BEYLER CONSULTING

24th Ave Short Plat Drainage

SITE ADDRESS: 13307 24th Avenue South, Seatac, WA 98168
SECTION 16, TOWNSHIP 23, RANGE 04

Technical Information Report

Prepared For: **Cuong & Phuong Trinh**
12200 Roseburg Ave S
Burien, WA 98168
(206) 596-6144

Date Prepared: **December 2020**

Prepared By: **Jerrett Schwab, EIT**
Rebecca Burke, EIT

Reviewed By: **Jim Cook, P.E.**

Beyler Consulting LLC
5920 100th St SW, #25
Lakewood, WA 98499
(253) 984-2900

CONTACT
(253) 984-2900
info@beylerconsulting.com
beylerconsulting.com

CORPORATE OFFICE
5920 100th St. SW, #25
Lakewood, WA 98499

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CIVIL & STRUCTURAL ENGINEERING | LAND SURVEYING | PLANNING
PROJECT MANAGEMENT | FEASIBILITY | PERMIT EXPEDITING

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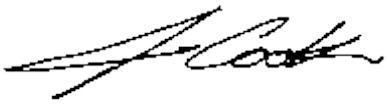
I. Project Engineers Certificate

I hereby certify that this **Technical Information Report** for the **24th Ave Short Plat Drainage Plan** has been prepared by me or under my direct supervision and meets minimum standards of **City of Seatac** and normal standards of engineering practice. I understand that **City of Seatac** does not and will not assume liability for the sufficiency, suitability, or performance of civil drawings designed by me, or under my supervision, and stamped by me.

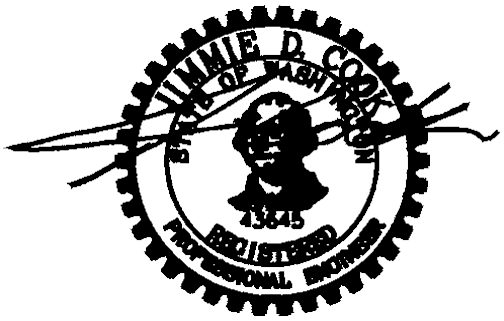
Prior to submitting the drawings and report to **City of Seatac** for review, I have carefully reviewed the checklist and assure that applicable items provided on it have been included into the documents being submitted.



Signature

December 4, 2020

Date



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II. Drainage Report

Section 1 – Project Overview

This project proposes to divide an existing parcel to develop two new single-family residences with associated driveways, utilities, drainage, grading, and landscaping. The property's address is 13307 24th Avenue South with a parcel identification number of 6404600020 in the City of Seatac. The site is 18,010 sf (0.413 ac), has a zoning classification of UL-7,200 per the Seatac Zoning Map.

The existing property is partially developed with a gravel road on the southern half of the site provides access from 24th Avenue South to adjacent parcel 6404600037, which is west of the project site. Two storage structures reside on the project parcel. The existing slope of the parcel is moderate at 5-15% from the 24th Avenue South access west toward the adjacent parcel to the west. A vicinity map is shown as Figure 1.2 – Vicinity Map.

The project will add or replace up to 5,292 square feet of new impervious surfaces, approximately 4,725 square feet of which is categorized as pollution generating hard surface (PGHS). Table 1 shows the new and replaced hard surface project totals, as well as 800 sf for future driveways that are not part of this project but whose PGHS areas are accounted for in stormwater design. The project will result in more than 2,000 square feet of new or replaced impervious surface so per section 1.1.1 of the 2016 Manual, it requires Drainage Review. The project is subject to Full Drainage Review per Figure 1.1.2.A of the King County Surface Water Design Manual (See Appendix A, Figure A.1). Full Drainage Review requires the project to demonstrate compliance with Core Requirements #1-9 and Special Requirements #1-5.

Table 1 – Proposed Added/Replaced Impervious Area

Access PGHS	DWY PGHS[1]	Roof	ROW PGHS	ROW non-PGHS Hard Surface	Gravel	Total
3,000 sf	800 sf	0 sf	925	567	0	5,292 sf

1. Two driveways, one for each residence at 400 sf, are accounted for in stormwater design.

This Technical Information Report (TIR) demonstrates the how the proposed project satisfies the requirements of the 2016 King County Surface Water Design Manual (2016 Manual).

Figure 1: TIR Worksheet (5 Pages)

KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: Cuong & Phuong Trinh
Phone: (206) 596-6144
Address: 12200 Roseburg Ave. S
Burien, WA 98168
Project Engineer: Jim Cook, PE
Company: Beyler Consulting, LLC
Phone: (253) 984-2900

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: 24th Ave Short Plat Drainage
DPER Permit #:
Location Township: 26
Range: 04
Section: 16
Site Address: 13307 24th Ave. S
Seatac, WA 98168

Part 3 TYPE OF PERMIT APPLICATION

- ☒ Landuse (e.g.,Subdivision / Short Subd. / UPD)
- ☐ Building (e.g.,M/F / Commercial / SFR)
- ☐ Clearing and Grading
- ☐ Right-of-Way Use
- ☐ Other

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other
- ☐ Shoreline Management
- ☐ Structural Rockery/Vault/
- ☐ ESA Section 7

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report		Site Improvement Plan (Engr. Plans)	
Type of Drainage Review (check one):	☒ Full ☐ Targeted ☐ Simplified ☐ Large Project ☐ Directed	Plan Type (check one):	☒ Full ☐ Modified ☐ Simplified
Date (include revision dates):	November 2020	Date (include revision dates):	November 2020
Date of Final:		Date of Final:	

Part 6 SWDM ADJUSTMENT APPROVALS

Type (circle one): Standard / Experimental / Blanket
Description: (include conditions in TIR Section 2)

Approved Adjustment No. _____ Date of Approval: _____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / (No)

Start Date: _____

Completion Date: _____

Describe: _____

Re: KCSWDM Adjustment No. _____

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : N/A

Special District Overlays: N/A

Drainage Basin: Duwamish River

Stormwater Requirements: All Core and Special Requirements

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- ☐ River/Stream
- ☐ Lake
- ☐ Wetlands
- ☐ Closed Depression
- ☐ Floodplain
- ☐ Other
- ☐ Steep Slope
- ☐ Erosion Hazard
- ☐ Landslide Hazard
- ☐ Coal Mine Hazard
- ☐ Seismic Hazard
- ☐ Habitat Protection
- ☐

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
Urban Land - Alderwood complex	0-5%	Low

- ☐ High Groundwater Table (within 5 feet)
- ☐ Other
- ☐ Sole Source Aquifer
- ☐ Seeps/Springs

☐ Additional Sheets Attached

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 11 DRAINAGE DESIGN LIMITATIONS

REFERENCE	LIMITATION / SITE CONSTRAINT
☐ Core 2 – Offsite Analysis	
☐ Sensitive/Critical Areas	
☐ SEPA	
☒ LID Infeasibility	Low infiltration rates
☐ Other	
☐	

☐ Additional Sheets Attached

Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area)

Threshold Discharge Area: (name or description)	TDA #1
Core Requirements (all 8 apply):	
Discharge at Natural Location	Number of Natural Discharge Locations: 1
Offsite Analysis	Level: (1) / 2 / 3 dated: 11/5/2020
Flow Control (include facility summary sheet)	Level: 1 / (2) / 3 or Exemption Number _____ Flow Control BMPs Basic Dispersion
Conveyance System	Spill containment located at: _____
Erosion and Sediment Control / Construction Stormwater Pollution Prevention	CSWPP/CESCL/ESC Site Supervisor: TBD Contact Phone: TBD After Hours Phone: TBD
Maintenance and Operation	Responsibility (circle one): (Private) / Public If Private, Maintenance Log Required: (Yes) / No
Financial Guarantees and Liability	Provided: Yes / (No)
Water Quality (include facility summary sheet)	Type (circle one): Basic / Sens. Lake / Enhanced Basic / Bog or Exemption No. 2 Landscape Management Plan: Yes / (No)
Special Requirements (as applicable):	
Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac. (None) Name: _____
Floodplain/Floodway Delineation	Type (circle one): Major / Minor / Exemption / (None) 100-year Base Flood Elevation (or range): _____ Datum:
Flood Protection Facilities	Describe:

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 12 TIR SUMMARY SHEET	(provide one TIR Summary Sheet per Threshold Discharge Area)
Source Control (commercial / industrial land use)	Describe land use: Describe any structural controls:
Oil Control	High-use Site: Yes / No Treatment BMP: _____ Maintenance Agreement: Yes / No with whom? _____
Other Drainage Structures	
Describe:	

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☒ Clearing Limits	☒ Stabilize exposed surfaces
☒ Cover Measures	☒ Remove and restore Temporary ESC Facilities
☒ Perimeter Protection	☒ Clean and remove all silt and debris, ensure operation of Permanent Facilities, restore operation of Flow Control BMP Facilities as necessary
☒ Traffic Area Stabilization	☐ Flag limits of SAO and open space preservation areas
☐ Sediment Retention	☐ Other _____
☐ Surface Water Collection	
☐ Dewatering Control	
☐ Dust Control	
☐ Flow Control	
☒ Protection of Flow Control BMP Facilities (existing and proposed)	
☒ Maintain BMPs / Manage Project	

Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch)

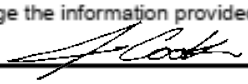
Flow Control	Type/Description	Water Quality	Type/Description
☐ Detention	_____	☐ Vegetated Flowpath	_____
☐ Infiltration	_____	☐ Wetpool	_____
☐ Regional Facility	_____	☐ Filtration	_____
☐ Shared Facility	_____	☐ Oil Control	_____
☒ Flow Control BMPs	Sheet Flow Dispersion	☐ Spill Control	_____
☐ Other	_____	☐ Flow Control BMPs	_____
		☐ Other	_____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 15 EASEMENTS/TRACTS		Part 16 STRUCTURAL ANALYSIS
☐ Drainage Easement		☐ Cast in Place Vault
☐ Covenant		☐ Retaining Wall
☐ Native Growth Protection Covenant		☐ Rockery > 4' High
☐ Tract		☐ Structural on Steep Slope
☒ Other Access		☐ Other _____

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER

I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate.



12/4/2020

Signed/Date

Figure 1.2: Vicinity Map

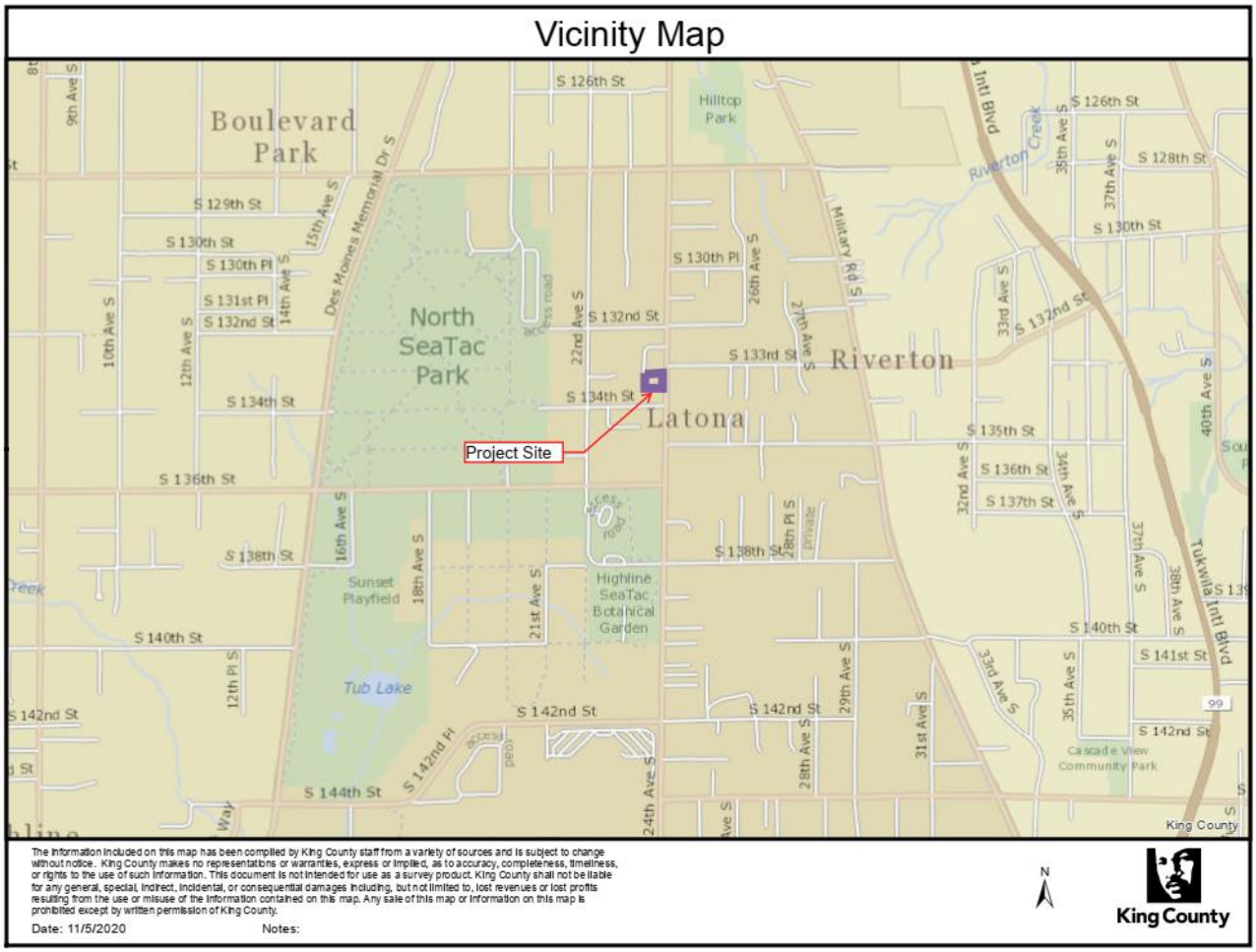


Figure 1.3 - Site Characteristics

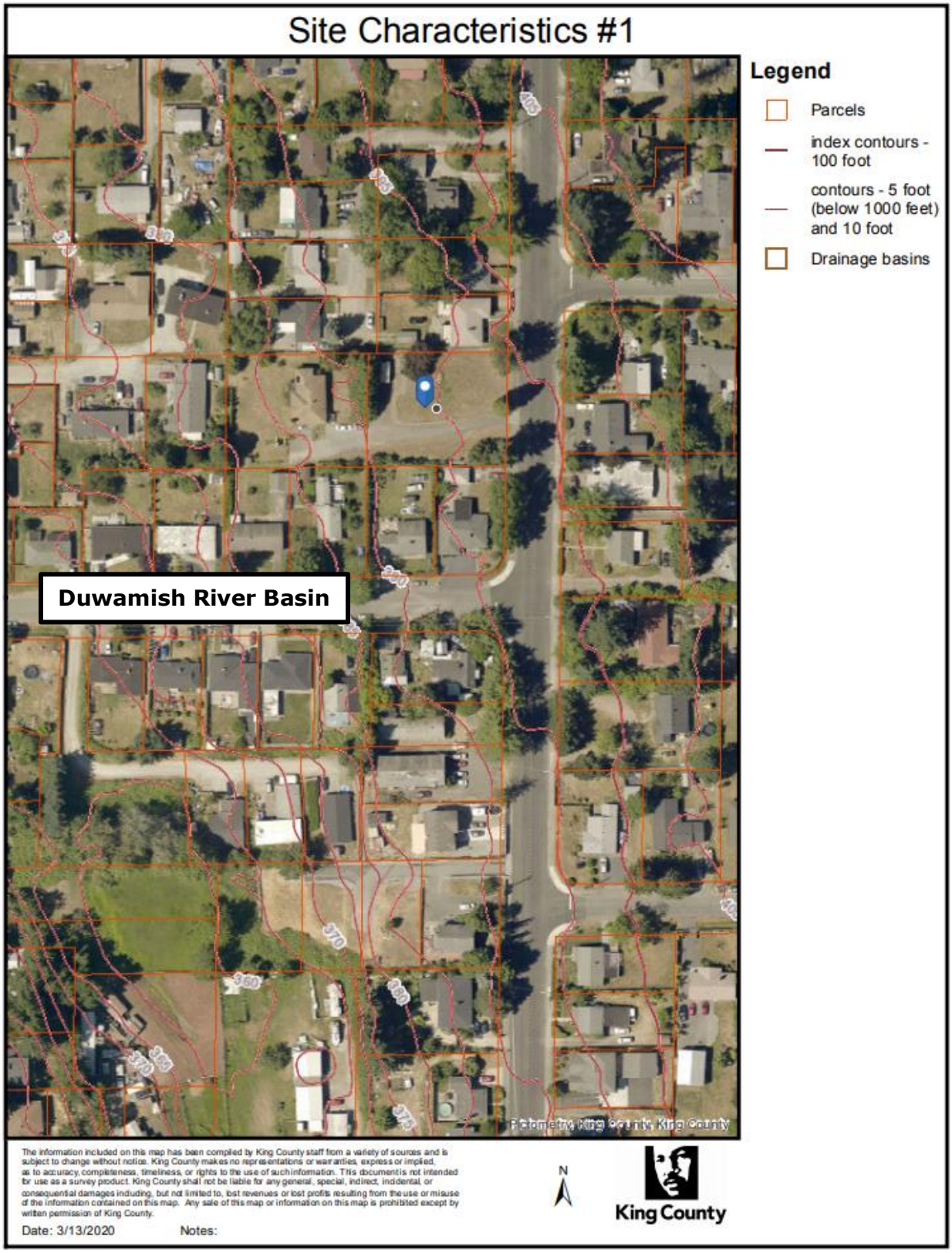


Figure 1.4: Soils

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3055	Urban land-Alderwood complex, 0 to 5 percent slopes	0.4	100.0%
Totals for Area of Interest		**0.4**	**100.0%**

Section 2 – Conditions and Requirements Summary

Projects triggering a Directed Drainage Review must meet Core Requirements #1-9 from Section 1.2, and Special Requirements #1-5 from Section 1.3.

Core Requirement #1: Discharge at the Natural Location
This project will use basic dispersion to mitigate the runoff generated by impervious surface. This will allow stormwater to flow as it does now and exit the site at its natural location in the southwest corner. This is shown in the Predeveloped and Developed Basin Maps shown as Appendix A.7 and A.8, respectively.

Core Requirement #2: Offsite Analysis
An offsite analysis and Level 1 downstream analysis can be found in Section 3 of this report.

Core Requirement #3: Flow Control
This project is exempt from flow control facilities per exception #2 of Section 1.2.3.1.B of the Manual. The site is classified as a Conservation Flow Control Area (Level 2) within the Duwamish-Green River Basin per the City of Seatac Flow Control Applications Map. See Figure A.2 in Appendix A and Section 4.D. of this report for more details on flow control.

Core Requirement #4: Conveyance System
No conveyance systems were required onsite for this project. The existing and proposed replacement stormwater infrastructure in the right of way will receive approximately the same flow as existing conditions.

Core Requirement #5: Construction Stormwater Pollution Prevention
A Construction Stormwater Pollution Prevention Plan is in Appendix C.

Core Requirement #6: Operations and Maintenance
An Operations and Maintenance manual is in Section 10.

Core Requirement #7: Financial Guarantees and Liability
Before starting construction, a drainage facilities restoration and site stabilization financial guarantee will be posted. This guarantee will be sufficient to cover the cost of corrective work performed on the project.

Core Requirement #8: Water Quality
This project is exempt from Water Quality requirements per exemption #1, Surface Area, in section 1.2.8 of the manual. The site is classified as a Basic Water Quality Treatment Area per the City of Seatac Water Quality Applications Map (Figure A.3). According to Section 1.2.8 of the Manual, projects that produce 5,000 sf or more of pollution-generating hard surfaces (PGHS) in a threshold discharge area require water quality facilities. The project will not produce more than 5,000 square feet of PGHS in its threshold discharge area.

Core Requirement #9 Flow Control BMPs
Per 1.2.9.1 of the 2016 Manual, projects that are subject to core requirement #9 must apply flow control BMPs to provide flow mitigation where flow control facilities are not

required. The project is inside the UGA and on a lot less than 5 acres, so it receives a Small Subdivision and Urban Subdivision Projects classification and associated BMP requirements for plat infrastructure improvements. Flow control is required as specified in the requirements list of Section 1.2.9.3.2. The project will provide onsite flow control BMPs using the list where feasible. See Section 4.C. of this report for more details on flow control BMPs.

Special Requirement #1: Other Adopted Area-Specific Requirements
There are no adopted area-specific requirements for the site.

Special Requirement #2: Floodplain/Floodway Delineation
This site is not within a 100-year floodplain. See Appendix A.6: FEMA FIRMette.

Special Requirement #3: Flood Protection Facilities
This requirement is not applicable.

Special Requirement #4: Source Control
This requirement is not applicable for residential projects.

Special Requirement #5: Oil Control
This requirement is not applicable for residential projects.

Section 3 – Offsite Analysis

Task 1: Study Area Maps

King County iMAP and City of Seatac GIS were reviewed to determine critical areas, drainage problems, basin features, and general information about the site and surrounding areas. See figures 1.2 – 1.4 in Section 1 and Figures A.4 – A.6 in Appendix A for the Study Area maps and figures used for Task 2: Resource Review.

Task 2: Resource Review

The 2016 KCSWDM outlines the resource requirements for off-site analysis:

- *Adopted Basin Plans*
  The property is found in the Duwamish River drainage basin and within the Duwamish–Green River watershed. The WRIA classification is Duwamish-Green (9).

- *Floodplain/Floodway (FEMA) Maps*
  Panel 53033C0960G of the Federal Emergency Management Agency maps shows that the site is categorized in Zone X, an area of minimal flood hazard. See Appendix A.6: FEMA FIRMette

- *Other Offsite Analysis Reports in the Sub-Basin*
  No other reports were found.

- *Sensitive Areas*

No sensitive areas appear to be on site, near the project site, or have the potential to be affected by the project.

- *Drainage Complaints and Studies*
  No relevant drainage complaints in the downstream area corridor were found to have been filed within the last 10 years per King County iMap.

- *Road Drainage Problems*
  No known road drainage problems exist.

- *King County Soils Survey*
  The Natural Resources Conservation Service (NRCS) Soil Survey classifies the site's soil as mainly Urban Land Alderwood Complex. See the soils report found in Appendix B of this report for additional soils information.

- *Wetlands Inventory Maps*
  There are no wetlands on or near the site.

- *Migrating River Studies*
  There are no migrating river studies available.

- *Clean Water Act Section 303d List of Polluted Waters*
  No polluted waters were found.

- *King County Designated Water Quality Problems*
  No water quality problems were found.

- *Adopted Stormwater Compliance Plans*
  There are no stormwater compliance plans available.

Task 3: Field Inspection

The upstream and downstream corridor was inspected utilizing available maps and on a site visit conducted on October 23, 2020.

Task 4: Drainage System Description and Problem Descriptions

The existing drainage system on the subject parcel consists of sheet flow across the site from east toward the northwest corner for ultimate collection into Catch Basins on South 134th Street, the entire system is a series of pipes and catch basins afterwards.

Task 5: Mitigation of Existing or Potential Problems

No existing problems were found and the small amount of increase in runoff is not expected to cause or exacerbate any problems.

Section 4 – Flow Control and Water Quality Facility Analysis and Design

A. Existing Site Hydrology

The existing site is 18,010 sf (0.413 ac) and is currently lightly developed with a gravel access road running to the adjacent western parcel from 24th Avenue South. The rest of the lot has been cleared and is in a pasture condition. The property contains moderate slopes that run down from the east. The total vertical relief is approximately 9 feet. Stormwater that falls on site will sheet flow to the west and slightly south. Stormwater that does not infiltrate into the ground will exit the property over the access road to the west. A geotechnical evaluation found that the site is underlain by glacial till. Infiltration testing was conducted and found perched groundwater and an infiltration rate that is considered infeasible for infiltration facilities. Stormwater that falls on the frontage improvements will flow to the City stormwater sewer by way of catch basins in the right of way. A network then conveys this stormwater south from 24th Avenue South to meet with storm sewer underlaying South 134th Street, where it flows west to meet with the project parcel discharge.

B. Developed Site Hydrology

The immediate development of this property will consist of the access road, sanitary sewer, and water utilities. Single-family residences and associated driveways will be constructed as future projects on Lot 1 and Lot 2. Runoff generated by future driveways is accounted for with stormwater management design under this project. The residences will require stormwater management to mitigate stormwater runoff generated by additional impervious surface.

C. Performance Standards

This project is a subdivision project and is within the Urban Growth Area and less than 5 acres in size. Therefore, flow control BMPs for plat infrastructure improvements shall meet the requirements described in section 1.2.9.3.2 of the Manual. Section 1.2.9.3.2 lists the BMPs that must be evaluated for the plat infrastructure improvements on this project. The list is below with the feasibility following.

SMALL ROAD IMPROVEMENT AND URBAN ROAD IMPROVEMENT PROJECTS BMP REQUIREMENTS

1. **Full Dispersion** – There is not enough room or native vegetation for full dispersion
2. Infiltration BMPs
    a. **Full Infiltration** – Infiltration is infeasible per the Geotechnical report.
    b. **Limited Infiltration –** Infiltration is infeasible per the Geotechnical report.
    c. **Bioretention –** Infiltration is infeasible per the Geotechnical report.
    d. **Permeable Pavement –** Infiltration is infeasible per the Geotechnical Report.
3. **Basic Dispersion** – Basic Dispersion will be used to mitigate the runoff from the access road and future driveways.

4. **Soil moisture holding capacity** – Disturbed soil will be amended.

Section 1.2.9.2 lists the BMPs to be evaluated for individual lots. The lots created by this short plat meet the requirements for a Small Lot as they are less than 22,000 square feet. Section 1.2.9.2.1 lists the small lot BMP requirements.

SMALL LOT BMP REQUIREMENTS

1. **Full Dispersion –** There is not enough room or native vegetation for full dispersion.
2. **Full infiltration of roof runoff -** Infiltration is infeasible per the Geotech report.
3. **Infiltration BMPs**
    a. **Full infiltration -** Infiltration is infeasible per the Geotech report.
    b. **Limited infiltration -** Infiltration is infeasible per the Geotech report.
    c. **Bioretention -** Infiltration is infeasible per the Geotech report.
    d. **Permeable Pavement -** Infiltration is infeasible per the Geotech report.
4. **Basic Dispersion -** Basic dispersion is fully implemented for the new access and driveway surfaces.
5. **Minimum implementation for impervious area of at least 10% of site/lot**
    a. The project will implement BMPs for at least 1,200 square feet of impervious surface for each lot. The BMPs of *Reduced Impervious Surface Credit* and *Native Growth Retention Credit* do not need to be evaluated.
6. **Soil moisture holding capacity –** Disturbed soil will be amended.
7. **Perforated Pipe Connection –** Not applicable, not connecting to local drainage system.

The following paragraphs further explain the BMPs implemented on site for permanent stormwater management.

Amended Soils

The soil moisture holding capacity of new pervious surfaces must be protected in accordance with KCC 16.82.100 (F) and (G). KCC 16.82.100 (F) requires that the duff layer or native topsoil be retained to the maximum extent practicable. KCC 16.82.100 (G) requires soil amendment to mitigate for lost moisture holding capacity where compaction or removal of some or all of the duff layer or underlying topsoil has occurred. The amendment must be such that the replaced topsoil is a minimum of 8 inches thick, unless the applicant demonstrates that a different thickness will provide conditions equivalent to the soil moisture holding capacity native to the site. The replaced topsoil must have an organic content of 5-10% dry weight and a pH suitable for the proposed surface vegetation (for most soils in King County, 4 inches of well-rotted compost tilled into the top 8 inches of soil is sufficient to achieve the organic content standard.) The amendment must take place between May 1 and October 1. The specifications for compost for soil amendment can be found in Reference 11-C in the Manual.

Basic Dispersion

Basic Dispersion will be utilized to manage all stormwater runoff from the proposed access road and future driveways. Sheet flow dispersion will be used to permanently manage

stormwater produced onsite by these impervious areas, which allows 20 feet of width to flow in a 10-foot vegetated flow path.

D. Flow Control System

This site does not require flow control systems. The site lies within a Conservation Flow Control Area. According to Section 1.2.3.1.B of the Manual Exception 2 the facility requirement in Conservation Flow Control Areas is waived for any threshold discharge area in which there is no more than a 0.15 cfs difference in the sum of developed 100-year peak flows for the target surfaces subject to this requirement and the historic site conditions 100-year peak flows. The predeveloped and developed project areas were modeled in WWHM2012 to compare the flow rates. The predeveloped and developed areas can be found in Table 4 below with the flow frequency comparison in Table 5.

Table 4 – WWHM2012 Input w/out Credits

Surface	Existing (ac)	Developed (ac)
C, Forest, Mod	0.460	-
C, Pasture, Mod	-	0.339
Sidewalk, Flat	-	0.013
Driveway, Flat	-	0.108

Table 5 - Flow Frequency

Return Period (15-Minute)	**Predeveloped Flow (cfs)**	**Developed Flow (cfs)**
2-Year	0.0137	0.0544
5-Year	0.0224	0.0730
10-Year	0.0281	0.0864
25-Year	0.0348	0.1048
50-Year	0.0394	0.1195
100-Year	**0.0437**	**0.1352**

The 100-year flows are shown as the last row of Table 5. The developed flow results in a 0.915 cfs increase in flows. This is less than 0.15 cfs so the site is exempt from the construction of flow control facilities. The full WWHM analysis can be found in Appendix D.

E. Water Quality System

This project is exempt from water quality facilities per exemption 1 in Section 1.2.8. of the Manual. This is a surface area exemption which requires less than 5,000 square feet

of PGIS and less than ¾ acre of PGPS. This project will add or replace 4,725 square feet of PGIS which is less than the 5,000 square feet required and will not produce more than ¾ acre PGPS.

Section 5 – Conveyance System Analysis and Design

No conveyance calculations were necessary for this project. The existing and proposed replacement stormwater infrastructure in the right of way will receive approximately the same flow as existing conditions.

Section 6 – Special Reports and Studies

A geotechnical report was furnished by Colbalt Geosciences on August 9, 2020 can be found in Appendix B of this report.

Section 7 – Other Permits

No other permits are known to affect this drainage review.

Section 8 – CSWPP Analysis and Design

A Construction Stormwater Pollution Prevention Plan (CSWPPP) can be found in Appendix C.

Section 9 – Bond Quantities, Facility Summaries, and Declaration of Covenant

Bond quantities, facility summaries, and any declarations of covenants will be provided upon request.

Section 10 – Operations and Maintenance Manual

This section contains maintenance instructions for the onsite stormwater BMPs. The continued maintenance of these BMPs ensures that they function properly and effectively as designed. Failure to properly maintain the BMPs can result in unintended flows that may adversely effect on site and downstream properties.

MAINTENANCE INSTRUCTIONS FOR BASIC DISPERSION

Your property contains a stormwater management flow control BMP (best management practice) called ***"basic dispersion,"*** which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious surfaces or non-native pervious surfaces on your property.

Basic dispersion is a strategy for utilizing any available capacity of onsite vegetated areas to retain, absorb, and filter the runoff from developed surfaces. This flow control BMP has two primary components that must be maintained:

(1) the devices that disperse runoff from the developed surfaces and

(2) the vegetated area over which runoff is dispersed.

Dispersion Devices

The **dispersion devices** used on your property include the following as indicated on the flow control BMP site plan (CHECK THE BOX(ES) THAT APPLY):

❑ splash blocks, ❑ rock pads, ❑ gravel filled trenches, ☒ sheet flow.

MAINTENANCE RESTRICTIONS

The size, placement, composition, and downstream flowpaths of these devices as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval either from the King County Water and Land Resources Division or through a future development permit from King County.

INSPECTION FREQUENCY AND MAINTENANCE GUIDELINES

This flow control BMP has two primary components that must be maintained:

(1) the devices that disperse runoff from the developed surfaces and

(2) the vegetated flowpath area over which runoff is dispersed.

Maintenance of Dispersion Devices

- Dispersion devices must be inspected annually and after major storm events to identify and repair any physical defects.
- When native soil is exposed or erosion channels are present, the sources of the erosion or concentrated flow need to be identified and mitigated.
- Concentrated flow can be mitigated by leveling the edge of the pervious area and/or realigning or replenishing the rocks in the dispersion device, such as in rock pads and gravel filled trenches.

Maintenance of Vegetated Flowpaths

- The vegetated area over which runoff is dispersed must be maintained in good condition free of bare spots and obstructions that would concentrate flows.

RECORDING REQUIREMENT

These basic dispersion flow control BMP maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant and grant of easement** per Requirement 3 of Section C.1.3.4 of the King County *Surface Water Design Manual*. The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; the King County Department of Permitting and Environmental Services (DPER) may require additional instructions based on site-specific conditions. See King County's Surface Water Design Manual website for additional information and updates.

NO. 34 – SHEET FLOW BMP			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
Site	Trash and debris	Trash and debris accumulated on the sheet flow site.	Sheet flow site free of any trash or debris.
Sheet flow area	Erosion	Soil erosion occurring in sheet flow zone.	Soil erosion is not occurring and rills and channels have been repaired.
	Concentrated flow	Sheet flow is not occurring in the sheet flow zone.	Sheet flow area is regraded to provide sheet flow.
Inspection	Frequency	Annually and after large storms	Rain harvesting equipment is functioning normally.

III. Appendices

Appendix A – Maps, Figures, and Flowcharts

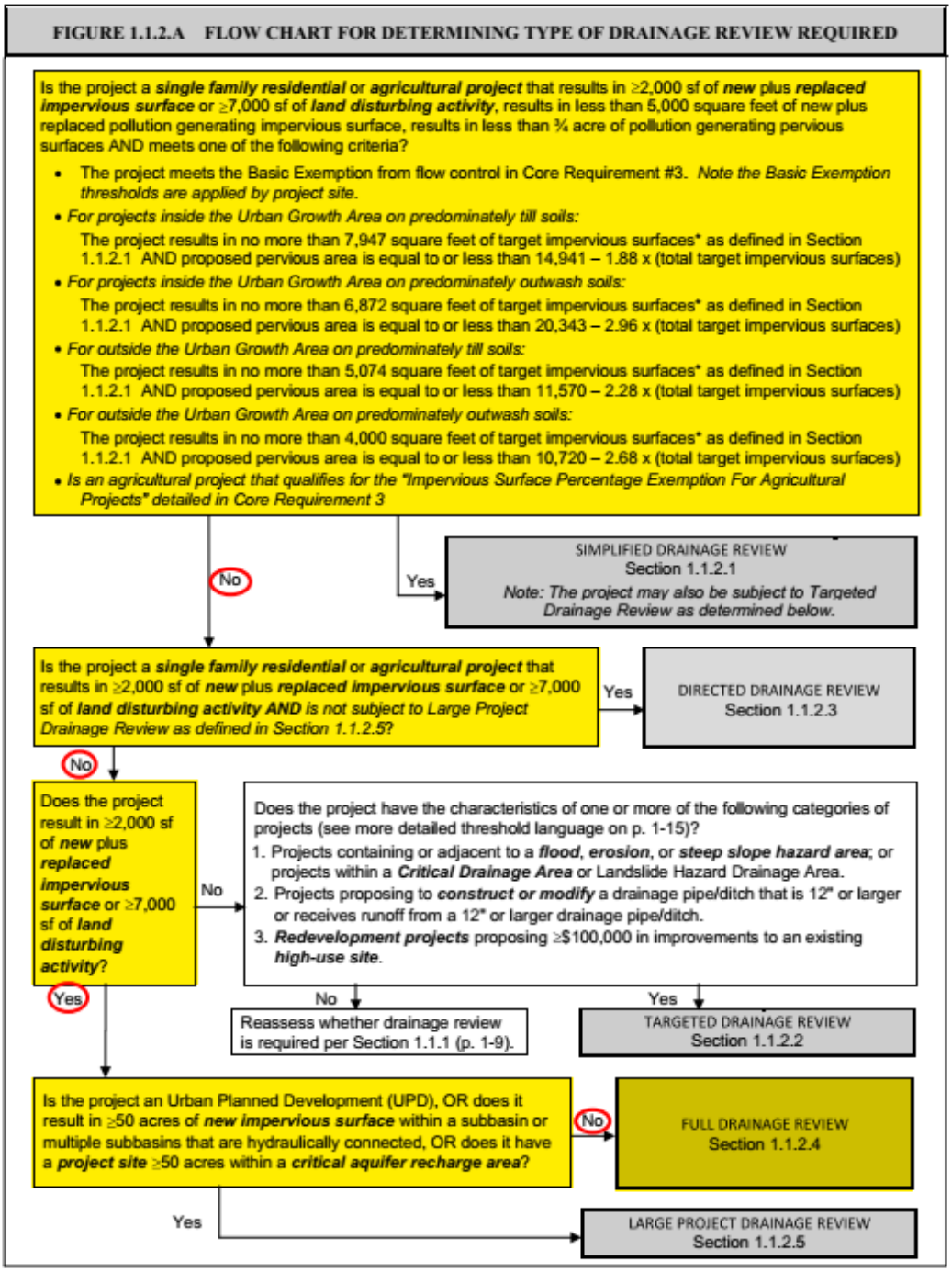


Figure A.1: Drainage Review Flowchart

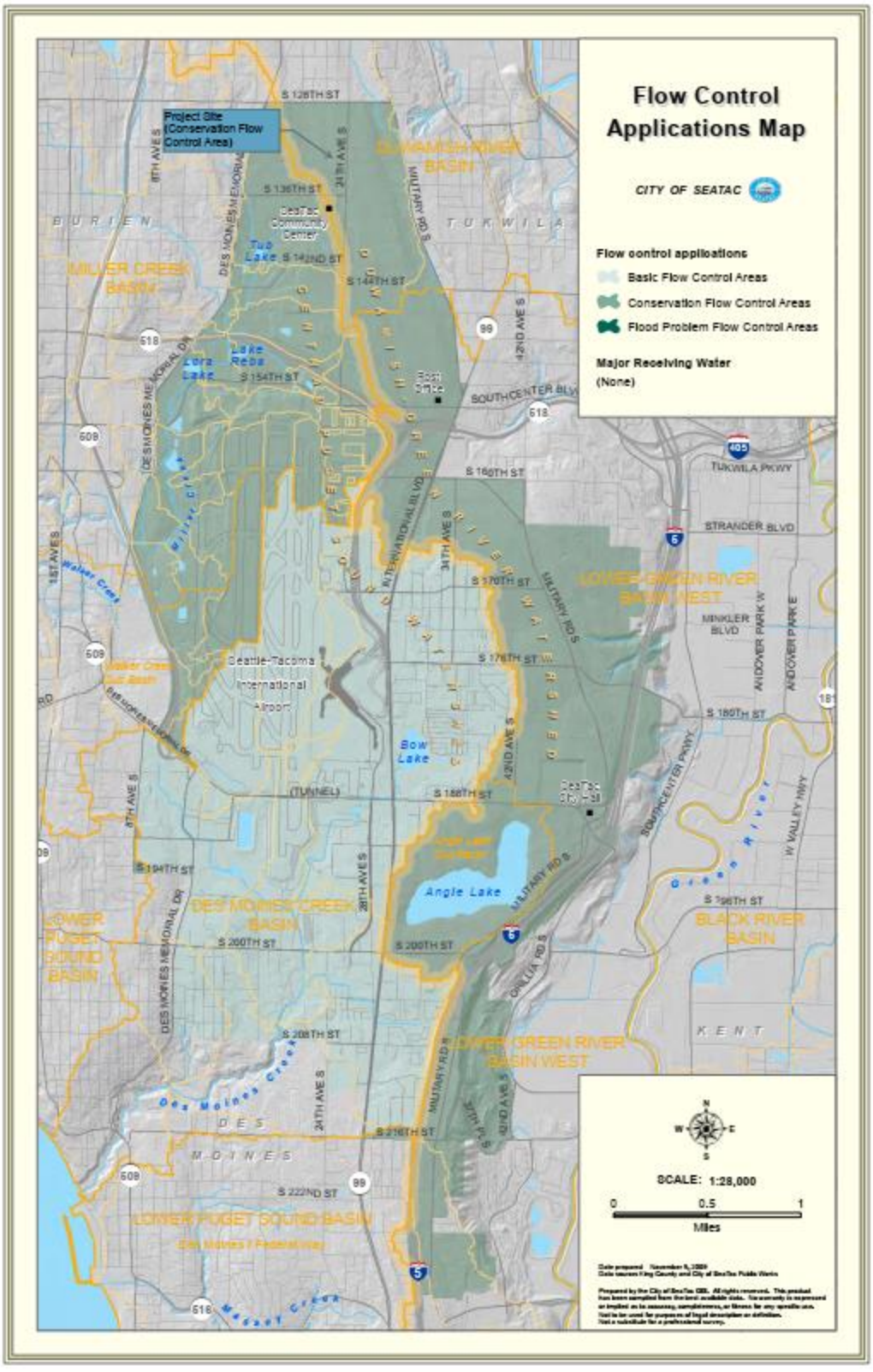


Figure A.2: Flow Control Applications Map

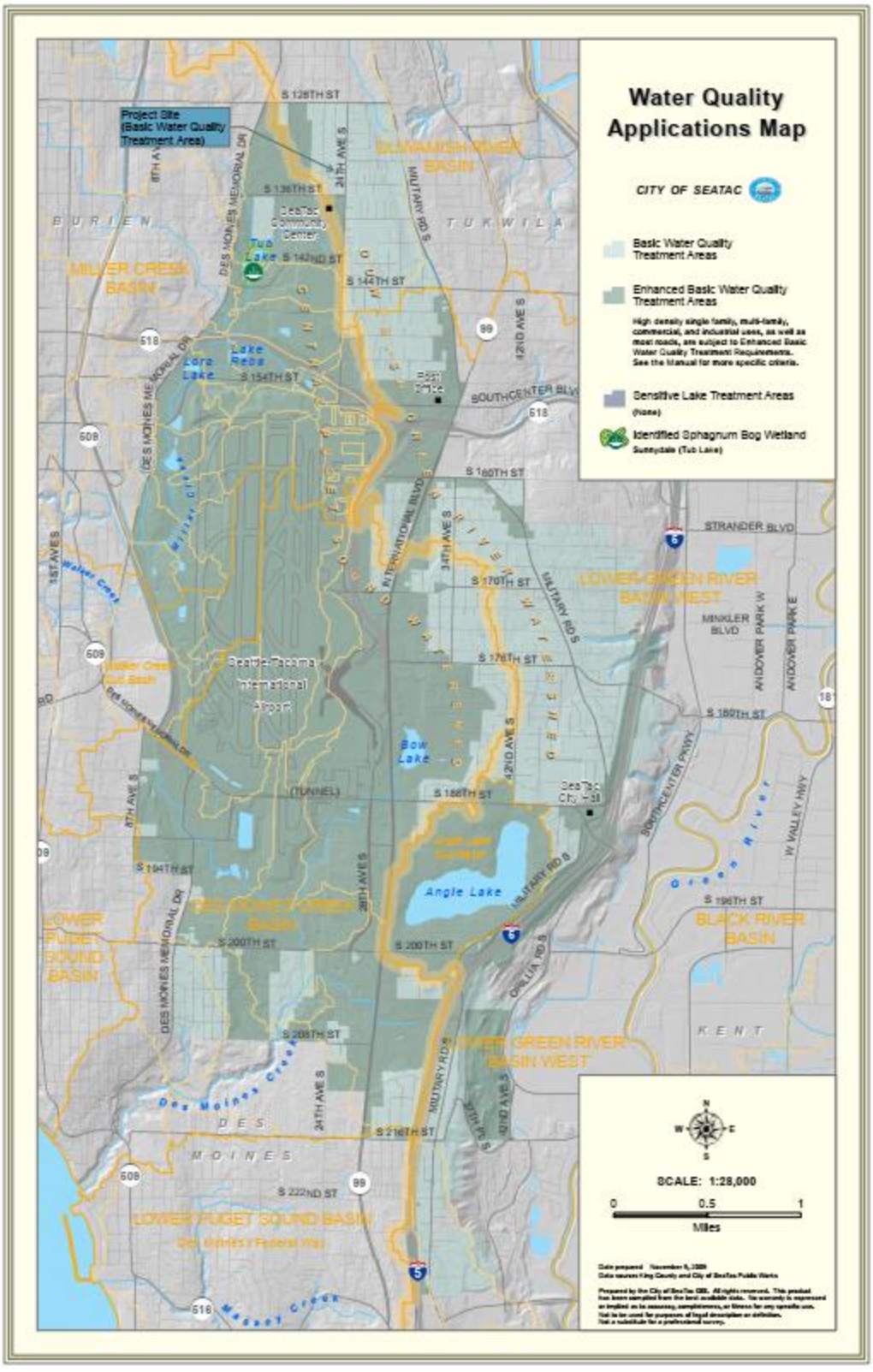


Figure A.3: Water Quality Applications Map

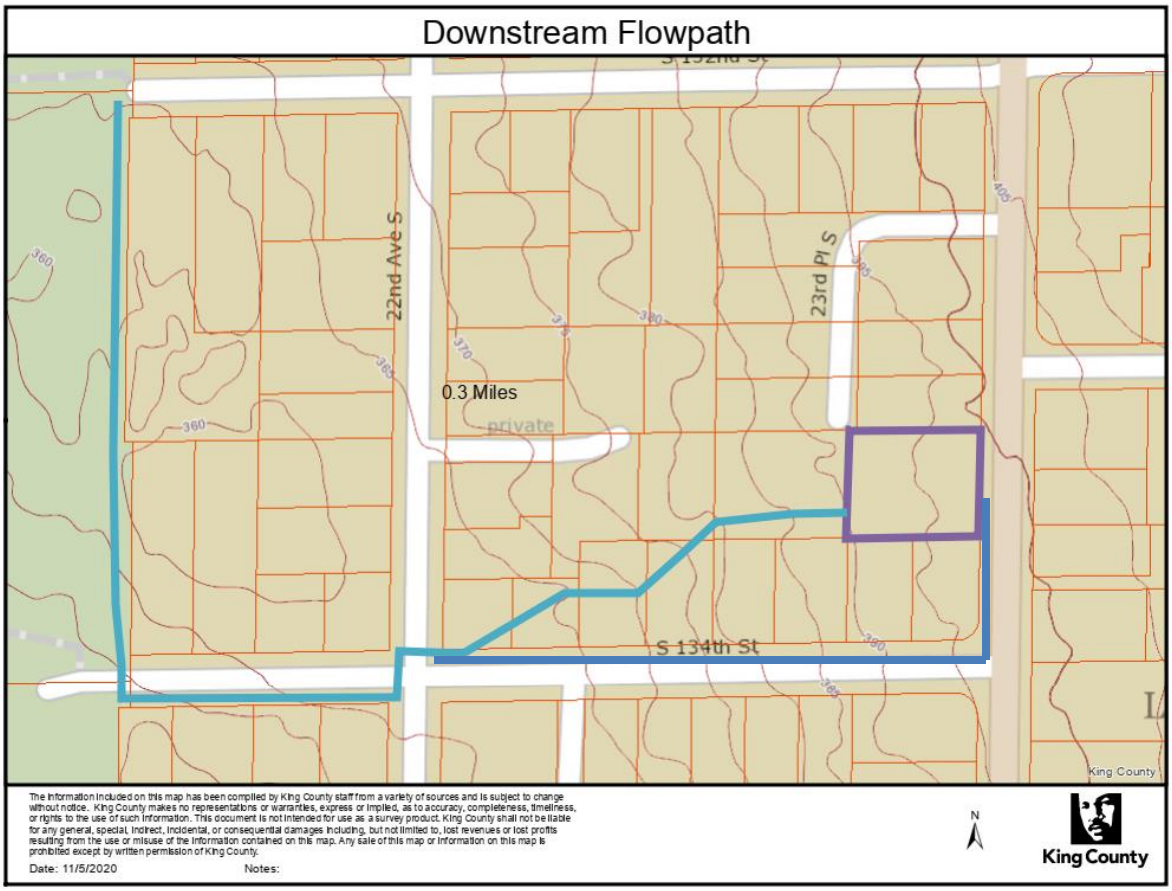


Figure A.4: ¼ Mile Downstream Flowpath

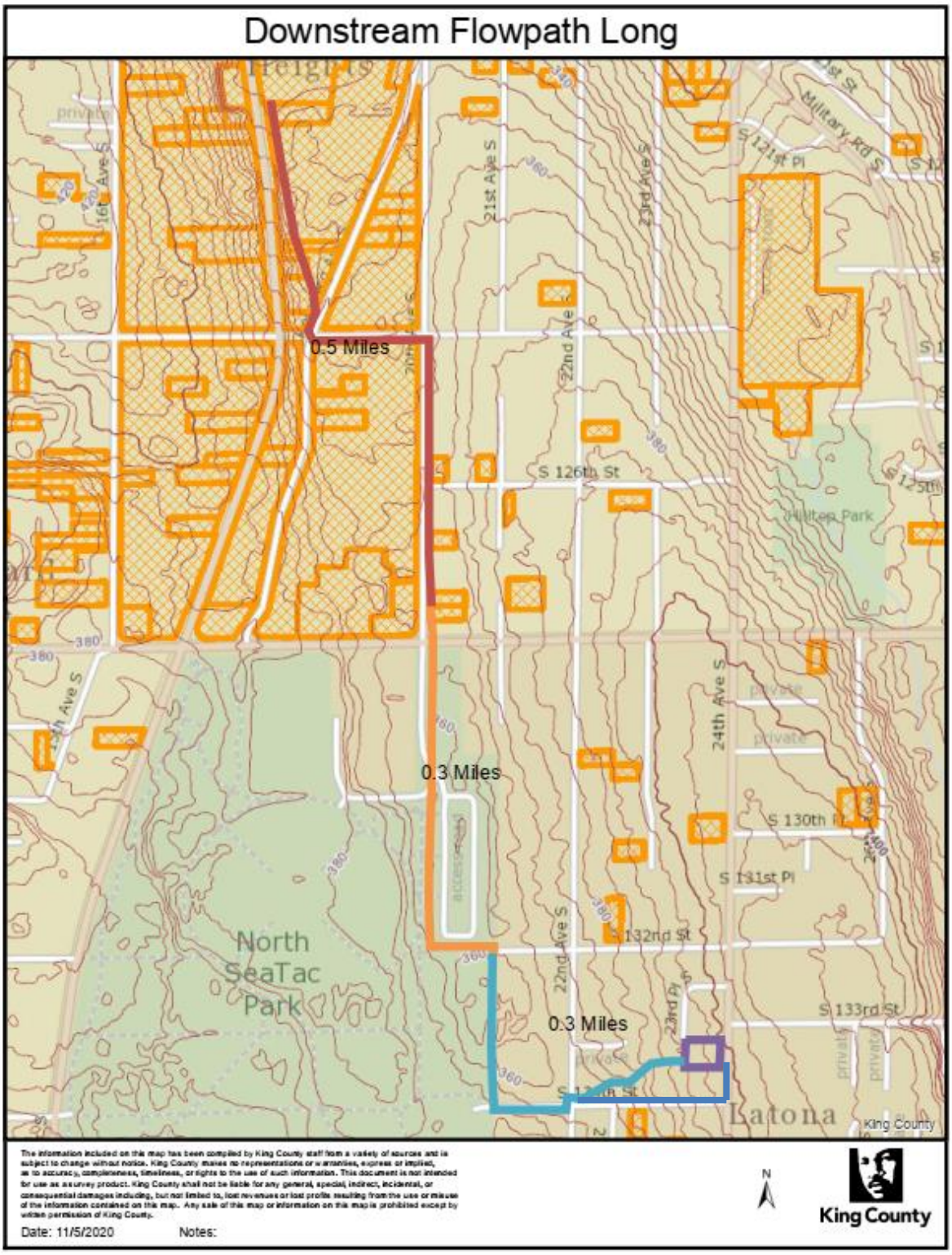


Figure A.5: 1 Mile Downstream Flowpath

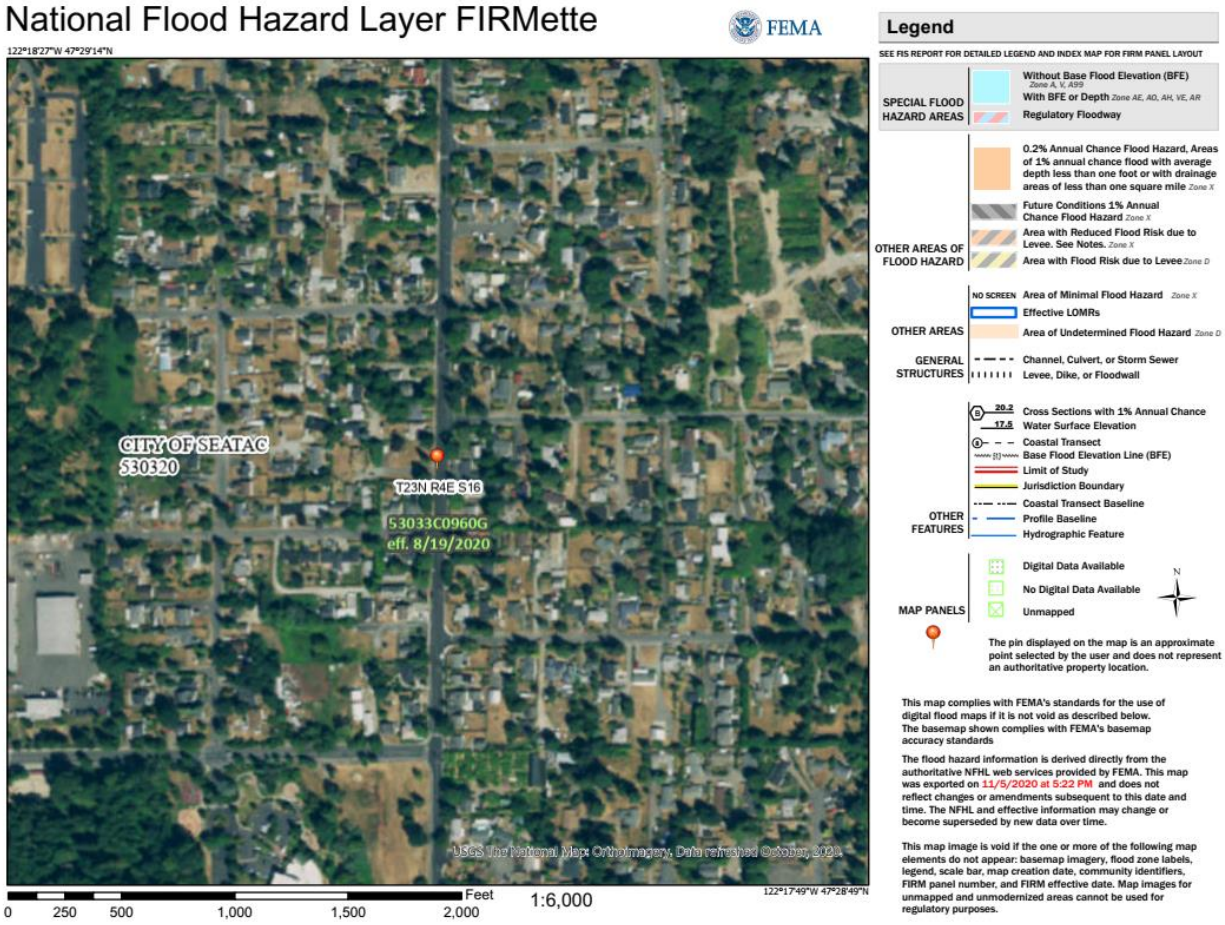
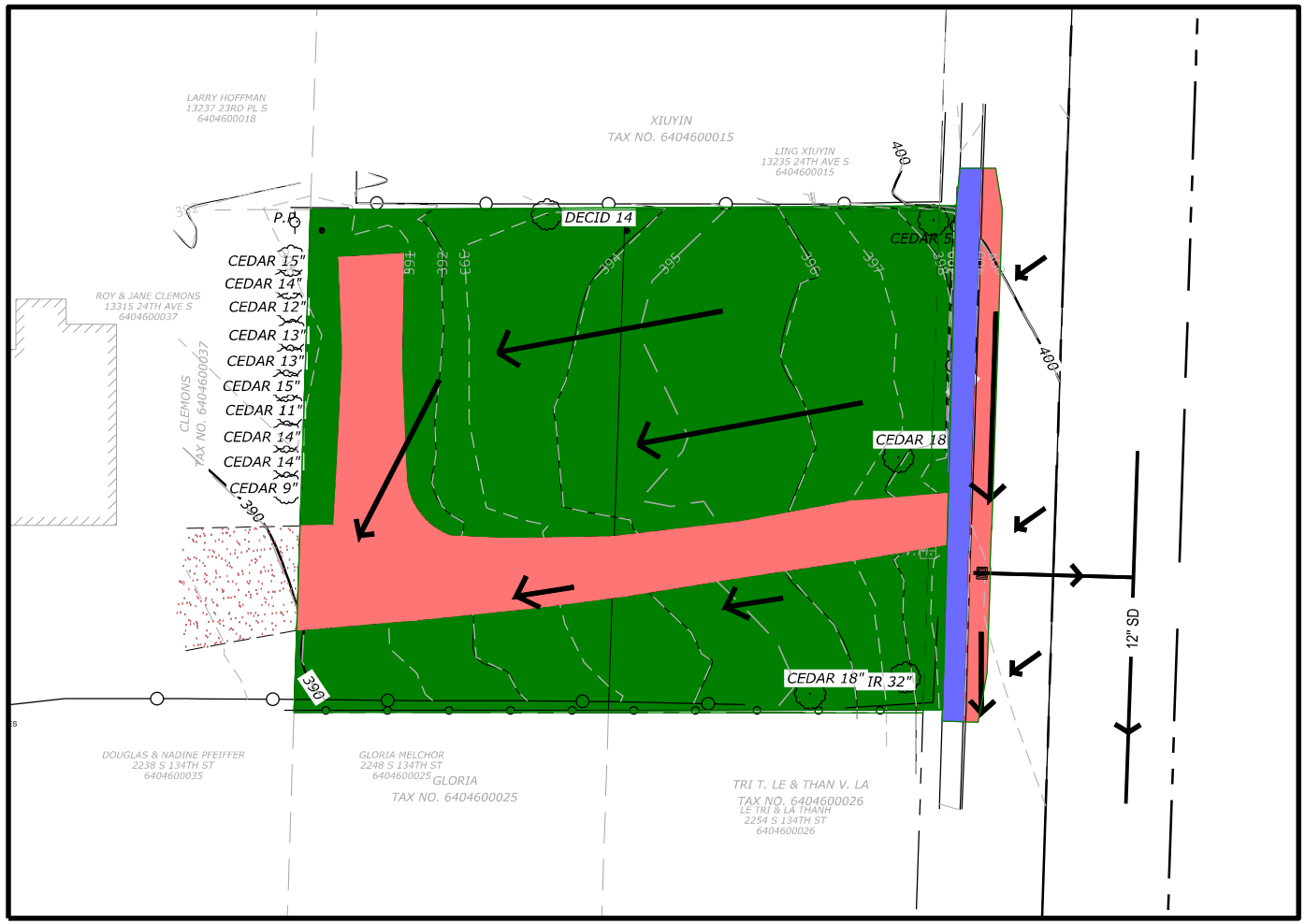


Figure A.6: FEMA FIRMette

Appendix A.7: Predeveloped Basin Map



AREA TOTALS			
	DESCRIPTION	AREA, SF (TOTAL)	AREA, AC (TOTAL)
	EXISTING PGHS	5,003	0.115
	CONCRETE	704	0.016
	PERVIOUS	14,325	0.329
TOTAL LAND AREA		20,032	0.460

Scale: 1"=

PREDEVELOPED BASIN MA

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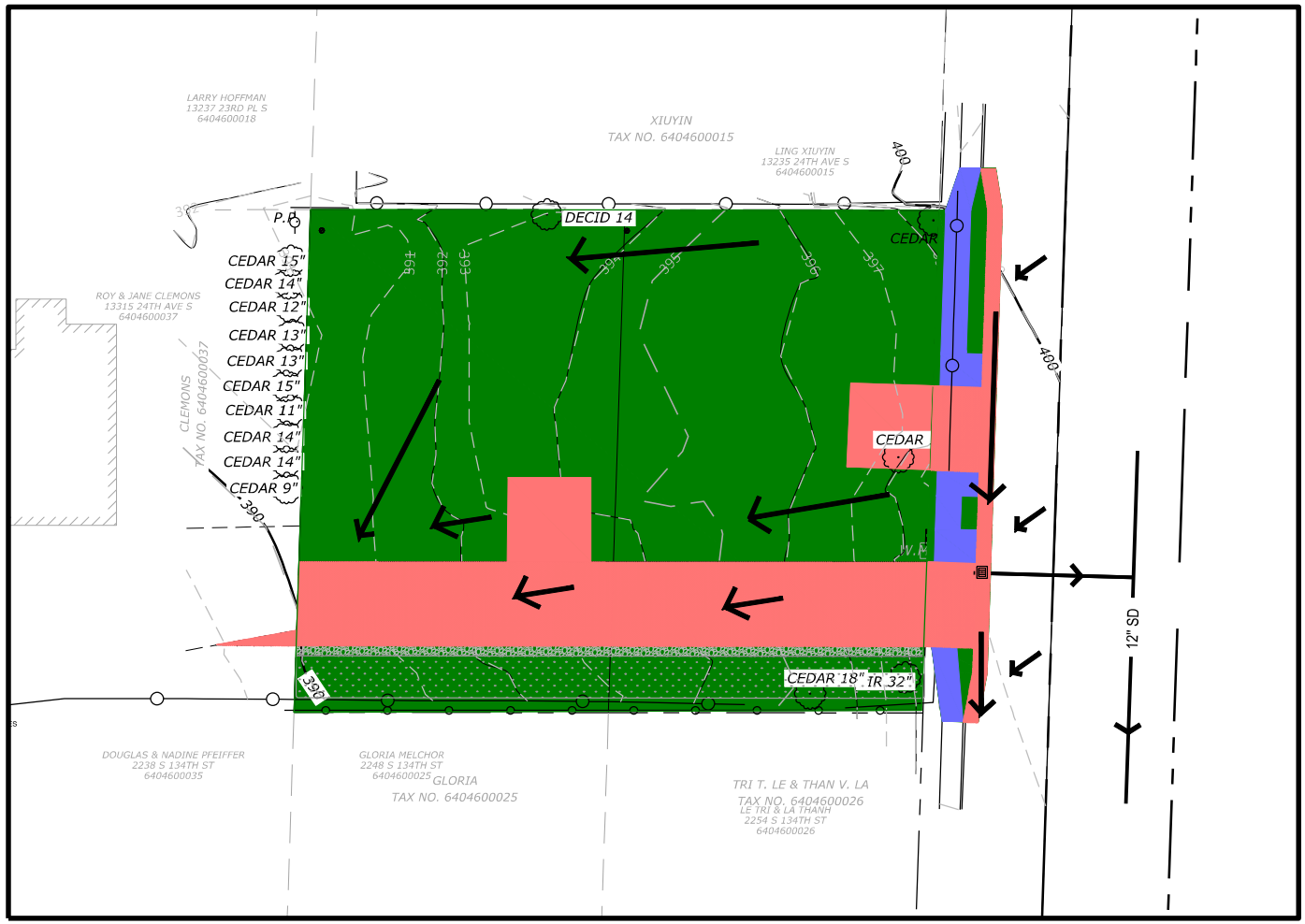
PROJECT MANAGEMENT | FEASIBILITY | PERMIT EXPEDITING

Project: *Trinh Drainage*

Project No: *20.00100* Designed By: RRB Checked By: RRB Date: 12/3/2020

CORPORATE OFFICE | 5920 100th St, Ste #25 | Lakewood, WA 98499 | phone: 253-984-2900 | beylerconsulting

Appendix A.8: Developed Basin Map



AREA TOTALS			
	DESCRIPTION	AREA, SF (TOTAL)	AREA, AC (TOTAL)
	NEW/REPLACED PGHS	4,725	0.108
	CONCRETE	567	0.013
	PERVIOUS	14,749	0.339
TOTAL LAND AREA		20,041	0.460

Scale: 1"=

DEVELOPED BASIN MA

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Appendix B – Geotechnical Report & NRCS Soil Survey

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

August 9, 2020

Cuong Trinh
C/O Kaycee Doty
kdoty@beylerconsulting.com

RE: Limited Geotechnical Evaluation
Proposed Two Lot Development
13307 24th Avenue South
Seatac, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our limited geotechnical evaluation at the referenced site.

The purpose of our evaluation was to determine the feasibility of utilizing infiltration devices for stormwater runoff management along with providing recommendations for foundation and retaining wall design.

Site and Project Description

The site is located at 13307 24th Avenue South in Seatac, Washington. The site consists of one nearly rectangular parcel (No. 6404600020) with a total area of about 18,000 square feet.

The property is undeveloped and vegetated with grasses and sparse bushes/trees. The site is nearly level to slightly sloping downward from east to west with relief of about 3 feet. There are local short walls near the east property line and along the east end of the north property line. These walls face into the property.

The site is bordered to the north, south, and west by residential properties and to the east by 24th Avenue South.

The project includes subdivision of the property into two lots followed by construction of a new multi-story residence with garage and crawlspace areas on each of the new lots. Stormwater management may include dispersion, detention, or infiltration facilities depending on feasibility.

Area Geology

The Geologic Map of King County indicates that the site is underlain by Vashon Glacial Till.

Vashon Glacial Till consists of nearly impermeable mixtures of silt, sand, gravel, and clay. These materials are typically dense to very dense. Vashon Recessional Outwash often overlies the till. Recessional outwash has not been consolidated by glacial activity and can be permeable.

Soil & Groundwater Conditions

As part of our evaluation, we excavated two test pits within the property to determine the shallow soil and groundwater conditions, where accessible.

The test pits encountered about 6 inches of topsoil and grass underlain by 2 to 3 feet of loose to medium dense, silty-fine to medium grained sand with gravel and debris (Fill). This layer was underlain by approximately 2.5 to 4 feet of loose to medium dense, silty-fine to medium grianed sand with gravel (Weathered Glacial Till). This layer was underlain by dense to very dense, silty-fine to medium grained sand with gravel (Glacial Till), which continued to the termination depths of the test pits.

Groundwater was not encountered in the explorations during the field work. We observed mottled soils between about 3 and 6 feet below grade. This indicates that perched groundwater may be present seasonally within the weathered glacial till, just below the fill.

Stormwater Management Feasibility

The site is underlain by fill and at depth by weathered and unweathered glacial till. These materials are not conducive for infiltration of runoff. The unweathered glacial till acts as a restrictive layer which prevent vertical infiltration of runoff.

We performed an in-situ infiltration test (Small Scale PIT) in TP-1 at a depth of approximately 4 feet below grade. After saturation, testing and application of correction factors for site variability (0.7), testing (0.5), and influent control (0.9), the infiltration rate was 0.11 inches per hour. This is lower than what is considered to be feasible. We excavated below the area after testing and found perched groundwater (from the testing) at a depth of 6 feet below grade.

It is likely that there will be seasonal perched groundwater at variable depths below the site during the wet season and the unweathered glacial till acts as a restrictive layer. We do not recommend utilizing infiltration devices at this site.

At this time, options for stormwater management likely include dispersion devices if there are adequate flow pants, rain gardens, or detention with overflow to City infrastructure. Due to the presence of fill, we suggest utilizing detention systems with overflow to City stormwater utilities. We can provide additional recommendations upon request.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

Foundation Design

The proposed residences may be supported on shallow spread footing foundation systems bearing on undisturbed dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 2 inches in size. The fill varied from 2.5 to 3.5 feet below grade in our test pits.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 225 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Concrete Retaining Walls

The following table, titled **Wall Design Criteria**, presents the recommended soil related design parameters for retaining walls with a level backslope. Contact Cobalt if an alternate retaining wall system is used. This has been included if detention vaults are to be utilized.

Wall Design Criteria	
"At-rest" Conditions (Lateral Earth Pressure – EFD[+])	55 pcf (Equivalent Fluid Density)
"Active" Conditions (Lateral Earth Pressure – EFD[+])	35 pcf (Equivalent Fluid Density)
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	11H* (Uniform Distribution)
Seismic Increase for "Active" Conditions (Lateral Earth Pressure)	6H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 300 pcf EFD[+]
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.40

[*]H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),
[+]EFD – Equivalent Fluid Density

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls. Uniform horizontal lateral active and at-rest pressures on the retaining walls from vertical surcharges behind the wall may be calculated using active and at-rest lateral earth pressure coefficients of 0.3 and 0.5, respectively. A soil unit weight of 125 pcf may be used to calculate vertical earth surcharges.

To reduce the potential for the buildup of water pressure against the walls, continuous footing drains (with cleanouts) should be provided at the bases of the walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, with perforations placed down and enveloped by a minimum 6 inches of pea gravel in all directions.

The backfill adjacent to and extending a lateral distance behind the walls at least 2 feet should consist of free-draining granular material. All free draining backfill should contain less than 3 percent fines (passing the U.S. Standard No. 200 Sieve) based upon the fraction passing the U.S. Standard No. 4 Sieve with at least 30 percent of the material being retained on the U.S. Standard No. 4 Sieve. The primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls, which require interior moisture sensitive finishes.

We recommend that the backfill be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. In place density tests should be performed to verify adequate compaction. Soil compactors place transient surcharges on the backfill. Consequently, only light hand operated equipment is recommended within 3 feet of walls so that excessive stress is not imposed on the walls.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Closure

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above and for the current site conditions and should not be used for any other site.

Sincerely,

Cobalt Geosciences, LLC

8/9/2020
Phil Haberman, PE, LG, LEG
Principal

PH/sc

TP-1 **Approximate Test Pit Location**

N

COBALT GEOSCIENCES	Proposed Two Lot Development 13307 24th Avenue South Seatac, Washington	**SITE PLAN** **FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	<#200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Moisture Content Definitions

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

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Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Soil Classification Chart

Figure C1

Test Pit TP-1

Date: August 4, 2020	Depth: 8'	Groundwater: None
Contractor: Jim	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description
				Topsoil/Grass
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, with debris, dark yellowish brown to grayish brown, dry to moist. (Fill)
2				
3				
4			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to grayish brown, moist. (Weathered Glacial Till)
5				
6				
7			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)
8				
9				End of Test Pit 8'
10				

Groundwater

Moisture Content (%): Plastic Limit — Liquid Limit

DCP Equivalent N-Value: 0 10 20 30 40 50

Test Pit TP-2

Date: August 4, 2020	Depth: 8'	Groundwater: None
Contractor: Jim	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description
				Topsoil/Grass
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, trace debris, dark yellowish brown to grayish brown, dry to moist. (Fill)
2				
3			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to grayish brown, moist. (Weathered Glacial Till)
4				
5				
6				
7			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)
8				
9				End of Test Pit 8'
10				

Groundwater

Moisture Content (%): Plastic Limit — Liquid Limit

DCP Equivalent N-Value: 0 10 20 30 40 50

COBALT GEOSCIENCES

Proposed Two Lot Development
13307 24th Avenue South
Seatac, Washington

Test Pit Logs

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Appendix C – Construction Stormwater Pollution Prevention Plan

BEYLER
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24th Ave Short Plat Drainage

SITE ADDRESS: 13307 24th Avenue South, Seatac, WA 98168
SECTION 16, TOWNSHIP 23, RANGE 04

Construction Stormwater Pollution Prevention Plan

Prepared For: **Cuong & Phuong Trinh**
12200 Roseburg Ave S
Burien, WA 98168
(206) 596-6144

Date Prepared: **December 2020**

Prepared By: **Jerrett Schwab, EIT**

Reviewed By: **Jim Cook, P.E.**
Beyler Consulting LLC
5920 100th St SW, #25
Lakewood, WA 98499
(253) 984-2900

CONTACT
(253) 984-2900
info@beylerconsulting.com
beylerconsulting.com

CORPORATE OFFICE
5920 100th St. SW, #25
Lakewood, WA 98499

Table of Contents

I. Construction Pollution Prevention Plan

Section 1 – Project Overview

This project proposes to divide the existing parcel #6404600020 into two parcels to develop two single-family residences with associated driveways, utilities, grading, and landscaping. The address of the parcel is 13307 24th Ave South. The site is approximately 18,010 square feet and has a zoning classification of UL-7,200.

Section 2 – Erosion Control Specialist

It will be responsibility of the owner and/or the contractor to regularly inspect and maintain the proposed erosion control BMPs, and will take additional measures, as necessary, to respond to changing site conditions. Should it become necessary, the engineer (or geotechnical engineer) can be made available in providing recommendations for additional erosion measures for the site.

Section 3 – Existing Site Conditions

The existing site is mostly undeveloped with the exception of a gravel access road that traverses the parcel from east to west to provide access to parcel 6404600037. The slopes across the site are moderate and slope down to the west across the parcel.

Section 4 – Adjacent Areas

The current land use of the site, single family development, mimics the surrounding properties within a quarter mile radius. The proposed development will not alter the current land use.

Section 5 – Critical Areas

No critical areas appear to exist on site.

Section 6 – Soils

The NRCS Web Soil Survey was consulted to identify soils on site. Urban land Alderwood complex, 0 to 5 percent slopes (Map Unit Symbol 3055) is the only soil identified on site.

Section 7 – Potential Erosion Problems

No known erosion hazards exist on the project site.

Section 8 – Construction Stormwater Pollution Prevention Elements

There are 13 categories of erosion and sediment control measures that must be considered for application to the project. Details on each BMP can be found in Appendix D, Section D.2 of the Manual.

Element 1: Clearing Limits

Prior to any site clearing or grading, those areas that are to remain undisturbed during project construction shall be delineated. At a minimum, clearing limits shall be installed at the edges of all critical area buffers and any other areas required to be left uncleared such as portions of the site subject to clearing limits under KCC 16.82.150, areas around significant trees identified to be retained, flow control BMP areas to be protected, and other areas identified to be left undisturbed to protect sensitive features.

Purpose: The purpose of clearing limits is to prevent disturbance of those areas of the project site that are not designated for clearing or grading. This is important because limiting site disturbance is the single most effective method for reducing erosion. Clearing limits may also be used to control construction traffic, thus reducing the disturbance of soil and limiting the amount of sediment tracked off site.

When to Install: Clearing limits shall be installed prior to the clearing and/or grading of the site.

Measures to Use: Marking clearing limits by delineating the site with a continuous length of brightly colored survey tape is sometimes sufficient. The tape may be supported by vegetation or stakes, and it shall be 3 to 6 feet high and highly visible. Critical areas and their buffers require more substantial protection and shall be delineated with plastic or metal safety fences or stake and wire fences. Fencing may be required at the County's discretion to control construction traffic or at any location where greater protection is warranted. Permanent fencing may also be used if desired by the applicant. Silt fence, in combination with survey flagging, is also an acceptable method of marking critical areas and their buffers.

ESC Measures:
~~D.2.1.1.1 Plastic or Metal Covering~~
D.2.1.3.1 Silt Fence

Element 2: Cover Measures

Temporary and permanent cover measures shall be provided to protect all disturbed areas, including the faces of cut and fill slopes. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two consecutive working days during the wet season (October 1 to April 30). These time limits may be relaxed if an area poses a low risk of erosion due to soil type, slope gradient, anticipated weather conditions, or other factors. Conversely, the County may reduce these time limits if site conditions warrant greater protection (e.g., adjacent to significant aquatic resources or highly erosive soils) or if significant precipitation (see Section D.2.4.2) is expected. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the County determines that winter weather makes vegetation establishment infeasible. During the wet season, slopes and stockpiles at 3H:1V or steeper and with more than ten feet of vertical relief shall be covered if they are to remain unworked for more than 12 hours. Also during the wet season, the material necessary to cover all disturbed areas must be stockpiled on site. The intent of these cover requirements is to have as much area as possible covered during any period of precipitation.

Purpose: The purpose of covering exposed soils is to prevent erosion, thus reducing reliance on less effective methods that remove sediment after it is entrained in runoff. Cover is the only practical method of reducing turbidity in runoff. Structural measures, such as silt fences and sediment ponds, are only capable of removing coarse particles and, in most circumstances, have little to no effect on turbidity.

When to Install: Any exposed soils that will remain unworked for more than the time limit set above shall be covered by the end of the working day. If the exposed area is to remain unworked for more than 30 days, the area shall be seeded with the temporary seed mix or an equivalent mix that will provide rapid protection (see Section D.2.1.2.6). If the disturbed area is to remain unworked for a year or more or if the area has reached final grade, permanent seed mix or an equivalent mix shall be applied.

Measures to Use: Cover methods include the use of surface roughening, mulch, erosion control nets and blankets, plastic covering, seeding, and sodding. Mulch and plastic sheeting are primarily intended to protect disturbed areas for a short period of time, typically days to a few months. Seeding and sodding are measures for areas that are to remain unworked for months. Erosion nets and blankets are to be used in conjunction with seeding steep slopes. The choice of measures is left to the designer; however, there are restrictions on the use of these methods, which are listed in the "Conditions of Use" and the "Design and Installation Specifications" sections for each measure.

The methods listed are by no means exhaustive. Variations on the standards presented here are encouraged if other cost-effective products or methods provide substantially equivalent or superior performance. Also, the details of installation can, and should, vary with the site conditions. A useful reference on the application of cover measures in the Puget Sound area is Improving the Cost Effectiveness of Highway Construction Site Erosion and Pollution Control, Horner, Guedry, and Kortenhof (1990).

ESC Measures:
~~D.2.1.2.1 Surface Roughening~~
D.2.1.2.2 Mulching
D.2.1.2.3 Nets and Blankets
D.2.1.2.4 Plastic Covering
~~D.2.1.2.5 Straw Wattles~~
D.2.1.2.6 Temporary and Permanent Seeding
~~D.2.1.2.7 Sodding~~
~~D.2.1.2.8 Polyacrylamide for Soils Erosion Protection~~
~~D.2.1.2.9 Compost Blankets~~

Element 3: Perimeter Protection

Perimeter protection to filter sediment from sheetwash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips as well as, constructed measures, such as silt fences, fiber rolls, sand/gravel barriers, brush or rock filters, triangular silt dikes and other methods. During the wet season, 50 linear feet of silt fence (and the necessary stakes) per acre of disturbed area must be stockpiled on site.

Purpose: The purpose of perimeter protection is to reduce the amount of sediment transported beyond the disturbed areas of the construction site. Perimeter protection is primarily a backup means of sediment control. Most, if not all, sediment-laden water is to be

treated in a sediment trap or pond. The only circumstances in which perimeter control is to be used as a primary means of sediment removal is when the catchment is very small (see below).

When to Install: Perimeter protection is to be installed prior to any upslope clearing and grading.

Measures to Use: The above measures may be used interchangeably and are not the only perimeter protection measures available. If surface water is collected by an interceptor dike or swale and routed to a sediment pond or trap, there may be no need for the perimeter protection measures specified in this section.

Criteria for Use as Primary Treatment: At the boundary of a site, perimeter protection may be used as the sole form of treatment when the flowpath meets the criteria listed below. If these criteria are not met, perimeter protection shall only be used as a backup to a sediment trap or pond.

Average Slope	**Slope Percent**	**Flowpath Length**
1.5H:1V or less	67% or less	100 feet
2H:1V or less	50% or less	115 feet
4H:1V or less	25% or less	150 feet
6H:1V or less	16.7% or less	200 feet
10H:1V or less	10% or less	250 feet

ESC Measures:
D.2.1.3.1 Silt Fence
~~D.2.1.3.2 Brush Barrier~~
~~D.2.1.3.3 Vegetated Strip~~
~~D.2.1.3.4 Triangular Silt Dike (Geotextile Encased Check Dam)~~
~~D.2.1.3.5 Compost Berms~~
~~D.2.1.3.6 Compost Socks~~

Element 4: Traffic Area Stabilization

Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site. Stabilized construction entrances shall be installed as the first step in clearing and grading. At the County's discretion, road and parking area stabilization is not required during the dry season (unless dust is a concern) or if the site is underlain by coarse-grained soils. Roads and parking areas shall be stabilized immediately after initial grading.

Purpose: The purpose of traffic area stabilization is to reduce the amount of sediment transported off site by construction vehicles and to reduce the erosion of areas disturbed by vehicle traffic. Sediment transported off site onto paved streets is a significant problem because it is difficult to effectively remove, and any sediment not removed ends up in the drainage system. Additionally, sediment on public right-of-way can pose a serious traffic hazard. Construction road and parking area stabilization is important because the combination of wet soil and heavy equipment traffic typically forms a slurry of easily erodible mud. Finally, stabilization also is an excellent form of dust control in the summer months.

When to Install: The construction entrance is to be installed as the first step in clearing and grading. Construction road stabilization shall occur immediately after initial grading of the construction roads and parking areas.

Measures to Use: There are two types of traffic area stabilization: (1) a stabilized construction entrance and (2) construction road/parking area stabilization. Both measures must be used as specified under "Conditions of Use" for each measure.

ESC Measures:
D.2.1.4.1 Stabilized Construction Entrance
~~D.2.1.4.2 Construction Road/Parking Area Stabilization~~
~~D.2.1.4.3 Wheel Wash~~

Element 5: Sediment Retention

Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.2.1.3, p. D-33). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, sediment ponds and traps are not required. A 10-year peak flow using the approved model with 15-minute time steps shall be used for sediment pond/trap sizing if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see below). At the County's discretion, sites may be worked during the dry season without sediment ponds and traps if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. For small sites, use the criteria defined in Section D.2.1.3, Perimeter Protection to determine minimum flow path length. If the site work has to be extended into the wet season, a back-up plan must be identified in the CSWPP plan and implemented. Protection of catch basins is required for inlets that are likely to be impacted by sediment generated by the project and that do not drain to an onsite sediment pond or trap. Sediment retention facilities shall be installed prior to grading of any contributing area and shall be located so as to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

Purpose: The purpose of sediment retention facilities is to remove sediment from runoff generated from disturbed areas.

When to Install: The facilities shall be constructed as the first step in the clearing and grading of the site. The surface water conveyances may then be connected to the facilities as site development proceeds.

Measures to Use: There are three sediment retention measures in this section. The first two, sediment traps and ponds, serve the same function but for different size catchments. All runoff from disturbed areas must be routed through a trap or pond except for very small areas at the perimeter of the site small enough to be treated solely with perimeter protection (see Section D.2.1.3, p. D-33). The third measure is for catch basin protection. It is only to be used in limited circumstances and is not a primary sediment treatment facility. It is only intended as a backup in the event of failure of other onsite systems.

Use of Permanent Drainage Facilities: All projects that are constructing permanent facilities for runoff quantity control are strongly encouraged to use the rough-graded or final-graded permanent facilities for ponds and traps. This includes combined facilities and infiltration facilities. When permanent facilities are used as temporary sedimentation facilities, the surface area requirements of sediment traps (for drainages less than 3 acres) or sediment ponds (more than 3 acres) must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the pond shall be enlarged to comply with the surface area requirement. The permanent pond shall also be divided into two cells as required for sediment ponds. Either a permanent control structure or the temporary control structure described in Section D.2.1.5.2 may be used. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the pond.

If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of three feet above final grade. Excavation should be done with a backhoe working at "arms-length" to minimize disturbance and compaction of the infiltration surface. Additionally, any required pretreatment facilities shall be fully constructed prior to any release of sediment-laden water to the facility. Pretreatment and shallow excavation are intended to prevent the clogging of soil with fines. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized (see Section D.2.4.5, p. D-115).

Selection of the Design Storm: In most circumstances, the developed condition 2-year peak flow using the approved model with 15-minute time steps is sufficient for calculating surface area for ponds and traps and for determining exemptions from the sediment retention and surface water collection requirements (Sections D.2.1.5 and D.2.1.6, respectively). In some circumstances, however, the approved model 10-year 15-minute peak flow should be used. Examples of such circumstances include the following:

- Sites that are within ¼ mile of salmonid streams, wetlands, and designated sensitive lakes such as Lake Sammamish
- Sites where significant clearing and grading is likely to occur during the wet season
- Sites with downstream erosion or sedimentation problems.

Natural Vegetation: Whenever possible, sediment-laden water shall be discharged into onsite, relatively level, vegetated areas. This is the only way to effectively remove fine particles from runoff. This can be particularly useful after initial treatment in a sediment retention facility. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system, not replace it because of the possibility of pump failure or runoff volume in excess of pump capacity.

ESC Measures:
~~D.2.1.5.1 Sediment Trap~~
~~D.2.1.5.2 Sediment Pond~~
D.2.1.5.3 Storm Drain Inlet Protection

Not applicable, scope of the project does not warrant a sediment trap/pond.

Element 6: Surface Water Collection

All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged downslope of any disturbed areas. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.2.1.3). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, surface water controls are not required. A 10-year approved model 15-minute peak flow shall be used for sizing surface water controls if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see the introduction to Section D.2.1.5). At the County's discretion, sites may be worked during the dry season without surface water controls, if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas. Surface water controls shall be installed concurrently with rough grading.

Purpose: The purpose of surface water control is to collect and convey surface water so that erosion is minimized, and runoff from disturbed areas is treated by a sediment pond or trap. Surface water control essentially consists of three elements:

1. Interception of runoff on and above slopes
2. Conveyance of the runoff to a sediment pond or trap (if the runoff was collected from a disturbed area)
3. Release of the runoff downslope of any disturbed areas.

When to Install: Surface water controls shall be constructed during the initial grading of an area and must be in place before there is any opportunity for storm runoff to cause erosion.

Measures to Install: Interceptor dikes/swales intercept runoff, ditches and pipe slope drains convey the runoff, and riprap or level spreaders help release the runoff in a non-erosive manner. Each measure is to be used under different circumstances so there is very little overlap. However, the two options for releasing water in a non-erosive manner, outlet protection and level spreaders, can be somewhat interchangeable. See Figure D.2.1.6.A for a schematic drawing demonstrating the use of these measures.

ESC Measures:
~~D.2.1.6.1 Interceptor Dike and Swale~~
~~D.2.1.6.2 Pipe Slope Drains~~
~~D.2.1.6.3 Subsurface Drains~~
D.2.1.6.4 Ditches
~~D.2.1.6.5 Outlet Protection~~
~~D.2.1.6.6 Level Spreader~~

Element 7: Dewatering Control

Any runoff generated by dewatering shall be treated through construction of a sediment trap (Section D.2.1.5.1) when there is sufficient space or by releasing the water to a well vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be

more effectively utilized for treatment. Discharge of sediment-laden water from dewatering activities to surface and storm waters is prohibited. If dewatering occurs from areas where the water has come in contact with new concrete, such as tanks, vaults, or foundations, the pH of the water must be monitored and must be neutralized prior to discharge. Clean non-turbid dewatering water, such as well point ground water can be discharged to systems tributary to, or directly to surface waters provided the flows are controlled so no erosion or flooding occurs. Clean water must not be routed through a stormwater sediment pond. Highly turbid or contaminated dewatering water must be handled separately from stormwater.

Purpose: To prevent the untreated discharge of sediment-laden water from dewatering of utilities, excavated areas, foundations, etc.

When to Install: Dewatering control measures shall be used whenever there is a potential for runoff from dewatering of utilities, excavations, foundations, etc.

Measures to install:

1. Foundation, vault, excavation, and trench dewatering water that has similar characteristics to stormwater runoff at the site shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Foundation and trench dewatering water that has similar characteristics to stormwater runoff at the site must be disposed of through one of the following options depending on site constraints:
   a) Infiltration,
   b) Transport offsite in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute surface waters,
   c) Discharge to the sanitary sewer discharge with local sewer district approval if there is no other option, or
   d) Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.
2. Clean, non-turbid dewatering water, such as well-point ground water, may be discharged via stable conveyance to systems tributary to surface waters, provided the dewatering flow does not cause erosion or flooding of receiving waters.
3. Highly turbid or contaminated dewatering water (high pH or other) shall be handled separately from stormwater. See Section D.2.2 (p. D-74), SWPPS Measures.

Element 8: Dust Control

Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources or adjacent properties.

Purpose: To prevent wind transport of dust from exposed soil surfaces onto roadways, drainage ways, and surface waters.

When to Install: Dust control shall be implemented when exposed soils are dry to the point that wind transport is possible and roadways, drainage ways, or surface waters are likely to be impacted. Dust control measures may consist of chemical, structural, or mechanical methods.

Measures to Install: Water is the most common dust control (or palliative) used in the area. When using water for dust control, the exposed soils shall be sprayed until wet, but runoff shall not be generated by spraying. Calcium chloride, Magnesium chloride, Lignin derivatives, Tree Resin Emulsions, and Synthetic Polymer Emulsions may also be used for dust control. Exposed areas shall be re-sprayed as needed. Oil shall not be used for dust control. The following table lists many common dust control measures. Some of the measures are not recommended for use in King County and must have prior approval prior to use from the DPER inspector assigned to specific projects.

Element 9: Flow Control

Surface water from disturbed areas must be routed through the project's onsite flow control facility or other provisions must made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the project site during construction.

Purpose: The purpose of surface water flow control is to mitigate increases in runoff peaks that occur during construction as a result of clearing vegetation, compacting the soil, and adding impervious surface. Such increases can cause or aggravate downstream flooding and erosion.

When to Install: Surface water flow control shall be installed or otherwise provided prior to any clearing and/or grading of the site, except that required to construct the surface water flow control facilities.

Measures to Use: The project's onsite flow control facility or other equivalent storage facility that meets the peak-matching performance criteria stated above.

Element 10: Protect Existing and Proposed Flow Control BMPs

Protection measures shall be applied/installed and maintained so as to prevent adverse impacts to existing flow control BMPs and areas of proposed flow control BMPs for the project. Adverse impacts can prompt the requirement to restore or replace affected BMPs.

Purpose: The purpose of protecting existing and proposed flow control BMP areas is to avoid
sedimentation and soil compaction that would adversely affect infiltration, and also avoid contamination by other pollutants.

When to Install: Flow control BMP area protection shall be installed or otherwise provided prior to any clearing and/or grading of the site, except that required to construct flow control BMPs.

Measures to Use:

1. Protect all flow control BMPs and proposed BMP footprints from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the flow control BMPs.
2. BMPs shall be restored to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP shall include, at a minimum, removal of sediment and any sediment-laden bioretention soils, and replacing the removed soils with soils meeting the design specification. Replacement with a new fully-functioning

BMP may be required if restoration to the fully-functioning condition can't be accomplished.
3. Prevent compacting Bioretention BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
4. Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements.
5. Pavements fouled with sediments or no longer passing an initial infiltration text must be cleaned using procedures from the local stormwater manual or the manufacturer's procedures.
6. Keep all heavy equipment off existing soils under flow control BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

Additional Guidance

See Chapter 5: Precision Site Preparation and Construction in the LID Technical Guidance Manual for Puget Sound for more detail on protecting LID integrated management practices. Note that the LID Technical Guidance Manual for Puget Sound (2012) is for additional informational purposes only. The guidance within this manual must be followed if there are any discrepancies between this manual and the LID Technical Guidance Manual for Puget Sound (2012).

Element 11: Maintain Protective BMPs

Protection measures shall be maintained to assure continued performance of their intended function, to prevent adverse impacts to existing flow control BMPs and areas of proposed flow control BMPs, and protect other disturbed areas of the project.

Purpose: The purpose of maintaining protective BMPs is to provide continuous erosion and sediment control protection throughout the life of the project, and avoid sedimentation, soil compaction and contamination by other pollutants that would adversely affect infiltration and surface runoff.

When to Maintain: Protection measures shall be monitored per Section D.2.4.4 at a minimum, and promptly maintained to fully functioning condition as necessary to assure continued performance of their intended function.

Measures to Use:

1. Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
2. Remove all temporary erosion and sediment control BMPs prior to final construction approval, or within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.
3. Provide protection to all BMPs installed for the permanent control of stormwater from sediment and compaction. All BMPs that are to remain in place following completion of construction shall be examined and placed in full operating conditions. If sediment enters the BMPs during construction, it shall be removed and the BMP shall be returned to the conditions specified in the construction documents or as required for full BMP replacement.

4. Remove or stabilize trapped sediment on site. Permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.

Element 12: Manage the Project

Coordination and timing of site development activities relative to ESC concerns (Section D.2.4), and timely inspection, maintenance and update of protective measures (Section D.2.3) are necessary to effectively manage the project and assure the success of protective ESC and SWPPS design and implementation. Projects shall assign a qualified CSWPP Supervisor (Section D.2.3.1) to be the primary contact for ESC and SWPPP issues and reporting, coordination with subcontractors and implementation of the CSWPP plan as a whole.

Measures to Use:

1. Phase development projects to the maximum degree practicable and take into account seasonal work limits.
2. Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with the Construction Stormwater General Permit and King County requirements.
3. Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP in accordance with the Construction Stormwater General Permit and King County requirements.
4. Projects that disturb one or more acres must have, site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL) (see Section D.2.3.1). Project sites less than one acre (not part of a larger common plan of development or sale) may have a person without CESCL certification conduct inspections. By the initiation of construction, the SWPPP must identify the CESCL or inspector, who shall be present on-site or on-call at all times.

The CESCL or inspector (project sites less than one acre) must have the skills to assess the:

- Site conditions and construction activities that could impact the quality of stormwater.
- Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
- The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

Based on the results of the inspection, construction site operators must correct the problems identified by:

- Reviewing the SWPPP for compliance with all construction SWPPP elements and making appropriate revisions within 7 days of the inspection.
- Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems not later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request an extension within the initial 10-day response period.

- Documenting BMP implementation and maintenance in the site log book (applies only to sites that have coverage under the Construction Stormwater General Permit).
- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month.

Section 9 – SWPPS Measures

Concrete Handling

Purpose: Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to surface waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the state.

Conditions of Use: Any time concrete is used, utilize these management practices. Concrete construction projects include, but are not limited to, curbs, sidewalks, roads, bridges, foundations, floors, stormwater vaults, retaining walls, driveways and runways.

Concrete Washout Area

Purpose: Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout off-site, or performing on-site washout in a designated area to prevent pollutants from entering surface waters or ground water.

Conditions of Use: Concrete washout area best management practices are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout off-site (ready mix plant, etc.).
- Concrete trucks, pumpers, or other concrete coated equipment are washed on-site.

Note: If less than 10 concrete trucks or pumpers need to be washed out on-site, the washwater may be disposed of in a formed area awaiting concrete or an upland disposal site where it will not contaminate surface or ground water. The upland disposal site shall be at least 50 feet from sensitive areas such as storm drains, open ditches, or water bodies, including wetlands.

Material Delivery, Storage and Containment

Purpose: Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

Conditions of Use: These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g. Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds
- Any other material that may be detrimental if released to the environment

Maintain Protective BMPs

Pollutant protection measures shall be maintained to assure continued performance of their intended function. Reporting and documentation shall be kept current and made available to DPER as indicated.

Purpose: The purpose of maintaining protective BMPs is to provide effective pollutant protection when and where required by the plan and the project, and to provide timely and relevant project information.

When to Maintain: Protection measures shall be monitored per Section D.2.4.4 at a minimum, continuously during operation, and promptly maintained to fully functioning condition as necessary to assure continued performance of their intended function. Documentation shall be kept current per specific BMP requirements.

Measures to Use:

1. Maintain and repair all pollutant control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
2. Maintain and repair storage locations for equipment and materials associated with BMP processes. Conduct materials disposal in compliance with County regulatory requirements. 4/24/2016 2016 Surface Water Design Manual – Appendix D D-106 D.2.2.11 MANAGE THE PROJECT
3. As required, provide current reporting and performance documentation at an accessible location for the site inspector and other DPER staff.
4. Remove all temporary pollutant control BMPs prior to final construction approval, or within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Manage the Project

SWPPP requirements shall be implemented and managed as part of the overall CSWPP plan. Concrete construction and its impacts are primary among pollutant concerns on site development projects. Fueling operations and materials containment of treatment chemicals and other project materials are also typical pollutant concerns. Operations that produce these and other pollutants are often conducted by subcontractors and their laborers, yet may require specific protective measures, documentation and reporting. Protective measures and BMPs need to be made available prior to construction and suitable oversight provided to assure inspection, monitoring and documentation requirements are met.

Projects shall assign a qualified CSWPP Supervisor (Section D.2.3.1) to be the primary contact for SWPPP and ESC issues and reporting, coordination with subcontractors and implementation of the CSWPP plan as a whole.

Measures to Use:

1. Phase development projects to the maximum degree practicable and take into account seasonal work limits.
2. Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with the Construction Stormwater General Permit and King County requirements. Coordinate with subcontractors and laborers to assure the SWPPP measures are followed.
3. Documentation and reporting: – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Document site inspections and monitoring in accordance with the Construction Stormwater General Permit, specific BMP conditions and King County requirements. Log sheets provided in Reference Section 8 may be used if appropriate. Follow reporting requirements and provide documentation as requested to DPER staff.
4. Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP in accordance with the Construction Stormwater General Permit and King County requirements. Obtain approval for specific SWPPP measures (e.g., chemical treatments of stormwater) well in advance of need. Coordinate SWPPP plan updates with the site inspector (see Section D.2.4.1).

Section 10 – Construction Sequence

General Construction Sequence:

1. Pre-construction meeting.
2. Post sign with name and phone number of CSWPP/ESC supervisor (may be consolidated with the required notice of construction sign).
3. Flag or fence clearing limits.
4. Install catch basin protection and flow control BMP area protection as required.
5. Grade and install construction entrance(s).
6. Install perimeter protection (silt fence, brush barrier, etc.).
7. Construct sediment ponds and traps.
8. Grade and stabilize construction roads.
9. Construct surface water controls (interceptor dikes, pipe slope drains, etc.) simultaneously with clearing and grading for project development. Construct SWPPS controls in anticipation of scheduled construction activity (e.g., concrete-related pH measures for utility, vault or roadway construction)
10. Maintain erosion control and SWPPS measures in accordance with King County standards and manufacturer's recommendations.
11. Relocate erosion control and SWPPS measures or install new measures so that as site conditions change the erosion and sediment control and pollutant protection is always in accordance with the King County Construction Stormwater Pollution Prevention Standards.
12. Cover all areas that will be unworked for more than seven days during the dry season or two days during the wet season with straw, wood fiber mulch, compost, or equivalent.
13. Stabilize all areas that reach final grade within seven days.
14. Seed or sod any areas to remain unworked for more than 30 days.

Upon completion of the project, all disturbed areas must be stabilized and BMPs removed if appropriate. All storm drainage facilities shall be protected in place from construction activity via brightly flagged stakes or, if necessary, temporary construction fencing.

Section 11 – Construction Schedule

Special consideration is necessary for erosion and source control during the wet season (Oct. 1 – April 30). This may include re-ordering construction phases, having materials available for immediate stabilization of disturbed areas, and diligent examination of the site for possible erosion concerns. Additional expenses and delays should be expected. It is recommended that construction take place during the dry season if possible.

Section 12 – Financial/Ownership Responsibilities

The property owner will be responsible for ensuring proper erosion and sediment control, bonds, and other required securities for this project.

Section 13 – Engineering Calculations

No calculations were required during the construction of this SWPPP plan.

Appendix D – WWHM Report

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	FC
Site Name:	Trinh SP
Site Address:	13307 24th Ave E
City:	Seatac
Report Date:	12/3/2020
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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	0.46
Pervious Total	0.46
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.46

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Mod	0.339
Pervious Total	0.339

Impervious Land Use	acre
DRIVEWAYS FLAT	0.108
SIDEWALKS FLAT	0.013
Impervious Total	0.121
Basin Total	0.46

Element Flows To:

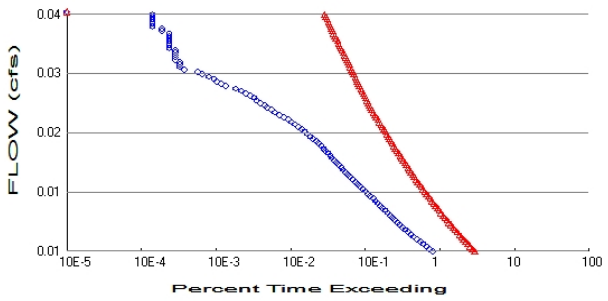
Surface	Interflow	Groundwater

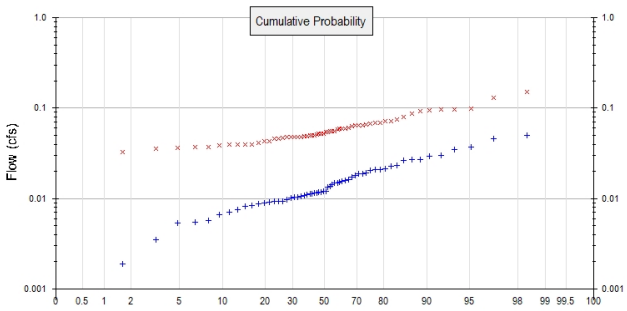
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.46
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.339
Total Impervious Area: 0.121

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.013697
5 year	0.022443
10 year	0.028067
25 year	0.034757
50 year	0.03939
100 year	0.043719

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.054441
5 year	0.072958
10 year	0.086399
25 year	0.104776
50 year	0.119511
100 year	0.135172

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.016	0.080
1950	0.019	0.068
1951	0.030	0.053
1952	0.009	0.037
1953	0.008	0.036
1954	0.012	0.046
1955	0.019	0.048
1956	0.015	0.047
1957	0.012	0.060
1958	0.013	0.043

1959	0.012	0.039
1960	0.021	0.058
1961	0.011	0.050
1962	0.007	0.037
1963	0.010	0.048
1964	0.014	0.043
1965	0.009	0.059
1966	0.009	0.039
1967	0.021	0.073
1968	0.012	0.065
1969	0.012	0.051
1970	0.009	0.052
1971	0.010	0.059
1972	0.023	0.069
1973	0.010	0.036
1974	0.011	0.055
1975	0.016	0.063
1976	0.011	0.048
1977	0.002	0.039
1978	0.009	0.050
1979	0.006	0.066
1980	0.027	0.095
1981	0.008	0.055
1982	0.017	0.087
1983	0.015	0.056
1984	0.009	0.040
1985	0.005	0.049
1986	0.023	0.056
1987	0.021	0.064
1988	0.008	0.039
1989	0.005	0.049
1990	0.050	0.150
1991	0.026	0.094
1992	0.011	0.041
1993	0.010	0.032
1994	0.004	0.033
1995	0.015	0.048
1996	0.035	0.075
1997	0.027	0.060
1998	0.007	0.046
1999	0.029	0.099
2000	0.010	0.054
2001	0.002	0.050
2002	0.012	0.071
2003	0.018	0.069
2004	0.019	0.097
2005	0.014	0.052
2006	0.016	0.047
2007	0.037	0.130
2008	0.046	0.098
2009	0.021	0.065

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0496	0.1498
2	0.0457	0.1296
3	0.0375	0.0995

4	0.0347	0.0976
5	0.0299	0.0969
6	0.0294	0.0952
7	0.0268	0.0937
8	0.0267	0.0867
9	0.0263	0.0804
10	0.0235	0.0751
11	0.0227	0.0725
12	0.0213	0.0712
13	0.0210	0.0690
14	0.0207	0.0689
15	0.0206	0.0678
16	0.0193	0.0657
17	0.0187	0.0647
18	0.0186	0.0646
19	0.0181	0.0644
20	0.0173	0.0628
21	0.0161	0.0602
22	0.0158	0.0596
23	0.0155	0.0589
24	0.0150	0.0587
25	0.0150	0.0583
26	0.0148	0.0560
27	0.0143	0.0555
28	0.0138	0.0555
29	0.0134	0.0547
30	0.0121	0.0542
31	0.0121	0.0527
32	0.0118	0.0522
33	0.0117	0.0520
34	0.0115	0.0506
35	0.0115	0.0503
36	0.0114	0.0502
37	0.0112	0.0495
38	0.0111	0.0492
39	0.0107	0.0488
40	0.0105	0.0483
41	0.0104	0.0480
42	0.0104	0.0478
43	0.0101	0.0476
44	0.0097	0.0474
45	0.0094	0.0468
46	0.0094	0.0463
47	0.0092	0.0457
48	0.0091	0.0430
49	0.0089	0.0427
50	0.0088	0.0414
51	0.0084	0.0397
52	0.0082	0.0395
53	0.0076	0.0393
54	0.0071	0.0392
55	0.0066	0.0391
56	0.0057	0.0370
57	0.0054	0.0369
58	0.0053	0.0360
59	0.0035	0.0359
60	0.0019	0.0326
61	0.0016	0.0318

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0068	17075	62455	365	Fail
0.0072	15481	58113	375	Fail
0.0075	14067	54199	385	Fail
0.0078	12797	50585	395	Fail
0.0082	11565	47248	408	Fail
0.0085	10515	44189	420	Fail
0.0088	9561	41473	433	Fail
0.0091	8750	38735	442	Fail
0.0095	8031	36297	451	Fail
0.0098	7347	34008	462	Fail
0.0101	6744	32019	474	Fail
0.0105	6192	30073	485	Fail
0.0108	5730	28233	492	Fail
0.0111	5309	26544	499	Fail
0.0115	4924	24982	507	Fail
0.0118	4575	23570	515	Fail
0.0121	4246	22202	522	Fail
0.0124	3957	20985	530	Fail
0.0128	3645	19849	544	Fail
0.0131	3390	18672	550	Fail
0.0134	3133	17609	562	Fail
0.0138	2915	16628	570	Fail
0.0141	2712	15779	581	Fail
0.0144	2490	14942	600	Fail
0.0147	2319	14110	608	Fail
0.0151	2136	13295	622	Fail
0.0154	1973	12647	641	Fail
0.0157	1825	11976	656	Fail
0.0161	1702	11360	667	Fail
0.0164	1577	10720	679	Fail
0.0167	1444	10164	703	Fail
0.0170	1327	9681	729	Fail
0.0174	1233	9186	745	Fail
0.0177	1148	8722	759	Fail
0.0180	1086	8307	764	Fail
0.0184	1020	7920	776	Fail
0.0187	947	7550	797	Fail
0.0190	885	7219	815	Fail
0.0193	826	6876	832	Fail
0.0197	761	6566	862	Fail
0.0200	725	6248	861	Fail
0.0203	675	5925	877	Fail
0.0207	623	5636	904	Fail
0.0210	589	5373	912	Fail
0.0213	549	5153	938	Fail
0.0216	506	4926	973	Fail
0.0220	469	4710	1004	Fail
0.0223	428	4500	1051	Fail
0.0226	388	4297	1107	Fail
0.0230	356	4134	1161	Fail
0.0233	328	3968	1209	Fail
0.0236	297	3782	1273	Fail
0.0239	270	3602	1334	Fail
0.0243	242	3450	1425	Fail

0.0246	218	3315	1520	Fail
0.0249	198	3157	1594	Fail
0.0253	174	3003	1725	Fail
0.0256	152	2862	1882	Fail
0.0259	130	2716	2089	Fail
0.0262	119	2612	2194	Fail
0.0266	104	2496	2400	Fail
0.0269	95	2408	2534	Fail
0.0272	84	2329	2772	Fail
0.0276	74	2257	3050	Fail
0.0279	69	2171	3146	Fail
0.0282	61	2092	3429	Fail
0.0285	53	2016	3803	Fail
0.0289	46	1937	4210	Fail
0.0292	39	1872	4800	Fail
0.0295	29	1787	6162	Fail
0.0299	25	1719	6876	Fail
0.0302	22	1660	7545	Fail
0.0305	20	1616	8080	Fail
0.0308	17	1562	9188	Fail
0.0312	14	1497	10692	Fail
0.0315	12	1438	11983	Fail
0.0318	8	1383	17287	Fail
0.0322	7	1340	19142	Fail
0.0325	7	1299	18557	Fail
0.0328	7	1255	17928	Fail
0.0331	6	1212	20200	Fail
0.0335	6	1163	19383	Fail
0.0338	6	1120	18666	Fail
0.0341	6	1081	18016	Fail
0.0345	6	1041	17350	Fail
0.0348	5	1002	20040	Fail
0.0351	5	964	19280	Fail
0.0354	5	936	18720	Fail
0.0358	5	908	18160	Fail
0.0361	5	863	17260	Fail
0.0364	5	832	16640	Fail
0.0368	5	800	16000	Fail
0.0371	4	773	19325	Fail
0.0374	4	744	18600	Fail
0.0377	3	731	24366	Fail
0.0381	3	708	23600	Fail
0.0384	3	684	22800	Fail
0.0387	3	660	22000	Fail
0.0391	3	634	21133	Fail
0.0394	3	606	20200	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.

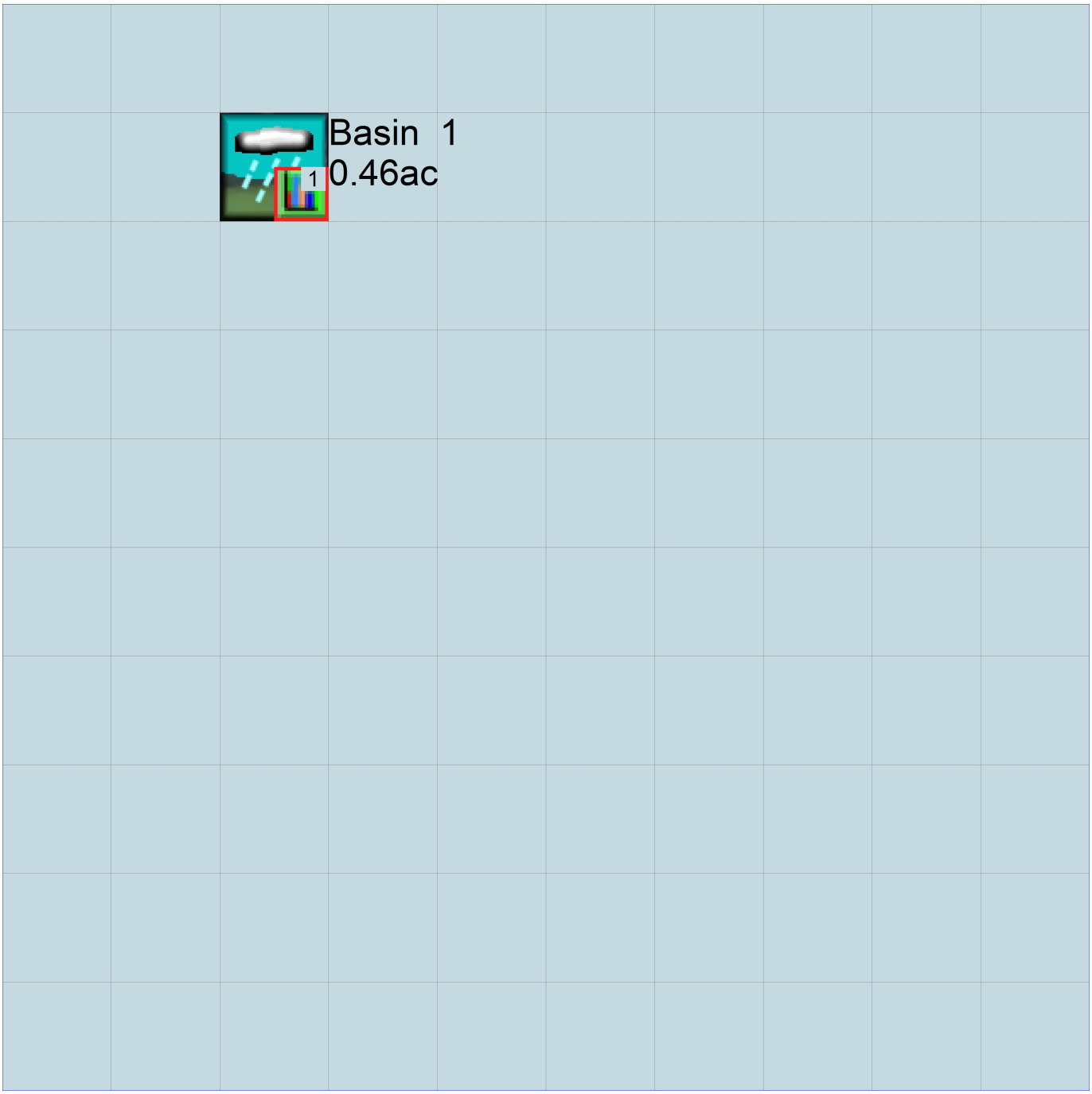
PERLND Changes

No PERLND changes have been made.

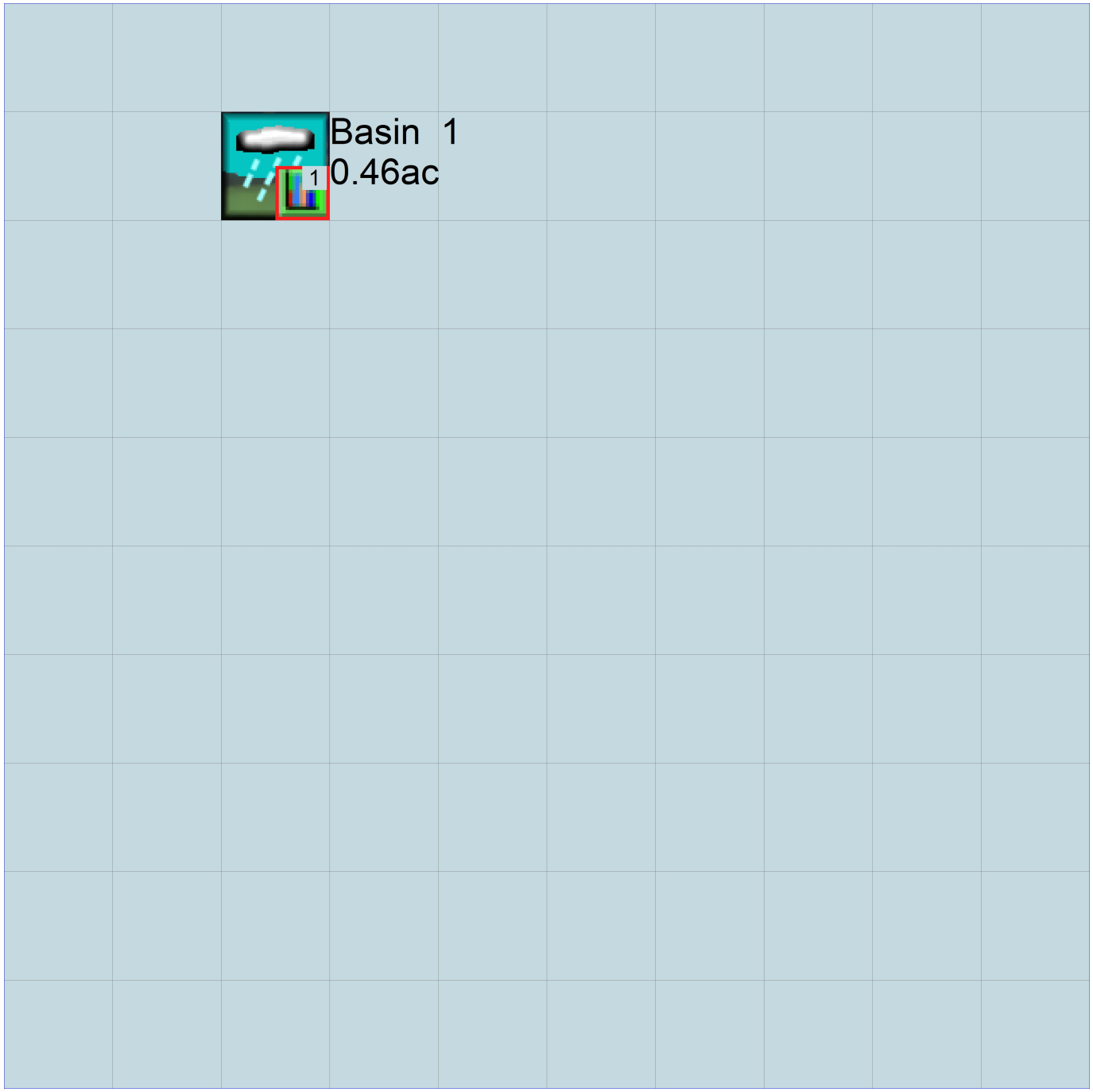
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
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   FC.wdm
MESSU       25   PreFC.MES
            27   PreFC.L61
            28   PreFC.L62
            30   POCFC1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      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           ***
   11     C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

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

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     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#   ***
Basin  1***
PERLND  11                        0.46     COPY   501     12
PERLND  11                        0.46     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   FC.wdm
MESSU       25   MitFC.MES
            27   MitFC.L61
            28   MitFC.L62
            30   POCFC1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      14
      IMPLND       5
      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           ***
   14     C, Pasture, Mod         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   14         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  *********
   14         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 ***
   14         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
   14              0       4.5      0.06       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   14              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   14           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
   14              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           ***
    5      DRIVEWAYS/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   ***
    5         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    *********
    5         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     ***
    5         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
    5            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
    5              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    5              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  14                      0.339     COPY   501     12
PERLND  14                      0.339     COPY   501     13
IMPLND   5                      0.108     COPY   501     15
IMPLND   8                      0.013     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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com