0	62	n/a	Fail
0.0272	0	58	n/a	Fail
0.0276	0	54	n/a	Fail
0.0279	0	54	n/a	Fail
0.0283	0	52	n/a	Fail
0.0287	0	50	n/a	Fail

0.0290	0	46	n/a	Fail
0.0294	0	45	n/a	Fail
0.0298	0	40	n/a	Fail
0.0301	0	38	n/a	Fail
0.0305	0	33	n/a	Fail
0.0309	0	32	n/a	Fail
0.0313	0	29	n/a	Fail
0.0316	0	28	n/a	Fail
0.0320	0	25	n/a	Fail
0.0324	0	22	n/a	Fail
0.0327	0	21	n/a	Fail
0.0331	0	20	n/a	Fail
0.0335	0	17	n/a	Fail
0.0338	0	13	n/a	Fail
0.0342	0	12	n/a	Fail
0.0346	0	9	n/a	Fail
0.0350	0	9	n/a	Fail
0.0353	0	9	n/a	Fail
0.0357	0	9	n/a	Fail
0.0361	0	8	n/a	Fail
0.0364	0	8	n/a	Fail
0.0368	0	8	n/a	Fail
0.0372	0	8	n/a	Fail
0.0376	0	8	n/a	Fail
0.0379	0	8	n/a	Fail
0.0383	0	8	n/a	Fail
0.0387	0	7	n/a	Fail
0.0390	0	7	n/a	Fail
0.0394	0	7	n/a	Fail
0.0398	0	7	n/a	Fail
0.0401	0	7	n/a	Fail
0.0405	0	7	n/a	Fail
0.0409	0	6	n/a	Fail
0.0413	0	6	n/a	Fail
0.0416	0	6	n/a	Fail
0.0420	0	6	n/a	Fail
0.0424	0	6	n/a	Fail
0.0427	0	6	n/a	Fail
0.0431	0	5	n/a	Fail
0.0435	0	5	n/a	Fail
0.0438	0	4	n/a	Fail
0.0442	0	3	n/a	Fail
0.0446	0	3	n/a	Fail
0.0450	0	2	n/a	Fail
0.0453	0	2	n/a	Fail
0.0457	0	2	n/a	Fail
0.0461	0	2	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0491 acre-feet
On-line facility target flow:	0.0649 cfs.
Adjusted for 15 min:	0.0649 cfs.
Off-line facility target flow:	0.0367 cfs.
Adjusted for 15 min:	0.0367 cfs.

0.0649 CFS = 29.1 GPM

29.1 GPM / 22.5 = 3 27", 1 GPM Cartridges

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

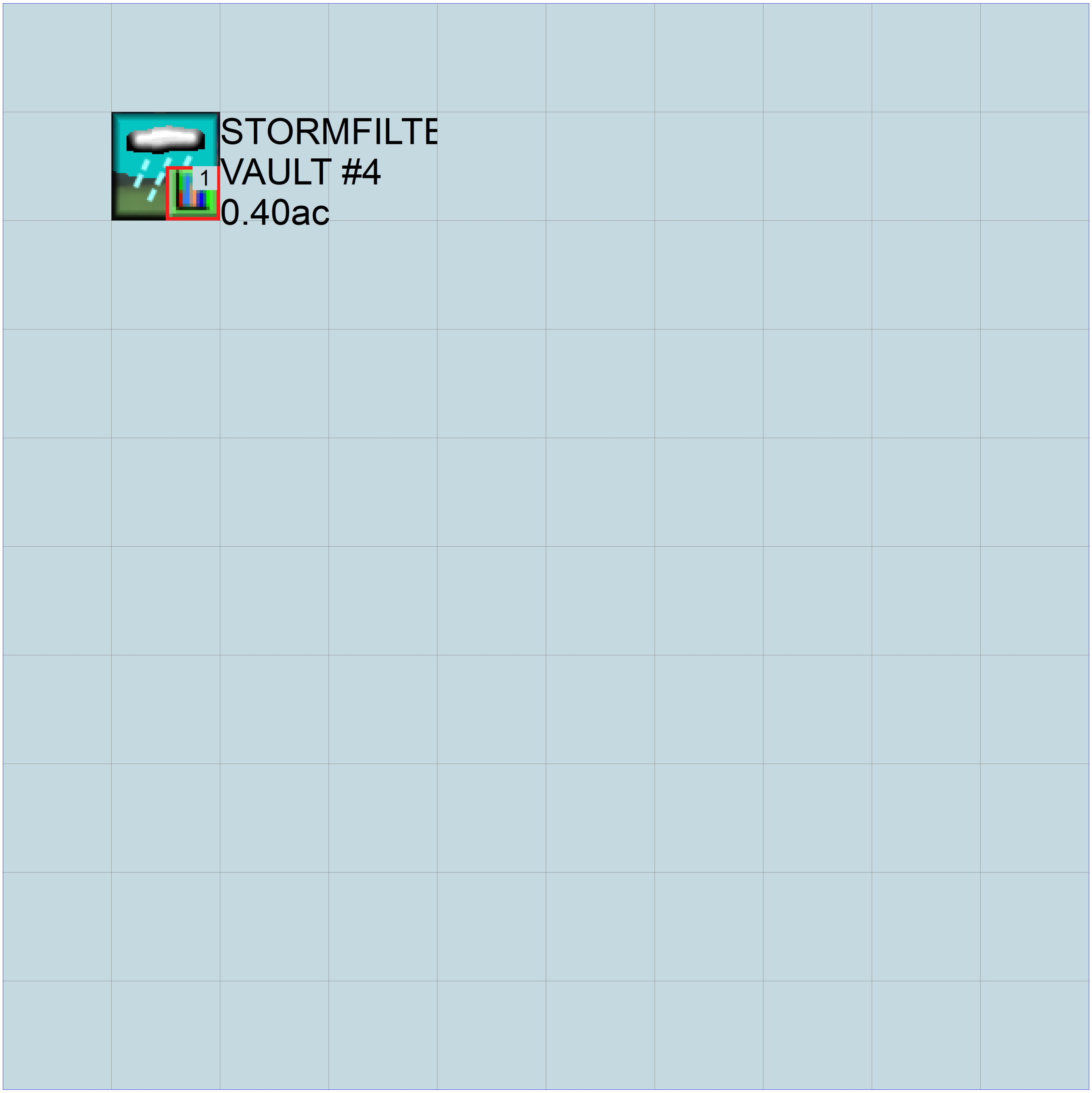
No PERLND changes have been made.

IMPLND Changes

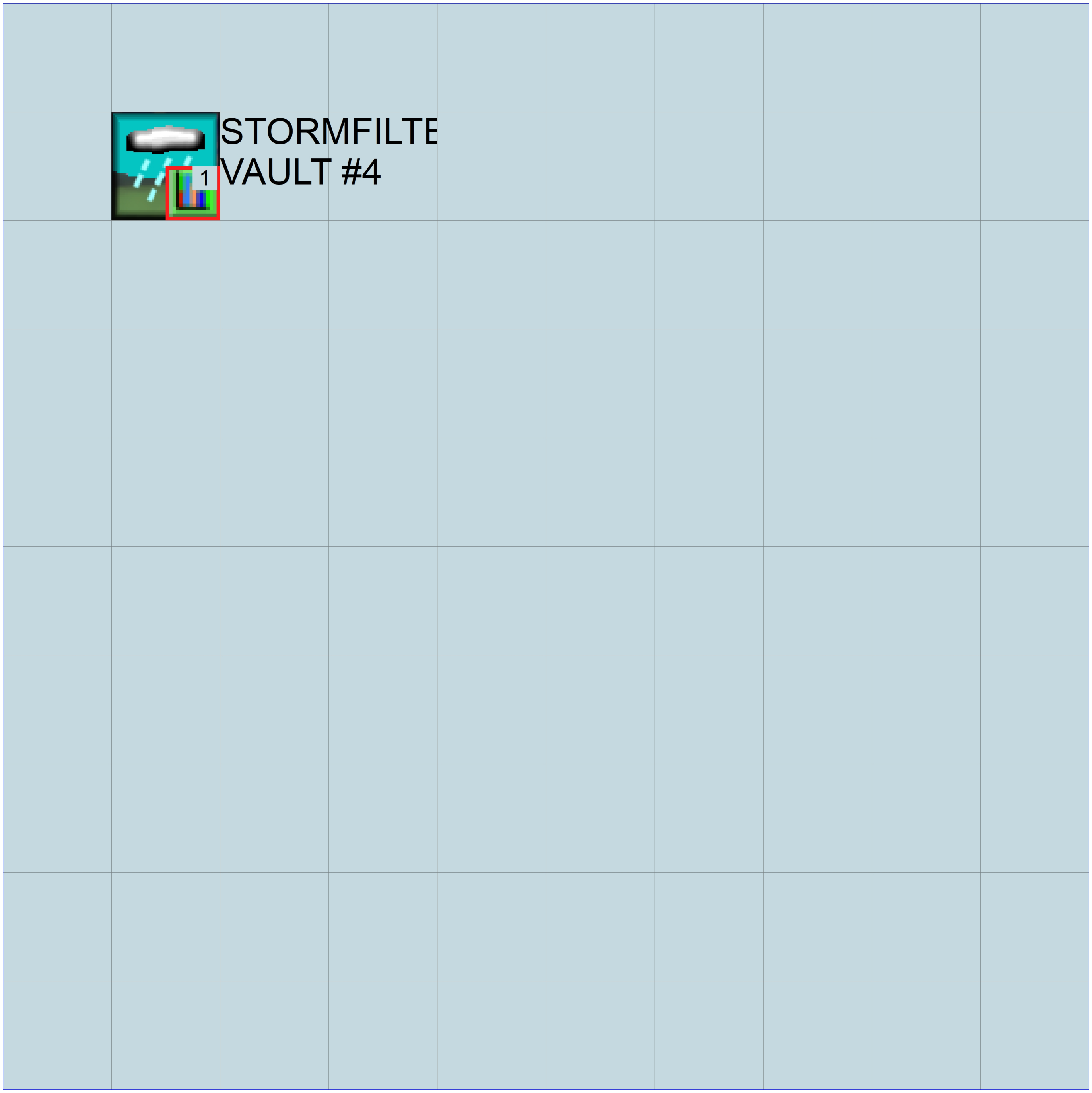
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   StormFilter_Vault_4.wdm
MESSU      25   MitStormFilter_Vault_4.MES
           27   MitStormFilter_Vault_4.L61
           28   MitStormFilter_Vault_4.L62
           30   POCStormFilter_Vault_41.dat
END FILES

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

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

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

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

```
  END PWAT-PARM1

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

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

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

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    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    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->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
STORMFILTER VAULT #4***
IMPLND   1                         0.4     COPY   501     15

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

```
END EXT SOURCES

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Local (360)943-0304

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WWHM2012

PROJECT REPORT

General Model Information

Project Name:	StormFilter_Vault_5
Site Name:	
Site Address:	
City:	
Report Date:	3/8/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

STORMFILTER VAULT #5

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	2.65
Pervious Total	2.65
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.65

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

STORMFILTER VAULT #5

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.06
Pervious Total	1.06
Impervious Land Use	acre
ROADS FLAT	1.59
Impervious Total	1.59
Basin Total	2.65

Element Flows To:

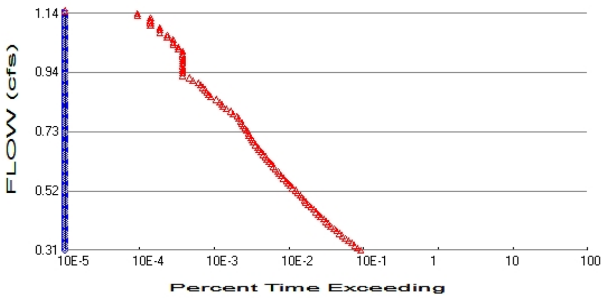
Surface	Interflow	Groundwater

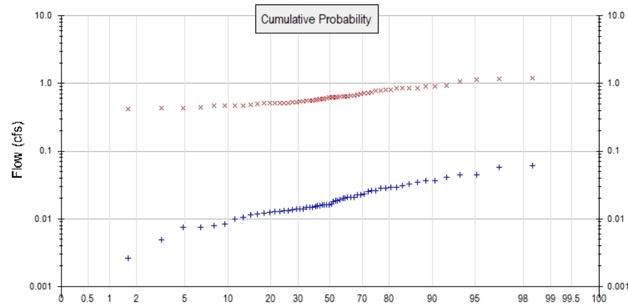
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.65
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.06
Total Impervious Area: 1.59

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.018817
5 year	0.029552
10 year	0.035636
25 year	0.042082
50 year	0.04607
100 year	0.049462

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.619185
5 year	0.781617
10 year	0.891925
25 year	1.034956
50 year	1.144393
100 year	1.256458

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.018	0.815
1950	0.023	0.849
1951	0.041	0.529
1952	0.013	0.437
1953	0.011	0.472
1954	0.016	0.509
1955	0.026	0.566
1956	0.021	0.558
1957	0.017	0.650
1958	0.019	0.512

1959	0.016	0.514
1960	0.028	0.550
1961	0.016	0.552
1962	0.010	0.465
1963	0.014	0.532
1964	0.018	0.506
1965	0.013	0.658
1966	0.012	0.447
1967	0.026	0.741
1968	0.016	0.842
1969	0.016	0.589
1970	0.013	0.582
1971	0.014	0.684
1972	0.031	0.718
1973	0.014	0.422
1974	0.015	0.626
1975	0.021	0.708
1976	0.015	0.500
1977	0.002	0.516
1978	0.013	0.631
1979	0.008	0.863
1980	0.029	0.800
1981	0.012	0.641
1982	0.022	0.897
1983	0.020	0.727
1984	0.012	0.469
1985	0.007	0.633
1986	0.033	0.548
1987	0.029	0.846
1988	0.011	0.513
1989	0.007	0.641
1990	0.060	1.180
1991	0.036	0.916
1992	0.014	0.467
1993	0.015	0.395
1994	0.005	0.428
1995	0.021	0.569
1996	0.044	0.636
1997	0.037	0.617
1998	0.008	0.590
1999	0.035	1.204
2000	0.015	0.615
2001	0.003	0.659
2002	0.016	0.777
2003	0.020	0.630
2004	0.026	1.130
2005	0.019	0.546
2006	0.022	0.487
2007	0.045	1.055
2008	0.058	0.900
2009	0.028	0.784

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0603	1.2042
2	0.0578	1.1802
3	0.0448	1.1297

4	0.0441	1.0554
5	0.0414	0.9165
6	0.0369	0.9003
7	0.0363	0.8966
8	0.0346	0.8633
9	0.0326	0.8488
10	0.0309	0.8458
11	0.0292	0.8422
12	0.0288	0.8153
13	0.0284	0.7996
14	0.0280	0.7836
15	0.0263	0.7774
16	0.0259	0.7410
17	0.0256	0.7273
18	0.0230	0.7178
19	0.0225	0.7080
20	0.0223	0.6835
21	0.0209	0.6591
22	0.0206	0.6583
23	0.0206	0.6499
24	0.0203	0.6413
25	0.0202	0.6406
26	0.0189	0.6356
27	0.0187	0.6328
28	0.0185	0.6306
29	0.0178	0.6304
30	0.0166	0.6263
31	0.0162	0.6175
32	0.0160	0.6150
33	0.0160	0.5895
34	0.0159	0.5895
35	0.0158	0.5825
36	0.0156	0.5692
37	0.0152	0.5663
38	0.0149	0.5582
39	0.0146	0.5523
40	0.0145	0.5503
41	0.0140	0.5481
42	0.0140	0.5456
43	0.0138	0.5325
44	0.0135	0.5291
45	0.0131	0.5157
46	0.0131	0.5137
47	0.0129	0.5128
48	0.0127	0.5121
49	0.0124	0.5094
50	0.0122	0.5063
51	0.0117	0.4999
52	0.0114	0.4867
53	0.0106	0.4715
54	0.0098	0.4693
55	0.0083	0.4669
56	0.0079	0.4649
57	0.0074	0.4466
58	0.0074	0.4367
59	0.0049	0.4280
60	0.0026	0.4220
61	0.0018	0.3953

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0094	0	1958	n/a	Fail
0.0098	0	1760	n/a	Fail
0.0101	0	1624	n/a	Fail
0.0105	0	1484	n/a	Fail
0.0109	0	1331	n/a	Fail
0.0113	0	1222	n/a	Fail
0.0116	0	1115	n/a	Fail
0.0120	0	1011	n/a	Fail
0.0124	0	933	n/a	Fail
0.0127	0	857	n/a	Fail
0.0131	0	781	n/a	Fail
0.0135	0	719	n/a	Fail
0.0139	0	670	n/a	Fail
0.0142	0	622	n/a	Fail
0.0146	0	570	n/a	Fail
0.0150	0	533	n/a	Fail
0.0153	0	497	n/a	Fail
0.0157	0	456	n/a	Fail
0.0161	0	421	n/a	Fail
0.0164	0	387	n/a	Fail
0.0168	0	360	n/a	Fail
0.0172	0	342	n/a	Fail
0.0176	0	319	n/a	Fail
0.0179	0	301	n/a	Fail
0.0183	0	280	n/a	Fail
0.0187	0	264	n/a	Fail
0.0190	0	241	n/a	Fail
0.0194	0	224	n/a	Fail
0.0198	0	210	n/a	Fail
0.0201	0	198	n/a	Fail
0.0205	0	180	n/a	Fail
0.0209	0	168	n/a	Fail
0.0213	0	158	n/a	Fail
0.0216	0	153	n/a	Fail
0.0220	0	139	n/a	Fail
0.0224	0	133	n/a	Fail
0.0227	0	124	n/a	Fail
0.0231	0	116	n/a	Fail
0.0235	0	109	n/a	Fail
0.0239	0	103	n/a	Fail
0.0242	0	97	n/a	Fail
0.0246	0	91	n/a	Fail
0.0250	0	84	n/a	Fail
0.0253	0	82	n/a	Fail
0.0257	0	77	n/a	Fail
0.0261	0	72	n/a	Fail
0.0264	0	69	n/a	Fail
0.0268	0	66	n/a	Fail
0.0272	0	62	n/a	Fail
0.0276	0	61	n/a	Fail
0.0279	0	58	n/a	Fail
0.0283	0	55	n/a	Fail
0.0287	0	52	n/a	Fail

0.0290	0	50	n/a	Fail
0.0294	0	48	n/a	Fail
0.0298	0	45	n/a	Fail
0.0301	0	43	n/a	Fail
0.0305	0	38	n/a	Fail
0.0309	0	36	n/a	Fail
0.0313	0	31	n/a	Fail
0.0316	0	28	n/a	Fail
0.0320	0	27	n/a	Fail
0.0324	0	25	n/a	Fail
0.0327	0	23	n/a	Fail
0.0331	0	19	n/a	Fail
0.0335	0	18	n/a	Fail
0.0338	0	17	n/a	Fail
0.0342	0	16	n/a	Fail
0.0346	0	15	n/a	Fail
0.0350	0	14	n/a	Fail
0.0353	0	13	n/a	Fail
0.0357	0	11	n/a	Fail
0.0361	0	10	n/a	Fail
0.0364	0	8	n/a	Fail
0.0368	0	8	n/a	Fail
0.0372	0	8	n/a	Fail
0.0376	0	8	n/a	Fail
0.0379	0	8	n/a	Fail
0.0383	0	8	n/a	Fail
0.0387	0	8	n/a	Fail
0.0390	0	8	n/a	Fail
0.0394	0	8	n/a	Fail
0.0398	0	8	n/a	Fail
0.0401	0	8	n/a	Fail
0.0405	0	7	n/a	Fail
0.0409	0	7	n/a	Fail
0.0413	0	6	n/a	Fail
0.0416	0	6	n/a	Fail
0.0420	0	6	n/a	Fail
0.0424	0	5	n/a	Fail
0.0427	0	5	n/a	Fail
0.0431	0	4	n/a	Fail
0.0435	0	4	n/a	Fail
0.0438	0	4	n/a	Fail
0.0442	0	3	n/a	Fail
0.0446	0	3	n/a	Fail
0.0450	0	3	n/a	Fail
0.0453	0	3	n/a	Fail
0.0457	0	2	n/a	Fail
0.0461	0	2	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2163 acre-feet
On-line facility target flow:	0.2549 cfs.
Adjusted for 15 min:	0.2549 cfs.
Off-line facility target flow:	0.1433 cfs.
Adjusted for 15 min:	0.1433 cfs.

0.2549 CFS = 114.4 GPM

114.4 GPM / 22.5 = 6 27", 2 GPM Cartridges

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

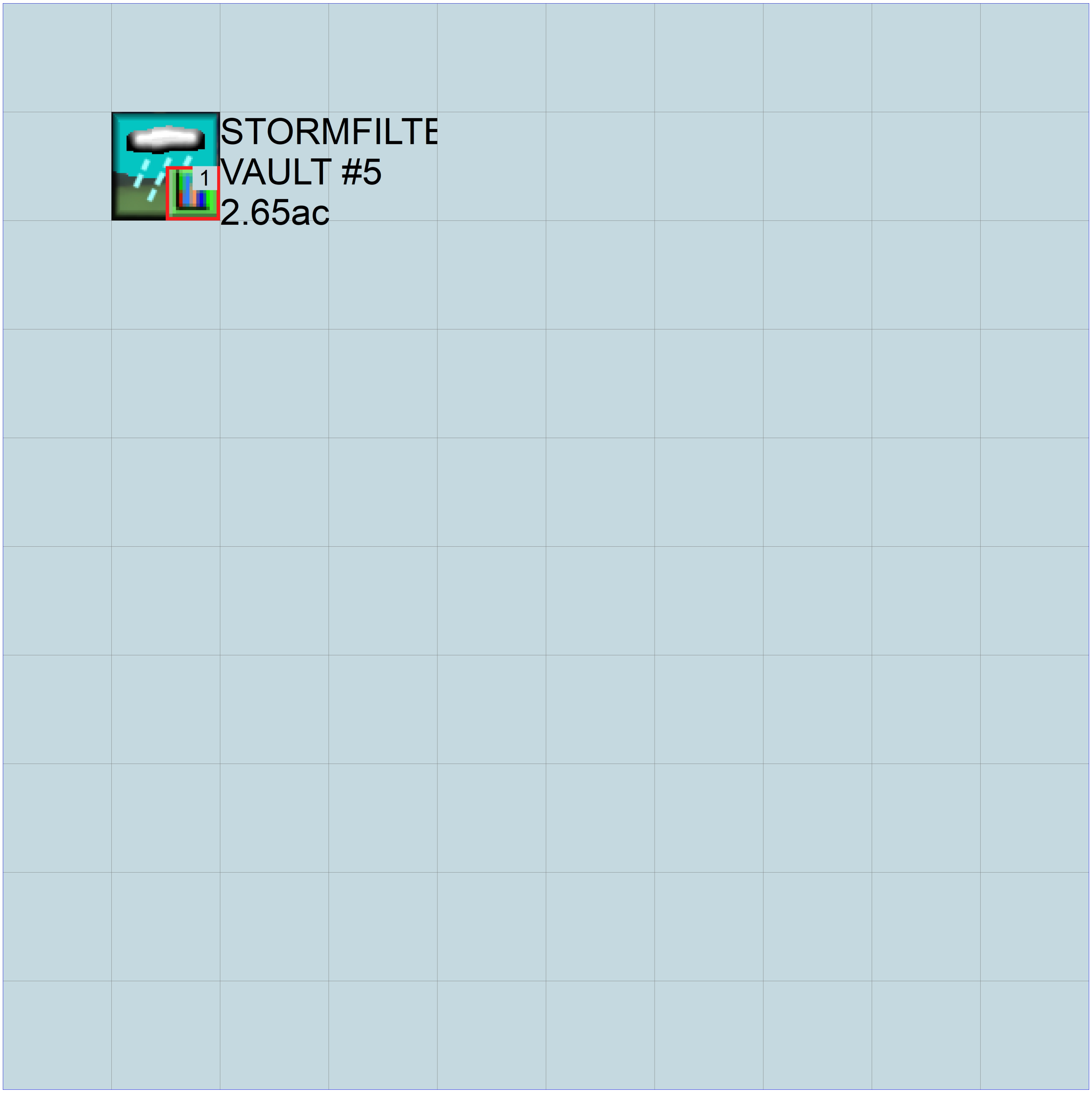
PERLND Changes

No PERLND changes have been made.

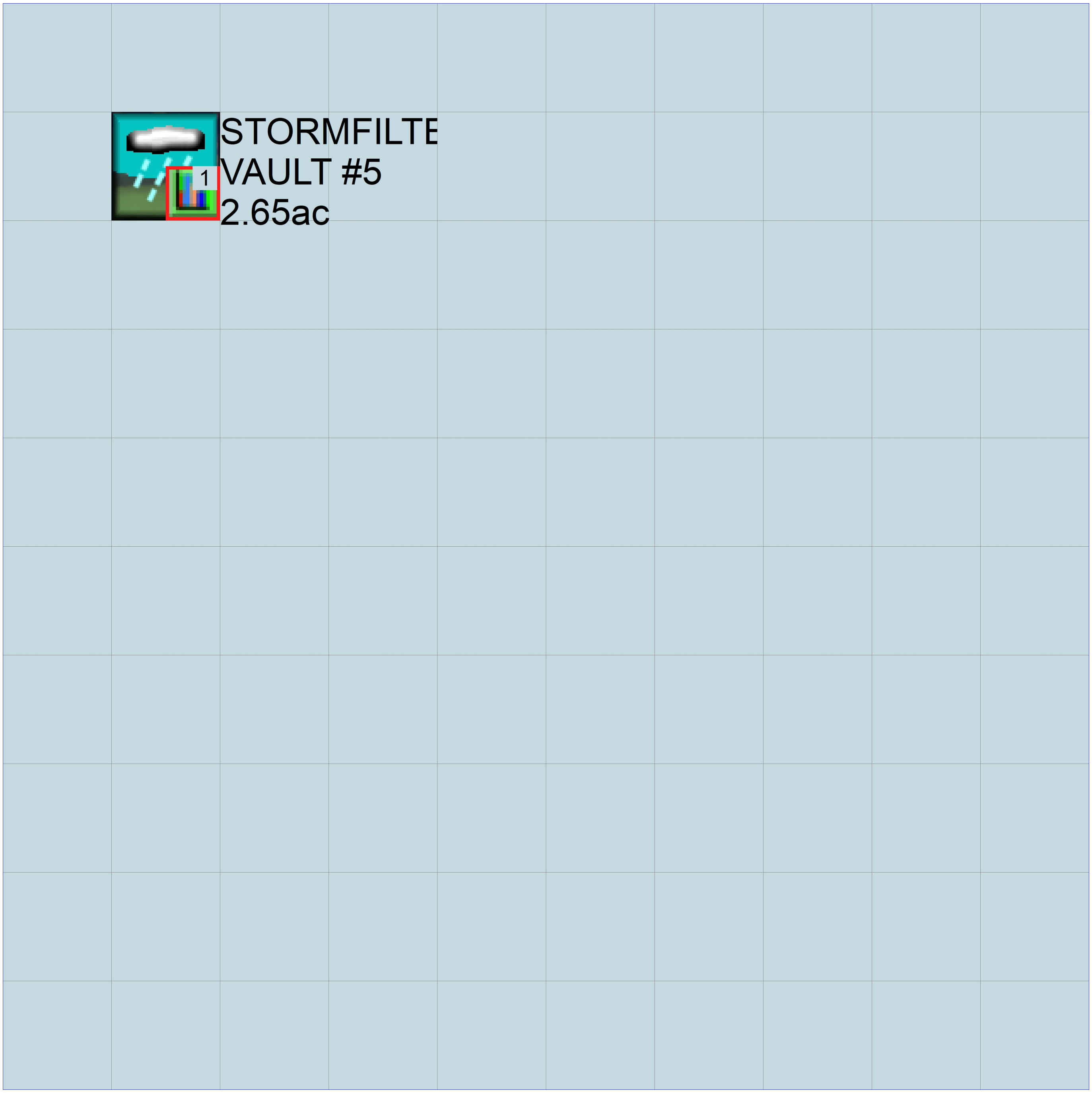
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

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PROJECT MEMO

TO:	Lisa Were, Project Manager City of Sammamish Public Works Department	**DATE:**	March 31, 2021
FROM:	Steve Nickison Tacoma - (253) 383-2422	**PROJECT NO.:** **PROJECT NAME:**	2190816.10 Sammamish Stormwater Retrofit
SUBJECT:	Demery Hill – D91349		

This memo describes the stormwater retrofit strategy for the division 1 and division 2 of the Demery Hill (D91349) site.

The concrete detention vault located in stormwater tract A for divisions 1 and 2 of the Demery Hill development was developed in the mid 1980's. This project was designed on a single-event model condition and is not in alignment with current flow control standards defined by the 2016 *King County Surface Water Design Manual* (KCSWDM). Additionally, no water quality mitigation currently existing for the existing detention system.

Site reconnaissance presented an open field which the existing ~42,000 CF concrete detention vault lies underneath. Single family residences exist to the east and south of the stormwater tract. A steep hillside and forest lie to the west and north of the tract. The existing vault occupies most but not all of the site area. The existing vault discharges westward and downhill towards NE 8th Street.

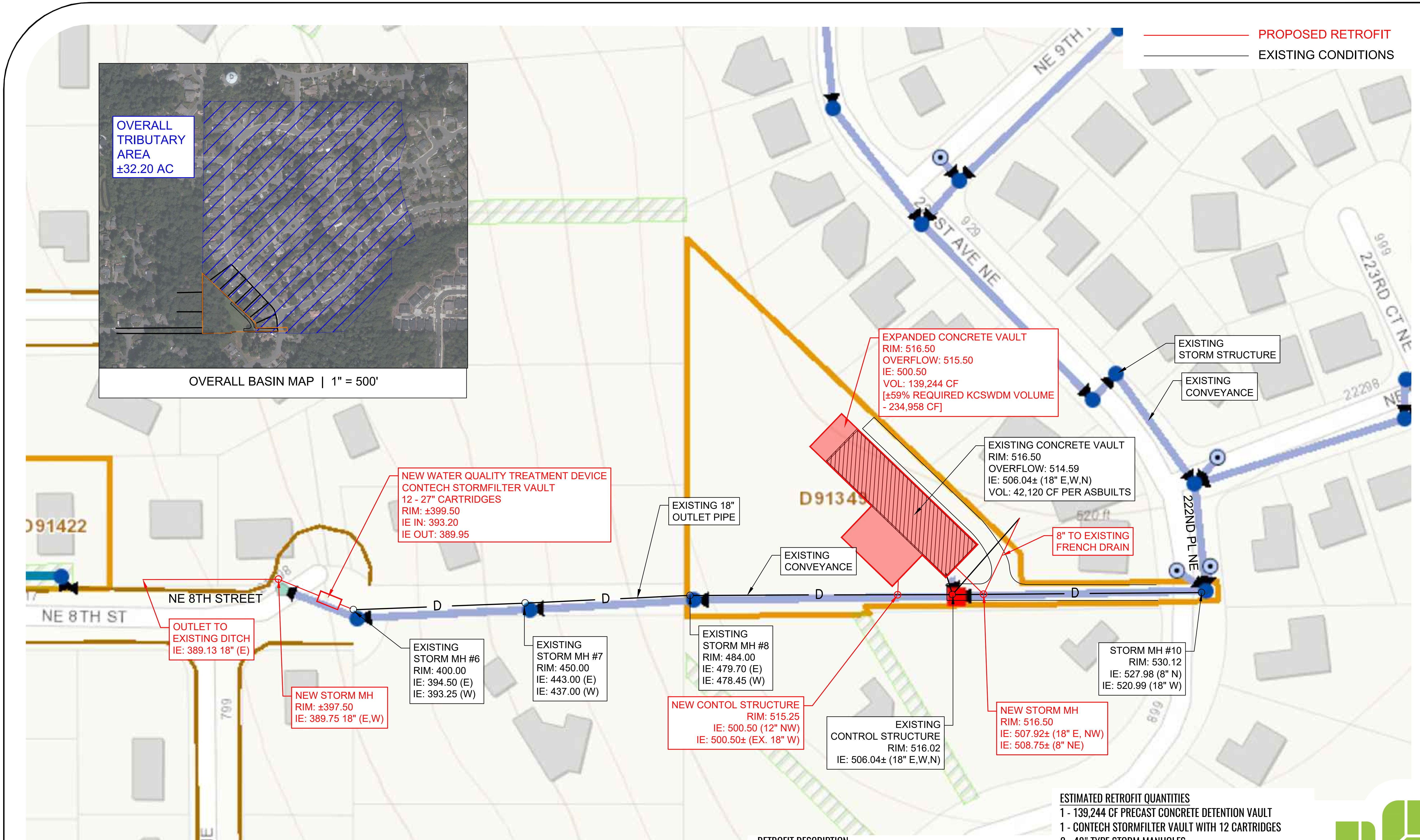
The tributary area for the project is approximately 32 acres of low-density single family residential area. This area is collected through conveyance systems along the roadway and yard french drains and is routed to the existing detention vault. The retrofit design maintains the existing tributary area and upsizes the vault to attempt to meet the 2016 KCSWDM standards. The proposed design consists of a 15-foot-deep concrete detention vault with an expanded footprint compared to the existing vault. This provides approximately 139,000 CF of storage, an increase of nearly 100,000 CF versus the existing condition. This is approximately 59% of the volume required to meet the 2016 KCSWDM lake protection standard (~235,000 CF). Additionally, the retrofit would add a water quality treatment device in a vault located at the outfall point in the NE 8th Street Cul-De-Sac. This point is significantly lower than the vault discharge and would have a sufficient amount of head to treat effluent stormwater to the standards defined within the 2016 KCSWDM. The retrofit design was analyzed in WWHM2012 software; see attachments below for the analysis report.

The proposed retrofit reconstructs the detention vault to provide significantly more detention volume compared to the existing condition and would bring this area closer to the standards defined within the 2016 KCSWDM. Additionally, water quality treatment would be added to this stormwater basin which would significantly increase the pollutant removal from stormwater generated by this area.

SLN/

c: Doreen Gavin, AHBL
Lucas Johnson, AHBL

Q:\2019\2190816\10_CIV\NON_CAD\SITE RECON\3000\10 Percent Design Narrative.docx



ESTIMATED RETROFIT QUANTITIES
1 - 139,244 CF PRECAST CONCRETE DETENTION VAULT
1 - CONTECH STORMFILTER VAULT WITH 12 CARTRIDGES
2 - 48" TYPE STORM MANHOLES
1 - 60" TYPE 2 STORM MANHOLE WITH RESTRICTOR TEE
80 LF 8" CPEP PIPE
15 LF 12" CPEP PIPE
210 LF 18" CPEP PIPE

RETROFIT DESCRIPTION
REPLACE EXISTING CONCRETE DETENTION VAULT WITH LARGER, DEEPER PRECAST CONCRETE DETENTION VAULT. INSTALL WATER QUALITY TREATMENT DEVICE DOWNSTREAM OF NEW DETENTION VAULT AT NE 8TH STREET.

EX B

SAMMAMISH STORMWATER RETROFIT PLANNING

DEMERY HILL RETROFIT - 10% DESIGN 1" = 80'

N

SITE ID:	D91349
DEVELOPMENT NAME:	DEMERY HILL
ADDRESS:	757 222ND PLACE NE, SAMMAMISH, WA 98074

AHBL

D91349 - Demery Hill

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	20210303 DH WWHM
Site Name:	
Site Address:	
City:	
Report Date:	3/30/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

Predeveloped

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	32.2
Pervious Total	32.2
Impervious Land Use	acre
Impervious Total	0
Basin Total	32.2

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Postdeveloped

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	20.35
Pervious Total	20.35
Impervious Land Use	acre
ROADS FLAT	11.85
Impervious Total	11.85
Basin Total	32.2

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Routing Elements

Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length:	134.44 ft.	
Bottom Width:	134.44 ft.	
Depth:	15 ft.	
Volume at riser head:	5.3939 acre-feet.	234,958 CF required.
Side slope 1:	0 To 1	
Side slope 2:	0 To 1	
Side slope 3:	0 To 1	
Side slope 4:	0 To 1	
Discharge Structure		
Riser Height:	13 ft.	
Riser Diameter:	18 in.	
Notch Type:	Rectangular	
Notch Width:	0.034 ft.	
Notch Height:	5.711 ft.	
Orifice 1 Diameter:	2.571 in. Elevation:0 ft.	
Element Flows To:		
Outlet 1	Outlet 2	

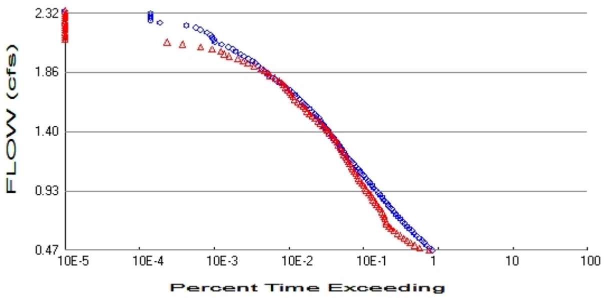
Pond Hydraulic Table

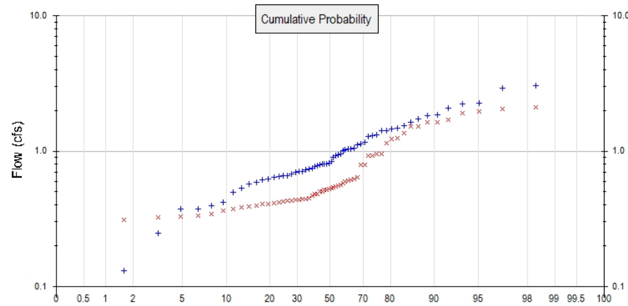
Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.414	0.000	0.000	0.000
0.1667	0.414	0.069	0.073	0.000
0.3333	0.414	0.138	0.103	0.000
0.5000	0.414	0.207	0.126	0.000
0.6667	0.414	0.276	0.146	0.000
0.8333	0.414	0.345	0.163	0.000
1.0000	0.414	0.414	0.179	0.000
1.1667	0.414	0.484	0.193	0.000
1.3333	0.414	0.553	0.207	0.000
1.5000	0.414	0.622	0.219	0.000
1.6667	0.414	0.691	0.231	0.000
1.8333	0.414	0.760	0.242	0.000
2.0000	0.414	0.829	0.253	0.000
2.1667	0.414	0.899	0.264	0.000
2.3333	0.414	0.968	0.274	0.000
2.5000	0.414	1.037	0.283	0.000
2.6667	0.414	1.106	0.292	0.000
2.8333	0.414	1.175	0.301	0.000
3.0000	0.414	1.244	0.310	0.000
3.1667	0.414	1.313	0.319	0.000
3.3333	0.414	1.383	0.327	0.000
3.5000	0.414	1.452	0.335	0.000
3.6667	0.414	1.521	0.343	0.000
3.8333	0.414	1.590	0.351	0.000
4.0000	0.414	1.659	0.358	0.000
4.1667	0.414	1.728	0.366	0.000
4.3333	0.414	1.798	0.373	0.000
4.5000	0.414	1.867	0.380	0.000
4.6667	0.414	1.936	0.387	0.000
4.8333	0.414	2.005	0.394	0.000
5.0000	0.414	2.074	0.401	0.000
5.1667	0.414	2.143	0.407	0.000

5.3333	0.414	2.212	0.414	0.000
5.5000	0.414	2.282	0.420	0.000
5.6667	0.414	2.351	0.427	0.000
5.8333	0.414	2.420	0.433	0.000
6.0000	0.414	2.489	0.439	0.000
6.1667	0.414	2.558	0.445	0.000
6.3333	0.414	2.627	0.451	0.000
6.5000	0.414	2.696	0.457	0.000
6.6667	0.414	2.766	0.463	0.000
6.8333	0.414	2.835	0.468	0.000
7.0000	0.414	2.904	0.474	0.000
7.1667	0.414	2.973	0.480	0.000
7.3333	0.414	3.042	0.486	0.000
7.5000	0.414	3.111	0.501	0.000
7.6667	0.414	3.181	0.520	0.000
7.8333	0.414	3.250	0.542	0.000
8.0000	0.414	3.319	0.565	0.000
8.1667	0.414	3.388	0.589	0.000
8.3333	0.414	3.457	0.614	0.000
8.5000	0.414	3.526	0.643	0.000
8.6667	0.414	3.595	0.673	0.000
8.8333	0.414	3.665	0.761	0.000
9.0000	0.414	3.734	0.804	0.000
9.1667	0.414	3.803	0.849	0.000
9.3333	0.414	3.872	0.895	0.000
9.5000	0.414	3.941	0.944	0.000
9.6667	0.414	4.010	0.993	0.000
9.8333	0.414	4.080	1.045	0.000
10.000	0.414	4.149	1.098	0.000
10.167	0.414	4.218	1.152	0.000
10.333	0.414	4.287	1.208	0.000
10.500	0.414	4.356	1.265	0.000
10.667	0.414	4.425	1.324	0.000
10.833	0.414	4.494	1.384	0.000
11.000	0.414	4.564	1.445	0.000
11.167	0.414	4.633	1.507	0.000
11.333	0.414	4.702	1.571	0.000
11.500	0.414	4.771	1.636	0.000
11.667	0.414	4.840	1.702	0.000
11.833	0.414	4.909	1.769	0.000
12.000	0.414	4.979	1.837	0.000
12.167	0.414	5.048	1.907	0.000
12.333	0.414	5.117	1.977	0.000
12.500	0.414	5.186	2.049	0.000
12.667	0.414	5.255	2.121	0.000
12.833	0.414	5.324	2.195	0.000
13.000	0.414	5.393	2.270	0.000
13.167	0.414	5.463	3.348	0.000
13.333	0.414	5.532	5.161	0.000
13.500	0.414	5.601	6.921	0.000
13.667	0.414	5.670	8.041	0.000
13.833	0.414	5.739	8.759	0.000
14.000	0.414	5.808	9.381	0.000
14.167	0.414	5.877	9.953	0.000
14.333	0.414	5.947	10.48	0.000
14.500	0.414	6.016	10.98	0.000
14.667	0.414	6.085	11.45	0.000
14.833	0.414	6.154	11.91	0.000

15.000	0.414	6.223	12.34	0.000
15.167	0.414	6.292	12.75	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 32.2
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 20.35
Total Impervious Area: 11.85

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.946707
5 year	1.48684
10 year	1.792943
25 year	2.117232
50 year	2.317903
100 year	2.488583

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.597255
5 year	0.986607
10 year	1.325624
25 year	1.864015
50 year	2.357107
100 year	2.940107

WQ after detention → Use full 2yr release rate
0.597 CFS = 268 GPM
268 GPM / 22.5 GPM per Cartridge = 11.91

Use 12 - 27" Cartridges in Contech Stormfilter Vault

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.930	0.406
1950	1.160	0.794
1951	2.085	2.106
1952	0.657	0.372
1953	0.531	0.425
1954	0.816	0.505
1955	1.301	0.527
1956	1.035	0.955
1957	0.835	0.482
1958	0.941	0.544

1959	0.807	0.433
1960	1.410	1.518
1961	0.795	0.500
1962	0.495	0.331
1963	0.679	0.480
1964	0.894	0.442
1965	0.640	0.619
1966	0.616	0.435
1967	1.287	0.518
1968	0.803	0.446
1969	0.786	0.418
1970	0.648	0.434
1971	0.693	0.532
1972	1.552	1.249
1973	0.705	0.611
1974	0.765	0.583
1975	1.037	0.466
1976	0.750	0.515
1977	0.089	0.330
1978	0.658	0.565
1979	0.398	0.340
1980	1.471	1.361
1981	0.588	0.445
1982	1.131	0.948
1983	1.014	0.537
1984	0.626	0.388
1985	0.371	0.361
1986	1.641	0.928
1987	1.451	1.233
1988	0.573	0.397
1989	0.374	0.323
1990	3.035	1.634
1991	1.827	1.641
1992	0.705	0.596
1993	0.734	0.410
1994	0.247	0.311
1995	1.053	0.638
1996	2.218	2.061
1997	1.854	1.707
1998	0.419	0.384
1999	1.739	1.146
2000	0.732	0.430
2001	0.131	0.307
2002	0.802	0.789
2003	1.023	0.405
2004	1.325	1.516
2005	0.951	0.557
2006	1.121	0.605
2007	2.253	1.915
2008	2.906	1.971
2009	1.427	0.931

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.0347	2.1056
2	2.9058	2.0610
3	2.2526	1.9712

4	2.2183	1.9147
5	2.0847	1.7068
6	1.8543	1.6408
7	1.8273	1.6339
8	1.7389	1.5176
9	1.6409	1.5162
10	1.5525	1.3605
11	1.4713	1.2487
12	1.4515	1.2330
13	1.4267	1.1460
14	1.4096	0.9554
15	1.3249	0.9477
16	1.3010	0.9308
17	1.2873	0.9276
18	1.1596	0.7944
19	1.1309	0.7889
20	1.1209	0.6381
21	1.0525	0.6185
22	1.0371	0.6107
23	1.0353	0.6052
24	1.0233	0.5964
25	1.0139	0.5834
26	0.9505	0.5646
27	0.9412	0.5571
28	0.9300	0.5442
29	0.8942	0.5370
30	0.8355	0.5324
31	0.8159	0.5268
32	0.8074	0.5175
33	0.8030	0.5154
34	0.8021	0.5046
35	0.7953	0.5000
36	0.7856	0.4822
37	0.7654	0.4798
38	0.7498	0.4663
39	0.7340	0.4465
40	0.7320	0.4453
41	0.7052	0.4421
42	0.7047	0.4353
43	0.6928	0.4340
44	0.6793	0.4331
45	0.6579	0.4300
46	0.6569	0.4253
47	0.6478	0.4180
48	0.6403	0.4103
49	0.6259	0.4061
50	0.6156	0.4055
51	0.5880	0.3974
52	0.5727	0.3883
53	0.5313	0.3844
54	0.4948	0.3721
55	0.4195	0.3605
56	0.3975	0.3404
57	0.3737	0.3314
58	0.3714	0.3303
59	0.2467	0.3233
60	0.1313	0.3112
61	0.0892	0.3073

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.4734	17586	15960	90	Pass
0.4920	16219	12089	74	Pass
0.5106	14998	10380	69	Pass
0.5292	13860	9058	65	Pass
0.5479	12855	8237	64	Pass
0.5665	11832	7386	62	Pass
0.5851	10902	6688	61	Pass
0.6038	10145	6000	59	Pass
0.6224	9396	5405	57	Pass
0.6410	8729	4984	57	Pass
0.6597	8166	4665	57	Pass
0.6783	7602	4359	57	Pass
0.6969	7084	4250	59	Pass
0.7156	6596	4128	62	Pass
0.7342	6149	4025	65	Pass
0.7528	5790	3933	67	Pass
0.7715	5437	3797	69	Pass
0.7901	5097	3572	70	Pass
0.8087	4815	3379	70	Pass
0.8274	4528	3202	70	Pass
0.8460	4265	3048	71	Pass
0.8646	4021	2885	71	Pass
0.8833	3784	2776	73	Pass
0.9019	3557	2654	74	Pass
0.9205	3341	2509	75	Pass
0.9391	3138	2357	75	Pass
0.9578	2954	2235	75	Pass
0.9764	2789	2147	76	Pass
0.9950	2597	2025	77	Pass
1.0137	2451	1916	78	Pass
1.0323	2308	1836	79	Pass
1.0509	2165	1757	81	Pass
1.0696	2029	1671	82	Pass
1.0882	1899	1582	83	Pass
1.1068	1791	1519	84	Pass
1.1255	1689	1457	86	Pass
1.1441	1585	1392	87	Pass
1.1627	1484	1332	89	Pass
1.1814	1381	1281	92	Pass
1.2000	1295	1239	95	Pass
1.2186	1222	1179	96	Pass
1.2373	1155	1120	96	Pass
1.2559	1098	1075	97	Pass
1.2745	1049	1034	98	Pass
1.2932	997	984	98	Pass
1.3118	930	943	101	Pass
1.3304	884	890	100	Pass
1.3490	837	840	100	Pass
1.3677	790	797	100	Pass
1.3863	743	749	100	Pass
1.4049	716	699	97	Pass
1.4236	670	660	98	Pass
1.4422	631	611	96	Pass

1.4608	596	568	95	Pass
1.4795	567	525	92	Pass
1.4981	539	477	88	Pass
1.5167	497	437	87	Pass
1.5354	473	399	84	Pass
1.5540	437	378	86	Pass
1.5726	401	356	88	Pass
1.5913	366	330	90	Pass
1.6099	348	305	87	Pass
1.6285	323	278	86	Pass
1.6472	296	252	85	Pass
1.6658	273	242	88	Pass
1.6844	256	230	89	Pass
1.7031	235	219	93	Pass
1.7217	217	206	94	Pass
1.7403	196	192	97	Pass
1.7589	181	183	101	Pass
1.7776	158	172	108	Pass
1.7962	145	156	107	Pass
1.8148	130	140	107	Pass
1.8335	119	119	100	Pass
1.8521	109	111	101	Pass
1.8707	97	101	104	Pass
1.8894	91	91	100	Pass
1.9080	82	73	89	Pass
1.9266	76	60	78	Pass
1.9453	69	52	75	Pass
1.9639	61	44	72	Pass
1.9825	54	34	62	Pass
2.0012	48	29	60	Pass
2.0198	41	26	63	Pass
2.0384	38	20	52	Pass
2.0571	33	14	42	Pass
2.0757	27	8	29	Pass
2.0943	22	5	22	Pass
2.1130	21	0	0	Pass
2.1316	20	0	0	Pass
2.1502	19	0	0	Pass
2.1688	17	0	0	Pass
2.1875	14	0	0	Pass
2.2061	12	0	0	Pass
2.2247	9	0	0	Pass
2.2434	4	0	0	Pass
2.2620	3	0	0	Pass
2.2806	3	0	0	Pass
2.2993	3	0	0	Pass
2.3179	3	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.8974 acre-feet
On-line facility target flow:	0.4553 cfs.
Adjusted for 15 min:	0.4553 cfs.
Off-line facility target flow:	0.2949 cfs.
Adjusted for 15 min:	0.2949 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
Trapezoidal Pond 1 POC	☐	2660.14			☐	0.00			
Total Volume Infiltrated		2660.14	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

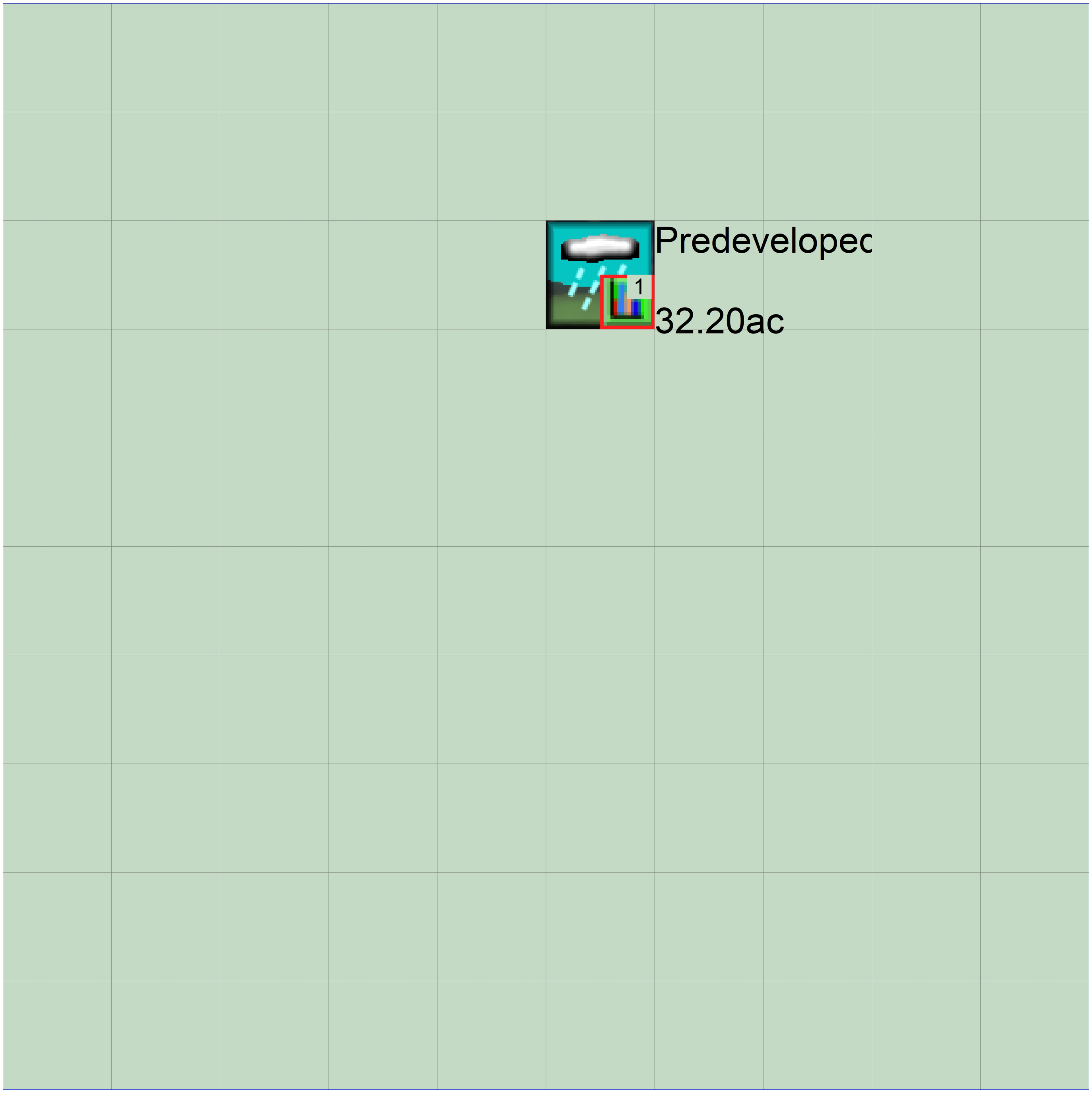
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   20210303 DH WWHM.wdm
MESSU      25   Pre20210303 DH WWHM.MES
           27   Pre20210303 DH WWHM.L61
           28   Pre20210303 DH WWHM.L62
           30   POC20210303 DH WWHM1.dat
END FILES

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

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Predeveloped***
PERLND  10                        32.2     COPY   501     12
PERLND  10                        32.2     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

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

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   20210303 DH WWHM.wdm
MESSU      25   Mit20210303 DH WWHM.MES
           27   Mit20210303 DH WWHM.L61
           28   Mit20210303 DH WWHM.L62
           30   POC20210303 DH WWHM1.dat
END FILES

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

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

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

```
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

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

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

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

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   13             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
  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    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->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Postdeveloped***
PERLND  13                       20.35     RCHRES   1      2
PERLND  13                       20.35     RCHRES   1      3
IMPLND   1                       11.85     RCHRES   1      5

******Routing******
PERLND  13                       20.35     COPY     1     12
IMPLND   1                       11.85     COPY     1     15
PERLND  13                       20.35     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                           in  out                           ***
    1     Trapezoidal Pond-007    1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

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

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

```
    1              1      0.03       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  0.414913  0.000000  0.000000
  0.166667  0.414913  0.069152  0.073230
  0.333333  0.414913  0.138304  0.103562
  0.500000  0.414913  0.207457  0.126838
  0.666667  0.414913  0.276609  0.146459
  0.833333  0.414913  0.345761  0.163747
  1.000000  0.414913  0.414913  0.179375
  1.166667  0.414913  0.484065  0.193748
  1.333333  0.414913  0.553218  0.207125
  1.500000  0.414913  0.622370  0.219689
  1.666667  0.414913  0.691522  0.231573
  1.833333  0.414913  0.760674  0.242875
  2.000000  0.414913  0.829827  0.253675
  2.166667  0.414913  0.898979  0.264033
  2.333333  0.414913  0.968131  0.274000
  2.500000  0.414913  1.037283  0.283617
  2.666667  0.414913  1.106435  0.292919
  2.833333  0.414913  1.175588  0.301934
  3.000000  0.414913  1.244740  0.310687
  3.166667  0.414913  1.313892  0.319201
  3.333333  0.414913  1.383044  0.327493
  3.500000  0.414913  1.452196  0.335581
  3.666667  0.414913  1.521349  0.343478
  3.833333  0.414913  1.590501  0.351197
  4.000000  0.414913  1.659653  0.358751
  4.166667  0.414913  1.728805  0.366148
  4.333333  0.414913  1.797957  0.373400
  4.500000  0.414913  1.867110  0.380513
  4.666667  0.414913  1.936262  0.387495
  4.833333  0.414913  2.005414  0.394354
  5.000000  0.414913  2.074566  0.401096
  5.166667  0.414913  2.143718  0.407726
  5.333333  0.414913  2.212871  0.414250
  5.500000  0.414913  2.282023  0.420673
  5.666667  0.414913  2.351175  0.426999
  5.833333  0.414913  2.420327  0.433233
  6.000000  0.414913  2.489480  0.439378
  6.166667  0.414913  2.558632  0.445439
  6.333333  0.414913  2.627784  0.451418
  6.500000  0.414913  2.696936  0.457319
  6.666667  0.414913  2.766088  0.463145
  6.833333  0.414913  2.835241  0.468899
  7.000000  0.414913  2.904393  0.474583
  7.166667  0.414913  2.973545  0.480199
  7.333333  0.414913  3.042697  0.486797
  7.500000  0.414913  3.111849  0.501703
  7.666667  0.414913  3.181002  0.520843
  7.833333  0.414913  3.250154  0.542355
  8.000000  0.414913  3.319306  0.565281
  8.166667  0.414913  3.388458  0.588968
  8.333333  0.414913  3.457610  0.613984
  8.500000  0.414913  3.526763  0.643051
```

```
  8.666667  0.414913  3.595915  0.673776
  8.833333  0.414913  3.665067  0.761432
  9.000000  0.414913  3.734219  0.804374
  9.166667  0.414913  3.803371  0.849166
  9.333333  0.414913  3.872524  0.895722
  9.500000  0.414913  3.941676  0.943969
  9.666667  0.414913  4.010828  0.993840
  9.833333  0.414913  4.079980  1.045278
  10.00000  0.414913  4.149133  1.098228
  10.16667  0.414913  4.218285  1.152645
  10.33333  0.414913  4.287437  1.208485
  10.50000  0.414913  4.356589  1.265708
  10.66667  0.414913  4.425741  1.324277
  10.83333  0.414913  4.494894  1.384159
  11.00000  0.414913  4.564046  1.445322
  11.16667  0.414913  4.633198  1.507738
  11.33333  0.414913  4.702350  1.571380
  11.50000  0.414913  4.771502  1.636220
  11.66667  0.414913  4.840655  1.702237
  11.83333  0.414913  4.909807  1.769407
  12.00000  0.414913  4.978959  1.837709
  12.16667  0.414913  5.048111  1.907123
  12.33333  0.414913  5.117263  1.977629
  12.50000  0.414913  5.186416  2.049210
  12.66667  0.414913  5.255568  2.121849
  12.83333  0.414913  5.324720  2.195529
  13.00000  0.414913  5.393872  2.270234
  13.16667  0.414913  5.463025  3.348636
  13.33333  0.414913  5.532177  5.160993
  13.50000  0.414913  5.601329  6.921646
  13.66667  0.414913  5.670481  8.041104
  13.83333  0.414913  5.739633  8.759854
  14.00000  0.414913  5.808786  9.381316
  14.16667  0.414913  5.877938  9.953107
  14.33333  0.414913  5.947090  10.48557
  14.50000  0.414913  6.016242  10.98589
  14.66667  0.414913  6.085394  11.45929
  14.83333  0.414913  6.154547  11.90973
  15.00000  0.414913  6.223699  12.34027
  END FTABLE  1
END FTABLES

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

END EXT SOURCES

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

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

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

```
  END MASS-LINK     3

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

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

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

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

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

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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PROJECT MEMO

TO:	Lisa Were, Project Manager City of Sammamish Public Works Department	**DATE:**	March 30, 2021
FROM:	Steve Nickison Tacoma - (253) 383-2422	**PROJECT NO.:**	2190816.10
		PROJECT NAME:	Sammamish Stormwater Retrofit
SUBJECT:	228th Ave SE & SE 20th Street – DS0011		

This memo describes the stormwater retrofit strategy for the 228th Ave SE & SE 20th Street (DS0011) site.

The combined detention wetpond at the southwest corner of 228th AVE SE & SE 20th Street was developed in 2001. Based on our site reconnaissance and research with as-built drawings, the pond outlet control structures do not appear to be properly constructed. This leads to increased flows through the existing emergency overflow structure which bypasses secondary water quality treatment and increased peak flows to the pond's outlet at Pine Lake.

Site reconnaissance did not identify significant opportunities to increase the footprint of the existing pond. There does however exist the potential to deepen the pond to generate more live storage volume. The proposed retrofit for this pond consists of converting the pond's dead storage volume to live storage volume as well as modifying the retaining wall and berm elevations around the pond perimeter to further increase the live storage volume. The existing treatment vault will be relocated to accommodate the lower pond outlet and a riser will be added to bring the vault rim to finished grade. The outlet pipe connecting the vault and emergency overflow to SE 20th Street conveyance will be re-laid. The proposed retrofit will maintain the original design intent of meeting the lake protection standard defined by the 2016 *King County Surface Water Design Manual* (KCSWDM).

The tributary area for the project is approximately 3 acres of roadway along 228th Ave SE. This area is collected through conveyance systems along the roadway and routed to the existing pond. For the retrofit design, this area was analyzed in WWHM2012 software; see attachments below for the analysis report. The retrofit condition attempts to maximize the volume available in the pond, however the lot area is too small to completely meet the 2016 KCSWDM lake protection standard. The proposed design provides approximately 41,000 CF of storage, an increase of nearly 24,500 CF versus the existing condition. This is approximately 63% of the volume required to meet the 2016 KCSWDM lake protection standard (~64,600 CF).

The proposed retrofit reconstructs the existing pond to properly drain through the pond control structure and water quality vault. This leads to a significant reduction in peak flow events directly flowing into Pine Lake and correctly treats pollutants from the upstream roadway prior to discharge to the lake.

SLN/

c: Doreen Gavin, AHBL
Lucas Johnson, AHBL

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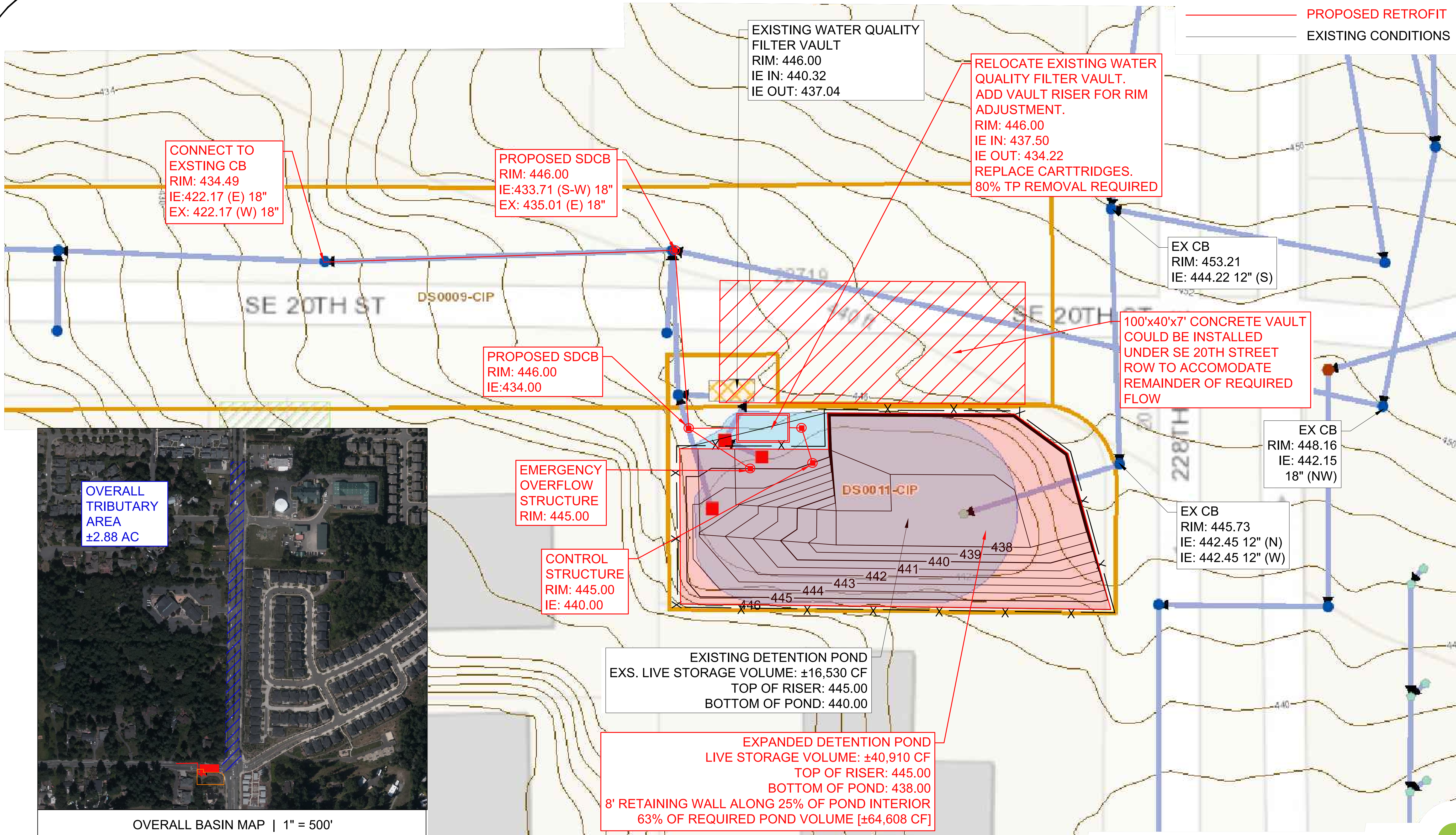


EX A

SAMMAMISH STORMWATER RETROFIT PLANNING

228TH AVE SE & SE 20TH STREET RETROFIT - 10% DESIGN 1" = 30'

N

SITE ID: DS0011
DEVELOPMENT NAME: 228TH AVE SE & SE 20TH STREET
ADDRESS: 22731 SE 20TH ST, SAMMAMISH, WA 98075

RETROFIT DESCRIPTION

EXPAND AND DEEPEN EXISTING DETENTION POND. REBUILD CONTROL AND OVERFLOW STRUCTURES. RELOCATE EXISTING WATER QUALITY VAULT AND REPLACE CARTRIDGES TO MEET 80% TP REMOVAL. RECONNECT TO DOWNSTREAM CONVEYANCE.

ESTIMATED RETROFIT QUANTITIES

4 - 48" TYPE 2 STORM CATCH BASIN
1 - 60" TYPE 2 STORM CATCH BASIN WITH RESTRICTOR TEE
35 LF 12" CPEP PIPE
200 LF 18" CPEP PIPE
110 LF 8' CIP RETAINING WALL
2 - 27" CONTECH CARTRIDGES IN RELOCATED VAULT

AHBL

DS0011 - 228th Ave SE & SE 20th Street

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	20210303 DS0011
Site Name:	
Site Address:	
City:	
Report Date:	3/31/2021
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.167
Version Date:	2019/09/13
Version:	4.2.17

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

Predeveloped

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	2.88
Pervious Total	2.88
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.88

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Postdeveloped

Bypass:	No	
GroundWater:	No	
Pervious Land Use	acre	
C, Lawn, Flat	0.15	
Pervious Total	0.15	
Impervious Land Use	acre	
ROADS FLAT	2.73	
Impervious Total	2.73	
Basin Total	2.88	

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length: 74.08 ft.
Bottom Width: 74.08 ft.
Depth: 8 ft.
Volume at riser head: 1.4832 acre-feet. 64,608 CF Required.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.010 ft.
Notch Height: 2.626 ft.
Orifice 1 Diameter: 0.95 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

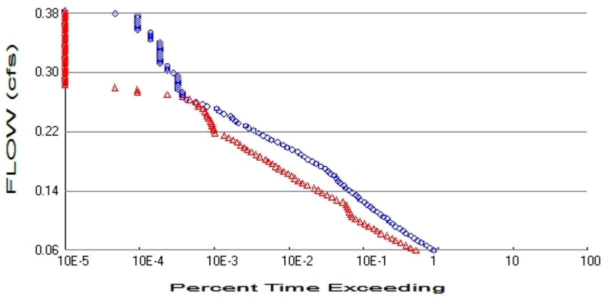
Pond Hydraulic Table

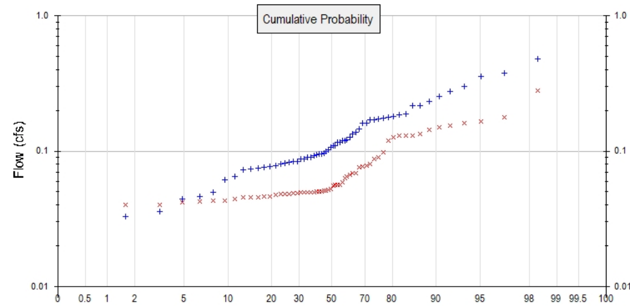
Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.126	0.000	0.000	0.000
0.0889	0.127	0.011	0.007	0.000
0.1778	0.129	0.022	0.010	0.000
0.2667	0.131	0.034	0.012	0.000
0.3556	0.133	0.046	0.014	0.000
0.4444	0.135	0.058	0.016	0.000
0.5333	0.137	0.070	0.017	0.000
0.6222	0.139	0.082	0.019	0.000
0.7111	0.140	0.094	0.020	0.000
0.8000	0.142	0.107	0.021	0.000
0.8889	0.144	0.120	0.023	0.000
0.9778	0.146	0.133	0.024	0.000
1.0667	0.148	0.146	0.025	0.000
1.1556	0.150	0.159	0.026	0.000
1.2444	0.152	0.173	0.027	0.000
1.3333	0.154	0.186	0.028	0.000
1.4222	0.156	0.200	0.029	0.000
1.5111	0.158	0.214	0.030	0.000
1.6000	0.160	0.228	0.031	0.000
1.6889	0.162	0.243	0.031	0.000
1.7778	0.164	0.257	0.032	0.000
1.8667	0.167	0.272	0.033	0.000
1.9556	0.169	0.287	0.034	0.000
2.0444	0.171	0.302	0.035	0.000
2.1333	0.173	0.317	0.035	0.000
2.2222	0.175	0.333	0.036	0.000
2.3111	0.177	0.349	0.037	0.000
2.4000	0.179	0.364	0.037	0.000
2.4889	0.181	0.381	0.038	0.000
2.5778	0.184	0.397	0.039	0.000
2.6667	0.186	0.413	0.040	0.000
2.7556	0.188	0.430	0.040	0.000

2.8444	0.190	0.447	0.041	0.000
2.9333	0.193	0.464	0.041	0.000
3.0222	0.195	0.481	0.042	0.000
3.1111	0.197	0.499	0.043	0.000
3.2000	0.199	0.516	0.043	0.000
3.2889	0.202	0.534	0.044	0.000
3.3778	0.204	0.552	0.045	0.000
3.4667	0.206	0.570	0.045	0.000
3.5556	0.209	0.589	0.046	0.000
3.6444	0.211	0.608	0.046	0.000
3.7333	0.213	0.626	0.047	0.000
3.8222	0.216	0.646	0.047	0.000
3.9111	0.218	0.665	0.048	0.000
4.0000	0.220	0.684	0.049	0.000
4.0889	0.223	0.704	0.049	0.000
4.1778	0.225	0.724	0.050	0.000
4.2667	0.228	0.744	0.050	0.000
4.3556	0.230	0.765	0.051	0.000
4.4444	0.233	0.785	0.052	0.000
4.5333	0.235	0.806	0.054	0.000
4.6222	0.238	0.827	0.056	0.000
4.7111	0.240	0.848	0.059	0.000
4.8000	0.243	0.870	0.062	0.000
4.8889	0.245	0.892	0.065	0.000
4.9778	0.248	0.913	0.068	0.000
5.0667	0.250	0.936	0.072	0.000
5.1556	0.253	0.958	0.075	0.000
5.2444	0.255	0.981	0.078	0.000
5.3333	0.258	1.003	0.082	0.000
5.4222	0.260	1.027	0.086	0.000
5.5111	0.263	1.050	0.090	0.000
5.6000	0.266	1.073	0.094	0.000
5.6889	0.268	1.097	0.099	0.000
5.7778	0.271	1.121	0.118	0.000
5.8667	0.274	1.145	0.124	0.000
5.9556	0.276	1.170	0.131	0.000
6.0444	0.279	1.195	0.137	0.000
6.1333	0.282	1.220	0.144	0.000
6.2222	0.285	1.245	0.151	0.000
6.3111	0.287	1.270	0.158	0.000
6.4000	0.290	1.296	0.165	0.000
6.4889	0.293	1.322	0.172	0.000
6.5778	0.296	1.348	0.180	0.000
6.6667	0.298	1.375	0.187	0.000
6.7556	0.301	1.401	0.195	0.000
6.8444	0.304	1.428	0.203	0.000
6.9333	0.307	1.455	0.211	0.000
7.0222	0.310	1.483	0.270	0.000
7.1111	0.312	1.510	0.805	0.000
7.2000	0.315	1.538	1.622	0.000
7.2889	0.318	1.567	2.593	0.000
7.3778	0.321	1.595	3.605	0.000
7.4667	0.324	1.624	4.545	0.000
7.5556	0.327	1.653	5.317	0.000
7.6444	0.330	1.682	5.869	0.000
7.7333	0.333	1.711	6.234	0.000
7.8222	0.336	1.741	6.647	0.000
7.9111	0.339	1.771	6.986	0.000

8.0000	0.342	1.801	7.308	0.000
8.0889	0.345	1.832	7.617	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.88
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.15
Total Impervious Area: 2.73

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.112508
5 year	0.185489
10 year	0.240889
25 year	0.318312
50 year	0.381101
100 year	0.448094

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.063452
5 year	0.097833
10 year	0.126821
25 year	0.171687
50 year	0.211885
100 year	0.258609

WQ after detention → Use full 2yr release rate
0.06 CFS = 26.94 GPM
26.94 GPM / 22.5 GPM per Cartridge = 2

Use 2 - 27" Cartridges in Contech Stormfilter Vault

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.138	0.046
1950	0.161	0.056
1951	0.231	0.162
1952	0.077	0.042
1953	0.065	0.056
1954	0.095	0.049
1955	0.146	0.048
1956	0.119	0.087
1957	0.107	0.049
1958	0.109	0.052

1959	0.093	0.046
1960	0.180	0.130
1961	0.090	0.069
1962	0.061	0.043
1963	0.088	0.051
1964	0.110	0.065
1965	0.082	0.080
1966	0.073	0.049
1967	0.171	0.059
1968	0.100	0.049
1969	0.096	0.048
1970	0.081	0.052
1971	0.103	0.051
1972	0.177	0.130
1973	0.083	0.077
1974	0.094	0.051
1975	0.134	0.048
1976	0.095	0.050
1977	0.033	0.046
1978	0.080	0.056
1979	0.050	0.040
1980	0.252	0.143
1981	0.073	0.050
1982	0.175	0.098
1983	0.120	0.050
1984	0.076	0.043
1985	0.044	0.046
1986	0.188	0.067
1987	0.173	0.119
1988	0.074	0.048
1989	0.046	0.046
1990	0.482	0.127
1991	0.217	0.130
1992	0.091	0.057
1993	0.088	0.043
1994	0.036	0.040
1995	0.117	0.069
1996	0.275	0.154
1997	0.217	0.166
1998	0.077	0.044
1999	0.300	0.133
2000	0.084	0.063
2001	0.022	0.039
2002	0.117	0.076
2003	0.160	0.049
2004	0.186	0.177
2005	0.122	0.049
2006	0.126	0.090
2007	0.356	0.280
2008	0.379	0.150
2009	0.171	0.078

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.4819	0.2803
2	0.3787	0.1773
3	0.3564	0.1661

4	0.3001	0.1615
5	0.2747	0.1538
6	0.2518	0.1497
7	0.2313	0.1432
8	0.2172	0.1330
9	0.2169	0.1303
10	0.1881	0.1299
11	0.1856	0.1297
12	0.1796	0.1266
13	0.1767	0.1190
14	0.1748	0.0978
15	0.1729	0.0897
16	0.1710	0.0874
17	0.1705	0.0799
18	0.1608	0.0782
19	0.1602	0.0774
20	0.1460	0.0755
21	0.1377	0.0690
22	0.1340	0.0688
23	0.1264	0.0665
24	0.1220	0.0653
25	0.1201	0.0632
26	0.1189	0.0587
27	0.1169	0.0567
28	0.1168	0.0565
29	0.1102	0.0561
30	0.1090	0.0559
31	0.1074	0.0521
32	0.1025	0.0517
33	0.0999	0.0513
34	0.0965	0.0508
35	0.0954	0.0505
36	0.0946	0.0500
37	0.0940	0.0500
38	0.0926	0.0496
39	0.0906	0.0494
40	0.0898	0.0494
41	0.0879	0.0493
42	0.0876	0.0492
43	0.0838	0.0488
44	0.0834	0.0488
45	0.0821	0.0483
46	0.0810	0.0481
47	0.0801	0.0480
48	0.0775	0.0476
49	0.0773	0.0465
50	0.0759	0.0462
51	0.0743	0.0458
52	0.0734	0.0458
53	0.0729	0.0456
54	0.0653	0.0443
55	0.0609	0.0432
56	0.0498	0.0431
57	0.0465	0.0427
58	0.0444	0.0419
59	0.0358	0.0403
60	0.0329	0.0398
61	0.0218	0.0393

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0563	18638	10692	57	Pass
0.0595	16418	9107	55	Pass
0.0628	14722	7954	54	Pass
0.0661	12726	6654	52	Pass
0.0694	11325	5722	50	Pass
0.0727	10140	5131	50	Pass
0.0759	9131	4432	48	Pass
0.0792	7901	3677	46	Pass
0.0825	7142	3234	45	Pass
0.0858	6444	2922	45	Pass
0.0891	5687	2488	43	Pass
0.0923	5221	2216	42	Pass
0.0956	4770	1935	40	Pass
0.0989	4393	1660	37	Pass
0.1022	3927	1498	38	Pass
0.1055	3572	1443	40	Pass
0.1088	3264	1395	42	Pass
0.1120	2864	1336	46	Pass
0.1153	2627	1293	49	Pass
0.1186	2391	1245	52	Pass
0.1219	2199	1121	50	Pass
0.1252	1960	931	47	Pass
0.1284	1810	805	44	Pass
0.1317	1696	689	40	Pass
0.1350	1514	596	39	Pass
0.1383	1354	532	39	Pass
0.1416	1240	467	37	Pass
0.1448	1155	374	32	Pass
0.1481	1043	323	30	Pass
0.1514	977	286	29	Pass
0.1547	920	256	27	Pass
0.1580	859	235	27	Pass
0.1613	772	206	26	Pass
0.1645	715	181	25	Pass
0.1678	650	158	24	Pass
0.1711	572	143	25	Pass
0.1744	493	127	25	Pass
0.1777	441	113	25	Pass
0.1809	386	104	26	Pass
0.1842	343	87	25	Pass
0.1875	314	78	24	Pass
0.1908	279	67	24	Pass
0.1941	235	59	25	Pass
0.1973	202	54	26	Pass
0.2006	178	48	26	Pass
0.2039	152	43	28	Pass
0.2072	125	38	30	Pass
0.2105	110	33	30	Pass
0.2138	97	29	29	Pass
0.2170	84	22	26	Pass
0.2203	72	21	29	Pass
0.2236	62	21	33	Pass
0.2269	56	20	35	Pass
0.2302	45	20	44	Pass

0.2334	41	19	46	Pass
0.2367	37	18	48	Pass
0.2400	35	17	48	Pass
0.2433	29	17	58	Pass
0.2466	25	16	64	Pass
0.2498	23	15	65	Pass
0.2531	17	13	76	Pass
0.2564	15	13	86	Pass
0.2597	12	12	100	Pass
0.2630	9	10	111	Fail
0.2663	8	8	100	Pass
0.2695	8	5	62	Pass
0.2728	8	2	25	Pass
0.2761	7	2	28	Pass
0.2794	7	1	14	Pass
0.2827	7	0	0	Pass
0.2859	7	0	0	Pass
0.2892	7	0	0	Pass
0.2925	7	0	0	Pass
0.2958	7	0	0	Pass
0.2991	6	0	0	Pass
0.3024	5	0	0	Pass
0.3056	5	0	0	Pass
0.3089	5	0	0	Pass
0.3122	4	0	0	Pass
0.3155	4	0	0	Pass
0.3188	4	0	0	Pass
0.3220	4	0	0	Pass
0.3253	4	0	0	Pass
0.3286	4	0	0	Pass
0.3319	4	0	0	Pass
0.3352	4	0	0	Pass
0.3384	4	0	0	Pass
0.3417	4	0	0	Pass
0.3450	3	0	0	Pass
0.3483	3	0	0	Pass
0.3516	3	0	0	Pass
0.3549	3	0	0	Pass
0.3581	2	0	0	Pass
0.3614	2	0	0	Pass
0.3647	2	0	0	Pass
0.3680	2	0	0	Pass
0.3713	2	0	0	Pass
0.3745	2	0	0	Pass
0.3778	2	0	0	Pass
0.3811	1	0	0	Pass

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0935 acre-feet
On-line facility target flow:	0.0472 cfs.
Adjusted for 15 min:	0.0472 cfs.
Off-line facility target flow:	0.0322 cfs.
Adjusted for 15 min:	0.0322 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
Trapezoidal Pond 1 POC	☐	482.81			☐	0.00			
Total Volume Infiltrated		482.81	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

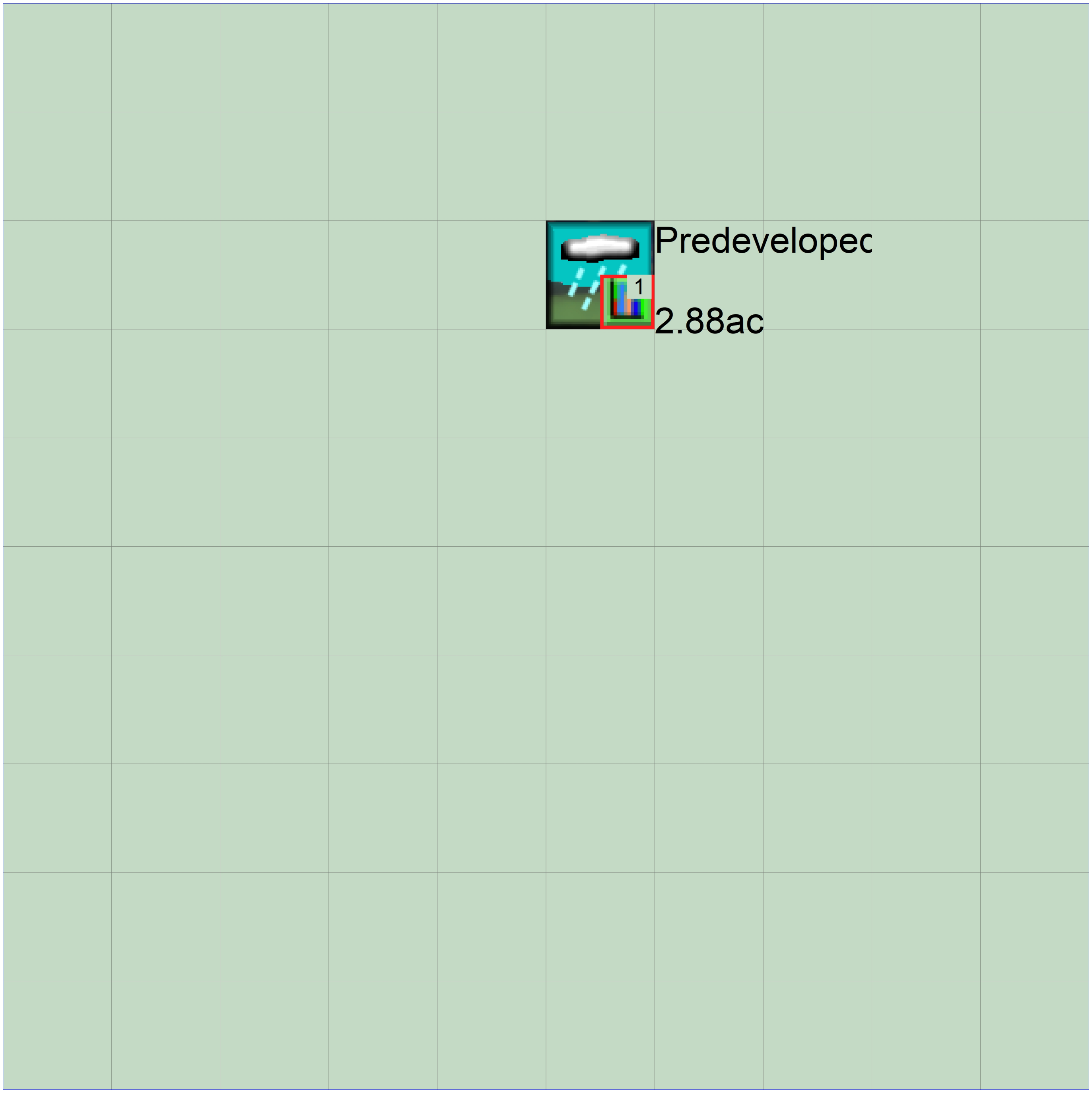
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

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

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<-ID->                                                             ***
WDM        26   20210303 DS0011.wdm
MESSU      25   Pre20210303 DS0011.MES
           27   Pre20210303 DS0011.L61
           28   Pre20210303 DS0011.L62
           30   POC20210303 DS00111.dat
END FILES

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

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Predeveloped***
PERLND  10                        2.88     COPY   501     12
PERLND  10                        2.88     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.167          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.167          IMPLND   1 999 EXTNL  PREC
```

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

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   20210303 DS0011.wdm
MESSU      25   Mit20210303 DS0011.MES
           27   Mit20210303 DS0011.L61
           28   Mit20210303 DS0011.L62
           30   POC20210303 DS00111.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                             in  out          ***
   16      C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

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

```
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16             0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out          ***
    1      ROADS/FLAT             1    1    1   27    0
  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    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->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Postdeveloped***
PERLND  16                        0.15     RCHRES   1      2
PERLND  16                        0.15     RCHRES   1      3
IMPLND   1                        2.73     RCHRES   1      5

******Routing******
PERLND  16                        0.15     COPY     1     12
IMPLND   1                        2.73     COPY     1     15
PERLND  16                        0.15     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                            in  out                          ***
    1     Trapezoidal Pond-007    1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

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

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

```
    1              1      0.01       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  0.125981  0.000000  0.000000
  0.088889  0.127801  0.011279  0.007302
  0.177778  0.129635  0.022721  0.010326
  0.266667  0.131482  0.034326  0.012647
  0.355556  0.133341  0.046096  0.014604
  0.444444  0.135214  0.058032  0.016327
  0.533333  0.137100  0.070135  0.017886
  0.622222  0.138999  0.082406  0.019319
  0.711111  0.140911  0.094846  0.020653
  0.800000  0.142836  0.107457  0.021905
  0.888889  0.144774  0.120240  0.023090
  0.977778  0.146725  0.133195  0.024217
  1.066667  0.148689  0.146325  0.025294
  1.155556  0.150666  0.159629  0.026327
  1.244444  0.152657  0.173110  0.027321
  1.333333  0.154660  0.186769  0.028280
  1.422222  0.156676  0.200606  0.029207
  1.511111  0.158706  0.214623  0.030106
  1.600000  0.160749  0.228821  0.030979
  1.688889  0.162804  0.243201  0.031828
  1.777778  0.164873  0.257765  0.032655
  1.866667  0.166955  0.272512  0.033461
  1.955556  0.169049  0.287446  0.034248
  2.044444  0.171157  0.302566  0.035018
  2.133333  0.173278  0.317874  0.035771
  2.222222  0.175412  0.333372  0.036509
  2.311111  0.177559  0.349059  0.037232
  2.400000  0.179719  0.364938  0.037941
  2.488889  0.181892  0.381010  0.038637
  2.577778  0.184078  0.397275  0.039321
  2.666667  0.186278  0.413736  0.039994
  2.755556  0.188490  0.430392  0.040655
  2.844444  0.190715  0.447246  0.041305
  2.933333  0.192954  0.464298  0.041946
  3.022222  0.195205  0.481549  0.042576
  3.111111  0.197470  0.499001  0.043198
  3.200000  0.199748  0.516655  0.043811
  3.288889  0.202038  0.534513  0.044415
  3.377778  0.204342  0.552574  0.045011
  3.466667  0.206659  0.570841  0.045600
  3.555556  0.208989  0.589314  0.046181
  3.644444  0.211332  0.607995  0.046754
  3.733333  0.213688  0.626885  0.047321
  3.822222  0.216057  0.645984  0.047881
  3.911111  0.218439  0.665295  0.048435
  4.000000  0.220834  0.684818  0.048982
  4.088889  0.223242  0.704555  0.049523
  4.177778  0.225663  0.724506  0.050059
  4.266667  0.228098  0.744674  0.050588
  4.355556  0.230545  0.765058  0.051113
  4.444444  0.233006  0.785660  0.052264
  4.533333  0.235479  0.806482  0.054246
```

```
  4.622222  0.237966  0.827524  0.056657
  4.711111  0.240465  0.848787  0.059371
  4.800000  0.242978  0.870274  0.062310
  4.888889  0.245504  0.891984  0.065423
  4.977778  0.248043  0.913919  0.068668
  5.066667  0.250595  0.936081  0.072012
  5.155556  0.253159  0.958470  0.075425
  5.244444  0.255737  0.981088  0.078885
  5.333333  0.258329  1.003935  0.082368
  5.422222  0.260933  1.027013  0.086211
  5.511111  0.263550  1.050324  0.090465
  5.600000  0.266180  1.073867  0.094865
  5.688889  0.268823  1.097645  0.099408
  5.777778  0.271480  1.121659  0.118567
  5.866667  0.274149  1.145909  0.124775
  5.955556  0.276832  1.170397  0.131154
  6.044444  0.279527  1.195124  0.137698
  6.133333  0.282236  1.220091  0.144404
  6.222222  0.284957  1.245300  0.151267
  6.311111  0.287692  1.270751  0.158283
  6.400000  0.290440  1.296446  0.165449
  6.488889  0.293201  1.322385  0.172761
  6.577778  0.295975  1.348571  0.180216
  6.666667  0.298762  1.375003  0.187812
  6.755556  0.301562  1.401684  0.195545
  6.844444  0.304375  1.428615  0.203413
  6.933333  0.307201  1.455796  0.211414
  7.022222  0.310040  1.483229  0.270340
  7.111111  0.312892  1.510915  0.805818
  7.200000  0.315758  1.538855  1.622884
  7.288889  0.318636  1.567050  2.593548
  7.377778  0.321528  1.595502  3.605509
  7.466667  0.324432  1.624211  4.545652
  7.555556  0.327350  1.653179  5.317376
  7.644444  0.330280  1.682407  5.869837
  7.733333  0.333224  1.711896  6.234799
  7.822222  0.336181  1.741648  6.647140
  7.911111  0.339150  1.771662  6.985964
  8.000000  0.342133  1.801942  7.308642
  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    1.167          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.167          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

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

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

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

```
  END MASS-LINK     3

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

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

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

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

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

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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