TECHNICAL INFORMATION REPORT
CITY OF MERCER ISLAND

For

Adams Mercer Island SFR
3508 96th Ave SE
Mercer Island, WA 98040

November 30, 2023

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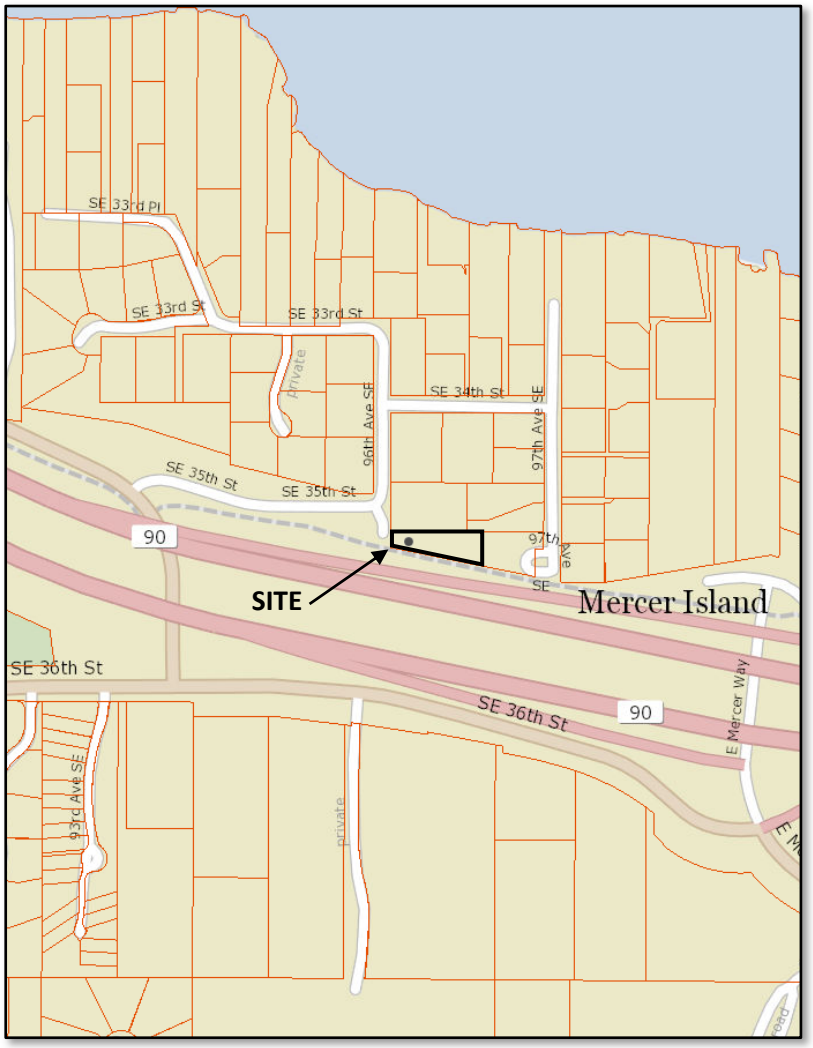
I. PROJECT OVERVIEW

Project Name:	Adams Mercer Island SFR
Site Address:	3508 96th Ave SE
King County Tax Parcel:	413930-0045
Zoning:	RS-9.6
Site Area:	11,900 SF (0.27 AC)
Site Location:	The site is located in the City of Mercer Island at 3508 96th Ave SE within the SE ¼ of Section 7, Township 24 North, Range 5 East, W.M.
Ex. Adjacent Development:	North – Single-Family Residence East – Single-Family Residence South – 96th Ave SE West – Interstate 90

Figure 1: Vicinity Map



Pre-developed Site Conditions:

The property is presently undeveloped with a demolished single-family residence with access to 96th Avenue SE. Except for the demolished structure, the site is vegetated with shrubs and trees. The site generally slopes down from the west to the east at an average grade of approximately 4%.

Critical Areas:

Per the City of Mercer Island GIS Mapping, the northeastern portion of the site is partially within a seismic hazard. Per FEMA Flood Map Number 53033C0654G the site is located outside of the floodplains. The property is not located within and does not contain any other known critical areas.

Post-developed Site Conditions:

The development proposal incorporates the construction of on-site and off-site infrastructure to support the construction of a new single-family residence. The existing structures will be demolished. The lot will be accessed via a new asphalt driveway extending from 96th Ave SE. The project site is located within the Mercer Island Drainage Basin. The site is defined by a single drainage basin that discharges to the northeast. Developed runoff will be collected in a detention system approved by the COMI and will convey to a catch basin along an existing drainage easement.

Soils:

The onsite soils are mapped as Kitsap silt Loam (KpB) by the US Department of Agriculture (USDA), Natural Resources Conservation Service (NCRS) Web Soil Survey information. Per the City of Mercer Island GIS infiltration LID map, the soils on site are feasible for moderate infiltration.

Figure 2: Soils Map and Legend

King County Area, Washington (WA633)

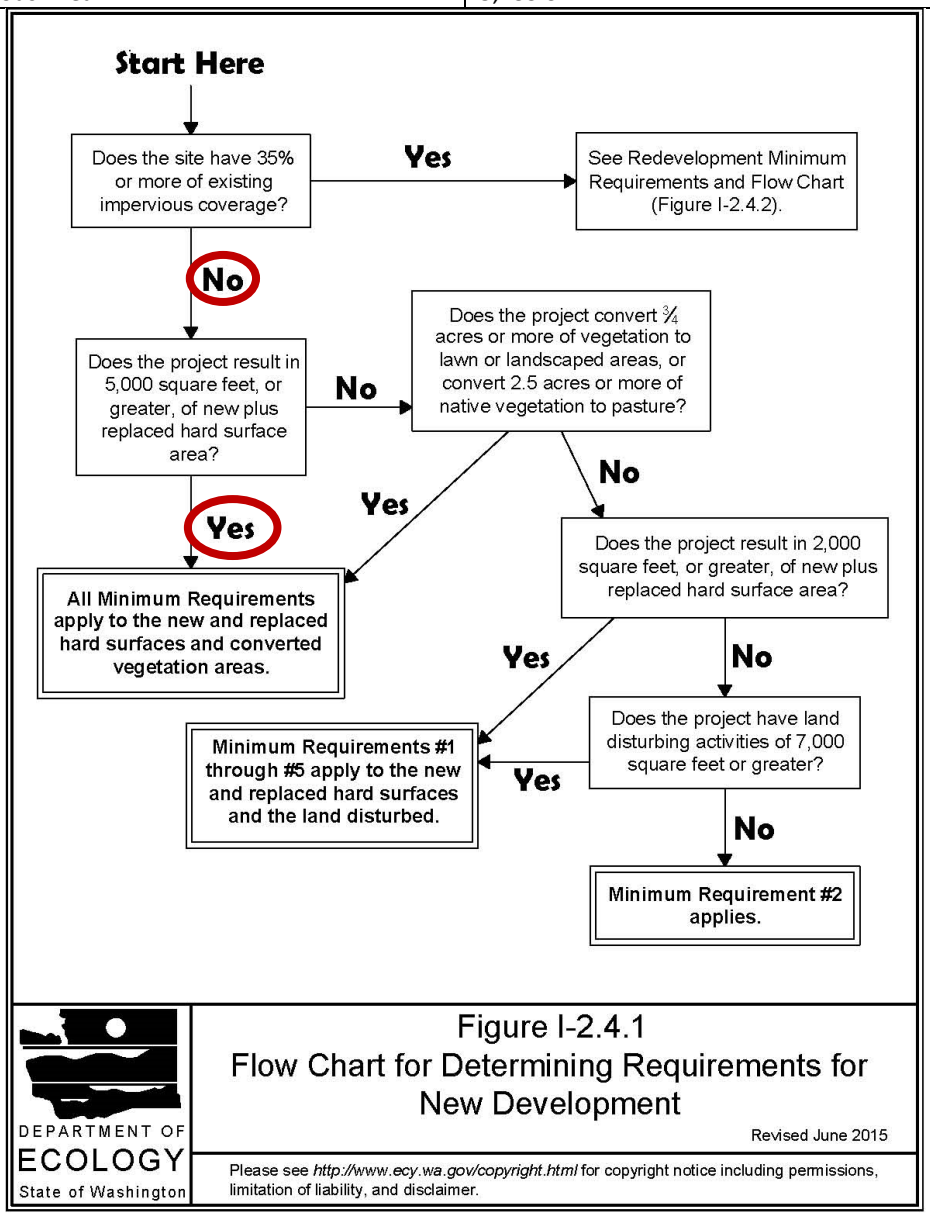
King County Area, Washington (WA633)

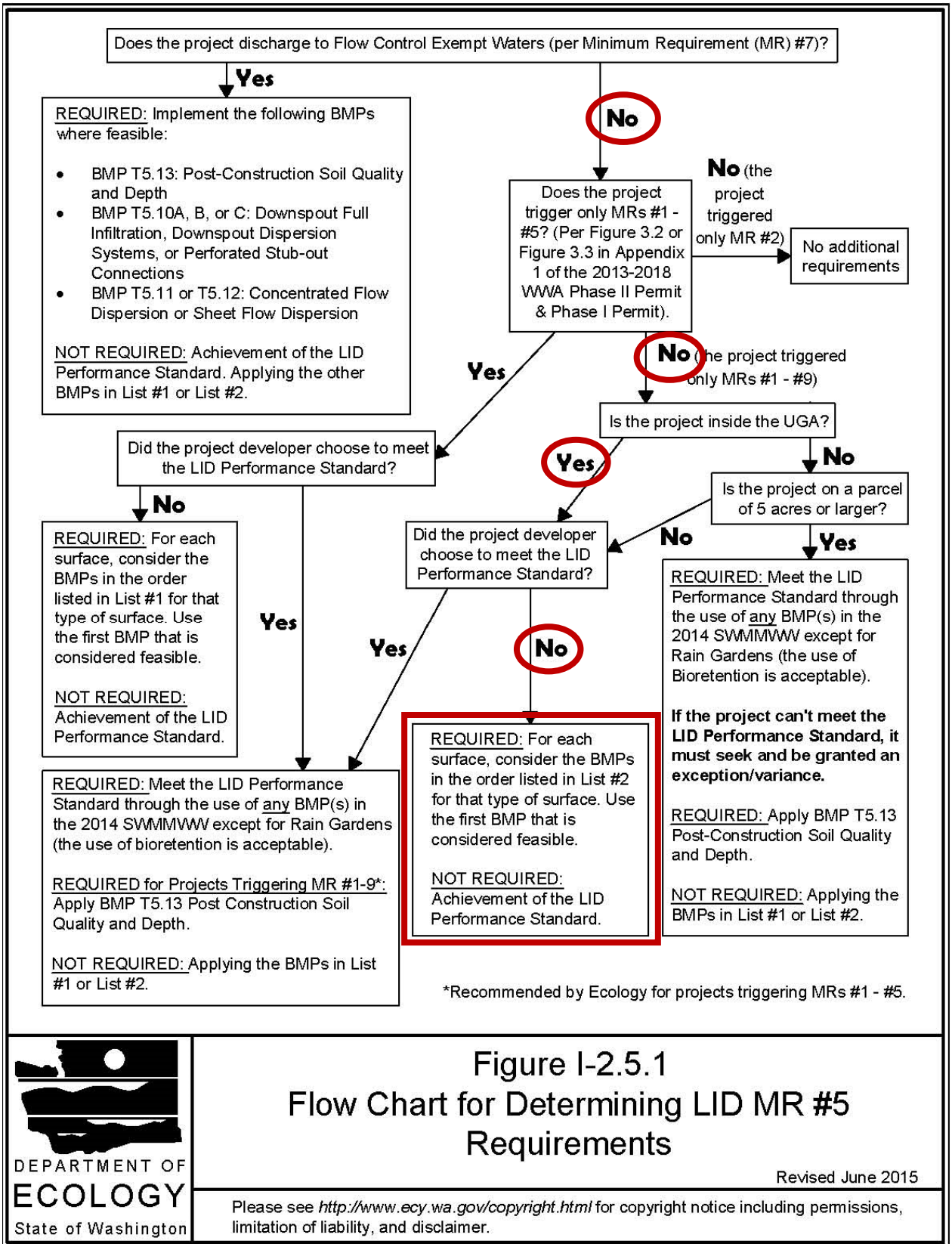
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KpB	Kitsap silt loam, 2 to 8 percent slopes	0.3	100.0%
Totals for Area of Interest		**0.3**	**100.0%**

II. CONDITIONS AND REQUIREMENTS SUMMARY

Flow Chart #1: Flow Chart for Determining Requirements for New Development was utilized to determine which requirements apply to the project. The site areas used are provided in the table below. Per Flow Chart #1, all Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas. Please refer to the flow chart below.

Parcel Area	11,900 SF
Roof Area	3,200 SF
Concrete Turnaround	536 SF
Concrete Slab (Patio)	480 SF
Asphalt Driveway (PGHS)	795 SF
Pervious Paver Area	455 SF (50%) = 228 SF
Total Impervious Area	5,239 SF





DEPARTMENT OF ECOLOGY
State of Washington

Figure I-2.5.1
Flow Chart for Determining LID MR #5 Requirements

Revised June 2015

Minimum Requirements #1-9:

Minimum Requirement No. 1 – Preparation of Stormwater Site Plans

A Stormwater Site Plan has been prepared for review by the city.

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

A SWPPP (i.e. TESC) is included in the project submittal.

Minimum Requirement No. 3 – Source Control of Pollution

Source control is not required as the proposed development is residential and is not a high use site.

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

The natural drainage pattern and discharges from the site will be maintained to the maximum extent practicable. No significant adverse impacts to the downstream system are expected or anticipated.

Minimum Requirement No. 5 – On-site Stormwater Management

Flow Chart #2 Flow Chart for Determining LID MR #5 Requirements was utilized to determine the requirements to meet On-site Stormwater Management. Per Flow Chart #2, List #2 was used to determine the On-site Stormwater Management BMPs feasible for the project. Please refer to Flow Chart #2 on page 7.

List #2 Analysis:

Per Section 2.5.5 of the Stormwater Management Manual for Western Washington, the BMPs must be considered in the order listed in List #2 for each surface. The first BMP considered feasible must be implemented to the maximum extent feasible. Below is the feasibility evaluation of the BMPs in the order listed.

Lawn and Landscaped areas:

1. Post Construction Soil Quality and Depth – This BMP is feasible and will be implemented per BMP T5.13 for all disturbed and converted vegetated areas that are sloped at less than 33%.

Roofs:

1. Full Dispersion – Infeasible due to setback requirements and lack of vegetated flow paths.
2. Rain Gardens or Bioretention – Infeasible due to setback requirements and lack of vegetated flow paths.
3. Downspout Dispersion Systems – Dispersion systems are infeasible due to the project site being mapped as a landslide hazard area. King County has secured an easement for extension of the sewer force main across the east portion of the site, making dispersion facilities in this area infeasible and not permissible.
4. Perforated Stub-out Connection – Infeasible due to landslide hazard area as mentioned above.

Other Hard Surfaces:

1. Full Dispersion – Infeasible due to lack of vegetated flow paths.
2. Permeable Pavement – Infeasible; per city mapping the site is labeled as "non-infiltrating".
3. Bioretention - Infeasible due to setback requirements and lack of vegetated flow paths.
4. Sheet Flow Dispersion – dispersion is infeasible due to the site being mapped as a landslide hazard area.

Since all the BMPs from List #2 are considered infeasible, the project proposes a detention system in accordance with City of Mercer Island standards. The project creates between 5,001 to 6,000 sf of new and replaced impervious surface area with Type C soils. Therefore, a 60" diameter detention pipe has been chosen with a length of 37 feet. The detention system will mitigate all runoff from the driveway, roof areas, concrete turnaround, and concrete slabs through conveyance systems that include catch basins, clean outs, area drains, and sediment control structures. Downstream from the detention system, the conveyance system will connect to an existing catch basin, running along a 10' utility and drainage easement.

Minimum Requirement No. 6 – Runoff Treatment

The pollution-generating impervious surfaces are less than 5,000 SF. Therefore, water quality treatment is not required.

Minimum Requirement No. 7 – Flow Control

Flow control requirements are satisfied through the implementation of City of Mercer Island's On-Site Detention Design Requirements. The 100-year flow frequency is required to be evaluated on a site-specific basis for projects on moderate or steep slopes. Since the project does not include steep slopes onsite, no further analysis is necessary and flow control measures are met.

Minimum Requirement No. 8 – Wetlands Protection

N/A – The project does not discharge to a wetland.

Minimum Requirement No. 9 – Operations and Maintenance

A draft Operations and Maintenance Manual is included in Appendix B.

III. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

The project SWPPP addresses the thirteen required elements as follows:

Element 1 – Preserve Vegetation/Mark Clearing Limits – Clearing limits will be delineated with silt fence and orange construction fencing.

Element 2 – Establish Construction Access - A quarry spall construction entrance and a wheel wash will be provided if warranted.

Element 3 – Control Flow Rates – The proposed detention tank will be used during construction as a sediment and flow control device. Upon competition of the project, the tank and associated catch basins to be flushed and cleaned of debris.

Element 4 – Install Sediment Controls – Silt fencing will be constructed and is expected to provide construction stormwater sediment control during construction.

Element 5 – Stabilize Soils – Stockpiled or unworked soils will be protected during construction by covering with plastic or temporary or permanent seeding. All exposed soils will be landscaped or seeded and BMP T5.13- Post Construction Soil Amendment will be implemented at the conclusion of the project.

Element 6 – Protect Slopes – Areas of cut slopes to be covered with plastic per BMP C123 until permanently stabilized.

Element 7 – Protect Drain Inlets – The existing and newly constructed conveyance system inlets in the vicinity of the project site will be protected with catch basin filters during construction.

Element 8 – Stabilize Channels and Outlets – There are no existing or proposed surface channels or outfalls. Therefore the use of typical energy dissipation devices and channel lining such as riprap are not anticipated.

Element 9 – Control Pollutants – The small size of this project will limit the opportunity for discharge of pollutants. Waste/demolition debris will not be stockpiled, fueling will be done off-site and concrete trucks will be washed out off-site.

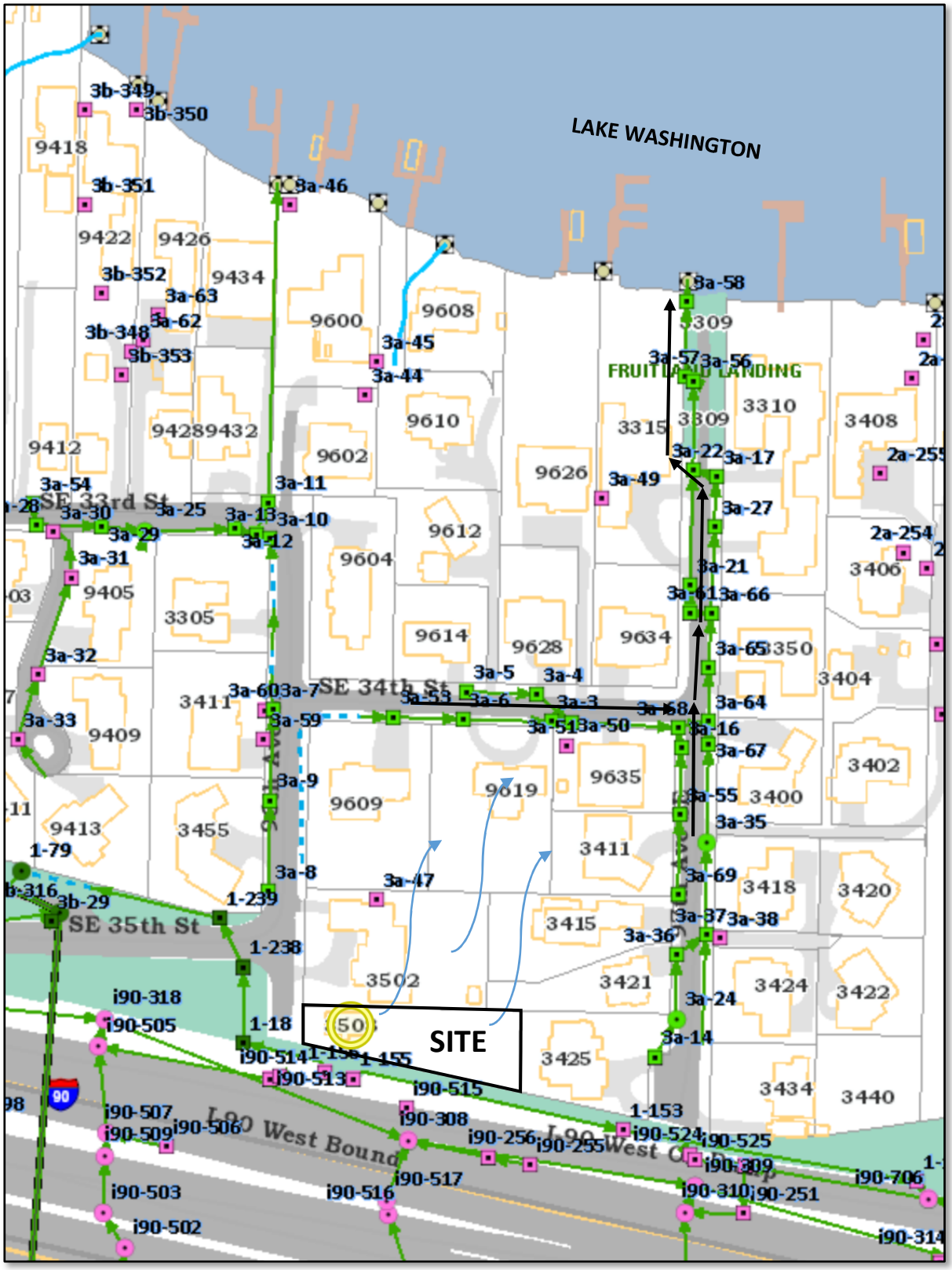
Element 10 – Control De-watering – De-watering is not anticipated.

Element 11 – Maintain BMPs – BMPs will be maintained as necessary to assure continued functioning.

Element 12 – Manage the Project – An inspector (sites less than 1 acre) will be present or on call to ensure BMPs are maintained and assess effectiveness of ESC measures. Rainy season requirements will be implemented if necessary.

Element 13 – Protect LID BMPs – N/A. No LID BMPs are proposed.

Figure 3: Downstream Map



IV. CONVEYANCE ANALYSIS

The post-detention conveyance pipe system (6" PVC) was checked for capacity utilizing Manning's equation and WWHM's 100-year flow capacity. At 2% slope, the pipe is capable of handling a flowrate of 0.9166 cfs. After inputting the proper areas into the WWHM model, the 100-year flowrate was determined to be 0.0884 cfs. Therefore, the pipe is sufficiently sized to handle the post-detention flowrate.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Adams Mercer Island SFR

Capacity Check

Inputs

Pipe diameter, d_0	6	in
Manning roughness, n	0.011	
Pressure slope (possibly ? equal to pipe slope), S_0	2	% rise/run
Relative flow depth, y/d_0	.8	fraction

Results

Flow depth, y	0.4000	ft
Flow area, a	0.1684	ft^2
Pipe area, a0	0.1964	ft^2
Relative area, a/a0	0.8576	fraction
Wetted perimeter, P_w	1.1071	ft
Hydraulic radius, R_h	0.1521	ft
Top width, T	0.4000	ft
Velocity, v	5.4433	ft/sec
Velocity head, h_v	0.4605	ft H2O
Froude number, F	1.48	
Average shear stress (tractive force), tau	0.1899	psf
Flow, Q (See notes)	0.9166	cfs
Full flow, Q0	0.9377	cfs
Ratio to full flow, Q/Q0	0.9775	fraction

Flow Frequency

Flow(cfs)	Predeveloped	Mitigated
2 Year =	0.0074	0.0435
5 Year =	0.0115	0.0549
10 Year =	0.0139	0.0627
25 Year =	0.0164	0.0727
50 Year =	0.0180	0.0805
100 Year =	0.0193	0.0884

Appendix A
MAINTENANCE & OPERATIONS MANUAL

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Pavements, all			adjacent pervious areas deposits soil, mulch or sediment on paving	other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ◦ Walk-behind vacuum (sidewalks) ◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots)

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				◦ ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A_b		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective main-

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				tenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: ◦ Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. ◦ Hand held pressure washer or power washer with rotating brushes ◦ Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate pre-

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				cautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ◦ Walk-behind vacuum (sidewalks) ◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ◦ ShopVac or brush brooms (small areas) Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A[b]		Surface is	• Review the overall per-

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	formance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. • Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper).

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
b A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be	

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			reduced/-eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).	
Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry	

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			• Parking lots and roadways: Vacuum sweep or stiff broom/-power brush for cleaning moss from pavement surface	
A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations	
A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections	
A		Settlement of	May require	

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
		surface	resetting	
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A_b		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of	Replenish aggregate material by

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			aggregate material in paving grid	spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A_b		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Rehabilitate per manufacturer's recommendations.

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet	A		Pipe is dam-	Repair/replace

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
pipe			aged	
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Aggregate Storage Reservoir				
Observation port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
Vegetation				
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	• Sweep leaf litter and sediment to prevent surface clogging and ponding • Prevent large root systems from damaging subsurface structural components
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement
Note that the inspection and routine maintenance frequencies listed above are recom-				

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
mended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".				
a Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).				
b Inspection should occur during storm event.				

Appendix B
ARBORIST REPORT

Arborist Report

Tree Inventory and Assessment

3508 96th Ave SE Mercer Island, WA 98040

Prepared for:

Sam Adams

Prepared by:

Alan Haywood

Certified Arborist, PN-0330AM

~~**March 23, 2022**~~

Revised/Updated: May 22, 2023

Alan Haywood – Arborist & Horticulturist, LLC
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Summary

There were nineteen trees large enough to count towards the City of Mercer Island's tree retention requirements on the lot owned by Mr. Sam Adams at 3508 96th Ave SE. Five of those trees were in poor condition and not suitable for retention. Three of the trees were large enough to be considered Exceptional trees by the City standards. The City requires at least 30 percent of the trees to be retained and prioritizes the retention of the Exceptional trees. Of the fourteen trees that were suitable for retention, the City would require at least four to be saved and would prefer the three Exceptional trees to be among the trees retained.

The North Mercer Interceptor Sewer Improvement Project will require the removal of thirteen trees from the site and nine trees from the adjacent ROW to the west. All three of the Exceptional trees will be removed. Four trees are proposed for retention.

Introduction

Background and History

I was contacted by Sam Adams to provide a tree inventory and assessment for their vacant property at 3508 96th Ave SE Mercer Island, WA 98040. He explained to me that he was proposing to build a house on the property and this report would be part of the permit application process with the City of Mercer Island. It was located at the end of the short dead-end street, 96th Ave SE. The street ends at the paved Mountains To Sound Greenway Trail to the south. Just past the trail is the Interstate 90 Freeway.

According to Mr. Adams, the property was vacant because the previous owner demolished a house that had previously stood there. The western half of the property had been mostly cleared, with just a few smaller trees remaining. The eastern half of the property was vegetated with mostly native trees and smaller plants, as well as a few invasive species, including English ivy (*Hedera helix*) and Himalayan blackberry (*Rubus discolor*).

Mr. Adams provided me with a Topographic Survey/site map dated 9/30/20. In addition to the property lines, it showed the locations of the significant trees onsite. The trees were labeled and their diameter was included.

Assignment

My assignment was to:

- Complete the tree inventory, including counting, measuring, tagging, identifying and assessing all of the significant trees on the site.
- Provide a site map with the trees numbered according to the inventory.
- Provide an arborist report that notes the condition and viability of the trees. Note any trees that are in poor condition now that would be a hazard (high risk) to the proposed development or to neighboring properties. Also identify any that would become hazardous due to damage or exposure that the trees would receive as part of the development.
- *Provide a tree retention and replacement plan.*

Limits of the Assignment

I was not provided a site plan showing the limits of clearing and grading, the location of any new structures or the location of utilities.

I was not asked to provide a Tree Removal and Retention Plan, since there was no conceptual construction plan yet.

I was asked to provide a tree removal and retention plan in 2023, after a conceptual site plan was developed.

Methodology

I examined the trees using the standard visual tree assessment method, as outlined in the *Tree Risk Assessment Manual* published by the International Society of Arboriculture. This is considered a Level 2 Basic Tree Risk Assessment. All of my observations were made from ground level. I did not climb the trees, perform any invasive tests on them or excavate any soil from around them.

The tree risk assessment methodology is based on three factors:

- How likely is the tree (or a tree part) to fail?
- How likely is the tree (or tree part) to hit a target of value when it fails?
- How likely is the tree (or tree part) to damage or injure the target if it hits it?

Tree structure, as well as health, plays a role in the risk determination. The proximity of a target of value is also considered. The presence of people and the duration of that presence (occupancy) is also factored it to the risk level determination.

Tree risk is categorized as Low, Moderate, High or Extreme. A normal healthy tree is generally considered low risk, because it is not likely to fail. It is the presence of defects in the tree that increases the likelihood of failure. If no one would be harmed or nothing of value would be damaged by the tree failure, it is also considered low risk. A tree that is likely to fail, but is unlikely to strike a target, is not a high risk tree.

Most trees are either Low Risk or Moderate Risk and are not considered Hazard Trees. However, a property owner's tolerance for risk may be low and a tree of Moderate Risk may be out of their comfort zone. In such cases, removal of the tree should be sought through other permitted means, not hazard tree removal. The definition of a Hazard Tree varies by jurisdiction.

Tree diameter measurements are taken at 4.5' above ground. This is known as Diameter at Breast Height – DBH. I used a diameter tape for this measurement. I used metal tags and flagging tape for tagging and numbering the trees.

Purpose and Use of this Report

The purpose of this report is to provide the tree information I gathered from my site visit and inspection for the purposes of generating a report to meet the permit requirements of the City of Mercer Island. This report is for the sole use of my client and may not be reproduced, used in any way, or disseminated in any form, without prior consent of the client and Alan Haywood – Arborist & Horticulturist, LLC.

Observations

I visited the site on March 4, 2022. I found the site to mostly level from the street heading east. In the northeast corner of the property, there was a gentle downhill slope. The site was dominated by several bigleaf maples (Acer macrophyllum) and one large Douglas fir (Pseudotsuga menziessii), with a few other trees present. The understory was a mix of vine maple, beaked hazelnut, small bitter cherries, a small western redcedar, western sword fern, salal, salmonberry and trailing blackberry. There were also a few non-native trees and invasive plant species (ivy and blackberry) present.

I tagged the trees with aluminum tags and numbered them according to the tree numbers shown on the Topographic Survey. Some trees in the western cleared area were already tagged. Trees that I found that were not shown on the plan, I numbered as well. Some trees that were in the numerical tree sequence were not on the Topographic Survey (1, 2, 3, 8, 9 and 10) were no longer present on the site. I came to this conclusion based on the sequence of the numbered trees that were present. I included these missing trees in the report, thinking that there may be a record of them associated with the demolition permit of the house. I also noted six newly planted trees on the site. My assumption was that they were replacement trees that were planted as mitigation for trees that had been removed at the same time as the house was removed.

I counted 19 trees on the property that were large enough to meet the Mercer Island criteria for a tree to be counted – 10" DBH and three that were large enough to be considered Exceptional – 24" DBH. Six of the countable trees were in poor condition and were not viable trees to be retained.

The tree inventory chart is included in Appendix A. There was a total count of 20 trees shown on the Topographic Survey map that were shown to be on the property. Another four were shown to be off site. Three of the off-site trees were in the street ROW and one was shown to be mostly in the neighbor's yard to the east. According to my count and measurements, six of the trees on the map were too small (under 10" DBH) to be counted. One of those was in poor condition and not viable for retention. I also counted another four trees that were large enough to be counted that weren't shown on the map (trees # 11, 12, 19 and 31). Based on my inventory and assessment, there were 25 trees on the property:

- 6 were too small to be counted
- 16 were large enough to be counted
- 3 qualified as exceptional

Of the 16 trees that were countable, 5 of them were in poor condition and not suitable for retention. These 5 trees would qualify as high risk trees, if there were a target within striking distance of them. High risk trees are generally considered hazard trees. This left 3 Exceptional trees and 11 countable trees for a total of 14 on the property to consider for retention.

There were also the 6 trees that had been recently planted on the property. They were 2" caliper trees, which were still staked and had a temporary irrigation system set up to water them. I assume that these trees are also required to be retained, but they are of a size that they could easily be transplanted.

There were 11 off-site trees included in the inventory and assessment. Eight of these trees were on the street ROW, with 3 of them being shown on the Topographical Survey. Only 2 were large enough to be counted and 1 of those was dead. The rest of the trees present in the street ROW were too small to be counted, but I inventoried and assessed them, nonetheless. These are

essentially City owned trees and the City and City owned trees would require City permission for removal, or could be required to be removed as part of this project by the City.

The large off site tree shown on the east border, mostly on the neighbor's property, was no longer present. I did use that symbol on the map for another tree on the property that was close to that location.

There were 2 trees on the neighbor's property to the north that overhung the subject property. One was large enough to the counted and the other was exceptional. These trees would require protection from any future development. There was also a row of Leyland Cypress planted as a hedge along the fence in the backyard of the neighbor to the north. None of these trees were large enough to count.

The complete tree inventory and assessment is shown in Appendix A and Appendix B. The trees large enough to be counted for retention and in good enough condition to be viable for retention broke down as follows:

- Douglas fir – 2
- Bigleaf maple -8
- Pacific Madrone – 1
- Black Cottonwood – 1
- European Plum – 1
- Unidentified Deciduous Tree – 1(To be identified when it leafs out)

Discussion and Recommendations

The City of Mercer Island requires a minimum of 30% of the trees with a diameter of 10" or greater be retained for all development proposals. They also require that the development proposal be designed to minimize the removal of large trees. Trees that are defined in the City Code to be "Exceptional" are prioritized for retention. Trees that are in poor health and declining condition, and trees that have significant defects that make them likely to fail, are not considered viable for retention.

There were three trees onsite that qualified as Exceptional Trees:

- Tree # 22 – 30" Bigleaf Maple
- Tree #23 – 30" Bigleaf Maple (with 13" dead leader)
- Tree #26 – 10" Pacific Madrone

There was also a 10" DBH Pacific Madrone off site, on the street ROW. However, it was dead and therefore, not viable for retention.

The North Mercer Interceptor Sewer Improvement Project will require the removal of fourteen trees from the site, along the south and east border of the project. It will also require the removal of eight trees from the ROW to the west of the site. All three of the Exceptional trees onsite will be removed as part of the sewer project. Eight trees are proposed for removal and are located in the proposed house footprint. One tree is proposed to be removed due to its poor condition and one ROW tree is proposed for removal that is located in the proposed driveway location.

The trees that are proposed for retention are #4, 5, 13, 19 and 20. They are native bigleaf maple trees and one cherry Tree. #4 and 19 are considered too small to be regulated. These five trees, as well as the two Douglas firs (#10 and 11) that are located offsite to the north should have tree protection measures taken.

~~Since my assignment was only to inventory and assess the trees and I wasn't provided with a construction proposal, I can't comment on the retention and removal of specific trees at this time. I can make recommendations for consideration when site design work begins.~~

The current plan shows eleven trees to be removed because they are in the building footprint and four trees to be removed because they are in the King County Utility easement on the east side of the property.

The current industry methodology for tree root protection is the Critical Root Zone (CRZ) formula. A CRZ is developed for an individual tree by measuring its DBH and measuring one foot out from the trunk in all directions for every one inch of trunk diameter. Using this formula, a 10" diameter tree would have a CRZ of 10' extending out from the trunk in all directions.

In some circumstances, it isn't possible to develop the property as proposed and protect this much of the root zone. What has been found successful is to allow encroachment into the CRZ on one side of the tree by up to 50%. This will still preserve over three quarters of the CRZ and most healthy trees can withstand this. This is particularly true when the other side of the tree is not disturbed at all. The same 10" DBH tree could have soil disturbance up to 5' away from its trunk on one side and be expected to survive, if the rest of its CRZ is left undisturbed. ~~Some jurisdictions refer to~~ this 50% measurement of the CRZ *is sometimes referred to* as the "Interior Critical Root Zone (ICRZ)."

To prevent unintended disturbances in the CRZ, a Tree Protection Zone (TPZ) should be established where no significant disturbance will take place. Ideally, this is at or beyond the CRZ. If the TPZ is reduced by up to 50% on one side, that would be the border of the TPZ. If the TPZ can't be set up to preserve at least three quarters of the CRZ, the tree is probably not a good candidate for retention. *This should be done for trees #4, 5, 13, 19 and 20 as well as the two Douglas firs (#10 and 11) that are located offsite to the north.*

Best management practices to reduce impacts to CRZs can include:

- Fencing of the TPZ - this is often required by the permitting jurisdiction.
- Cantilevering over root zones rather than installing a solid foundation wall.
- Use of pier piling construction methods instead of solid foundation walls.
- Cutting of large roots (over 2" diameter) that need to be removed, not tearing them out with excavation equipment
- Keeping Cut roots moist to prevent dehydration and further dieback. Covering them with moist organic mulch, wood chips or moist fabric (burlap, cloth tarp, etc.) until they are covered with soil.
- Tunneling under roots when possible.
- Using pneumatic or hydraulic excavation methods to preserve roots, rather than open trenching with excavation equipment.
- Prohibiting the storage of materials and the use of heavy equipment within the TPZ.
- *Providing extra irrigation during the summer dry season.*
- *Providing supplemental organic fertilizer and root bio-stimulant products to promote root growth.*

All of the above practices should be considered and implemented as is deemed appropriate by the City of Mercer Island. Agencies sometimes require an arborist to be onsite to monitor work done within the protected CRZs of trees. If any of the trees can't be saved due to unforeseen circumstances during construction, then the arborist can help make that determination. Tree replacement or other mitigation measures can be required by the permitting agency. Again, the arborist can help advise on what would be appropriate under the existing circumstances. *The proposed utility connection to the house is shown to run through the CRZ of the neighbor's two large Douglas firs. I recommend either tunneling or compressed air excavation through the CRZ of the these two trees.*

Tree #13 is proposed for retention, but its ICRZ will be impacted by the house construction. Appropriate BMPs will be implemented to try to successfully retain the tree. However, it is recognized that that it may not survive or thrive after construction and that removal would be required if that were the case. The City could determine appropriate mitigation at that time. The City might also determine that the risk to the tree is too great and that removal is the better course of action with some sort of mitigation planting added to the plan.

The proposed mitigation planting for this project is located along the south border of the property and on the western portion of the property on the north side of the driveway. Because of the utility easement on the east side of the property, the potential mitigation planting sites are limited. At some point, off-site mitigation planting or fee in lieu of mitigation may have to be considered, if what is proposed isn't acceptable. It is also a possibility that a smaller tree slated for removal could be transplanted and retained elsewhere on the site. Trees #11 and 12 are slated for removal, due to their condition, but they could be retained in their current location.

Tree Replacement

The proposed tree removal will require 11 tree replacement trees. At least Fifty percent of the replacements are required to be native species. The trees proposed as replacements are 1 Douglas fir, 4 shore pines and 3 vine maples for native species and 3 Japanese flowering cherries as non-native ornamental species. The trees will be planted in the dormant season and will be mulched per City specifications and will be given supplemental organic fertilizer with bio-stimulants for enhanced root growth.

Conclusion

The information in this report is based on my site visit and inspection completed on March 4, 2022 and the plans for the project that I have reviewed. I attest that all of the information within this report is accurate, to the best of my knowledge. It does not provide any guarantees or implications that conditions of the trees on the site won't change over time. All trees eventually fail and even sound, healthy trees fail during severe weather events.

Thank you for the opportunity to be of service to you with this project. Please feel free to contact me if you have any questions about this report or if you have any further need for my services.

Sincerely,

Alan Haywood

Alan Haywood – Arborist & Horticulturist, LLC.

ISA Certified Arborist/Municipal Specialist – PN 0330-AM
ISA Qualified Tree Risk Assessor
ASCA Qualified Tree and Plant Appraiser
WSNLA Certified Professional Horticulturist - 2332
ecoPRO Certified Sustainable Landscape Professional – 6017
WSDA Licensed Pest Control Consultant – 7627

Appendix A: Tree Chart – On Subject Property-*Revised 5/23*

Tree #	Species	DBH "	Cndtn	Excptnl	Comments & Recommendations
1					Not Present
2					Not Present
3					Not Present
4	BL	9	Fair	No	**Small**. Adjacent to the property line – could be a shared tree. Leans to the west, ivy on trunk, growing next to a Hawthorn tree on adjacent property. **Retain.**
5	CH	7 & 4	Fair	No	**Small**. Trunk forks at 1', leans to the south, ivy on trunk, over topped by neighbor's 24" Douglas fir. **Retain.**
6	EP	8, 5, 5, 5 & 7	Fair	No	One 3" trunk is dead, crown is dense and overgrown due to previous pruning practices, some cherry bark tortrix infestation present. **To be removed as part of King County Sewer Improvement Project.**
7	EP	3, 4, 5, 6, & 7	Poor	No	**Small**. Trunks 3, 5 and 7" are dead. Decay and cracks in trunk are present. **To be removed as part of King County Sewer Improvement Project.**
8					Not Present
9					Not Present
10					Not Present
11	As	2, 3, 3, 3, 4 & 5	Fair	No	**Small**. Poor structure, **To be removed.**
12	BS	7	Poor	No	**Small**. Leans to the west with an uneven crown. Sparse foliage and low vigor due to spruce aphid damage. **To be removed.**
13	BLM	19	Fair	No	Ivy on trunk. **Retain**.
14	BLM	18	Fair	No	Ivy on trunk. **To be removed – In house footprint.**
15	BLM	18	Fair	No	Ivy on trunk. **To be removed – In house footprint.**
16	BLM	14	Poor	No	Decay in trunk from 10 – 15'. **To be removed – In house footprint.**
17	BLM	11	Fair	No	Uneven crown due to crowding. **To be removed – In house footprint.**
18	BLM	15	Poor	No	Main trunk dead at 15'. **To be removed – In house footprint**
19	BLM	7	Good	No	**Small. Retain.**
20	BLM	11 & 14	Fair	No	Ivy on trunk, bark inclusion at fork. **Retain.**
21	BLM	7, 12, 7 & 7	Poor	No	Brittle Cinder fungus (*Kretzchmaria deusta*) present, dead wood in crown. **To be removed – In house footprint.**
22	BLM	30	Fair	Yes	Trunk forks at 12', ivy on trunk, dead wood in crown. **To be removed– In house footprint.**
23	BLM	30 & 13	Fair	Yes	30" trunk forks at 7'. 13" trunk forks at 5' with one dead leader. Recommend removal of dead leader. **To be removed as part of King County Sewer Improvement Project.**
24	DF	26	Good	No	Ivy on trunk. **To be removed – In house footprint.**

Tree #	Species	DBH "	Cndtn	Excptnl	Comments & Recommendations
25	BLM	15	Fair	No	Dead wood in crown. **To be removed ~~as part of King County Sewer Improvement Project. –~~ In house footprint.**
26	PM	10	Fair	Yes	Significant lean over trail. Tree is stable – phototropic lean is characteristic of the species. **To be removed ~~as part of King County Sewer Improvement Project. –~~ In house footprint.**
27	DF	13	Fair	No	Uneven crown. **To be ~~removed as part of King County Sewer Improvement Project. –~~ In house footprint.**
28	BCW	12	Fair	No	Trunk has dogleg and leans to the south with low taper. **To be removed as part of King County Sewer Improvement Project.**
29	BLM	18 & 10	Poor	No	Ivy on trunk, 18" trunk is forks at 18' – one fork broken off. 10" trunk has decay up to 7' with a basal hollow. **To be removed as part of King County Sewer Improvement Project.**
30	DT	4, 5, 6 & 6	Fair	No	Basal inclusion. **To be removed as part of King County Sewer Improvement Project.**
31	SS	12	Poor	No	Trunk has significant lean to the north that is self-corrected at 12'. Trunk forks at 6' with bark inclusion. **To be removed as part of King County Sewer Improvement Project.**
Cs-1	Cs	2	Fair	No	Replacement Tree. **To be relocated on site.**
Cs-2	Cs	2	Fair	No	Replacement Tree. **To be relocated on site.**
Cs-3	Cs	2	Fair	No	Replacement Tree. **To be relocated on site.**
VM-1	VM	2	Fair	No	Replacement Tree, **To be removed as part of King County Sewer Improvement Project.**
VM-2	VM	2	Fair	No	Replacement Tree, **To be removed as part of King County Sewer Improvement Project.**
VM-3	VM	2	Fair	No	Replacement Tree, **To be removed as part of King County Sewer Improvement Project.**

Abbreviations

As = Ash sp. (*Fraxinus* sp.)
DF = Douglas Fir (*Pseudotsuga mensiezii*)
BCW = Black Cottonwood (*Populus trichocarpa*)
BL = Black Locust (*Robinia Pseudoacacia*)
BLM = Bigleaf Maple (*Acer macrophyllum*)
BS = Colorado Blue Spruce (*Picea pungens*)
CH = Common Hawthorn (*Crataegus monogyna*)
Cs = Cascara (*Rhamnus purshiana*)
DT = Deciduous Tree – Unidentified
PM = Pacific Madrone
EP = European Plum (*Prunus x domestica*)
SS = Sitka Spruce (*Picea sitchensis*)
VM = Vine Maple (*Acer circinatum*)

Appendix B: Tree Chart – Off Site *in ROW*

Tree #	Species	DBH "	Cndtn	Excptnl	Comments & Recommendations
1	NS	6	Fair	No	**Small**, In ROW. **To be removed**
2	BL	6 & 2	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
3	BL	5&5	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
4	PM	10	Poor	Yes	Dead with Damaged trunk **.To be removed as part of King County Sewer Improvement Project.**
5	SW	9	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
6	FP	3	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
7	BL	9, 7 & 9	Fair	No	In ROW. **To be removed as part of King County Sewer Improvement Project.**
8	As	8	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
9	BL	8"	Fair	No	**Small**, In ROW. **To be removed as part of King County Sewer Improvement Project.**
10	DF	24"	Fair	No	Neighbor to the north. **Retain.**
11	DF	20"	Fair	No	Neighbor to the north. **Retain.**

Abbreviations

As = Ash sp. (*Fraxinus* sp.)

BL = Black Locust (*Robinia Pseudoacacia*)

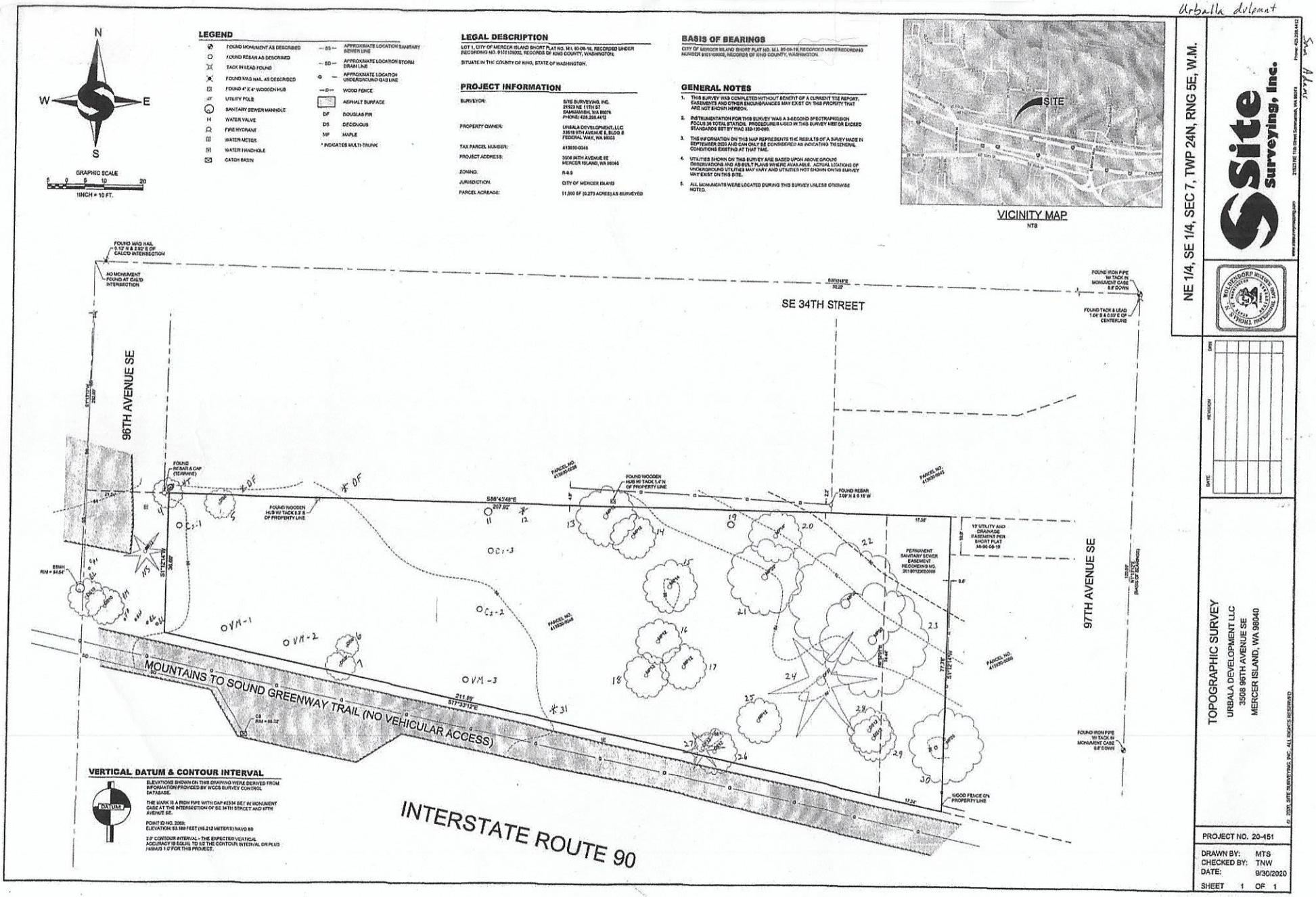
FP = Flowering Plum

NS = Norway Spruce

PM = Pacific Madrone

SW = Scouler's Willow

Appendix C: Tree Map



Appendix C
WWHM Capacity Check Output

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Adams's SFR Capacity Check
Site Name:
Site Address:
City:

Report Date:	11/14/2023
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.25
Pervious Total	0.25
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.25

Mitigated Land Use

Basin 1

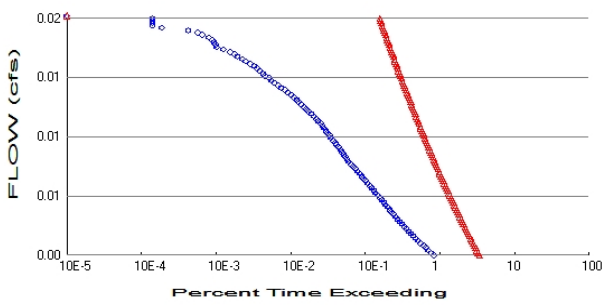
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.073
ROADS FLAT	0.03
SIDEWALKS FLAT	0.011
Impervious Total	0.114
Basin Total	0.114

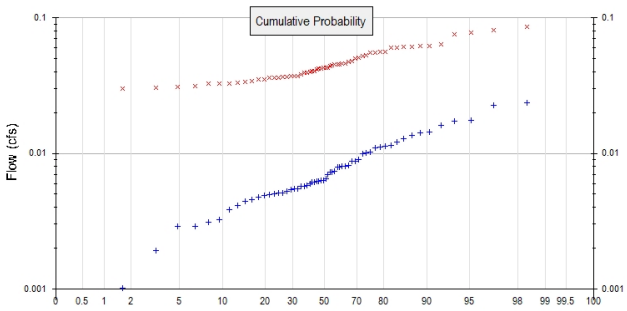
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.25
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.114

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.00735
5 year	0.011544
10 year	0.01392
25 year	0.016438
50 year	0.017996
100 year	0.019321

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.043464
5 year	0.0549
10 year	0.06267
25 year	0.072749
50 year	0.080463
100 year	0.088365

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.007	0.056
1950	0.009	0.061
1951	0.016	0.035
1952	0.005	0.031
1953	0.004	0.034
1954	0.006	0.035
1955	0.010	0.040
1956	0.008	0.039
1957	0.006	0.045
1958	0.007	0.036

1959	0.006	0.037
1960	0.011	0.036
1961	0.006	0.038
1962	0.004	0.033
1963	0.005	0.037
1964	0.007	0.036
1965	0.005	0.046
1966	0.005	0.031
1967	0.010	0.053
1968	0.006	0.060
1969	0.006	0.042
1970	0.005	0.040
1971	0.005	0.048
1972	0.012	0.050
1973	0.005	0.030
1974	0.006	0.044
1975	0.008	0.051
1976	0.006	0.034
1977	0.001	0.037
1978	0.005	0.045
1979	0.003	0.062
1980	0.011	0.056
1981	0.005	0.045
1982	0.009	0.064
1983	0.008	0.052
1984	0.005	0.033
1985	0.003	0.045
1986	0.013	0.039
1987	0.011	0.061
1988	0.004	0.037
1989	0.003	0.046
1990	0.024	0.077
1991	0.014	0.062
1992	0.005	0.033
1993	0.006	0.028
1994	0.002	0.031
1995	0.008	0.040
1996	0.017	0.043
1997	0.014	0.042
1998	0.003	0.042
1999	0.014	0.086
2000	0.006	0.043
2001	0.001	0.047
2002	0.006	0.055
2003	0.008	0.043
2004	0.010	0.081
2005	0.007	0.037
2006	0.009	0.033
2007	0.017	0.075
2008	0.023	0.061
2009	0.011	0.056

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0236	0.0863
2	0.0226	0.0808
3	0.0175	0.0775

4	0.0172	0.0755
5	0.0162	0.0640
6	0.0144	0.0619
7	0.0142	0.0619
8	0.0135	0.0608
9	0.0127	0.0608
10	0.0121	0.0606
11	0.0114	0.0604
12	0.0113	0.0563
13	0.0111	0.0562
14	0.0109	0.0555
15	0.0103	0.0551
16	0.0101	0.0531
17	0.0100	0.0521
18	0.0090	0.0508
19	0.0088	0.0499
20	0.0087	0.0483
21	0.0082	0.0472
22	0.0081	0.0461
23	0.0080	0.0460
24	0.0079	0.0454
25	0.0079	0.0453
26	0.0074	0.0452
27	0.0073	0.0447
28	0.0072	0.0441
29	0.0069	0.0430
30	0.0065	0.0429
31	0.0063	0.0428
32	0.0063	0.0422
33	0.0062	0.0420
34	0.0062	0.0416
35	0.0062	0.0405
36	0.0061	0.0403
37	0.0059	0.0401
38	0.0058	0.0394
39	0.0057	0.0393
40	0.0057	0.0382
41	0.0055	0.0370
42	0.0055	0.0370
43	0.0054	0.0369
44	0.0053	0.0368
45	0.0051	0.0368
46	0.0051	0.0363
47	0.0050	0.0361
48	0.0050	0.0361
49	0.0049	0.0353
50	0.0048	0.0352
51	0.0046	0.0341
52	0.0044	0.0338
53	0.0041	0.0333
54	0.0038	0.0329
55	0.0033	0.0326
56	0.0031	0.0326
57	0.0029	0.0313
58	0.0029	0.0308
59	0.0019	0.0307
60	0.0010	0.0302
61	0.0007	0.0282

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0037	17547	72230	411	Fail
0.0038	16166	69514	430	Fail
0.0040	14966	66861	446	Fail
0.0041	13856	64295	464	Fail
0.0043	12816	61835	482	Fail
0.0044	11809	59568	504	Fail
0.0045	10902	57386	526	Fail
0.0047	10121	55226	545	Fail
0.0048	9383	53215	567	Fail
0.0050	8733	51269	587	Fail
0.0051	8147	49408	606	Fail
0.0053	7593	47718	628	Fail
0.0054	7060	46007	651	Fail
0.0056	6590	44360	673	Fail
0.0057	6145	42756	695	Fail
0.0058	5779	41280	714	Fail
0.0060	5431	39869	734	Fail
0.0061	5097	38478	754	Fail
0.0063	4808	37110	771	Fail
0.0064	4524	35762	790	Fail
0.0066	4252	34564	812	Fail
0.0067	4017	33431	832	Fail
0.0069	3782	32254	852	Fail
0.0070	3546	31163	878	Fail
0.0071	3339	30137	902	Fail
0.0073	3138	29110	927	Fail
0.0074	2950	28169	954	Fail
0.0076	2785	27207	976	Fail
0.0077	2599	26308	1012	Fail
0.0079	2447	25431	1039	Fail
0.0080	2304	24576	1066	Fail
0.0082	2160	23784	1101	Fail
0.0083	2024	22950	1133	Fail
0.0084	1898	22223	1170	Fail
0.0086	1790	21496	1200	Fail
0.0087	1688	20794	1231	Fail
0.0089	1585	20157	1271	Fail
0.0090	1483	19483	1313	Fail
0.0092	1380	18910	1370	Fail
0.0093	1292	18324	1418	Fail
0.0095	1217	17746	1458	Fail
0.0096	1155	17212	1490	Fail
0.0098	1098	16668	1518	Fail
0.0099	1048	16140	1540	Fail
0.0100	998	15680	1571	Fail
0.0102	930	15188	1633	Fail
0.0103	884	14715	1664	Fail
0.0105	838	14258	1701	Fail
0.0106	790	13845	1752	Fail
0.0108	743	13430	1807	Fail
0.0109	718	13056	1818	Fail
0.0111	669	12701	1898	Fail
0.0112	633	12335	1948	Fail
0.0113	596	11956	2006	Fail

0.0115	567	11648	2054	Fail
0.0116	539	11280	2092	Fail
0.0118	497	10930	2199	Fail
0.0119	473	10596	2240	Fail
0.0121	436	10284	2358	Fail
0.0122	402	9997	2486	Fail
0.0124	369	9721	2634	Fail
0.0125	348	9441	2712	Fail
0.0126	323	9172	2839	Fail
0.0128	296	8926	3015	Fail
0.0129	272	8701	3198	Fail
0.0131	257	8476	3298	Fail
0.0132	235	8239	3505	Fail
0.0134	217	8006	3689	Fail
0.0135	195	7751	3974	Fail
0.0137	180	7512	4173	Fail
0.0138	158	7287	4612	Fail
0.0139	145	7090	4889	Fail
0.0141	129	6885	5337	Fail
0.0142	119	6701	5631	Fail
0.0144	110	6521	5928	Fail
0.0145	97	6329	6524	Fail
0.0147	91	6154	6762	Fail
0.0148	82	5991	7306	Fail
0.0150	76	5854	7702	Fail
0.0151	69	5696	8255	Fail
0.0152	61	5559	9113	Fail
0.0154	54	5401	10001	Fail
0.0155	48	5238	10912	Fail
0.0157	41	5112	12468	Fail
0.0158	38	4986	13121	Fail
0.0160	33	4830	14636	Fail
0.0161	27	4708	17437	Fail
0.0163	22	4575	20795	Fail
0.0164	21	4460	21238	Fail
0.0165	20	4342	21710	Fail
0.0167	19	4231	22268	Fail
0.0168	17	4126	24270	Fail
0.0170	14	4008	28628	Fail
0.0171	12	3901	32508	Fail
0.0173	9	3811	42344	Fail
0.0174	4	3711	92775	Fail
0.0176	3	3604	120133	Fail
0.0177	3	3525	117500	Fail
0.0179	3	3435	114500	Fail
0.0180	3	3369	112300	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 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
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.

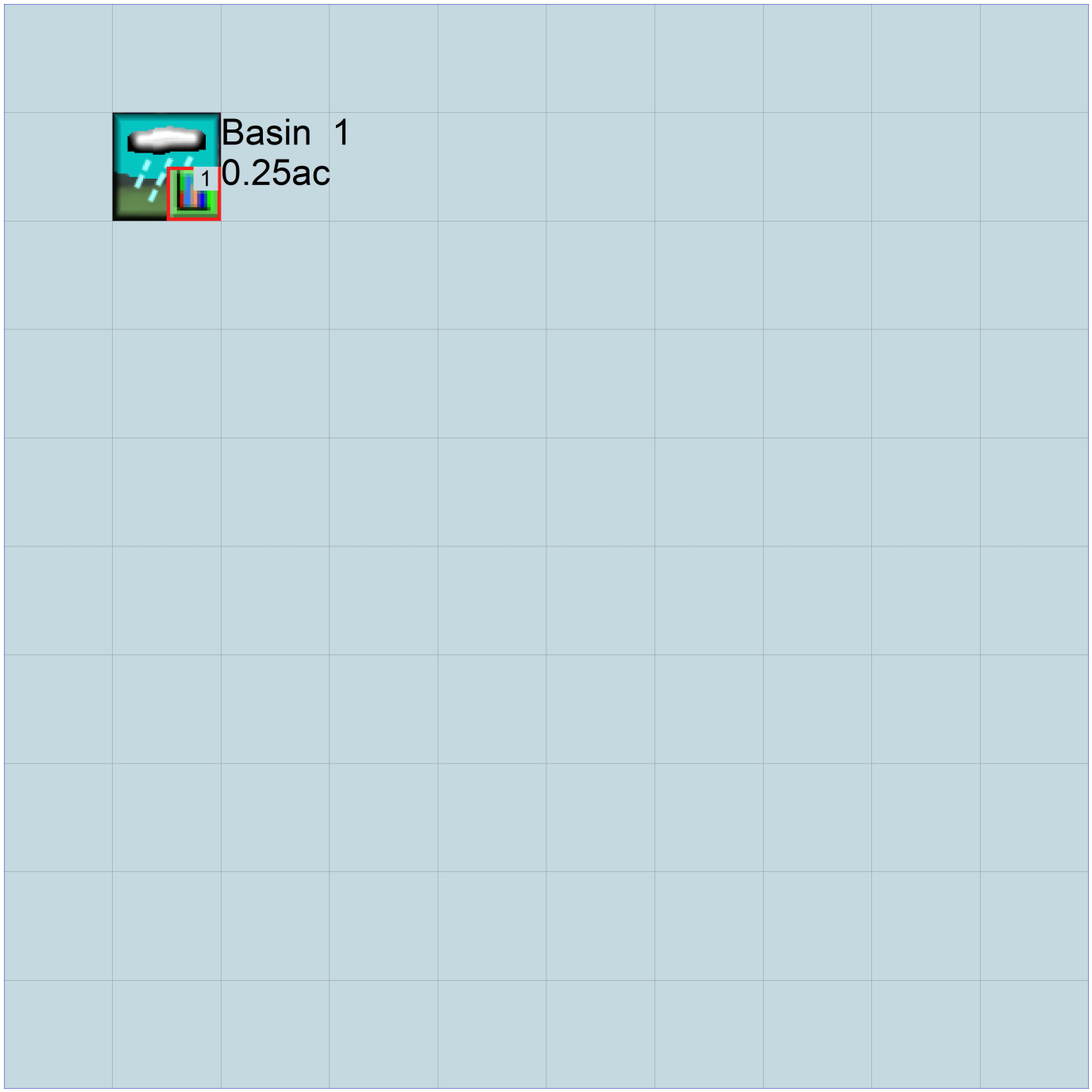
PERLND Changes

No PERLND changes have been made.

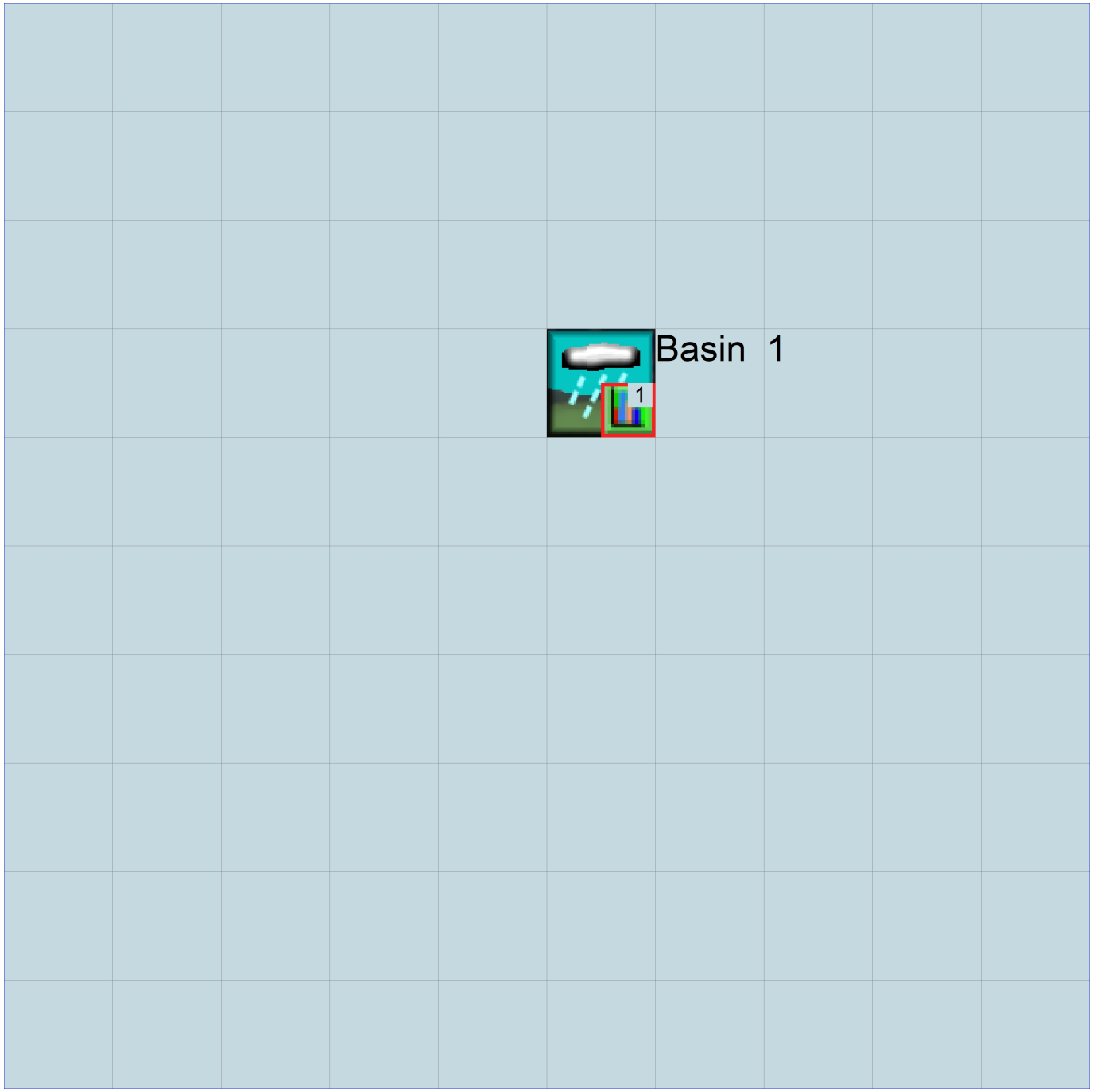
IMPLND Changes

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   Adams's SFR Capacity Check.wdm
MESSU       25   MitAdams's SFR Capacity Check.MES
            27   MitAdams's SFR Capacity Check.L61
            28   MitAdams's SFR Capacity Check.L62
            30   POCAdams's SFR Capacity Check1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       4
      IMPLND       1
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  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           ***
  END GEN-INFO
  *** Section PWATER***

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

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

  PWAT-PARM1
```

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

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

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

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

END PERLND

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

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

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

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

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

  IWAT-PARM3
```

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

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

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
IMPLND   4                      0.073     COPY   501     15
IMPLND   1                       0.03     COPY   501     15
IMPLND   8                      0.011     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

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