JACOBSON
CONSULTING ENGINEERS

Barnabie Point Project Drainage Report

for Storm Water Management

Barnabie Point Project

3700 E Mercer Way, Mercer Island, WA 98040
December 11, 2025

Prepared for

Herzl-Ner Tamid Conservative Congregation
3700 E Mercer Way
Mercer Island, WA 98040

Prepared through

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Storm Drainage Report for

Herzl-Ner Tamid Conservative Congregation – Barnabie Point Project

JACOBSON CONSULTING ENGINEERS

Project No. C230007-0191

December 11, 2025

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I. PROJECT OVERVIEW

GENERAL DESCRIPTION

The following Drainage Report provides the drainage analysis for the Barnabie Point K-8 project. The storm water design for the project was based on the requirements set forth in the Department of Ecology 2019 Stormwater Management Manual for Western Washington (2019 SWMMWW), as adopted by the City of Mercer Island.

The site is located at 3700 E Mercer Way in Mercer Island on the property of Herzl-Ner Tamid Conservative Congregation (See *Figure 1 – Vicinity Map).* The area within the site includes four parcels. Parcel A (0824059045) is 0.62 acres, parcel B (2107000010) is 1.11 acres, parcel C (1515600010) is 1.97 acres, and the northern parcel (151560TRCT) is 0.43 acres. The total area of the site is 4.12 acres, of which approximately 1.42 acres will be developed for the proposed project. The parcels are bounded by Interstate 90 to the north, Lake Washington to the east, single family residences to the south, and East Mercer Way to the west. The site is in Section 8, Township 24 North, Range 5 East, Willamette Meridian together with a portion of the SE quarter of Section 7, Township 24 North, Range 5 East, Willamette Meridian.

The proposed project consists of adding a new school building on parcel A and redevelopment of the existing parking lot south of the proposed building. The northwest corner of the site is currently a heavily forested area (parcel A); most trees will be removed as part of the clearing and grading of the site to prepare for the construction of the new site development.

EXISTING CONDITIONS

The existing property is developed with three buildings, parking primarily along the south of the property, and drive aisles, with a heavily forested area in the northwest corner *(See Figure 2 – Existing Conditions).*

Topographically, the highest point on the site is in the southwest area with an elevation of 108 feet. The lowest point is at the east end of the site with an elevation of 17 feet. On the west side of the site, there is a gradual slope from the parking lot north towards Frontage Road. To the east of the forested area, there is an elevation change of approximately 91 vertical feet at an average slope of 11% to the shoreline of Lake Washington.

Existing soil conditions of the site include 5' to 10' of surficial layer of existing fill overlying glacially consolidated native sediments including stiff to hard pre-Fraser nonglacial and lacustrine deposits. See *Figure 3 – Soils Map* and the project geotechnical report included in Section VI of this report. See Section III of this report and *Figure 4 – Quarter Mile Downstream* for downstream conditions analysis.

PROPOSED CONDITIONS

The proposed 1.42-acre development project consists of removing existing trees and constructing a new school building in the northeast corner of the campus, redeveloping the existing parking lot, and creating pedestrian pathways. Additionally, site improvements and new utilities, including water, sewer, storm drainage, and communications are proposed to be installed (See *Figure 5 – Proposed Conditions).*

PROPOSED DRAINAGE SYSTEM

The threshold discharge area (TDA) discharges directly to a flow control exempt receiving water: Lake Washington, as designated by Appendix I-A of the 2019 SWMMWW. Therefore, a stormwater flow control system is not required for this project. A new private stormwater main, along with a new outfall (HPA required to be obtained through WDFW), was installed as a private drainage repair that did not require a city permit. This system upgrades the previous system that was undersized and lacked the capacity to manage stormwater from a fully-developed site. The stormwater connection from this school project will connect to this newly-built system. Stormwater will continue to discharge into Lake Washington east of the site.

II. MINIMUM REQUIREMENTS

The site is considered a redevelopment if there is greater than 35% of existing hard surface coverage, per the 2019 SWMMWW. Refer *to Figure 6 – Existing Impervious Coverage*. This site has approximately 51.7% of impervious coverage, and therefore, Figure I-3.2 of the 2019 SWMMWW will be used for determining the applicable minimum requirements.

As determined using Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment, this project is subject to addressing all minimum requirements for new and replaced hard surfaces and converted vegetation areas. See *Figure 7 – Minimum Requirements Flow Chart*. This section will address the nine required minimum requirements set forth by the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) as adopted by the City of Mercer Island.

MR1 (PREPARATION OF STORMWATER SITE PLANS)

This document is the stormwater site plan (drainage report), which has been conforms to the requirements set forth in the 2019 SWMMWW Section III-3 for this project.

MR2 (CONSTRUCTION STORM WATER POLLUTION PREVENTION PLAN)

A temporary erosion and sediment control (TESC) plan is provided as part of the Clear and Grade permit drawings. Erosion control methods such as marking the clearing and grading limits, using silt fence, installing rock construction entrances, stockpile covering, erosion control, sediment storage and limiting disturbed areas will be used during construction to reduce runoff and control sediment discharge from the site. See Appendix B for the Stormwater Pollution Prevention Plan (SWPPP) narrative associated with this project.

MR3 (SOURCE CONTROL OF POLLUTION)

Stormwater source control BMPs will be implemented on this project to prevent stormwater pollution from occurring. The following source control BMPs will be implemented on site:

BMP S407 Dust Control: Exposed soils will be kept wet with water trucks in order to control dust on site. Sediment containment methods will be implemented to prevent sediment from entering the storm system.

BMP S410 Correcting Illicit Storm Discharges: On-site storm systems will be examined to identify any potential illicit discharges. Confirmed illicit discharges will be remedied.

BMP S411 Landscaping and Lawn/Vegetation Management: Post-construction soil quality standards will be met, and appropriate landscaping will be installed on site. Noxious weeds will be removed and disposed of immediately.

BMP S417 Maintenance of Stormwater Drainage and Treatment Systems: Stormwater conveyance, catch basins, and detention systems on-site will be properly maintained and cleared of debris and sediment in order to maintain proper operation.

BMP S438 Construction Demolition: Construction demolition debris will be properly contained and removed promptly from the site so that loose debris will not come in contact with and contaminate stormwater.

BMP S442 Labeling Storm Drain Inlets: Storm drain grates will be marked with "DUMP NO WASTE – DRAINS TO STREAM".

BMP S450 Irrigation: Irrigated vegetation will only be watered as necessary to maintain plant life and prevent runoff and discharge to drainage systems.

BMP S451 Building, Repair, Remodeling, Painting, and Construction: All construction materials will be properly contained, and employees will be educated in best practices to prevent stormwater contamination.

BMP S453 Formation of a Pollution Prevention Team: A pollution prevention team will maintain all BMPs address corrective actions as needed to mitigate potential stormwater contamination.

BMP S454 Preventative Maintenance/Good Housekeeping: Preventative maintenance and good housekeeping practices shall be implemented on site to reduce the potential for stormwater contamination.

BMP S455 Spill Prevention and Cleanup: Spill prevention practices shall be put in place and a spill plan developed in order to properly respond to a spill. Areas with a higher potential for spills will have a spill cleanup kit, and waste will be properly disposed of.

BMP S456 Employee Training: Members of the pollution prevention team will be properly trained in identifying pollutants, pollutant control measures, spill prevention and response, emergency response, and proper handling practices.

BMP S457 Inspections: A qualified individual will perform monthly inspections and maintain a record of each inspection on-site.

BMP S458 Record Keeping: Record of inspections shall be kept and maintained on-site as required.

MR4 (PRESERVATION OF NATURAL DRAINAGE SYSTEM AND OUTFALLS)

Stormwater will continue to flow towards the current discharge point located to the east of the site which directly drains to Lake Washington. This project will not alter the natural drainage course, nor the outfall that are in the existing conditions.

MR5 (ON-SITE STORM WATER MANAGEMENT)

In accordance with the drainage manual, Low Impact Development (LID) Best Management Practices (BMP) must be implemented to the maximum extent feasible. Operation and maintenance guidelines for any proposed BMPs and stormwater infrastructure are attached in Appendix A of this report. There are two compliance methods for MR5: the "LID Performance Standard" and the "List Approach." This project will use the List Approach for compliance with the MR5 (as the LID Performance Standard requires the site soil to have a good infiltration capacity in order to comply with the stormwater discharge requirements). The feasibility of List #3 BMPs were evaluated for this project. See Table 1 below for a list of the BMPs reviewed for feasibility:

TABLE 1 – ON-SITE STORMWATER MANAGEMENT BMPS

Surfaces	List #3	Infeasibility Criteria
Lawn and Landscaped Areas	BMP T5.13 Post-Construction Soil Quality and Depth	Will be implemented on all new landscaped areas, except where existing vegetation will be retained on steep slopes, and all areas disturbed that are not covered in impervious surfacing.
Roofs	BMP T5.10A Downspout Full Infiltration Systems	A professional Geotechnical Engineer has determined that infiltration is not feasible on this site due to low permeability soils; therefore, Downspout Full Infiltration is not feasible.
	BMP T5.10B Downspout Dispersion Systems	Minimum flow path requirement of 50 feet for Downspout Dispersion Systems cannot be met on this site; therefore Downspout Dispersion is not feasible for this project.
	BMP T5.10C Perforated Stub-out Connections	A professional Geotechnical Engineer has determined that infiltration is not feasible on this site due to low permeability soils; therefore, Perforated Stub-out Connections are not feasible.

Other Hard Surfaces	BMP T5.12 Sheet Flow Dispersion OR BMP T5.11 Concentrated Flow Dispersion	Minimum flow path requirements for Concentrated Flow Dispersion and Sheet Flow Dispersion cannot be met on this site, therefore both BMPs (T5.11 and T5.12) are not feasible for this project.

The City of Mercer Island Code (MICC 15.09) includes an addendum to Minimum Requirement 5 (MR5), which applies to projects that:
a. Result in 2,000 square feet, or greater, of new plus replaced hard surface area; or
b. Have a land disturbing activity of 7,000 square feet or greater; or
c. Result in a net increase of impervious surface of 500 square feet or greater.

This threshold applies to our project. According to the code, if all on-site stormwater management BMPs listed in List #1 and List #2 are determined to be infeasible for roof and/or other hard surfaces, on-site detention is required where applicable. However, for this project, on-site detention is not required because there is not a capacity constraint in the system and the site discharges directly to a flow control exempt receiving water, Lake Washington.

MR6 (RUNOFF TREATMENT)

The project is proposing 24,626 square feet (0.57 acres) of pollution generating impervious surface, which exceeds the threshold of 5,000 square feet of pollution generating impervious surfaces. Therefore, a water quality treatment system is required for this project. This project proposes to implement a Filterra treatment unit, manufactured by Contech Engineered Solutions LLC. See the Water Quality sub-section of Section IV in this report for more information.

MR7 (FLOW CONTROL)

The threshold discharge area (TDA) discharges directly to a flow control exempt receiving water, Lake Washington. Therefore, flow control systems are not required for this project.

MR8 (WETLAND PROTECTION)

There are no wetlands within the project site or in close proximity. Therefore, MR8 is not applicable to this project.

MR9 (OPERATION AND MAINTENANCE)

An operation and maintenance manual is included in Appendix A and will be kept at to the school's office for all stormwater facilities that are to be privately maintained.

III. OFF-SITE ANALYSIS

FIELD INSPECTION

A site visit was conducted by Jacobson Consulting Engineers on October 23, 2023 to gather information about the existing drainage system, including a Level 1 Downstream Analysis. Please refer to Downstream Analysis below for more information.

DRAINAGE SYSTEM PROBLEM DESCRIPTIONS

To the best of our knowledge, we are not aware of any drainage problems present within or associated with the existing property as a result of previously existing problems.

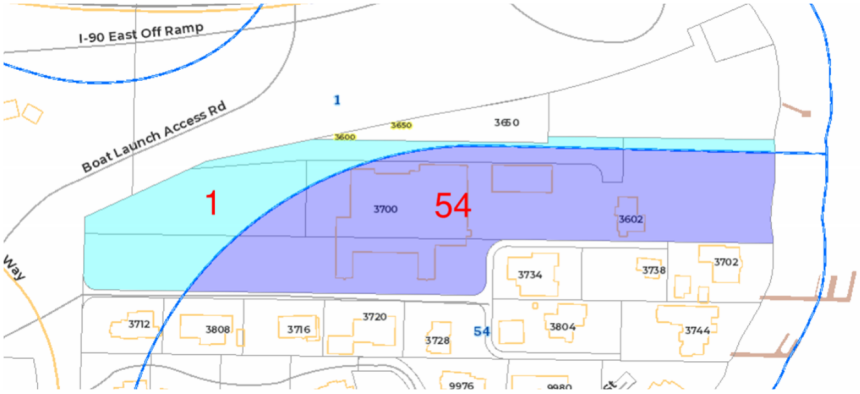
UPSTREAM ANALYSIS

The site does not have significant upstream areas contributing to the project area. There is a small, vegetated slope along the south side of the property that may generate incidental runs-on to the site, but it will be collected by the existing conveyance system. This southern existing system does not connect to the downstream system for the project, and thus will not have an impact on the drainage calculations.

DOWNSTREAM ANALYSIS

The existing site of Barnabie Point K-8 straddles two regional stormwater basins. Topographically, the site has a high point and separates near the west side of the site, which causes stormwater to drain to both the east and to the west. The project is located within drainage basins 1 and 54 of the Lake Washington/Cedar River Watershed. The first stormwater flow path (westerly basin) sheet flows in the north direction to the drainage system within Frontage Road. At the northwest corner of the existing parking lot, a 12" diameter pipe flows from the site south towards E Mercer Way. The 12" diameter pipe then flows north to a 24" diameter pipe that crosses Frontage Road. Flowing east across Frontage Road, the piped stormwater system then crosses under Interstate 90, discharges to drainage basin 1, and ultimately drains to Lake Washington. The second flow path on the site is an existing private storm that outfalls to Lake Washington.

Flowing east, there is a 4" diameter pipe that runs along the north side of the Herzl-Ner Tamid Conservative Congregation that flows to a 6" diameter pipe. On the south side of the Herzl-Ner Tamid Conservative Congregation, there is a second 6" diameter pipe that also flows east. The two 6" diameter pipes intersect at the east end of the parking lot and flows to an 8" diameter pipe that continues to flow east, discharges to drainage basin 54, and ultimately drains through a private outfall to Lake Washington. See *Figure 4 – Quarter Mile Downstream.*



MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

Not applicable.

IV. FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

EXISTING SITE HYDROLOGY (PART A)

Refer to Section III – Offsite Analysis, within this report, for more information on the existing site hydrology. Storm drainage from the site directly discharges to Lake Washington.

DEVELOPED SITE HYDROLOGY (PART B)

In the proposed conditions, stormwater will generally be collected by roof downspouts, catch basin, and a trench drain and conveyed via a piped system. Stormwater is conveyed to the northeast of the proposed building where it will connect with the outfall system that will be installed in the early utility work phase of the project. The water quality facility will be installed downstream as part of the early work project, and the facility has been sized to accommodate the full buildout of this project including non-pollution generating surfaces such as roofs and sidewalks.

The following Table 2 below shows the total new plus replaced impervious area associated with this project, along with the pervious area affected by this project. This can also be seen on *Figure 5 – Proposed Conditions*.

TABLE 2 – DEVELOPED PROJECT CONDITIONS AREA BREAKDOWN

Land Cover	Area
Impervious Area	**1.16 acres**
Pervious Area	**0.21 acres**
Total Project Site Disturbance	**1.37 acres**

PERFORMANCE STANDARDS AND FLOW CONTROL SYSTEM (PART C AND D)

The runoff from the site drains directly to Lake Washington, which is a flow control exempt receiving water. Therefore, a stormwater flow control system is not required for this project.

WATER QUALITY SYSTEM (PART E)

The project is proposing 24,626 square feet (0.57 acres) of pollution-generating impervious surface. This exceeds the threshold of 5,000 square feet of pollution generating impervious surfaces, and thus water quality treatment is required on this project to treat the pollution-generating surfaces.

A Filterra unit is proposed downstream in order to treat all proposed pollution generating impervious surfaces. It was sized by Contech Engineered Solutions, based on section III-2.6 of the 2019 SWMMWW, which requires the Water Quality Design Flow to be the flow rate at or below which 91% of the total runoff volume is treated (as there are no detention facilities on this project). See MGS Flood output attached in Appendix B, which identifies the water quality design flow. The resulting Filterra system is a 6'x8' peak diversion underground vault that will be installed as part of the Early Work phase, but accounts for the totality of this project.

V. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

This section discusses the criteria used to analyze and design the proposed storm conveyance system.

DEVELOPED STORM SYSTEM DESCRIPTION

Stormwater runoff from the proposed development will sheet flow toward collection systems, which will discharge runoff to either a detention system or directly to the downstream point of connection. Conveyance systems were designed to convey the 100-year storm without overtopping any structure rims.

CONVEYANCE ANALYSIS

The method used to analyze the stormwater conveyance capacity for the proposed site development uses the Rational Method to estimate peak flows to the inlets (catch basins, trench drains, etc.) and the Continuity Equation/Manning's Formula to determine the required size of pipe. The continuity equation is shown below:

$$Q = A \times V$$

Where:

Q = flow rate (ft^3/s)
A = cross-sectional area of conveyance pipe (ft^2)
V = velocity of flow in pipe, derived from Manning's Formula (ft/s)

Manning's Formula:
Manning's equation is used to estimate flows through channels and is based on the assumption of uniform flow, where flow, depth, area of cross-section, velocity of flow, and discharge are the same at every section of the pipe segment. The formula can be derived by equating the propulsive force due to the weight of water in the direction of flow with the retarding shear force at the pipe boundary. This empirical formula is shown below:

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

Where:

V = velocity of flow (ft/s)
n = roughness coefficient
R = hydraulic radius (ft)
S = slope of pipe (ft/ft)

Once the velocity of flow is found in the pipe using Manning's Formula, the continuity equation is used to calculate the flow rate for each pipe.

Rational Method:
The Rational Method refers to a method of computing peak storm water flows from small urban watersheds. The method is an empirical approach, derived from storm water observations and tests. The basic equation of the rational method has the form:

$$Q_R = C \times I_R \times A$$

Where:

Q_R = peak rate of flow (ft^3/s) for storm frequency (R)
C = runoff coefficient
I_R = peak rainfall intensity (in/hr) for storm frequency (R)
A = drainage basin area (ac)

The runoff coefficient, C, is a highly critical element that serves the function of converting the average rainfall rate of a particular recurrence interval to the peak runoff intensity of the same frequency. Therefore, it accounts for

many complex phenomena in the runoff process. Its magnitude will be affected by antecedent moisture conditions, ground slope, ground cover, depression storage, soil moisture, shape of drainage area, overland flow velocity, intensity of rain, and so on. Yet its value is generally considered fixed for any drainage area, depending only on the surface type. Values of the coefficient are given below in Table 6:

TABLE 6 – TYPICAL RUNOFF COEFFICIENTS

Surface	C Value
Asphalt Paving	**0.7-0.9**
Roofs	**0.7-0.9**
Landscape	
>7° Slope	**0.15-0.35**
2-7° Slope	**0.10-0.22**
<2° Slope	**0.05-0.17**
Forest	**0.18**
Cultivated Land	**0.30**

For an area having different types of surfaces, a composite coefficient is determined by estimating the fraction of each type of surface within the total area, multiplying each fraction by the appropriate coefficient of that type of surface, and then summing the products for all types of surfaces. The coefficients are selected so as to reflect the conditions that are expected at the end of the design period.

The drainage basin area, A, represents the drainage area for a site under consideration. For a natural system it represents the watershed. For a storm system network, it is the area tributary to a point of inlet, such as a catch basin or downspout. If a system consists of a number of inlets and pipes, the complete area is sub-dived into component parts separating a tributary area to each inlet point of every storm system segment, or pipe. For this project, a conservative assumption of 0.9 is used for all impervious surfaces and 0.25 for all pervious surfaces and weighted to find a composite C value for each subbasin. See *Figure 8 – Catchment Areas* and *Section VII – Engineering Calculations* for subbasin C Value calculations.

Rainfall intensity, I_R, is dependent on the duration of rainfall (short duration storms are more intense) and the storm frequency (or recurrence interval). The peak rainfall intensity I_R for the specified design storm of return frequency R is determined using a unit peak rainfall intensity factor i_R in the following equation:

$$I = \frac{\mathbf{m}}{T_c^n}$$

Where:

I = rainfall intensity (in/hr) for storm frequency (R)
T_C = time of concentration (min)
m, n = constants based on storm frequency (R) and regional climate

The values for constants m and n are obtained using observed rainfall data for the locality selected. See Table 7 below for frequency intervals of 2, 5, 10, 25, 50, and 100 years for values typical of the region of Mercer Island.

TABLE 7 – COEFFICIENTS FOR THE RATIONAL METHOD "I_R" EQUATION

Design Storm Return Frequency	m	n
2-year	3.69	0.556
5-year	5.20	0.570
10-year	6.31	0.575
25-year	7.83	0.582
50-year	8.96	0.585
100-year	10.07	0.586

Time of concentration, Tc, is defined as the time required for rainfall from the hydraulically most remote part of the drainage basin to reach the point of reference (or inlet). Since rainfall intensity reduces with increase in storm duration, the duration should be as short as possible. However, if the rainfall duration is less then Tc, then only a part of the drainage area will be contributing to the runoff. For an entire area to contribute, the shortest storm duration should equal Tc. Thus, the time of concentration is used as a unit duration for which rainfall intensity is determined. In storm system design, in addition to the time required for the rain falling on the most remote point of the tributary area to flow across the ground surface, along streets, and gutters, to the point of entry into the storm system, the time of flow through the storm pipe is also important. The surface runoff and subsurface storm pipe flow times are added together when computing the capacity for the downstream system.

Due to the mathematical limits of the peak rainfall intensity equation coefficients, values of Tc less than 5.0 minutes or greater than 100 minutes cannot be used. Therefore, real values of Tc less than 5.0 minutes must be assumed to be equal to 5 minutes, and values greater than 100 minutes must be assumed to be equal to 100 minutes.

See Section VII - Engineering Calculations for the 25-year, 24-hour storm and 100-year, 24-hour storm conveyance analysis results.

VI. SUPPLEMENTAL REPORTS AND REQUIREMENT SUMMARY

Geotechnical Engineering Report – by Associated Earth Sciences, Inc., dated October 27, 2023.

associated
earth sciences
incorporated



Subsurface Exploration, Geologic Hazard,
and Preliminary Geotechnical Engineering Report

HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12 EXPANSION

Mercer Island, Washington

Prepared For:

HERZL-NER TAMID CONSERVATIVE CONGREGATION

Project No. 20210371E001
October 27, 2023



Associated Earth Sciences, Inc.

www.aesgeo.com

Kirkland | Mount Vernon | Tacoma

associated earth sciences incorporated

October 27, 2023
Project No. 20210371E001

Herzl-Ner Tamid Conservative Congregation
3700 East Mercer Way
Mercer Island, Washington 98040

Attention: Ms. Audrey Covner

Subject: Subsurface Exploration, Geologic Hazard,
and Preliminary Geotechnical Engineering Report
Herzl-Ner Tamid Conservative Congregation K-12 Expansion
3700 East Mercer Way
Mercer Island, Washington

Dear Ms. Covner:

We are pleased to present our preliminary geotechnical engineering report for the proposed K-12 school expansion project at the Herzl-Ner Tamid Conservative Congregation Synagogue Campus. This report summarizes the results of our subsurface explorations, geologic hazard, infiltration feasibility, and geotechnical engineering studies and offers preliminary design recommendations based on our present understanding of the project. Once project plans are developed and finalized, we should review the plans and confirm or update the recommendations in this report.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

G. Bradford Drew, P.E.
Senior Engineer

BD/ld - 20210371E001-003

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12 EXPANSION

Mercer Island, Washington

Prepared for:
Herzl-Ner Tamid Conservative Congregation
3700 East Mercer Way
Mercer Island, Washington 98040

Prepared by:
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911 5th Avenue
Kirkland, Washington 98033
425-827-7701

October 27, 2023
Project No. 20210371E001

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc.'s (AESI's) subsurface exploration, geologic hazard, and preliminary geotechnical engineering study for the proposed K-12 school expansion at the Herzl-Ner Tamid Conservative Congregation Synagogue Campus in Mercer Island, Washington. Our recommendations are preliminary as the project is in the conceptual design phase at this time. We will provide a final design report that addresses the project details once the type, size, and locations of the new buildings and ancillary structures are finalized. The site location is shown on the "Vicinity Map," Figure 1. The approximate locations of explorations completed for this study are shown on the "Existing Site and Exploration Plan," Figure 2. Copies of the exploration logs for this current study are included in Appendix A.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface soil and groundwater data to be utilized in the design of the project. Our study included reviewing available geologic literature, advancing three exploration borings, and performing a geologic study to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow groundwater conditions across the project area. Geotechnical engineering studies were completed to determine the type of suitable foundations, allowable foundation soil bearing pressures, anticipated foundation settlements, drainage considerations, and stormwater infiltration feasibility. This report summarizes our current fieldwork and offers preliminary design recommendations based on our present understanding of the project.

2.0 SITE AND PROJECT DESCRIPTION

The project location is the Herzl-Ner Tamid Conservative Congregation Synagogue Campus located at 3700 East Mercer Way in Mercer Island, Washington. The campus includes several King County parcels covering an approximate area of 3.6 acres with the main synagogue building centrally located across the parcels. To the west of the building is an undeveloped forested area covering approximately 0.6 acres. South of the forested area is a paved parking lot. Topography across the forested portion of the site slopes down gently to the north and gradually steepens beyond the property boundary toward Frontage Road. Overall vertical relief across the forested area ranges from about 5 to 10 feet, and the slope to the north of the forested area is inclined at about 60 percent over a maximum height of about 20 feet. East of the synagogue building topography slopes down gently to the east toward the Lake Washington shoreline.

We understand that a new K-12 school building is being planned within the forested portion of the site, west of the existing synagogue building. A conceptual site plan provided by the project architect, Anjali Grant Design LLC, indicates the new building will contain three levels of above-grade classrooms and rental offices, and a basement level for the gymnasium. The basement level generally spans the eastern half and southern margin of the forested area, extends about 18 feet below existing site grades at its deepest point, and generally daylights along the northwest margin of the site. The concept plans, dated September 6, 2023, are attached in Appendix B for reference.

3.0 SITE EXPLORATION

Our field studies for this phase of work were completed in September 2023 and included advancing three exploration borings (EB-1 through EB-3) across the site to define the general soil and shallow groundwater conditions below the proposed K-12 expansion building. The exploration locations are shown on the "Existing Site and Exploration Plan," Figure 2 and "LIDAR Based Shaded Relief," Figure 3. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in Appendix A. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types in the field. The locations of our field explorations were determined by approximate measurements from known site features.

The conclusions and recommendations presented in this report are based, in part, on the exploration borings completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions might sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

3.1 Exploration Borings

The exploration borings were completed by Geologic Drill Partners Inc., an independent driller working under subcontract to AESI, by advancing a 6-inch outside-diameter, hollow-stem auger with a track-mounted drill rig. During the drilling process, samples were generally obtained at 2½-foot to 5-foot-depth intervals. After drilling, each borehole was backfilled with bentonite chips, and the surface was patched using cold-mix asphalt in existing pavement areas.

Disturbed, but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with *ASTM International* (ASTM) D-1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached exploration boring logs.

The borings were continuously observed and logged by a geologist from our firm. The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and laboratory testing. The exploration logs presented in Appendix A are based on the N-values, field observations, and drilling action.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of applicable geologic literature. The following sections describe observed site stratigraphy, regional geology, and local groundwater.

The near-surface native sediments encountered in our explorations generally consisted of a surficial layer of existing fill overlying native nonglacial sediments of pre-Fraser age. The following section presents more detailed subsurface information.

4.1 Stratigraphy

The following subsections summarize our observations and interpretations of different sedimentary units observed in subsurface explorations in order of deposition from most recent to oldest.

Fill

Directly below the ground surface and pavement sections, existing fill soils (those not naturally deposited) were encountered within exploration borings EB-1, EB-2, and EB-3. The fill generally consisted of dry to slightly moist, primarily gray with zones of brown and tan, soft to stiff fine sandy silt ranging to silt with variable gravel and organic content. The existing fill ranged in thickness from about 4 to 5 feet in EB-1 and EB-2, and about 10 feet in EB-3.

Existing fill is not considered suitable for foundation support and will require removal and replacement with structural fill in areas where the building foundation is close to existing grade, such as the northwest portion of the site. Given the west and south portions of the building will be 10 to 18 feet below grade, we anticipate the extent of fill removal will be confined to the northwest portion of the site (although variable conditions can be expected in unexplored areas).

Excavated existing fill material may be suitable for reuse in structural fill applications if such reuse is specifically allowed by project plans and specifications, if excessively organic and any other deleterious materials are removed, and if moisture content is adjusted to allow compaction to the specified level and to a firm and unyielding condition. The silty fill soils may prove difficult to reuse as structural fill due to the high percentage of fine-grained (silt-sized) sediments which make them highly moisture-sensitive and subject to disturbance when wet. Existing fill is not suitable for infiltration of stormwater.

Pre-Fraser Nonglacial Deposits

Directly below the existing fill, explorations EB-1 and EB-2 encountered a deposit of dry grading to moist with depth, stiff grading to hard with depth, sandy silt with variable beds of dense sand and silty sand. These sediments also contained occasional silt and clay interbeds, slightly disturbed textures, sandy laminations, micas, scattered fine organics, and dark orange-brown to black iron-oxide staining. We interpreted these sediments as pre-Fraser nonglacial sediments. These sediments were deposited in a nonglacial environment and overridden by glacial ice during a subsequent glaciation. Due to their stratigraphic position, we infer that these sediments were deposited prior to the Fraser Glaciation that occurred between 12,500 to 15,000 years before present and have been consolidated by at least one glaciation. The pre-Fraser nonglacial sediments extended to depths of approximately 40.5 feet in EB-1 and the termination depth of EB-2 at 21.5 feet.

The stiff to hard pre-Fraser nonglacial sediments are suitable for foundation support with proper preparation as recommended in this report. The pre-Fraser sediments generally contain a significant fraction of fine-grained material (silt and clay) and will be difficult to reuse as structural fill as they are highly moisture-sensitive, difficult to aerate and dry when above optimum moisture, and subject to disturbance when wet. Due to the high percentage of fine-grained material and high density, the pre-Fraser fine-grained sediments are expected to have low-permeability characteristics and are considered unsuitable as a stormwater infiltration receptor.

Pre-Fraser Lacustrine Deposits

Directly below the pre-Fraser nonglacial sediments, EB-1 and EB-3 encountered stiff to hard, bluish gray to light brown silt with trace fine micas and trace to absent sand content. We

interpreted these sediments as pre-Fraser lacustrine deposits. The pre-Fraser lacustrine sediments consist of fine sediments that were deposited in a lake environment prior to the Vashon Stade of the Fraser Glaciation, approximately 12,500 to 15,000 years ago. The high relative density characteristic of the pre-Fraser lacustrine deposits is due to its consolidation by the glacial ice that overrode these sediments after their deposition. The pre-Fraser lacustrine deposits extended beyond the maximum depths explored in EB-1 (41.5 feet) and EB-3 (26.5 feet).

While it is not likely that pre-Fraser lacustrine sediments will be handled in substantial quantity during construction due to the depth and location in which they were encountered, these sediments are suitable for support of building foundations with proper preparation. Sand content of the pre-Fraser lacustrine sediments was variable but generally low. Due to the high percentage of fine-grained material and high density, the pre-Fraser lacustrine sediments are expected to have low-permeability characteristics and are considered unsuitable as a stormwater infiltration receptor.

4.2 Regional Geologic Mapping

Review of the geologic map of the project area (*Geologic Map of Mercer Island, Washington,* by Kathy G. Troost and Aaron P. Wisher, GeoMapNW, October 2006) indicates that the site is expected to be underlain by Vashon subglacial till deposits with older pre-Fraser nonglacial deposits just south of the site. Our interpretation of the sediments encountered in our recent explorations is somewhat in agreement with the regional geologic map. We did not encounter Vashon till below the site but did encounter the older pre-Fraser nonglacial deposits beneath the existing fill.

4.3 Hydrology

No groundwater was encountered at the time of drilling within any of the three explorations completed for this study; however, it should be noted that our site explorations were conducted in September when groundwater levels are typically nearing a seasonal low. During wetter periods of the year, zones of perched groundwater may be present within more-permeable strata in existing fill and within sandy zones of the pre-Fraser nonglacial deposits. The occurrence and level of groundwater seepage encountered during construction will largely depend on the soil grain-size distribution, topography, seasonal precipitation, on- and off-site land usage, and other factors.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic, slope, and ground and surface water conditions, as observed and discussed herein. The discussion will be limited to landslide, seismic, and erosion hazards. Individual geologic hazard topics are discussed in further detail below.

5.0 LANDSLIDE HAZARDS AND MITIGATIONS

Topography across the forested portion of the site and within the footprint of the proposed K-12 expansion building generally slopes down gently to the north, with localized areas of moderately sloping terrain and hummocky topography, and gradually steepens beyond the property boundary toward Frontage Road. We interpret the hummocky topography to be a result of random fill placement across the site rather than indicative of landslide activity. Areas to the east, south, and west of the proposed building are generally flat to gently sloping. Overall vertical relief across the forested area ranges from about 5 to 10 feet.

The area that steepens to the north toward Frontage Road contains a steep slope inclined at about 60 percent over a maximum height of about 20 feet. The crest of this slope is located about 10 to 25 feet away from the proposed building footprint. This slope classifies as a landslide hazard area in accordance with the *City of Mercer Island Municipal Code*. Based on our site reconnaissance and review of site topography, this slope appears to be the result of grading for Frontage Road that crosses beneath Interstate 90 and could be a combination of cut and fill. The slope is well vegetated with ivy ground cover and mature trees. Some of the trees appeared to be leaning or slightly bowed near the trunk, indicating the slope may be experiencing soil creep; however, we did not observe any obvious signs of landslide activity or groundwater seepage emanating from the slope face.

We also reviewed the 2021 King County Light Detection and Ranging (LIDAR)-based shaded relief map of the site and steep slope area as provided on the Washington State Department of Natural Resources (WADNR), Division of Geology and Earth Resources, LIDAR portal. Shaded relief maps generated from LIDAR data provide a detailed image of the ground surface, even in heavily vegetated areas. Such images can reveal the presence of geomorphic features, such as faults or landslide features, not visible on conventional aerial photos. The LIDAR-based shaded relief map of the project site and vicinity along with topographic contours are shown on Figure 3. The LIDAR imaging does not reveal any indications of recent landsliding activity along the steep slope area.

Provided the slope is comprised of glacially consolidated native sediments at shallow depths, similar to the subsurface conditions encountered within exploration EB-1, and considering that

the eastern half of the proposed building will contain a basement level that results in additional setback between the building footings and slope face (up to 50 feet of setback where the basement level finished floor is proposed at an elevation of about 86 feet), the risk of slope movement affecting the proposed development is low, in our opinion. Additional explorations and slope stability evaluation may become necessary as the project design and proposed site grading are finalized.

6.0 SEISMIC HAZARDS AND MITIGATIONS

The following discussion is a general assessment of seismic hazards that is intended to be useful to the project design team in terms of understanding seismic issues, and to the structural engineer for design.

All of Western Washington is at risk of strong seismic events resulting from movement of the tectonic plates associated with the Cascadia Subduction Zone (CSZ), where the offshore Juan de Fuca plate subducts beneath the continental North American plate. The site lies within a zone of strong potential shaking from subduction zone earthquakes associated with the CSZ. The CSZ can produce earthquakes up to magnitude 9.0, and the recurrence interval is estimated to be on the order of 500 years. Geologists infer the most recent subduction zone earthquake occurred in 1700 (Goldfinger et al., 2012[1]). Three main types of earthquakes are typically associated with subduction zone environments: crustal, intraplate, and interplate earthquakes. Seismic records in the Puget Sound region document a distinct zone of shallow crustal seismicity (e.g., the Seattle Fault Zone [SFZ]). These shallow fault zones may include surficial expressions of previous seismic events, such as fault scarps, displaced shorelines, and shallow bedrock exposures. The shallow fault zones typically extend from the surface to depths ranging from 16 to 19 miles. A deeper zone of seismicity is associated with the subducting Juan de Fuca plate. Subduction zone seismic events produce intraplate earthquakes at depths ranging from 25 to 45 miles beneath the Puget Lowland including the 1949, 7.2-magnitude event; the 1965, 6.5-magnitude event; and the 2001, 6.8-magnitude event) and interplate earthquakes at shallow depths near the Washington coast including the 1700 earthquake, which had a magnitude of approximately 9.0. The 1949 earthquake appears to have been the largest in this region during recorded history and was centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and 4) ground

[1] Goldfinger, C., Nelson, C.H., Morey, A.E., Johnson, J.E., Patton, J.R., Karabanov, E., Gutierrez-Pastor, J., Eriksson, A.T., Gracia, E., Dunhill, G., Enkin, R.J., Dallimore, A., and Vallier, T., 2012, *Turbidite Event History—Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone*: U.S. Geological Survey Professional Paper 1661–F, 170.

motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

Seattle Fault Zone

The site is located within the mapped limits of the SFZ. The SFZ is a broad east-west oriented zone that extends from approximately Issaquah to Alki Beach, and is approximately 2.5 to 4 miles in width from north to south. The SFZ is speculated to contain multiple distinct fault "strands," some of which are well understood and some of which may be poorly understood or unknown. Mapping of individual fault strands is imprecise, as a result of pervasive modification of the land surface by development, which has obscured possible surficial expression of past seismic events. Studies by the U.S. Geological Survey (USGS) and others have provided evidence of surficial ground rupture along strands of the Seattle Fault (USGS, 2010[2]; Pratt et al., 2015[3]; Haugerud, 2005[4]; Liberty et al., 2008[5]). According to USGS studies the latest movement of this fault was about 1,100 years ago when about 20 feet of surficial displacement took place. This displacement can presently be seen in the form of raised, wave-cut beach terraces along Alki Point in West Seattle and Restoration Point at the south end of Bainbridge Island. Based on our review of the WADNR website, inferred fault traces associated with the SFZ are located along the southern boundary of the subject property. Further review of the Mercer Island Seismic Hazard Assessment (Kathy Troost, Aaron Wisher; April, 2009) indicates that the strand is mapped as the Vasa Park Fault, and has no known surface rupture on Mercer Island; however, it does form a scarp east of Mercer Island. It further indicates that the fault is not well defined on Mercer Island. Due to the suspected long recurrence interval, lack of known surficial rupture, and location uncertainty, the potential for surficial ground rupture is considered to be low during the expected life of the proposed structure.

6.2 Seismically Induced Landslides

Similar to the discussion in the "Landslide Hazards and Mitigations" section above, it is our opinion that the potential risk of damage to the proposed improvements by seismically induced slope failures is low provided the slope is comprised of glacially consolidated native sediments at

[2] U.S. Geological Survey, 2010, *Quaternary Fault and Fold Database for the United States*, accessed November 10, 2010, from USGS web site: http://earthquake.usgs.gov/hazards/qfaults/.

[3] Pratt et al., 2015, *Kinematics of Shallow Backthrusts in the Seattle Fault Zone, Washington State*: Geosphere, v. 11, no. 6, p. 1-27).

[4] Haugerud, R.A., 2005, *Preliminary Geologic Map of Bainbridge Island, Washington*: U.S. Geological Survey Open-File Report 2005-1387, version 1.0, 1 sheet, scale 1:24,000.

[5] Liberty, Lee M.; Pratt, Thomas L., 2008, *Structure of the Eastern Seattle Fault Zone, Washington State - New Insights from Seismic Reflection Data*: Bulletin of the Seismological Society of America, v. 98, no. 4, p. 1681-1695.

shallow depths, similar to the subsurface conditions encountered within exploration EB-1, and considering that the eastern half of the proposed building will contain a basement level that provides additional setback between the building footings and slope face. Additional explorations and slope stability evaluation may become necessary as the project design and proposed site grading are finalized.

6.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibrations, such as those which occur during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts and by the fluid pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a temporary decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment and settlement of overlying structures. Areas most susceptible to liquefaction include those areas underlain by very soft to stiff, non-cohesive silt and very loose to medium dense, non-silty to silty sands with low relative densities, accompanied by a shallow water table.

The project site is generally comprised of a surficial layer of existing fill underlain by glacially consolidated native sediments with a lack of adverse groundwater conditions. In our opinion, the potential risk of damage to the proposed site improvements by liquefaction is low due to the high relative density of the underlying native sediments and the absence of adverse groundwater conditions at the site. No detailed liquefaction hazard analysis was performed for this study, and none is warranted, in our opinion.

6.4 Ground Motion/Seismic Site Class

It is our opinion that earthquake damage to the proposed building, when founded on suitable bearing strata in accordance with the recommendations contained herein, will be caused by the intensity and acceleration associated with the event. We assume that structural design of the buildings will follow the 2018 *International Building Code* standards and the American Society of Civil Engineers (ASCE) *7 - Minimum Design Loads for Buildings and Other Structures*, the current version of which is ASCE 7-16. Based on the subsurface conditions encountered in our explorations within the vicinity of the proposed building, we recommend using Site Class "D" as defined in Table 20.3-1 of ASCE 7-16.

7.0 EROSION HAZARDS AND MITIGATIONS

The sediments underlying the site generally consist of fine sand and silt. These sediments will be susceptible to erosion and off-site sediment transport when exposed during construction. Therefore, the project should follow best management practices (BMPs) to mitigate erosion hazards and potential for off-site sediment transport. To mitigate the potential for off-site sediment transport, we recommend the following:

1. Construction activity should be scheduled or phased as much as possible to reduce the amount of earthwork activity that is performed during the winter months.

2. The winter performance of a site is dependent on a well-conceived plan for control of site erosion and stormwater runoff. The project temporary erosion and sediment control (TESC) should include ground-cover measures, access roads, and staging areas. The contractor must implement and maintain the required measures.

3. TESC measures for a given area, to be graded or otherwise worked, should be installed prior to any activity within that area. The recommended sequence of construction within a given area would be to install sediment traps and/or ponds and establish perimeter flow control prior to starting earthwork.

4. During the wetter months of the year, or when large storm events are predicted during the summer months, each work area should be stabilized so that if precipitation occurs, the work area can receive the rainfall without excessive erosion or sediment transport. The required measures for an area to be "buttoned-up" will depend on the time of year and the duration the area will be left unworked. During the winter months, areas that are to be left unworked for more than 2 days should be mulched or covered with plastic. During the summer months, stabilization will usually consist of seal-rolling the subgrade. Such measures will aid in the contractor's ability to get back into a work area after a storm event. The stabilization process also includes establishing temporary stormwater conveyance channels through work areas to route runoff to the approved treatment facilities.

5. All disturbed areas should be revegetated as soon as possible. If it is outside of the growing season, the disturbed areas should be covered with mulch, or as recommended in the erosion control plan. Straw mulch provides a cost-effective cover measure and can be made wind-resistant with the application of a tackifier after it is placed.

6. Surface runoff and discharge should be controlled during and following development. Uncontrolled discharge may promote erosion and sediment transport.

7. Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering with plastic sheeting, the use of low stockpiles in flat areas, or the use of straw bales/silt fences around pile perimeters. During the local wet season period, between November 1 and March 31, these measures are required.

It is our opinion that with the proper implementation of the TESC plans and by field-adjusting appropriate mitigation elements (BMPs) throughout construction, the potential for adverse impacts from erosion hazards on the project may be mitigated.

III. PRELIMINARY DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our explorations indicate that, from a geotechnical engineering standpoint, the proposed project is feasible provided the recommendations contained herein are properly followed. At the locations explored, we encountered a surficial layer of existing fill, ranging in thickness from about 5 to 10 feet, overlying glacially consolidated native sediments consisting of stiff to hard pre-Fraser nonglacial deposits and pre-Fraser lacustrine deposits. The pre-Fraser sediments will provide suitable support for conventional spread and strip footings with proper preparation. The existing fill soils are not considered suitable for direct foundation support and may require remedial measures for support of slabs-on-grade, pavements, and hardscapes.

The following sections provide our preliminary design recommendations for site preparation, temporary and permanent slopes, structural fill, foundation support, slab-on-grade support, lateral earth pressures on below-grade walls, drainage considerations, temporary excavation shoring methods, pavement design, and infiltration feasibility. Our recommendations are preliminary in that site development plans, site grading plans, structural plans, and construction methods have not been finalized.

9.0 SITE PREPARATION

Prior to site work, erosion and surface water control should be established around the perimeter of the site to satisfy City of Mercer Island requirements, as discussed in the "Erosion Hazards and Mitigations" section of this report.

9.1 Clearing and Stripping

Existing pavements, buried utilities, vegetation, topsoil, and any other deleterious materials should be removed where they are located below planned construction areas. Any disturbed soils or depressions, such as those that may be caused by demolition activities or tree removal, below planned final grades should be compacted with a smooth-drum vibratory roller to at least 95 percent of the modified Proctor maximum dry density as determined by the ASTM D-1557 test procedure, and to a firm and unyielding surface. Structural fill should be placed as needed to restore planned grades as discussed under the "Structural Fill" section of this report.

Where excavated existing fill and natural sediments are free of organics and near their optimum moisture content for compaction they can be segregated and considered for reuse as structural fill if allowed by project specifications. Most of the native sediments encountered in our

explorations contained significant silt fractions and are considered highly moisture-sensitive; these soils may be difficult to reuse as structural fill.

9.2 Existing Fill

After clearing, stripping, and any planned excavations have been completed, any remaining existing fill should be addressed. Below the planned building, existing fill should be removed and replaced with structural fill as needed to establish the building pad. Below areas of planned pavements, the existing fill should be exposed, compacted, and proof-rolled under the observation of AESI. Any areas that are soft, yielding, or contain excessive organic material or debris should be corrected as needed prior to paving.

Erosion and surface water control should be established around the perimeter of the excavation to satisfy City of Mercer Island requirements. Site preparation should include removal of all existing pavements, structures, buried utilities, and any other deleterious material below the building footprint. Existing fill should be removed from below the building foundations until suitable native soils are exposed, and the fill removal should extend laterally beyond a 1H:1V (Horizontal:Vertical) slope projected down from the footing limits. The resulting surface should then be compacted and proof-rolled before placing structural fill, as necessary, to reach planned grades.

9.3 Site Disturbance

The existing fill and native sediments contain a high percentage of fine-grained material. These sediments are considered to be highly moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and the area brought to grade with structural fill.

9.4 Wet Weather Considerations

The on-site soils are considered to be highly moisture-sensitive. If construction takes place in, during, or immediately following the wetter periods of the year, we anticipate the on-site soils will become unsuitable for structural fill applications. If earthwork will be completed during wet season months, we recommend budgeting to construct all structural fills with select, imported fill materials. For construction immediately following wet periods, significant, but unavoidable effort will be needed to scarify, aerate, and dry site soils to reduce moisture content prior to compaction in structural fill applications. Care should be taken to seal all earthwork areas during mass grading at the end of each workday by grading all surfaces to drain and sealing them with a smooth-drum roller. Stockpiled soils that will be reused in structural fill applications should be covered whenever rain is possible.

Construction during extended wet weather periods could create the need to overexcavate exposed soils if they become disturbed and cannot be recompacted due to elevated moisture content and/or weather conditions. Even during dry weather periods, soft/wet soils may be encountered in some portions of the site that will require overexcavation. If overexcavation is necessary, it should be confirmed through continuous observation and testing by AESI. Soils that have become unstable may require remedial measures in the form of one or more of the following:

1. Drying and recompaction. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry and warm weather.

2. Removal of affected soils to expose a suitable bearing subgrade and replacement with compacted structural fill.

3. Mechanical stabilization with a coarse crushed aggregate compacted into the subgrade, possibly in conjunction with a geotextile.

4. Soil/cement admixture stabilization.

Consideration should be given to protecting access and staging areas with an appropriate section of crushed rock or asphalt treated base (ATB). If crushed rock is considered for the access and staging areas, it should be underlain by engineering stabilization fabric (such as Mirafi 500X or approved equivalent) to reduce the potential of fine-grained materials pumping up through the rock during wet weather and turning the area to mud. The fabric will also aid in supporting construction equipment, thus reducing the amount of crushed rock required. We recommend that at least 10 inches of rock be placed over the fabric. Crushed rock used for access and staging areas should be of at least 2-inch size.

9.5 Temporary and Permanent Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, we anticipate that temporary, unsupported cuts into the existing fill or native soils can be made near vertical to a maximum depth of 4 feet. If excavations greater than 4 feet are required, then temporary, unsupported cut slopes can be planned at maximum inclinations of 1.5H:1V. These slope angles are for areas where groundwater seepage is not present at the faces of the slopes. If groundwater or surface water is present when the temporary excavation slopes are exposed, flatter slope angles on the order of 2H:1V to 3H:1V may be required. As is typical with earthwork operations, some sloughing and raveling may occur, especially if groundwater seepage is present in the excavation cuts, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent cut and structural fill slopes that are not intended to be exposed to surface water should be designed at inclinations of 2H:1V or flatter. All permanent cut or fill slopes should be compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by ASTM D-1557, and the slopes should be protected from erosion by sheet plastic until vegetation cover can be established during favorable weather.

10.0 STRUCTURAL FILL

We anticipate that placement of structural fill may be necessary to establish desired grades at the site and for backfilling within utility trenches and around foundation elements. All references to structural fill in this report refer to subgrade preparation, fill type, and placement and compaction of materials as discussed in this section.

10.1 Subgrade Compaction

After overexcavation/stripping have been performed to the satisfaction of the geotechnical engineer, the upper 12 inches of exposed ground should be recompacted to a firm and unyielding condition. If the subgrade contains too much moisture, suitable recompaction may be difficult or impossible to attain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below. After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades.

10.2 Structural Fill Compaction

Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to at least 95 percent of the modified Proctor maximum dry density using ASTM D-1557 as the standard. Utility trench backfill should be placed and compacted in accordance with applicable municipal codes and standards.

10.3 Use of On-Site Soils as Structural Fill

The existing fill and native soils onsite consisting of sand, silty sand, and sandy silt are suitable for use as structural fill provided they are free of roots or other deleterious materials and have a moisture content suitable for achieving the specified compaction. At the time of our exploration, the moisture content for the majority of the near-surface fill and native sediments encountered in our exploration appeared to be near or slightly below optimum for achieving suitable

compaction. It should be noted that our explorations were completed in the dry season when moisture conditions are near a seasonal low. The moisture content of the near-surface soils can be expected to be above optimum during wetter periods of the year.

Soils in which the amount of fine-grained material (smaller than No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. The majority of existing fill and native soils contain a substantial amount of silt and are considered highly moisture-sensitive. These soils may require moisture-conditioning before use as structural fill. Good construction practices and erosion control measures will be necessary to protect the fine-grained soils and prevent over-optimum moisture conditions from developing in the finer-grained soil areas.

If structural fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil, with the amount of fine-grained material (silt and clay) limited to 5 percent by weight when measured on the minus No. 4 sieve fraction, and at least 25 percent retained on the No. 4 sieve.

10.4 Structural Fill Testing

Compaction testing will likely be required by the City of Mercer Island. We recommend that a representative from our firm observe the subgrades and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time.

11.0 FOUNDATIONS

Based on the explorations completed for this study, native glacially consolidated sediments suitable for conventional shallow foundation support were observed at about 5 to 10 feet below the existing ground surface. Spread and strip footings may be used for building support when founded either directly on stiff to hard native sediments properly prepared as described in this report, or on structural fill placed over these materials after removal of existing fill.

For footings founded either directly upon stiff to hard native sediments, or on structural fill placed over these native sediments, we recommend using a maximum allowable bearing pressure of 3,000 pounds per square foot (psf) for design purposes, including both dead and live loads. An increase in the allowable bearing pressure of one-third may be used for short-term wind or seismic loading. If structural fill is placed below footing areas, the structural fill should extend laterally beyond a 1H:1V slope projected down from the footing limits.

Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection. However, all foundations must penetrate to the prescribed bearing strata, and no foundations should be constructed in or above loose, organic, or existing fill soils. Anticipated settlement of footings founded as recommended should be less than 1 inch with differential settlement one-half of the anticipated total settlement. Most of this movement should occur during initial dead load applications. However, disturbed material not removed from footing trenches prior to footing placement could result in increased settlements. All footing areas should be observed by AESI prior to placing concrete to verify that the foundation subgrades are undisturbed and construction conforms to the recommendations contained in this report. Foundation bearing verification by AESI will likely be required by the City as a condition of permitting. Perimeter footing drains should be provided as discussed under the "Drainage Considerations" section of this report.

It should be noted that the area bounded by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM D-1557. In addition, a 1.5H:1V line extending down and away from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edges of steps or cuts in the bearing soils.

The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be removed and foundations extended down to competent natural soil. If foundation excavation will occur during the wet season, consideration should be given to "armoring" the exposed subgrade with a 6- to 8-inch layer of crushed rock or ballast rock to provide a working surface during foundation construction.

12.0 SLAB-ON-GRADE SUPPORT

Floor slabs can be supported directly on stiff to hard native sediments, or on new structural fill placed above the native sediments after removal of any existing fill. All fill placed beneath the slab must be compacted to at least 95 percent of ASTM D-1557. The floor should be cast atop a minimum of 4 inches of washed crushed "chip rock" to act as a capillary break. It should also be protected from dampness by an impervious, 15-mil (minimum thickness) plastic sheeting placed atop the capillary break specifically designed for use as a moisture barrier.

13.0 BASEMENT WALLS

We have provided preliminary design and construction recommendations for design of the basement walls below.

13.1 Static Lateral Earth Pressures

It is likely that some yielding of the basement walls will occur before the interior floor diaphragms are constructed. As such, the walls can be designed to withstand an appropriate *static active earth pressure*. For restrained walls that deflect less than 0.005 times the wall height, an appropriate *static at-rest earth pressure* should be used instead. In both cases, these pressures act over the entire back of the wall and vary with the backslope inclination. Assuming a level backslope and well-drained conditions, we recommend using the following values, which are given in pounds per cubic foot (pcf) of equivalent fluid pressure.

Static Active Earth Pressure:	35 pcf
Static At-Rest Earth Pressure:	55 pcf

13.2 Static Lateral Surcharge Pressures

Any backslope load located within a 45-degree plane projected upward from the wall base will apply a lateral surcharge on the wall. Possible sources of surcharge loading include parking lots, traffic lanes, and structure footings. These surcharge pressures act over the portion of wall adjacent to the load source. For distributed vertical loads, active and at-rest static lateral surcharge pressures can be approximated by multiplying the vertical pressure "Q" in psf by the appropriate coefficient shown below. We recommend using a vertical pressure of 250 psf to model traffic and parking loads behind the wall.

Static Active Surcharge Pressure:	0.28(Q) psf
Static At-Rest Surcharge Pressure:	0.44(Q) psf

13.3 Undrained Wall Pressures

If groundwater is allowed to build up behind a basement wall, a hydrostatic surcharge pressure will act on the inundated portion of the wall. Because this hydrostatic pressure also reduces the aforementioned static earth pressures, the net effect is diminished relative to full hydrostatic water pressure. We recommend using the following combined soil and hydrostatic surcharge pressures for design of undrained walls.

Static Active Earth Pressure:	80 pcf
Static At-Rest Earth Pressure:	90 pcf

13.4 Seismic Lateral Surcharge Pressures

The total static pressures acting on a wall should be increased to account for seismic surcharge loadings resulting from lateral earthquake motions. These surcharge pressures act over the entire

back of the wall and vary with the backslope inclination, the seismic acceleration, and the wall height. For retaining walls with a level backslope, active and at-rest seismic lateral surcharge pressures can be approximated by multiplying the wall height "H" (in feet) by the appropriate coefficient shown below.

Seismic Active Surcharge Pressure:	10(H) psf
Seismic At-Rest Surcharge Pressure:	15(H) psf

13.5 Resisting Forces

Lateral pressures acting on a wall are resisted by a combination of passive lateral earth pressure from the embedded portion of wall foundations system, friction between the foundation and the native soils or supporting structural fill soils, and from resistance from the structural slab. For on-site basement walls, we recommend using the following values. These values incorporate static and seismic safety factors of at least 1.5 and 1.1, respectively. Interface friction acting along the bottom of a wall footing can be combined with passive pressure to resist sliding. The coefficient of friction value incorporates a safety factor of 1.5. The soil under the footings must be recompacted to 95 percent of ASTM D-1557 for this value to apply.

Allowable Static Passive Earth Pressure:	300 pcf
Allowable Seismic Passive Earth Pressure:	400 pcf
Coefficient of Friction:	0.30

14.0 DRAINAGE CONSIDERATIONS

Traffic across the on-site soils when they are damp or wet will result in disturbance of the otherwise firm stratum. Therefore, during site work and construction, the contractor should provide surface drainage and subgrade protection, as necessary.

No groundwater was encountered at the time of drilling within any of the three explorations completed for this study; however, it should be noted that our site explorations were conducted in September when groundwater levels are typically nearing a seasonal low. During wetter periods of the year, zones of perched groundwater may be present within more-permeable strata in existing fill and within sandy zones of the pre-Fraser nonglacial deposits. Therefore, we recommend the contractor be prepared to encounter groundwater seepage during excavation for the basement level. We anticipate that surface and groundwater seepage can be managed during construction with conventional ditches and sumps, and that more complex dewatering systems will not be needed.

All perimeter footings, slabs, and below-grade walls should be provided with a drain at the footing or subgrade elevation. Drains should consist of rigid, perforated, PVC pipe surrounded by washed gravel. The level of the perforations in the pipe should be set at or slightly below the bottom of the footing, and the perforations should be located on the lower portion of the pipe. The drains should be constructed with sufficient gradient to allow gravity discharge away from the structures.

We recommend that curtain drains be installed behind the basement walls in order to prevent hydrostatic pressure from developing behind the walls. A curtain drain is a vertical layer of drainage material placed against the back of a wall to dissipate hydrostatic pressures. The curtain drains should communicate with the perimeter footings drains, have a minimum width of 12 inches, and should be installed along the full height of the wall to a depth of 12 inches below final grade.

To minimize erosion, stormwater discharge or concentrated runoff should not be allowed to flow down any steep slopes. In planning, exterior grades adjacent to walls should be sloped downward away from the structures at an inclination of at least 3 percent to achieve surface drainage. Roof and surface runoff should not discharge into the foundation drain system, but should be handled by a separate, rigid, tightline drain that ties into the site stormwater system.

15.0 TEMPORARY EXCAVATION SHORING SYSTEM

Since the planned basement excavation will extend up to 18 feet below existing site grades, we anticipate that temporary excavation shoring may be required to support portions of the building excavation that are near adjacent structures, streets, and utilities. If an excavation shoring system is needed for the project, we anticipate that cantilever soldier pile walls with timber lagging will be adequate for this project. Tieback anchors may be needed to control horizontal deflections of the shoring wall depending on the proximity of the excavation to existing structures. The shoring system will require a specialty shoring subcontractor(s) to determine the appropriate design details, construction methods, and procedures for installation of the shoring system. We are available to provide recommended soil parameters and earth pressure diagrams to aid in the design of the shoring system as the project design develops.

A monitoring program will likely be required by the City to measure any horizontal or vertical movement of the excavation sidewalls and the installed shoring system. The monitoring should be performed by a licensed surveyor with monitoring points established on settlement-sensitive structures (buildings, manholes, poles, etc.) around the excavation and at regular intervals along the shoring system. Monitoring should be performed at least twice a week and the specifics of the monitoring program should be provided to AESI for review prior to implementation. We recommend the monitoring program be prepared as part of the final shoring wall design.

16.0 PAVEMENT RECOMMENDATIONS

The pavement sections included in this report section are for driveway and parking areas onsite and are not applicable to right-of-way improvements. At this time, we are not aware of any planned right-of-way improvements; however, if any new paving of public streets is required, we should be allowed to offer situation-specific recommendations.

Pavement areas should be prepared in accordance with the "Site Preparation" section of this report. If the stripped native soil or existing fill pavement subgrade can be compacted to 95 percent of ASTM D-1557 and is firm and unyielding, no additional overexcavation is required. Soft or yielding areas should be overexcavated to provide a suitable subgrade and backfilled with structural fill. The upper 2 feet of pavement subgrade should be recompacted to 95 percent of ASTM D-1557. If required, structural fill may then be placed to achieve desired subbase grades.

We anticipate the project will include light-duty pavements for passenger vehicles and heavy-duty pavements for buses, fire trucks, and/or garbage trucks. In light-duty traffic areas, we recommend a pavement section consisting of 3 inches of hot-mix asphalt (HMA) underlain by 4 inches of crushed surfacing base course (CSBC) as the recommended minimum in areas of planned passenger car lanes and parking. In heavy-duty traffic areas, a minimum pavement section consisting of 4 inches of HMA underlain by 6 inches of CSBC is recommended. The CSBC must be compacted to 95 percent of the maximum density, as determined by ASTM D-1557. All paving materials should meet gradation criteria contained in the current Washington State Department of Transportation (WSDOT) Standard Specifications.

Depending on construction staging and desired performance, the crushed base course material may be substituted with asphalt treated base (ATB) beneath the final asphalt surfacing. The substitution of ATB should be as follows: 4 inches of crushed rock can be substituted with 3 inches of ATB, and 6 inches of crushed rock may be substituted with 4 inches of ATB. ATB should be placed over a firm and unyielding subgrade as determined by proof-rolling and a 1½- to 2-inch thickness of crushed rock to act as a working surface. If ATB is used for construction access and staging areas, some rutting and disturbance of the ATB surface should be expected. The general contractor should remove affected areas and replace them with properly compacted ATB prior to final surfacing.

17.0 INFILTRATION FEASIBILITY

Infiltration opportunities appear limited to not feasible with the current building layout and proposed basement level. The project site is generally underlain by existing fill soils and native pre-Fraser sediments that generally consisted of stiff to hard silt and sandy silt. A layer of slightly moist to moist sand with trace silt was encountered within EB-1 from a depth of about 12 to

22 feet that may provide opportunity for infiltration; however, a significant portion of this layer will be removed during construction of the basement level. The fill soils are not considered suitable receptor soils for infiltration due to the relatively high silt content observed and variable composition. The pre-Fraser sediments are also not considered suitable receptor soils for infiltration due to the relatively high silt content and high relative density. Based on our experience with similar soil types in the Puget Sound region, the field infiltration rate of the pre-Fraser sediments is anticipated to be on the order of 1 to 2 inches per month. Therefore, it is our opinion that shallow infiltration is not feasible within the limits of the project site.

18.0 RECOMMENDATIONS FOR ADDITIONAL EXPLORATION

Due to equipment access constraints and utility conflicts, no explorations were completed along the northern margin of the site for this current study. We recommend completing up to three additional explorations with a miniature or portable drill rig that can access the forested area within the central and northwest portions of the site to explore the depth to native sediments. The exploration data in this area would also aid us in evaluating the steep slope that descends to the north of the project site.

19.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, we can confirm that our recommendations have been correctly interpreted and implemented in the design. The City may require a plan review by the geotechnical engineer as a condition of permitting.

The City may also require geotechnical special inspections during construction and preparation of a final summary letter when construction is complete. We are available to provide geotechnical engineering services during construction. The integrity of the earthwork and foundations depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

We have enjoyed working with you on this study and are confident these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

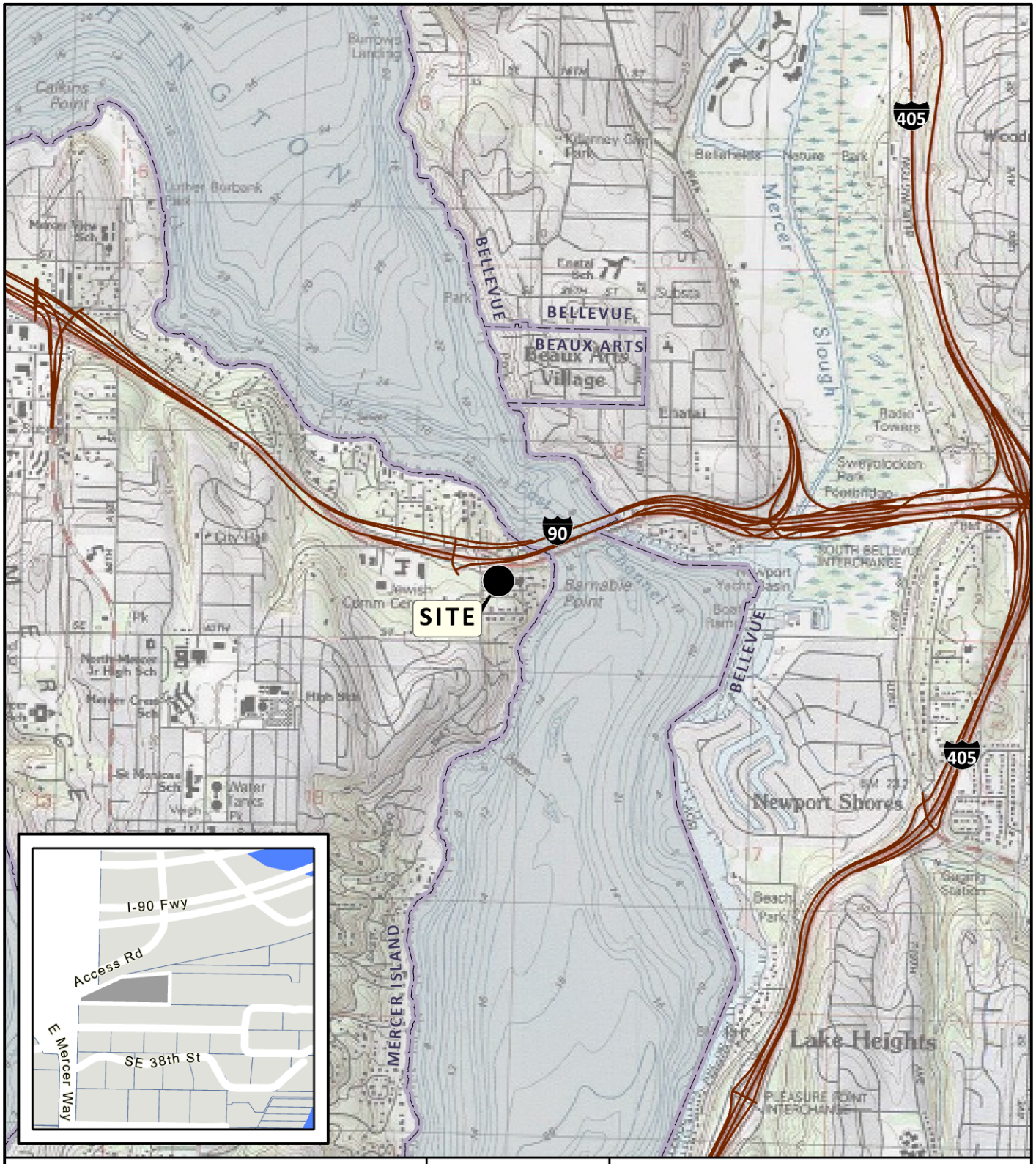


10/27/2023

Kurt D. Merriman, P.E.
Senior Principal Engineer

G. Bradford Drew, P.E.
Senior Engineer

Attachments:
Figure 1: Vicinity Map
Figure 2: Existing Site and Exploration Plan
Figure 3: LIDAR-Based Shaded Relief Map
Appendix A: Exploration Logs
Appendix B: Concept Plans



DATA SOURCES / REFERENCES:
USGS: 7.5' SERIES TOPOGRAPHIC MAPS, ESRI/I-CUBED/NGS 2013
KING CO: STREETS 5/23, PARCELS 4/23, CITY LIMITS, PARKS 5/23
LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

N

0 2000

FEET

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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VICINITY MAP

HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12
MERCER ISLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20210371E001	9/23	1

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LEGEND

- SITE
- EXPLORATION BORING
- CONTOUR 10 FT
- CONTOUR 2 FT
- PARCEL

DATA SOURCES / REFERENCES:
WADNR WGS: WA LIDAR PORTAL, KING CO. 2021, USGS 3DEP
GRID CELL SIZE 1.5', FLOWN 4/2021
CONTOURS DERIVED FROM LIDAR

KING CO: STREETS, PARCELS, 4/23
AERIAL PICTOMETRY INT. 2021

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



N

0 60

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BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

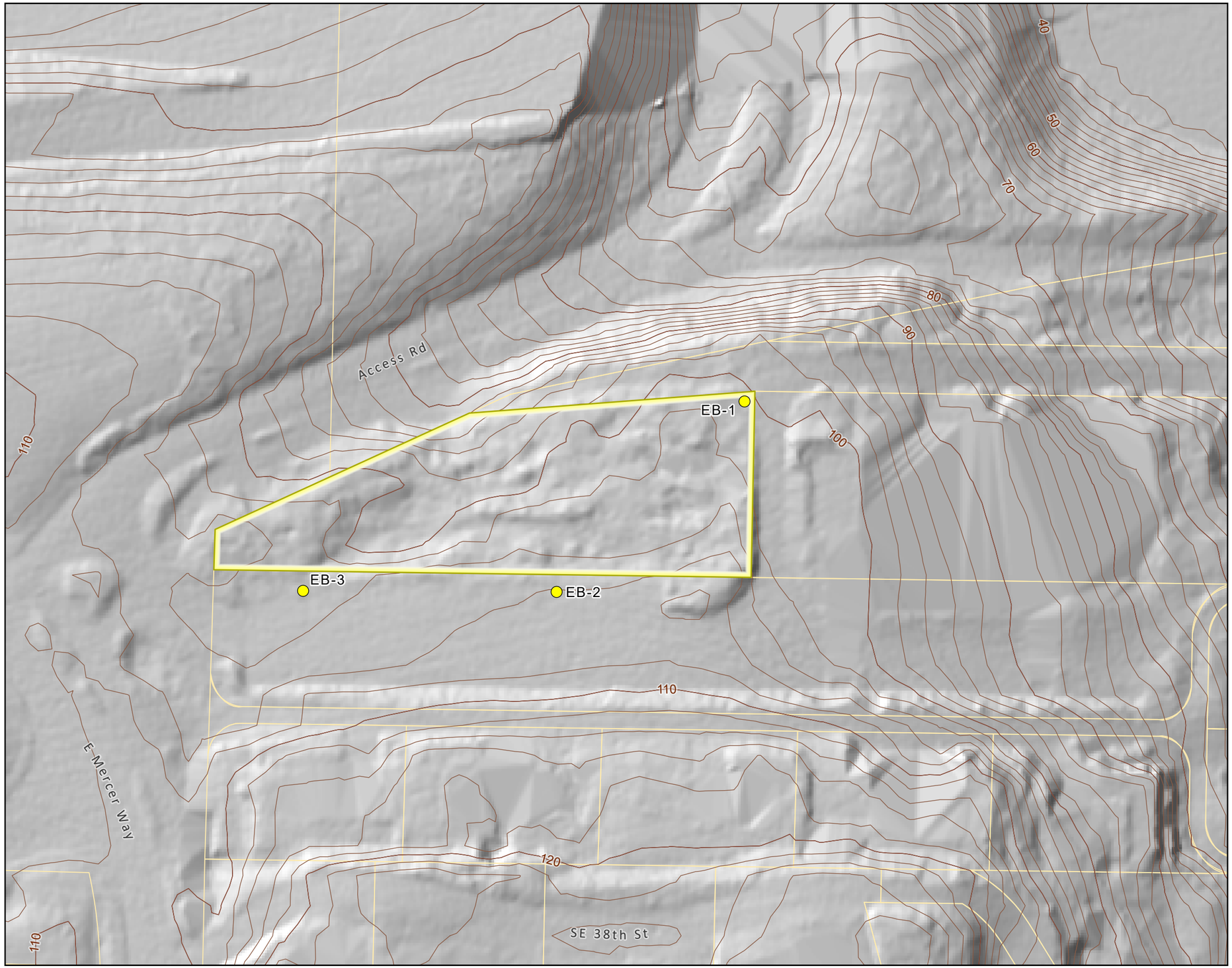
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EXISTING SITE AND EXPLORATION PLAN

HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12
MERCER ISLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20210371E001	9/23	2

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LEGEND

- SITE
- EXPLORATION BORING
- CONTOUR 10 FT
- CONTOUR 2 FT
- PARCEL

DATA SOURCES / REFERENCES:
WADNR WGS: WA LIDAR PORTAL, KING CO. 2021, USGS 3DEP
GRID CELL SIZE 1.5', FLOWN 4/2021
CONTOURS DERIVED FROM LIDAR

KING CO: STREETS, PARCELS, 4/23

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



N

0 60

FEET

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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LIDAR BASED SHADED RELIEF

HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12
MERCER ISLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20210371E001	9/23	3

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APPENDIX A

Exploration Logs

Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines[2]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines[2]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines[2]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines[2]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

Coarse-Grained Soils	Density	SPT[3] blows/foot
	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

Fine-Grained Soils	Consistency	SPT[3] blows/foot
	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

[4] Estimated Percentage

Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols

Sampler Type and Description

- Blows/6" or portion of 6"
- Split-Spoon Sampler (SPT)
- California Sampler
- Ring Sampler
- Continuous Sampling
- Grab Sample
- Portion not recovered

Groundwater depth

- ATD At time of drilling
- Static water level (date)

- Cement grout surface seal
- Bentonite seal
- Filter pack with blank casing section
- Screened casing or Hydrotip with filter pack
- End cap

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

(1) Percentage by dry weight
(2) Combined USCS symbols used for fines between 5% and 12%
(3) (SPT) Standard Penetration Test (ASTM D-1586)
(4) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

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EXPLORATION LOG KEY

FIGURE: A1

Blocks\ dwg \ log_key 2022.dwg LAYOUT: Layout 5 - 2022 Logdraft

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Exploration Boring EB-1

Herzl-Ner Tamid Conservative Congregation K-12 — Sheet: 1 of 2

Mercer Island, WA	Start Date: 9/7/23	Logged By: JTL
20210371E001	Ending Date: 9/7/23	Approved By: CMM

Driller/Equipment: Geologic Drill/Recon Track Rig
Hammer Weight/Drop: 140#/30"
Hole Diameter (in): 2
Groundwater Depth ATD (ft): Not encountered

Total Depth (ft): 41.5
Ground Surface Elevation (ft): ≈101
Datum: NAVD88
Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot (10 20 30 40 50+)	Other Tests
0					**Fill**				
					Dry, sandy, GRAVEL to gravelly, SAND; topsoil organics and rootlets (GP/SP).				
		1			Dry, tan, SILT, some fine gravel, trace fine sand; rootlets (ML).		3 3 3	6	
5		2			**Pre-Fraser Nonglacial** Dry, tan with iron oxide staining, fine sandy, SILT, trace fine gravel (ML).		7 9 7	16	
		3			Dry, light tan, fine sandy, SILT, some fine to medium gravel (ML). Becomes moist, less gravel.		3 18 20	38	
10		4			Dry to slightly moist, brown to tan, fine SAND with silt interbeds, trace fine gravel (SP-SM). Gravel increases.		12 13 18	31	
15		5	6		Slightly moist, gray and brown with iron oxide staining, medium SAND, trace fine sand, trace gravel (SP).		50/6"	50/6"	
20		6			Moist, light brown, medium SAND, trace gravel; white silt at tip of spoon (SP).		13 20 31	51	
25		7			Moist to wet, dark brown, fine sandy, SILT; micas present (ML). Becomes sandier at 26.5 feet.		19 40 43	83	
30		8			Slightly moist to moist, tan and brown, fine silty, SAND (SM).		13 20 25	45	
35		9			Moist to wet, tan and brown with iron oxide staining and mottling, fine sandy, SILT, trace gravel; organics present; slightly disturbed texture (ML).		1 18 20	38	

10/2/2023

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Exploration Boring EB-1

Herzl-Ner Tamid Conservative Congregation K-12 Sheet: 2 of 2

Mercer Island, WA	Start Date: 9/7/23	Logged By: JTL
20210371E001	Ending Date: 9/7/23	Approved By: CMM

Driller/Equipment: Geologic Drill/Recon Track Rig
Hammer Weight/Drop: 140#/30"
Hole Diameter (in): 2
Groundwater Depth ATD (ft): Not encountered

Total Depth (ft): 41.5
Ground Surface Elevation (ft): ≈101
Datum: NAVD88
Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot (10 20 30 40 50+)	Other Tests
40		10			Moist to wet, tan and brown with iron oxide staining and mottling, fine sandy, SILT, trace gravel; organics present; slightly disturbed texture (ML). As above.		8 16 20	36	
					Pre-Fraser Lacustrine Slightly moist to moist, bluish gray, SILT, trace sand (ML).				
					No groundwater encountered.				
45									
50									
55									
60									
65									
70									
75									

10/2/2023

20210371E001

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Exploration Boring EB-2

Herzl-Ner Tamid Conservative Congregation K-12 — Sheet: 1 of 1

Mercer Island, WA	Start Date: 9/7/23	Logged By: JTL
20210371E001	Ending Date: 9/7/23	Approved By: CMM

Driller/Equipment: Geologic Drill/Recon Track Rig
Hammer Weight/Drop: 140#/30"
Hole Diameter (in): 2
Groundwater Depth ATD (ft): Not encountered

Total Depth (ft): 21.5
Ground Surface Elevation (ft): ≈106
Datum: NAVD88
Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot (10 20 30 40 50+)	Other Tests
0					**Asphalt - 4 inches**				
					Fill				
		1			Slightly moist, mottled gray and brown with some iron oxide staining, SILT, some fine to medium sand, some gravel (ML).		8 17 8	25	
5		2			**Pre-Fraser Nonglacial** Slightly moist to moist, mottled brown with iron oxide staining, silty, fine SAND, some gravel; local silty interbeds; fine micas (SM).		2 5 8	13	
		3			Slightly moist to wet, brown, fine sandy, SILT, some fine sand; trace silt interbeds (ML).		5 8 9	17	
10		4			Slightly moist, light brown, silty, fine SAND to fine sandy, SILT, trace gravel (SM/ML).		6 9 13	22	
15		5			Moist, light brown with slight iron oxide staining, fine sandy, SILT; very fine micas (ML). Becomes finer, darker.		11 18 21	39	
20		6			Moist, brown, SILT, trace fine sand; very fine micas (ML).				
					No groundwater encountered.				
25									
30									
35									

10/2/2023

20210371E001

associated earth sciences incorporated

Exploration Boring EB-3

Herzl-Ner Tamid Conservative Congregation K-12 Sheet: 1 of 1

Mercer Island, WA	Start Date: 9/7/23	Logged By: JTL
20210371E001	Ending Date: 9/7/23	Approved By: CMM

Driller/Equipment: Geologic Drill/Recon Track Rig
Hammer Weight/Drop: 140#/30"
Hole Diameter (in): 2
Groundwater Depth ATD (ft): Not encountered

Total Depth (ft): 26.5
Ground Surface Elevation (ft): ≈103
Datum: NAVD88
Groundwater Depth Post Drilling (ft) (Date): ()

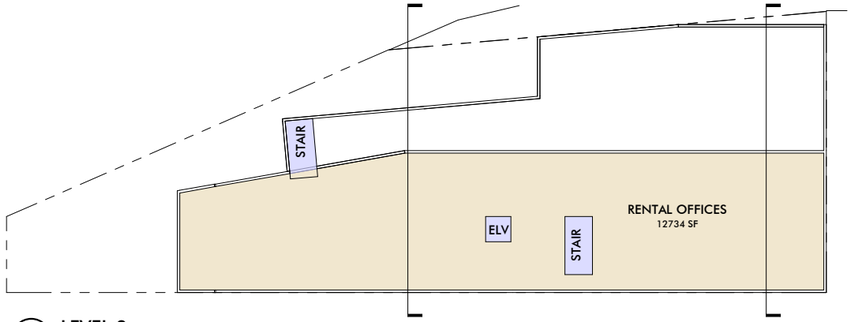
Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot (10 20 30 40 50+)	Other Tests
0					**Asphalt - 6 inches**				
					Fill				
		1			Slightly moist, gray, fine sandy, SILT, trace gravel (ML).		3 5 4	9	
5		2			Slightly moist to moist, gray and bluish gray, fine sandy, SILT, trace gravel; trace organics (ML).		3 4 2	6	
		3			Slightly moist to moist, gray, sandy, SILT; black organics (ML).		2 1 1	2	
10		4			**Pre-Fraser Lacustrine** Slightly moist to moist, blue and gray mottling with iron oxide stains, SILT (ML). Grades to tan.		4 7 7	14	
15		5			Moist, brown with iron oxide stains, SILT; fine micas (ML).		1 5 9	14	
20		6			Moist, light brown with heavy iron oxide staining, SILT, trace gravel (ML).		5 8 12	20	
25		7			Moist, bluish gray, SILT (ML).		4 9 17	26	
					No groundwater encountered.				
30									
35									

10/2/2023

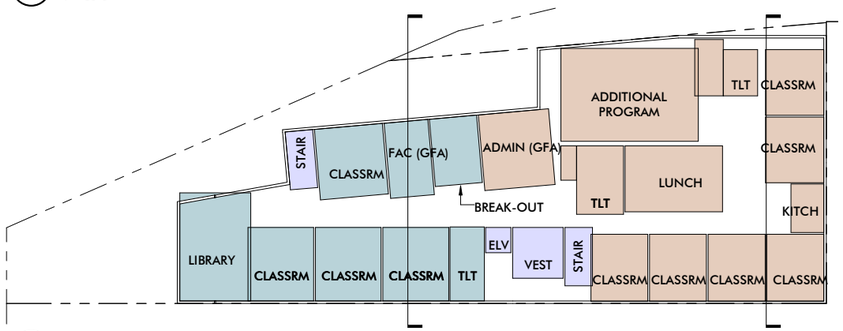
20210371E001

APPENDIX B

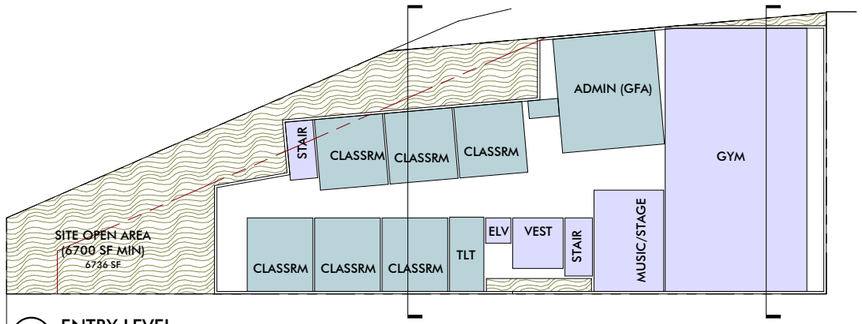
Concept Plans



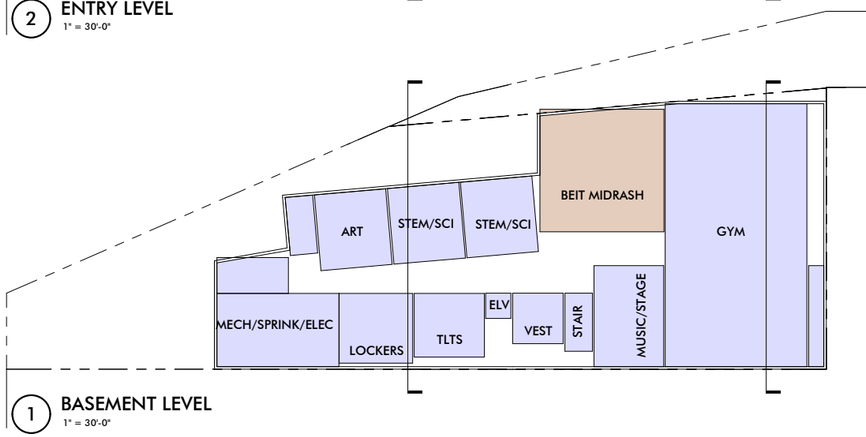
9 LEVEL 3
1" = 30'-0"



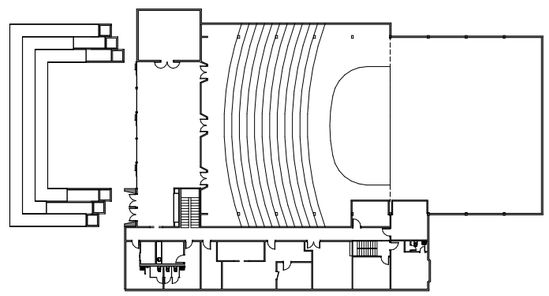
3 LEVEL 2
1" = 30'-0"

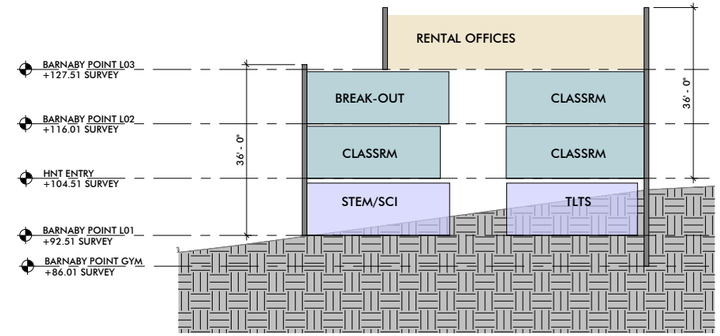


2 ENTRY LEVEL
1" = 30'-0"

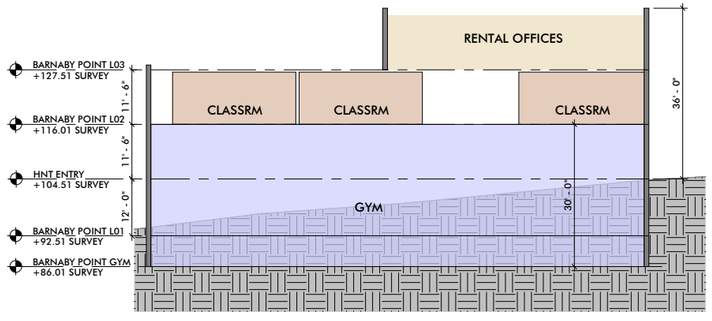


1 BASEMENT LEVEL
1" = 30'-0"





5 SECTION DIAGRAM 1 LOOKING WEST
1/16" = 1'-0"



6 SECTION DIAGRAM 2 LOOKING WEST
1/16" = 1'-0"

PROGRAM AREAS

PARTNER	SPACE TYPE	QTY	TOTAL AREA
JDS	ADMIN (GFA)	1	1,822 SF
JDS	BREAK-OUT	1	500 SF
JDS	CLASSRM	10	7,560 SF
JDS	FAC (GFA)	1	518 SF
JDS			10,400 SF
NYHS	ADDITIONAL PROGRAM	1	2,000 SF
NYHS	ADMIN (GFA)	1	837 SF
NYHS	CLASSRM	6	3,600 SF
NYHS	KITCH	1	250 SF
NYHS	LUNCH	1	1,000 SF
NYHS	STAFF TLT	1	84 SF
NYHS	TLT	3	1,000 SF
NYHS			8,771 SF
SHARED	ART	1	850 SF
SHARED	ELV	1	100 SF
SHARED	GYM	1	5,824 SF
SHARED	LOCKERS	1	800 SF
SHARED	MECH/SPRINK/ELEC	2	1,800 SF
SHARED	MUSIC/STAGE	1	1,100 SF
SHARED	STAIR	2	500 SF
SHARED	STEM/SCI	2	1,700 SF
SHARED	TELESCOPIC SEATING	1	240 SF
SHARED	TLTS	1	700 SF
SHARED	VEST	2	800 SF
SHARED			14,414 SF
			33,585 SF

GFA Gym Scheme 1

Comments	Area
ENTRY LEVEL	13,953 SF
L01/GYM	21,557 SF
L02	18,534 SF
L03	13,820 SF
	67,865 SF

GFA Gym Scheme 2

Comments	Area
L01/GYM	20,552 SF
L02	20,811 SF
HNT ENTRY	12,299 SF
L03	13,341 SF
	67,003 SF

CONCEPT PLANS

HERZL FEASIBILITY / 6 SEPTEMBER 2023

ORIGINAL SHEET SIZE 22 x 34; REDUCE DRAWING SCALE BY 50% IF VIEWING AS 11 x 17

anyaï grant design LLC

VII. ENGINEERING CALCULATIONS

TESC SIZING CALCULATIONS

CONVEYANCE ANALYSIS RESULTS – 25-YEAR AND 100-YEAR RETURN DESIGN STORMS

MGS FLOOD – WATER QUALITY DESIGN FLOW

TESC Sediment Trap Sizing (BMP C240)

$$\mathbf{SA = FS\ (Q_2 / V_S)}$$

SA = Surface Area (ft^2)
FS = Factor of Safety = 2
Q_2 = 2-year, 24-hour storm flow rate (ft^3/s)
V_S = Settling Velocity = 0.00096 ft/s

Total Site:

Pervious Area	0.21 ac
Impervious Area	1.16 ac
Total Area	1.37 ac

Per MGS Flood TESC Sizing Report:
2-year, 24-hour storm event **Q_2 = 0.586 ft^3/s**

Surface Area Calculation:
SA = FS (Q2 / VS)
SA = 2 (0.586 / 0.00096)
SA = 1,220.83 ft^2

V_R = SA * 3.5 ft minimum storage depth
V_R = 1,220.83 * 3.5
V_R = 4,273 ft^3 Storage Volume Required

V_R = 4,272.92 ft^3 * (7.48 gal/ 1 ft^3)
V_R = 31,961 Gallons Required

Volume Provided:
(2) 18,900 Gallon sediment storage tanks
V = 37,800 Gallons Provided

TESC BAKER TANK SIZING

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.64
Program License Number: 201910001
Project Simulation Performed on: 05/29/2025 2:54 PM
Report Generation Date: 05/29/2025 3:00 PM

Input File Name: Barnabie Point.fld
Project Name: Barnabie Point
Analysis Title:
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 1
Precipitation Station : 95003205 Puget West 32 in_5min 10/01/1939-10/01/2097
Evaporation Station : 951032 Puget West 32 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	1.370	1.370
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	1.370	1.370

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
SIDEWALKS/MOD	1.370

Subbasin Total 1.370

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
SIDEWALKS/MOD 1.370

Subbasin Total 1.370

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	0.000
Total:	0.000

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	0.000
Total:	0.000

Total Predevelopment Recharge Equals Post Developed

TESC BAKER TANK SIZING

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.000 ac-ft/year, Post Developed: 0.000 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.586	2-Year	0.586
5-Year	0.778	5-Year	0.778
10-Year	0.944	10-Year	0.944
25-Year	1.119	25-Year	1.119
50-Year	1.343	50-Year	1.343
100-Year	1.709	100-Year	1.709
200-Year	1.927	200-Year	1.927
500-Year	2.215	500-Year	2.215

TESC DESIGN STORM

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

Barnabie Point K-8

Drainage Inlet Sub-Basin Areas

Sub-Basin	Total Area *(Acres)*	Pavement Area C=0.90 *(Sq. Ft.)*	Roof Area C=0.90 *(Sq. Ft.)*	Lawn/Landscape Area C=0.25 *(Sq. Ft.)*	Forest Area C=0.15 *(Sq. Ft.)*	Composite C Value
A1	0.19	7901	0	366	0	0.87
A2	0.04	1624	0	0	0	0.90
A3	0.12	1325	3979	0	0	0.90
A5	0.24	10158	0	98	0	0.89
B1	0.16	181	6701	0	0	0.90
B2	0	200	0	0	0	0.90
B3	0.04	564	0	1034	0	0.48
B4	0.03	0	0	1113	0	0.25
B5	0.17	0	6767	838	0	0.83
A5	0.04	1908	0	0	0	0.90
A6	0.22	6293	0	3135	0	0.68
A7	0.10	2823	0	1415	0	0.68
A8	0.12	3985	0	1046	0	0.76
A9	0.18	3015	2525	2225	0	0.71
A10	0.58	8726	14671	1983	0	0.85
A11	0.01	260	0	0	0	0.90
A12	0.70	16129	8802	5591	0	0.78

CONVEYANCE SYSTEM ANALYSIS AND SIZING TABLE USING THE RATIONAL METHOD

Location		Sub Basin	Area	C	C*A	Sum	Tc	i	Q(R)	Pipe	Typ.	Slope	Q(F)	V	V	L	Tt	% d/D
From	To	Number	(ac)			C*A	(min.)		(cfs)	(in.)	n	(ft.ft.)	(pipe full)	(pipe full)	(at Q(R))	(ft.)	(min.)	
A1	A2	A1	0.19	0.87	0.17	0.17	6.3	2.68	0.44	8	0.013	2.5%	1.92	5.50	4.51	53	0.20	32.50%
A2	A3	A2	0.04	0.90	0.03	0.20	6.5	2.64	0.52	8	0.013	1.0%	1.21	3.47	3.30	65	0.33	46.50%
A3	A5	A3	0.12	0.90	0.11	0.31	6.8	2.56	0.79	8	0.013	1.0%	1.21	3.47	3.69	198	0.90	59.00%
A5	A6	A5	0.24	0.89	0.21	0.52	7.7	2.38	1.24	8	0.013	5.1%	2.74	7.85	7.57	149	0.33	47.50%
B1	B2	B1	0.16	0.90	0.14	0.14	6.3	2.68	0.38	8	0.013	0.5%	0.86	2.46	2.37	16	0.11	47.00%
B2	B3	B2	0.00	0.90	0.00	0.15	6.4	2.65	0.39	8	0.013	0.5%	0.86	2.46	2.38	15	0.11	47.50%
B3	B4	B3	0.04	0.48	0.02	0.16	6.5	2.63	0.43	8	0.013	0.5%	0.86	2.46	2.44	38	0.26	50.50%
B4	B5	B4	0.03	0.25	0.01	0.17	6.8	2.57	0.44	8	0.013	0.5%	0.86	2.46	2.45	80	0.55	51.00%
B5	A6	B5	0.17	0.83	0.14	0.31	7.3	2.46	0.77	8	0.013	0.6%	0.94	2.69	3.04	51	0.28	68.50%
A6	A7	A6	0.22	0.68	0.15	0.83	8.0	2.33	1.93	12	0.013	3.9%	7.05	8.98	7.59	97	0.21	36.00%
A7	A8	A7	0.10	0.68	0.07	0.90	8.3	2.29	2.06	12	0.013	18.2%	15.24	19.40	140.03	153	0.02	5.00%
A8	A9	A8	0.12	0.76	0.09	0.99	8.3	2.29	2.26	12	0.013	9.6%	11.07	14.09	153.62	121	0.01	5.00%
A9	A10	A9	0.18	0.71	0.13	1.11	8.3	2.29	2.54	12	0.013	3.9%	7.05	8.98	8.13	49	0.10	42.00%
A10	A11	A10	0.58	0.85	0.49	1.61	8.4	2.27	3.65	12	0.013	5.0%	7.99	10.17	9.79	69	0.12	48.00%
A11	A12	A11	0.01	0.90	0.01	1.61	8.5	2.25	3.63	12	0.013	1.5%	4.38	5.58	6.23	13	0.03	69.50%
A12	A13	A12	0.70	0.78	0.55	2.16	8.5	2.25	4.85	12	0.013	1.5%	4.38	5.58	6.18	20	0.05	99.90%
A13	OUT	A13	0.00	0.00	0.00	2.16	8.5	2.25	4.85	12	0.013	9.9%	11.24	14.31	13.57	164	0.20	46.50%

Project:	Barnabie Point K-8		R=	25 yr		Calcs by:	CC	Job No:	C230007-0191
Location:	Mercer Island, WA					Date:	10/21/2025	Page	1

Barnabie Point K-8
Proposed Site Conditions
25-Yr Backwater

Backwater Mannings Coefficient 0.011

Location		Q	L	Diameter	TYP	Outlet	Inlet	Barrel	Barrel	Velocity	Excel	Critical	TW	Friction	HGL	Entry	Entry	Exit	Outlet	Headwater	Inlet	Approach	Bend	Bend	Junction	Headwater	Rim	Elev.	O.K.?
Downstream	Upstream	(cfs)	(FT)	(in).	n	Elev	Elev	Area	Velocity	Head	Check	Depth	Elev	Loss	Elev	Coef	Loss	Loss	Control	Depth	Control	Head	Coefficient	Loss	Loss	Elevation		Difference	
		Q	L	D	n	ELVO	ELVI	A	V	H		dc	TW	Floss	HGL	Ke	ENLoss	Eloss	Eloc	HW/D	Elic	Hv	Kb	Bl	Junc	HW	Rim	HGL	
OUT	A13	4.85	164	12	0.011	19.88	36.18	0.785	6.179	0.593	1.00	0.91	*28.03*	2.157	30.19	0.50	0.296	0.593	31.076	1.59	37.77	-0.59	0.84	0.50	0.00	37.67	40.76	3.09	yes
A13	A12	4.85	20	12	0.011	38.80	39.10	0.785	6.179	0.593	1.00	0.91	*37.67*	0.263	39.80	0.50	0.296	0.593	40.689	1.63	40.73	-0.59	0.00	0.00	0.00	40.14	42.22	2.08	yes
A12	A11	3.63	13	12	0.011	39.10	39.30	0.785	4.625	0.332	1.00	0.81	*40.14*	0.096	40.23	0.50	0.166	0.332	40.732	1.30	40.60	-0.33	1.04	0.35	0.00	40.75	42.85	2.10	yes
A11	A10	3.65	69	12	0.011	39.30	42.75	0.785	4.647	0.335	1.00	0.81	*40.75*	0.513	41.26	0.50	0.168	0.335	41.761	1.29	44.04	-0.34	0.08	0.03	0.00	43.73	47.59	3.86	yes
A10	A9	2.54	49	12	0.011	42.75	44.67	0.785	3.239	0.163	1.00	0.68	*43.73*	0.177	43.91	0.50	0.081	0.163	44.151	1.12	45.79	-0.16	0.08	0.01	0.00	45.64	49.47	3.83	yes
A9	A8	2.26	121	12	0.011	44.67	56.37	0.785	2.872	0.128	1.00	0.64	*45.64*	0.344	45.98	0.50	0.064	0.128	46.174	1.01	57.38	-0.13	0.00	0.00	0.00	57.25	59.03	1.78	yes
A8	A7	2.06	153	12	0.011	56.37	84.15	0.785	2.618	0.106	1.00	0.61	*57.25*	0.361	57.61	0.50	0.053	0.106	57.769	0.91	85.06	-0.11	0.00	0.00	0.00	84.95	87.53	2.58	yes
A7	A6	1.93	97	12	0.011	84.15	87.89	0.785	2.461	0.094	1.00	0.59	*84.95*	0.202	85.15	0.50	0.047	0.094	85.292	0.94	88.83	-0.09	1.04	0.10	0.04	88.87	98.71	9.84	yes
A6	B5	0.77	51	8	0.011	88.22	88.52	0.349	2.217	0.076	1.00	0.42	*88.87*	0.148	89.02	0.50	0.038	0.076	89.134	1.02	89.20	-0.08	0.48	0.04	0.00	89.16	99.9	10.74	yes
B5	B4	0.44	80	8	0.011	88.52	88.92	0.349	1.254	0.024	1.00	0.31	*89.16*	0.074	89.23	0.50	0.012	0.024	89.269	0.72	89.40	-0.02	0.00	0.00	0.00	89.38	95.29	5.91	yes
B4	B3	0.43	38	8	0.011	88.92	89.10	0.349	1.235	0.024	1.00	0.31	*89.38*	0.034	89.59	0.50	0.012	0.024	89.622	0.72	89.58	-0.02	0.00	0.00	0.00	89.60	92.63	3.03	yes
B3	B2	0.39	15	8	0.011	89.10	89.18	0.349	1.113	0.019	1.00	0.29	*89.60*	0.011	89.77	0.50	0.010	0.019	89.796	0.67	89.63	-0.02	0.16	0.00	0.00	89.78	92.83	3.05	yes
B2	B1	0.38	16	8	0.011	89.18	89.27	0.349	1.093	0.019	1.00	0.29	*89.78*	0.011	89.85	0.50	0.009	0.019	89.874	0.67	89.72	-0.02	0.00	0.00	0.00	89.86	92.94	3.08	yes
A6	A5	1.24	149	8	0.011	88.22	95.84	0.349	3.543	0.195	1.00	0.53	*92.03*	1.105	93.13	0.50	0.097	0.195	93.427	1.23	96.66	-0.19	1.04	0.01	0.00	96.48	102.97	6.49	yes
A5	A3	0.79	198	8	0.011	95.84	97.87	0.349	2.263	0.080	1.00	0.42	*96.48*	0.599	97.08	0.50	0.040	0.080	97.196	1.03	98.55	-0.08	0.16	0.01	0.00	98.49	105.29	6.80	yes
A3	A2	0.52	65	8	0.011	97.87	98.52	0.349	1.502	0.035	1.00	0.34	*98.49*	0.087	98.57	0.50	0.018	0.035	98.627	0.80	99.05	-0.04	0.00	0.00	0.00	99.02	104.30	5.28	yes
A2	A1	0.44	53	8	0.011	98.52	99.88	0.349	1.271	0.025	1.00	0.31	*98.49*	0.051	99.19	0.50	0.013	0.025	99.224	0.72	100.36	-0.03	0.00	0.00	0.00	100.33	103.01	2.68	yes

CONVEYANCE SYSTEM ANALYSIS AND SIZING TABLE USING THE RATIONAL METHOD

Location		Sub Basin	Area	C	C*A	Sum	Tc	i	Q(R)	Pipe	Typ.	Slope	Q(F)	V	V	L	Tt	% d/D
From	To	Number	(ac)			C*A	(min.)		(cfs)	(in.)	n	(ft.ft.)	(pipe full)	(pipe full)	(at Q(R))	(ft.)	(min.)	
A1	A2	A1	0.19	0.87	0.17	0.17	6.3	3.42	0.57	8	0.013	2.5%	1.92	5.50	4.82	53	0.18	37.00%
A2	A3	A2	0.04	0.90	0.03	0.20	6.5	3.37	0.67	8	0.013	1.0%	1.21	3.47	3.52	65	0.31	53.50%
A3	A5	A3	0.12	0.90	0.11	0.31	6.8	3.28	1.01	8	0.013	1.0%	1.21	3.47	3.87	198	0.85	70.00%
A5	A6	A5	0.24	0.89	0.21	0.52	7.6	3.06	1.59	8	0.013	5.1%	2.74	7.85	8.07	149	0.31	55.00%
B1	B2	B1	0.16	0.90	0.14	0.14	6.3	3.42	0.49	8	0.013	0.5%	0.86	2.46	2.50	16	0.11	54.50%
B2	B3	B2	0.00	0.90	0.00	0.15	6.4	3.39	0.50	8	0.013	0.5%	0.86	2.46	2.52	15	0.10	55.00%
B3	B4	B3	0.04	0.48	0.02	0.16	6.5	3.36	0.55	8	0.013	0.5%	0.86	2.46	2.60	38	0.24	58.50%
B4	B5	B4	0.03	0.25	0.01	0.17	6.7	3.29	0.56	8	0.013	0.5%	0.86	2.46	2.61	80	0.51	59.00%
B5	A6	B5	0.17	0.83	0.14	0.31	7.3	3.15	0.99	8	0.013	0.6%	0.94	2.69	2.84	51	0.30	99.90%
A6	A7	A6	0.22	0.68	0.15	0.83	8.0	2.99	2.48	12	0.013	3.9%	7.05	8.98	8.19	97	0.20	41.00%
A7	A8	A7	0.10	0.68	0.07	0.90	8.1	2.95	2.64	12	0.013	18.2%	15.24	19.40	180.02	153	0.01	5.00%
A8	A9	A8	0.12	0.76	0.09	0.99	8.2	2.94	2.90	12	0.013	9.6%	11.07	14.09	11.84	121	0.17	35.00%
A9	A10	A9	0.18	0.71	0.13	1.11	8.3	2.91	3.24	12	0.013	3.9%	7.05	8.98	8.68	49	0.09	48.00%
A10	A11	A10	0.58	0.85	0.49	1.61	8.4	2.89	4.64	12	0.013	5.0%	7.99	10.17	10.49	69	0.11	55.00%
A11	A12	A11	0.01	0.90	0.01	1.61	8.5	2.87	4.62	12	0.013	1.5%	4.38	5.58	5.89	13	0.04	99.90%
A12	A13	A12	0.70	0.78	0.55	2.16	8.6	2.86	6.18	12	0.013	1.5%	4.38	5.58	7.86	20	0.04	99.90%
A13	OUT	A13	0.00	0.00	0.00	2.16	8.6	2.86	6.18	12	0.013	9.9%	11.24	14.31	14.44	164	0.19	53.50%

Project:	Barnabie Point K-8		R=	100 yr	Calcs by:	CC	Job No:	C230007-0191
Location:	Mercer Island, WA				Date:	10/21/2025	Page	1

Barnabie Point K-8
Proposed Site Conditions
100-Yr Backwater

Backwater Mannings Coefficient 0.011

Location		Q	L	Diameter	TYP	Outlet	Inlet	Barrel	Barrel	Velocity	Excel	Critical	TW	Friction	HGL	Entry	Entry	Exit	Outlet	Headwater	Inlet	Approach	Bend	Bend	Junction	Headwater	Rim	Elev.	O.K.?
Downstream	Upstream	(cfs)	(FT)	(in).	n	Elev	Elev	Area	Velocity	Head	Check	Depth	Elev	Loss	Elev	Coef	Loss	Loss	Control	Depth	Control	Head	Coefficient	Loss	Loss	Elevation		Difference	
		Q	L	D	n	ELVO	ELVI	A	V	H		dc	TW	Floss	HGL	Ke	ENLoss	Eloss	Eloc	HW/D	Elic	Hv	Kb	Bl	Junc	HW	Rim	HGL	
OUT	A13	6.18	164	12	0.011	19.88	36.18	0.785	7.864	0.960	1.00	0.96	*28.03*	3.494	31.52	0.50	0.480	0.960	32.964	2.05	38.23	-0.96	0.84	0.81	0.00	38.08	40.76	2.68	yes
A13	A12	6.18	20	12	0.011	38.80	39.10	0.785	7.864	0.960	1.00	0.96	*38.08*	0.426	39.80	0.50	0.480	0.960	41.240	2.09	41.19	-0.96	0.00	0.00	0.00	40.28	42.22	1.94	yes
A12	A11	4.62	13	12	0.011	39.10	39.30	0.785	5.887	0.538	1.00	0.89	*40.28*	0.155	40.44	0.50	0.269	0.538	41.242	1.56	40.86	-0.54	1.04	0.56	0.00	41.26	42.85	1.59	yes
A11	A10	4.64	69	12	0.011	39.30	42.75	0.785	5.912	0.543	1.00	0.90	*41.26*	0.831	42.09	0.50	0.271	0.543	42.909	1.55	44.30	-0.54	0.08	0.04	0.00	43.80	47.59	3.79	yes
A10	A9	3.24	49	12	0.011	42.75	44.67	0.785	4.119	0.263	1.00	0.77	*43.80*	0.286	44.09	0.50	0.132	0.263	44.482	1.20	45.87	-0.26	0.08	0.02	0.00	45.63	49.47	3.84	yes
A9	A8	2.90	121	12	0.011	44.67	56.37	0.785	3.693	0.212	1.00	0.73	*45.63*	0.568	46.20	0.50	0.106	0.212	46.517	1.19	57.56	-0.21	0.00	0.00	0.00	57.35	59.03	1.68	yes
A8	A7	2.64	153	12	0.011	56.37	84.15	0.785	3.365	0.176	1.00	0.70	*57.35*	0.597	57.95	0.50	0.088	0.176	58.209	1.08	85.23	-0.18	0.00	0.00	0.00	85.05	87.53	2.48	yes
A7	A6	2.48	97	12	0.011	84.15	87.89	0.785	3.161	0.155	1.00	0.67	*85.05*	0.334	85.38	0.50	0.078	0.155	85.616	1.10	88.99	-0.16	1.04	0.16	0.06	89.06	98.71	9.65	yes
A6	B5	0.99	51	8	0.011	88.22	88.52	0.349	2.843	0.126	1.00	0.47	*89.06*	0.244	89.30	0.50	0.063	0.126	89.491	1.19	89.31	-0.13	0.48	0.06	0.00	89.43	99.9	10.47	yes
B5	B4	0.56	80	8	0.011	88.52	88.92	0.349	1.605	0.040	1.00	0.35	*89.43*	0.122	89.55	0.50	0.020	0.040	89.607	0.84	89.48	-0.04	0.00	0.00	0.00	89.57	95.29	5.72	yes
B4	B3	0.55	38	8	0.011	88.92	89.10	0.349	1.578	0.039	1.00	0.35	*89.57*	0.056	89.62	0.50	0.019	0.039	89.681	0.83	89.65	-0.04	0.00	0.00	0.00	89.64	92.63	2.99	yes
B3	B2	0.50	15	8	0.011	89.10	89.18	0.349	1.422	0.031	1.00	0.33	*89.64*	0.018	89.77	0.50	0.016	0.031	89.814	0.78	89.70	-0.03	0.16	0.01	0.00	89.79	92.83	3.04	yes
B2	B1	0.49	16	8	0.011	89.18	89.27	0.349	1.395	0.030	1.00	0.33	*89.79*	0.018	89.85	0.50	0.015	0.030	89.892	0.77	89.78	-0.03	0.00	0.00	0.00	89.86	92.94	3.08	yes
A6	A5	1.59	149	8	0.011	88.22	95.84	0.349	4.546	0.321	1.00	0.58	*92.03*	1.819	93.85	0.50	0.160	0.321	94.331	1.47	96.82	-0.32	1.04	0.01	0.00	96.51	102.97	6.46	yes
A5	A3	1.01	198	8	0.011	95.84	97.87	0.349	2.896	0.130	1.00	0.48	*96.51*	0.981	97.49	0.50	0.065	0.130	97.687	1.20	98.67	-0.13	0.16	0.02	0.00	98.56	105.29	6.73	yes
A3	A2	0.67	65	8	0.011	97.87	98.52	0.349	1.919	0.057	1.00	0.39	*98.56*	0.141	98.70	0.50	0.029	0.057	98.789	0.93	99.14	-0.06	0.00	0.00	0.00	99.08	104.30	5.22	yes
A2	A1	0.57	53	8	0.011	98.52	99.88	0.349	1.622	0.041	1.00	0.35	*98.56*	0.082	99.19	0.50	0.020	0.041	99.248	0.83	100.43	-0.04	0.00	0.00	0.00	100.39	103.01	2.62	yes

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.64
Program License Number: 201910001
Project Simulation Performed on: 04/24/2025 3:25 PM
Report Generation Date: 04/24/2025 3:25 PM

Input File Name: 2025-02-14 Water Quality Sizing.fld
Project Name: Barnabie Point K-8
Analysis Title: Water Quality
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 14
Precipitation Station : 96003605 Puget East 36 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961036 Puget East 36 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	2.991	2.991
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	2.991	2.991

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Flat 2.991

Subbasin Total 2.991

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.040
C, Lawn, Mod	0.228
C, Lawn, Steep	0.196
PARKING/FLAT	1.816
PARKING/MOD	0.520
PARKING/STEEP	0.191
Subbasin Total	2.991

********** LINK DATA **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** LINK DATA **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** Subbasin: Subbasin 1 **********

Flood Frequency Data (cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.054
5-Year	1.367
10-Year	1.668
25-Year	2.080
50-Year	2.679
100-Year	3.383
200-Year	3.755

500-Year	4.241

********** Link: New Copy Lnk1 ********** Link Inflow Frequency Stats

Flood Frequency Data (cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.054
5-Year	1.367
10-Year	1.668
25-Year	2.080
50-Year	2.679
100-Year	3.383
200-Year	3.755
500-Year	4.241

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: New Copy Lnk1 **********

2-Year Discharge Rate : 1.054 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge

On-line Design Discharge Rate (91% Exceedance): 0.36 cfs

Off-line Design Discharge Rate (91% Exceedance): 0.19 cfs

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: New Copy Lnk1

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.828E-02	2-Year	1.054
5-Year	8.155E-02	5-Year	1.367
10-Year	0.111	10-Year	1.668
25-Year	0.146	25-Year	2.080
50-Year	0.170	50-Year	2.679
100-Year	0.194	100-Year	3.383
200-Year	0.259	200-Year	3.755
500-Year	0.347	500-Year	4.241

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

VIII. FIGURES

FIGURE 1 – VICINITY MAP

FIGURE 2 – EXISTING CONDITIONS

FIGURE 3 – SOILS MAP

FIGURE 4 – QUARTER MILE DOWNSTREAM

FIGURE 5 – PROPOSED CONDITIONS

FIGURE 6 – EXISTING IMPERVIOUS COVERAGE

FIGURE 7 – MINIMUM REQUIREMENTS FLOW CHART

FIGURE 8 – CATCHMENT AREAS

FIGURE 9 – ISOPLUVIAL MAP

FIGURE 10 – WATER QUALITY DESIGN FLOW AREAS

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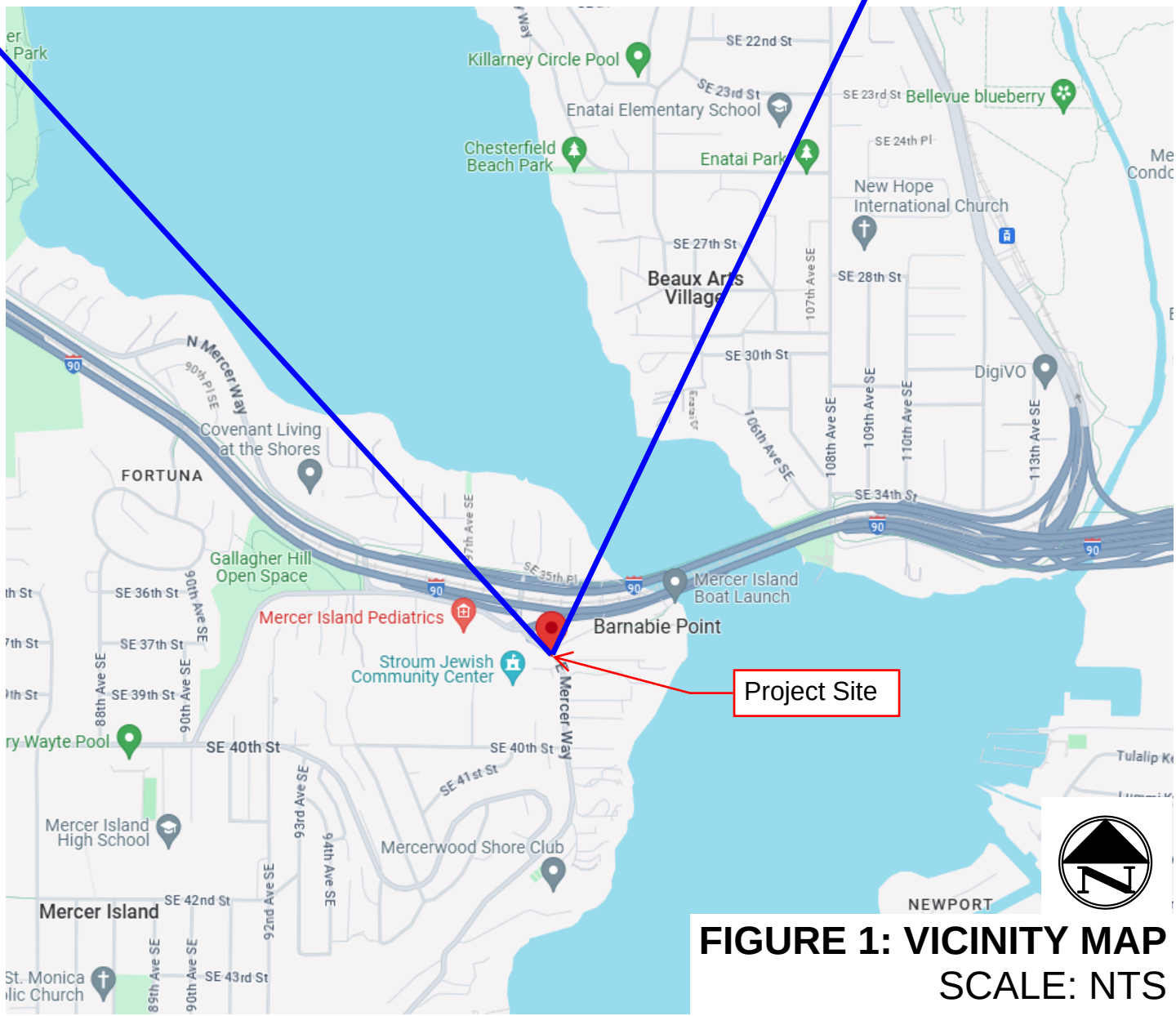
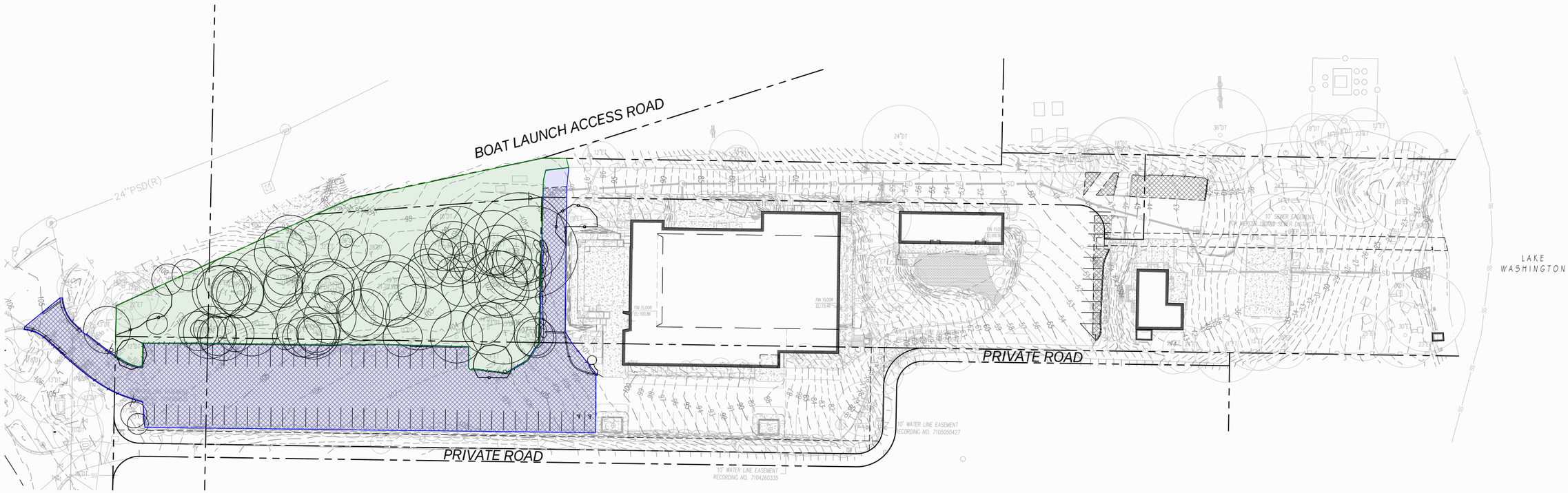


FIGURE 1: VICINITY MAP
SCALE: NTS



Legend

Description	Quantity	Unit
Impervious	0.61	ac
Pervious	0.76	ac

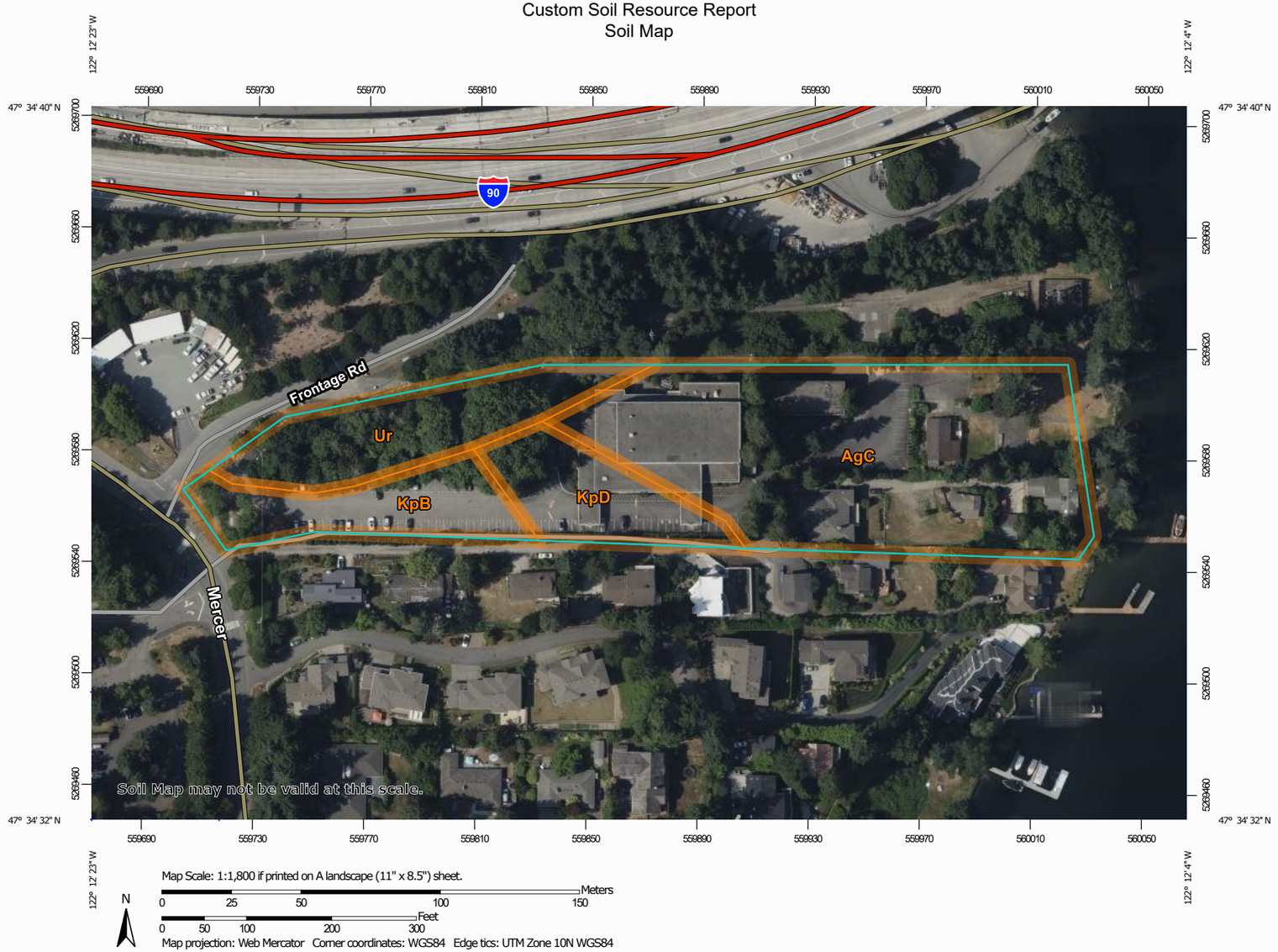
N

0 40 80 160

SCALE 1"=80'

FIGURE 2: EXISTING CONDITIONS

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 19, Aug 29, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	2.7	57.2%
KpB	Kitsap silt loam, 2 to 8 percent slopes	0.6	13.2%
KpD	Kitsap silt loam, 15 to 30 percent slopes	0.6	12.2%
Ur	Urban land	0.8	17.4%
Totals for Area of Interest		**4.7**	**100.0%**

FIGURE 3: SOILS MAP

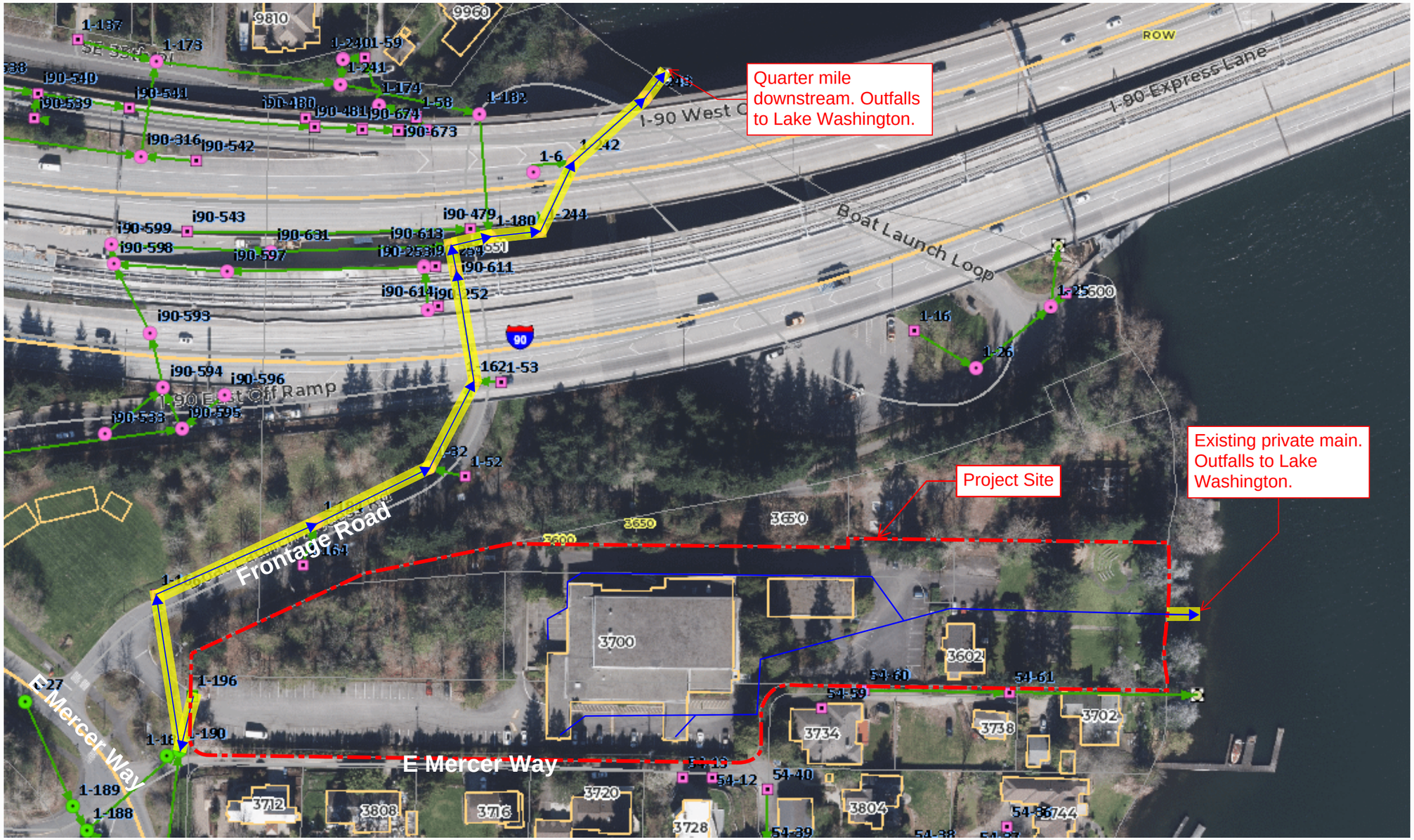


FIGURE 4: QUARTER MILE DOWNSTREAM
SCALE: NTS

Legend

Description	Quantity	Unit	
Building	0.37	ac	(16,286 sf)
Concrete	0.19	ac	(8,198 sf)
Landscaping	0.21	ac	(9,240 sf)
Parking Lot	0.57	ac	(24,626 sf)
Path	0.03	ac	(1,237 sf)
Total:	**1.37**	**ac**	(59,587 sf)

Summary

Impervious Area	1.16 ac
Pervious Area	0.21 ac
Total	**1.37 ac**

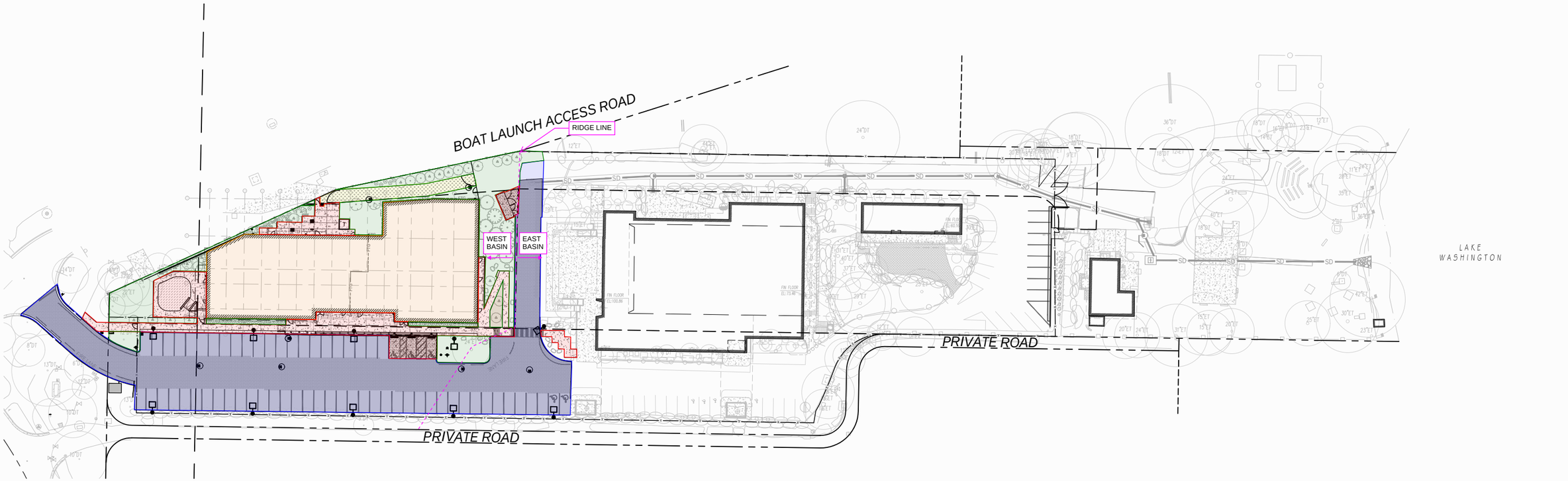
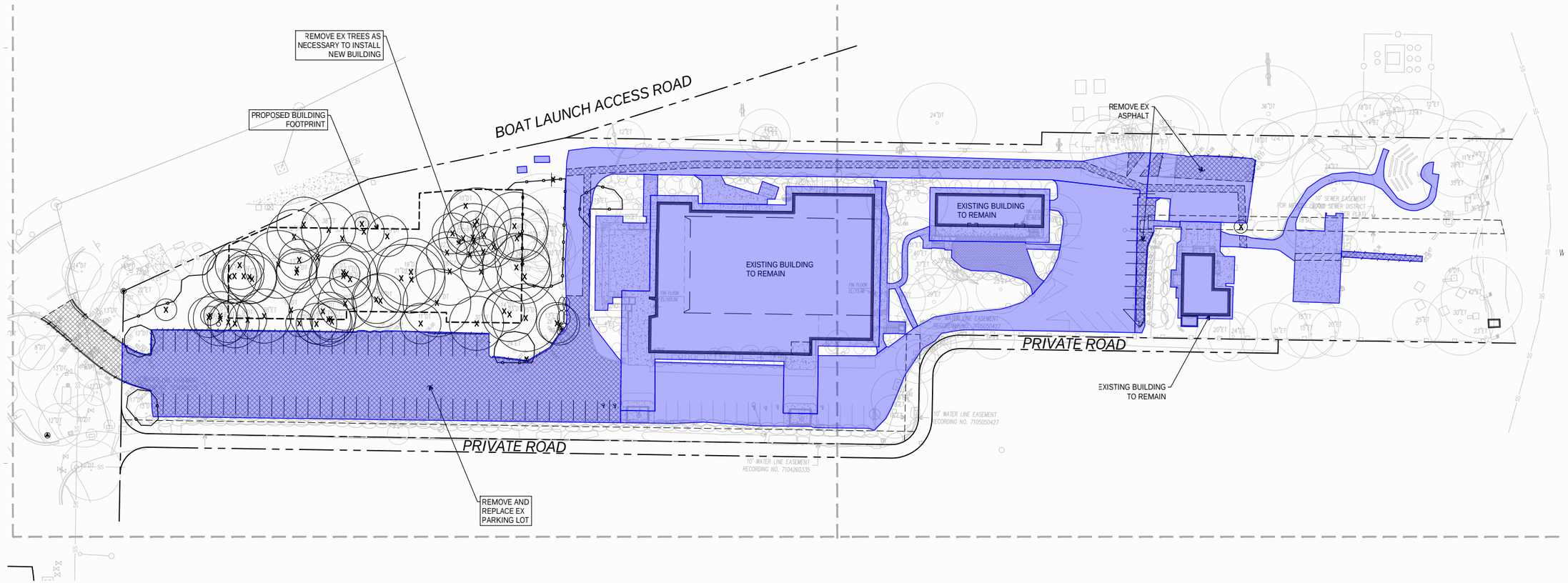


FIGURE 5: PROPOSED CONDITIONS



Existing Impervious Coverage

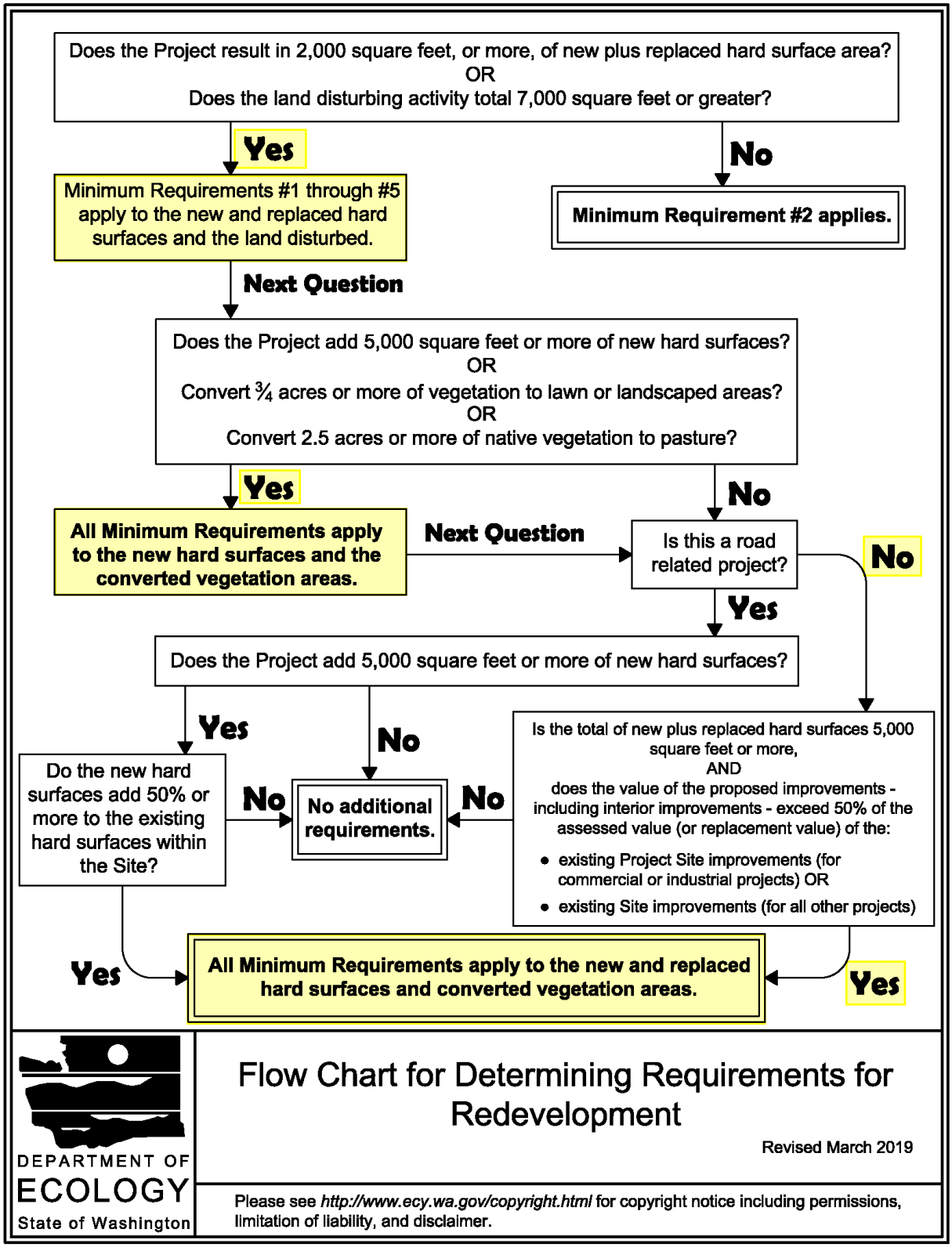
Description	Quantity	Unit
Impervious	2.129	ac
Total Site Area	4.12	ac
Impervious Coverage	51.7%	

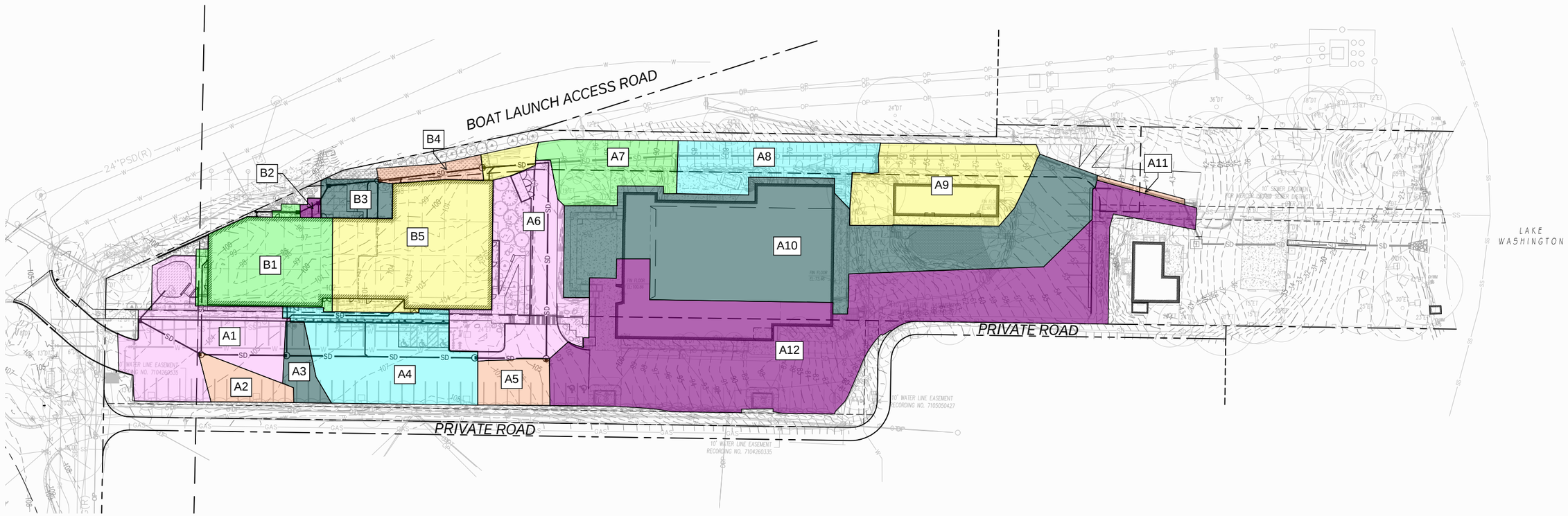
0 40 80 160

SCALE 1"=80'

FIGURE 6: EXISTING IMPERVIOUS COVERAGE

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



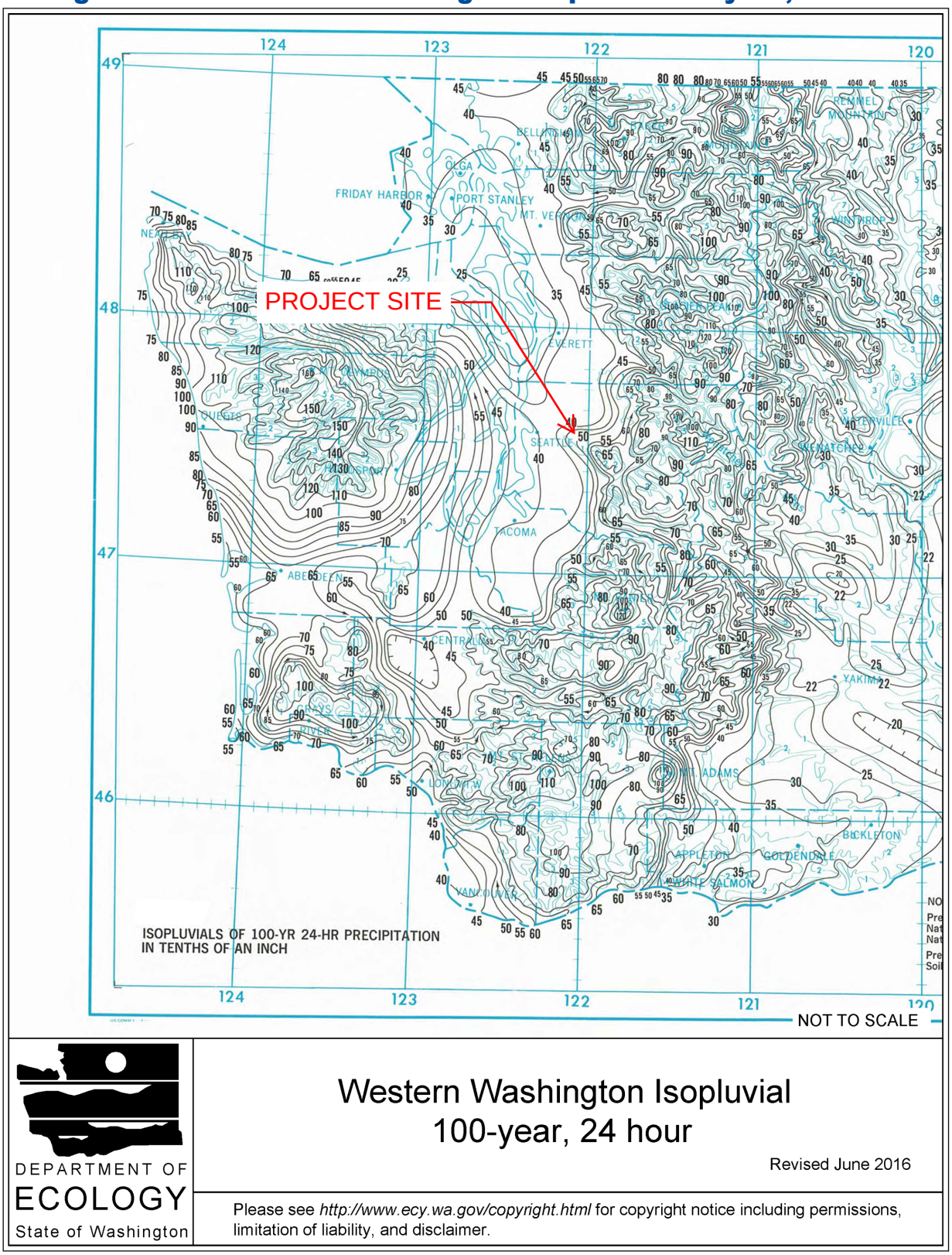


0 40 80 160

SCALE 1"=80'

FIGURE 8: CATCHMENT AREAS

Figure III-B.3: Western Washington Isopluvial 100-year, 24 hour



DEPARTMENT OF ECOLOGY
State of Washington

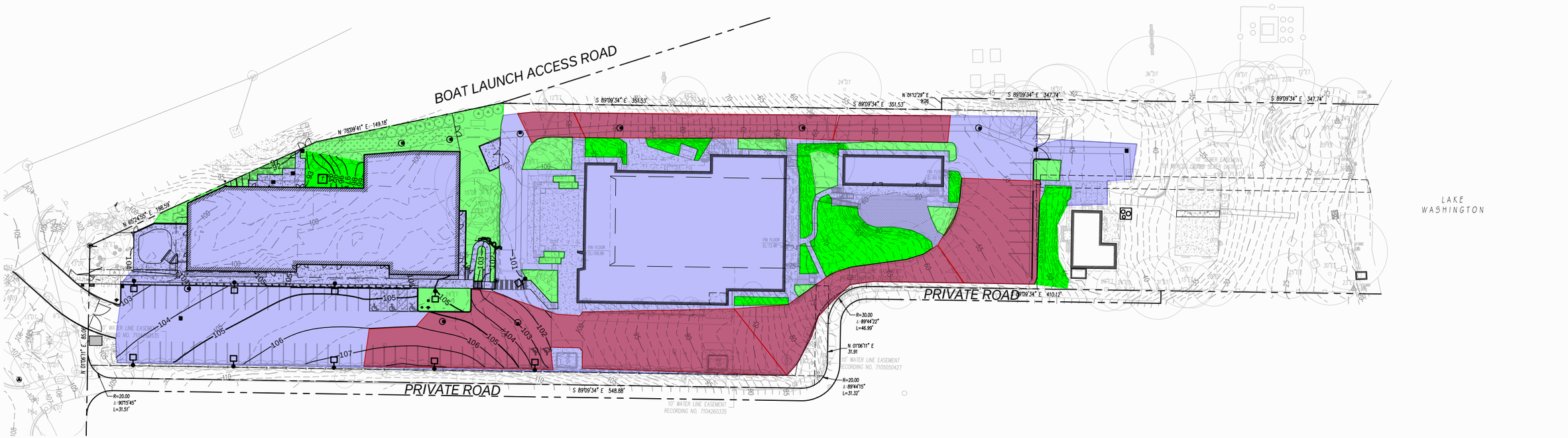
Western Washington Isopluvial
100-year, 24 hour

Revised June 2016

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Legend

Description	Quantity	Unit
Flat - Impervious	1.816	ac
Flat - Lawn	0.040	ac
Moderate - Impervious	0.520	ac
Moderate - Lawn	0.228	ac
Steep - Impervious	0.191	ac
Steep - Lawn	0.196	ac
Total:	**2.991**	**ac**



0 40 80 160

SCALE 1"=80'

FIGURE 10: WATER QUALITY DESIGN FLOW AREAS

APPENDIX A

OPERATIONS AND MAINTENANCE MANUAL

OPERATIONS AND MAINTENANCE MANUAL

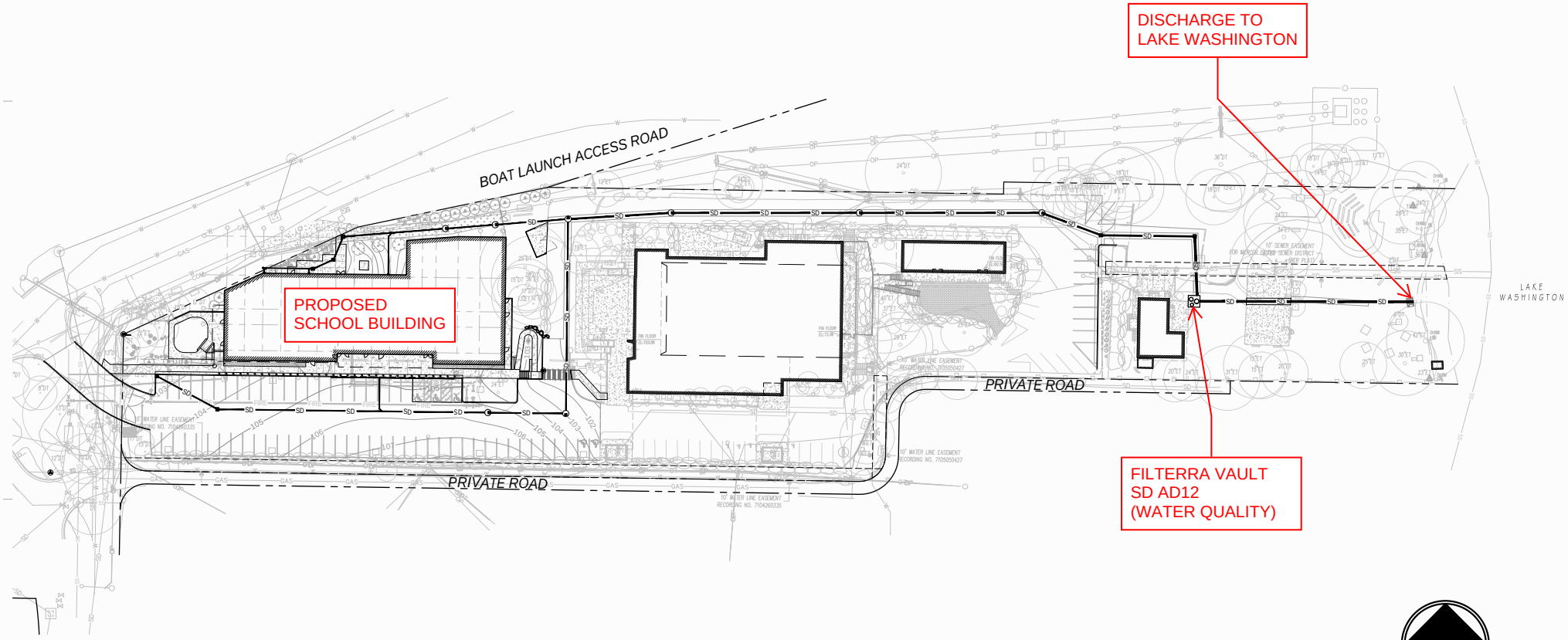
for

Barnabie Point Project

PARTY RESPONSIBLE FOR MAINTENANCE AND OPERATIONS:

Herzl-Ner Tamid
Conservative Congregation

A COPY OF THE OPERATION AND MAINTENANCE MANUAL SHALL BE RETAINED ON SITE OR WITHIN REASONABLE ACCESS TO THE SITE AND SHALL BE TRANSFERRED WITH THE PROPERTY TO ANY NEW OWNER



SCALE: NTS

255 S. King Street, Suite 800, Seattle, WA 98104 | 206.426.2600 | JACOBSONENGINEERS.COM

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Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan of your Filterra media.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials entering the inlet. This may include trash, silt and leaves etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

When to Maintain?

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; in regions with less rainfall often only (1) one visit per annum is sufficient. Varying land uses can affect maintenance frequency. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the maintenance provider of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology.



Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not included as part of the final site assessment. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra (where the cleaned runoff drains to, such as drop inlet) and block off the throat of the Filterra. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra and surrounding area
2. Removal of tree grate or access cover and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation and pruning or replacement as necessary
6. Clean area around Filterra
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media available from the Supplier.

Box Length	Box Width	Filter Surface Area (ft^2)	Volume at 3" (ft^3)	# of 2 ft^3 Mulch Bags
4	4	16	4	2
6	4	24	6	3
8	4	32	8	4
6	6	36	9	5
8	6	48	12	6
10	6	60	15	8
12	6	72	18	9
13	7	91	23	12

Other sizes not listed - 1 bag per 8 ft^2 of media.

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.



1. Inspection of Filterra and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).



2. Removal of tree grate or access cover and erosion control stones

- Remove cast iron grates or covers for access into Filterra box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	_____



- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____



4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra inlet to allow for entry of trash during a storm event.
- Replace Filterra grates or covers correctly using appropriate lifting or moving tools, taking care not to damage the plant, if applicable.



5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health, if applicable, and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above Grate	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no



6. Clean area around Filterra

- Clean area around unit and remove all refuse to be disposed of appropriately.



7. Complete paperwork

- Deliver Maintenance Report.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Plant Care for Filterra® Systems w/ Vegetation Specified and/or Required

After Activation, the Contractor is responsible for proper care of the vegetation until the site is handed over to the Owner. After that, it is the Site Owner's responsibility to care for the vegetation. Contech recommends the following care for the plants:

1. To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
2. Plant staking may be required.
3. With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
4. Contech recommends irrigation of the Filterra® Vegetation. The following guidance will help to ensure the vegetation is properly irrigated.

Irrigation Recommendations:

- Each Filterra® system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra® plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore if dry periods exceed 3 weeks, irrigation may be required.

*** Five gallons per square yard approximates 1 inch of water. Therefore for a 6' x 6 foot Filterra® approximately 20-60 gallons of applied water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five gallon bucket to estimate the applied water flow rate. Then calculate the time needed to irrigate the Filterra®, For example is the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6'x6' filter.*

Plant Replacement:

In some cases, plants will require replacement. Please follow the procedures below to ensure a properly functioning Filterra® system.

1. Remove the existing plant, and leave as much of the Filterra® media in place as possible.
2. Select a replacement per the Filterra® Activation Package.
3. Prior to removing the plant from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
4. Cut away any roots which are growing out of the container drain holes.
5. Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
6. Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
7. Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
8. All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
9. Reinstall or add mulch to a depth of 3" per Contech's mulch specifications for Filterra® systems.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation (where applicable)	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation (where applicable)	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra Inspection & Maintenance Log

Filterra System Size/Model:_____**Location:** _____

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate (if applicable)	Vegetation Species (if applicable)	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3"*	*Lowe's Premium Brown Mulch*	*4'*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

APPENDIX B

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

Construction Stormwater General Permit (CSWGP)

Stormwater Pollution Prevention Plan (SWPPP)

for

Barnabie Point K-8 School

Prepared for:

Herzl-Ner Tamid Conservative Congregation and Project Contractor

Permittee / Owner	Developer	Operator / Contractor
Herzl-Ner Tamid Conservative Congregation	Herzl-Ner Tamid Conservative Congregation	Exxel Pacific

3700 E Mercer Way, Mercer Island, WA

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Alan Jacobson	Jacobson Consulting Engineers	Office: (206) 426-2600

SWPPP Preparation Date

05 / 30 / 2025

Project Construction Dates

Activity / Phase	Start Date	End Date
Sitework and Building Construction	TBD	TBD

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G. Contaminated Site Information (N/A)

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List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: Barnabie Point K-8 School
Street/Location: 3700 E Mercer Way
City: Mercer Island State: WA Zip code: 98040
Subdivision: N/A
Receiving waterbody: Cedar River / Lake Washington

1.1 Existing Conditions

The project for the Jewish Day School is located at 3700 E Mercer Way, Mercer Island, WA 98040 on the property of Herzl-Ner Tamid Conservative Congregation. The area within the site includes four parcels. Parcel A (0824059045) is 0.62 acres, parcel B (2107000010) is 1.11 acres, parcel C (1515600010) is 1.97 acres, and the northern parcel (151560TRCT) is 0.43 acres. The total area of the property is 4.12 acres, of which approximately 1.42 acres will be developed for the proposed project. The existing property is developed with three buildings, parking primarily along the south of the property, and drive aisles, with a heavily forested area in the northwest corner. The property slopes to the east with approximately 91 feet of elevation change across the whole site.

Total acreage:	4.12-acres
Disturbed acreage:	1.42-acres
Landscape topography:	In general, the site of the Barnabie Point K-8 School property slopes to the east with an elevation change of approximately 91 vertical feet.
Drainage patterns:	Stormwater from the project site flows to the east side of the property and discharges into Lake Washington.
Existing Vegetation:	Generally, the entire site is developed with approximately 0.6 acres of native forest on the parcel. On the campus the pervious areas are made up of lawn areas and landscaped areas.
Critical Areas:	There are no critical areas in the vicinity of the proposed project work.

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: The project discharges to Lake Washington with no known TMDL and is not 303(d) listed.

Table 1 below includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
Oil and Grease	Parking Lot	Surface	Typical concentration from parking lots
Total Suspended Solids	Buildings and Parking Lots	Surface	N/A
pH	Newly installed concrete areas	Surface	N/A

1.2 Proposed Construction Activities

Description of site development:
The proposed project consists of removing existing trees and constructing a new building, redeveloping the existing parking lot, and a new private storm main from the building to Lake Washington. Along with site improvements, new utilities, including water, sewer, storm drainage, and communications are proposed to be installed.

Description of construction activities (example: site preparation, demolition, excavation):
Project will consist of site preparation, demolition, excavation for foundations and utilities, building construction, and paving.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
The proposed system will route stormwater from the project site to the east side of the property and will discharge into Lake Washington.

The site is bound by Interstate 90 to the north, Lake Washington to the east, single-family residences to the south, and East Mercer Way to the west. Generally, the single-family residences to the south flow towards the site which will provide some offsite flow. The existing system being maintained currently intercepts this flow.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
At final stabilization the project will include a new building, play area, associated paving, and landscaping.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

There is no contaminated soil or groundwater conditions known at the project site and therefore no proposed activities for the cleanup of existing contamination.

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible. The BMPs relevant to marking the clearing limits that will be applied for this project include:

List and describe BMPs:

- Preserving Natural Vegetation (BMP C101)
- High-Visibility Fence (BMP C103)

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction.

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters. All wash wastewater shall be controlled on site. The specific BMPs related to establishing construction access that will be used on this project include:

List and describe BMPs:

- Stabilized Construction Access (BMP C105)
- Wheel Wash (BMP C106)
- Construction Road/Parking Area Stabilization (BMP C107)

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction.

2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. The specific BMPs for flow control that shall be used on this project include:

Will you construct stormwater retention and/or detention facilities?
No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?
No

List and describe BMPs:

- Interceptor Dike and Swale (BMP C200)
- Check Dams (BMP C207)
- Sediment Trap (BMP C240)
- Temporary Water Storage Tanks for Sedimentation

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized and permanent flow control facilities are functioning.

2.1.4 Element 4: Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility. Specific BMPs to be used for controlling sediment on this project include:

List and describe BMPs:

- Inlet Protection (BMP C220)
- Silt Fence (BMP C233)
- Straw Wattles (BMP C235)
- Sediment Trap (BMP C240)
- Temporary Water Storage Tanks for Sedimentation

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction.

2.1.5 Element 5: Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project are listed below:

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Plastic Covering (BMP C123)
- Dust Control (BMP C140)

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Will you construct during the wet season? YES

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized.

2.1.6 Element 6: Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion during construction.

Will steep slopes be present at the site during construction? NO

List and describe BMPs:

N/A; there are no existing steep slopes on or adjacent to the site or that will be constructed as part of the project development.

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site. All inlets will be inspected weekly at a minimum and daily during storm events. Inlet protection devices will be cleaned or replaced when sediment has reached 1/3 capacity or as specified by the product manufacturer.

List and describe BMPs:

- Interceptor Dike and Swale (BMP C200)
- Check Dams (BMP C207)
- Inlet Protection (BMP C220)
- Silt Fence (BMP C233)
- Wattles (BMP C235)
- Sediment Trap (BMP C240)
- Temporary Water Storage Tanks for Sedimentation

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized and permanent flow control facilities are functioning.

2.1.8 Element 8: Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural discharge point, efforts will be taken to prevent downstream erosion. Temporary settlement tanks will be provided on site to attenuate flows and remove sediment before discharging to the existing storm system. Hydrologic analysis has been performed and found in Appendix H.

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

List and describe BMPs:

- Interceptor Dike and Swale (BMP C200)
- Check Dam (BMP C207)
- Outlet Protection (BMP C209)
- Sediment Trap (BMP C240)
- Temporary Water Storage Tanks for Sedimentation

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized and permanent flow control facilities are functioning.

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (and source, if applicable)
Vehicles and construction equipment
Demolition
Concrete and grout
Sanitary wastewater

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).
- Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing Sawcutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151)

Sanitary wastewater:

- Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.
- Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system or to the sanitary sewer as part of Wheel Wash implementation (BMP C106).

List and describe BMPs:

- Wheel Wash (BMP C106)
- Dust Control (BMP C140)
- Materials on Hand (BMP C150)
- Concrete Handling (BMP C151)
- Sawcutting and Surfacing Pollution Prevention (BMP C152)
- Material Delivery, Storage, and Containment (BMP C153)
- Concrete Washout Area (BMP C154)

Installation Schedules: BMP's will be implemented at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

NO

Will wheel wash or tire bath system BMPs be used during construction?

YES

Water discharged from the wheel wash will be routed to the temporary settlement tanks on site which will remove sediment before discharge to the existing storm system.

List and describe BMPs:

- Wheel Wash (BMP C106)

Installation Schedules: BMP's will be installed at the beginning of construction and be inspected and maintained throughout construction until site is fully stabilized and wheel wash is no longer needed.

Will pH-modifying sources be present on-site?
YES

Table 3 – pH-Modifying Sources

	None
X	Bulk cement
	Cement kiln dust
	Fly ash
X	Other cementitious materials
X	New concrete washing or curing waters
X	Waste streams generated from concrete grinding and sawing
	Exposed aggregate processes
	Dewatering concrete vaults
	Concrete pumping and mixer washout waters
	Recycled concrete
	Other (i.e. calcium lignosulfate) [please describe]

List and describe BMPs:

- Materials on Hand (BMP C150)
- Concrete Handling (BMP C151)
- Sawcutting and Surfacing Pollution Prevention (BMP C152)
- Material Delivery, Storage and Containment (BMP C153)
- Concrete Washout Area (BMP C154)
- Treating and Disposing of High pH Water (BMP C252)

Installation Schedules: BMP's will be implemented at the beginning of construction and be inspected and maintained throughout construction as required.

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

2.1.10 Element 10: Control Dewatering

This project does not propose dewatering and therefore will not be implementing any dewatering BMPs associated with Element 10.

Table 4 – Dewatering BMPs

	Infiltration
	Transport off-site in a vehicle (vacuum truck for legal disposal)
	Ecology-approved on-site chemical treatment or other suitable treatment technologies
	Sanitary or combined sewer discharge with local sewer district approval (last resort)
	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs: N/A

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

X	Design the project to fit the existing topography, soils, and drainage patterns
X	Emphasize erosion control rather than sediment control
X	Minimize the extent and duration of the area exposed
X	Keep runoff velocities low
X	Retain sediment on-site
X	Thoroughly monitor site and maintain all ESC measures
X	Schedule major earthwork during the dry season
	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
[Insert construction activity]	[Insert BMP]	[MM/DD/YYYY]	[Insert Season]

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
[Insert construction activity]	[Insert BMP]	[MM/DD/YYYY]	[Insert Season]

2.1.13 Element 13: Protect Low Impact Development (LID) BMPs

The project will be implementing BMP T5.13 for Post-Construction Soil Quality and Depth. To comply with the requirements of this BMP, the duff layer and native topsoils will be stockpiled and retained on site during grading activities to be reapplied for use in post-construction soils prior to planting. Existing vegetation or landscaped areas will be protected during construction (BMP C101, C102, C103, and C233). Topsoils will be imported as needed to meet BMP T5.13 requirements. Soil quality and depth will be established at the end of construction to prevent compaction from heavy machinery.

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	
Resident Engineer	Alan Jacobson, Jacobson Consulting Engineers	(206) 426-2600
Emergency Ecology Contact	Andy Maher, DOE Pollution Prevention Team	(509) 290-7806
Emergency Permittee/ Owner Contact	TBD	
Non-Emergency Owner Contact	TBD	
Monitoring Personnel	TBD	
Ecology Regional Office	Northwest Regional Office	(425) 649-7098

4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

File a blank form under Appendix D.

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

Complete the following paragraph for sites that discharge to impaired waterbodies for fine sediment, turbidity, phosphorus, or pH:

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

X	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours. https://www.ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue
    - Central Region (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490
    - Eastern Region (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
    - Northwest Region (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000
    - Southwest Region (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for “Significant concrete work” (i.e. greater than 1000 cubic yards poured concrete or recycled concrete over the life of the project).The use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

Table 9 – pH Sampling Method

X	pH meter
	pH test kit
	Wide range pH indicator paper

5 Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies

5.1 303(d) Listed Waterbodies

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

NO

List the impairment(s): N/A

List and describe BMPs: N/A

5.2 TMDL Waterbodies

In order to remain TMDL compliant, stormwater discharges from the site will be controlled. The specific BMPs for flow control that shall be used on this project include:

- Storm Drain Inlet Protection (BMP C220)
- Straw Wattles (BMP C235)

In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements.

The Straw Wattles and Catch Basin Filter Socks shall be installed at the beginning of construction activities prior to significant excavation and grading work to ensure the protection of properties downstream to the maximum extent possible. These BMPs shall be inspected to ensure they are functioning properly before constructing site improvements.

Inspection and Maintenance Plan to be prepared by contractor in accordance with Volume II of the State of Washington Department of Ecology's 2019 Stormwater Management Manual for Western Washington, found in Appendix B.

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

Note: A Construction Stormwater General Permit is required for this project as it will disturb more than 1.0 acres of land.

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

6.1.2 Records Retention

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

6.2 Reporting

6.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.

DMRs will be reported online through Ecology's WQWebDMR System.

6.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

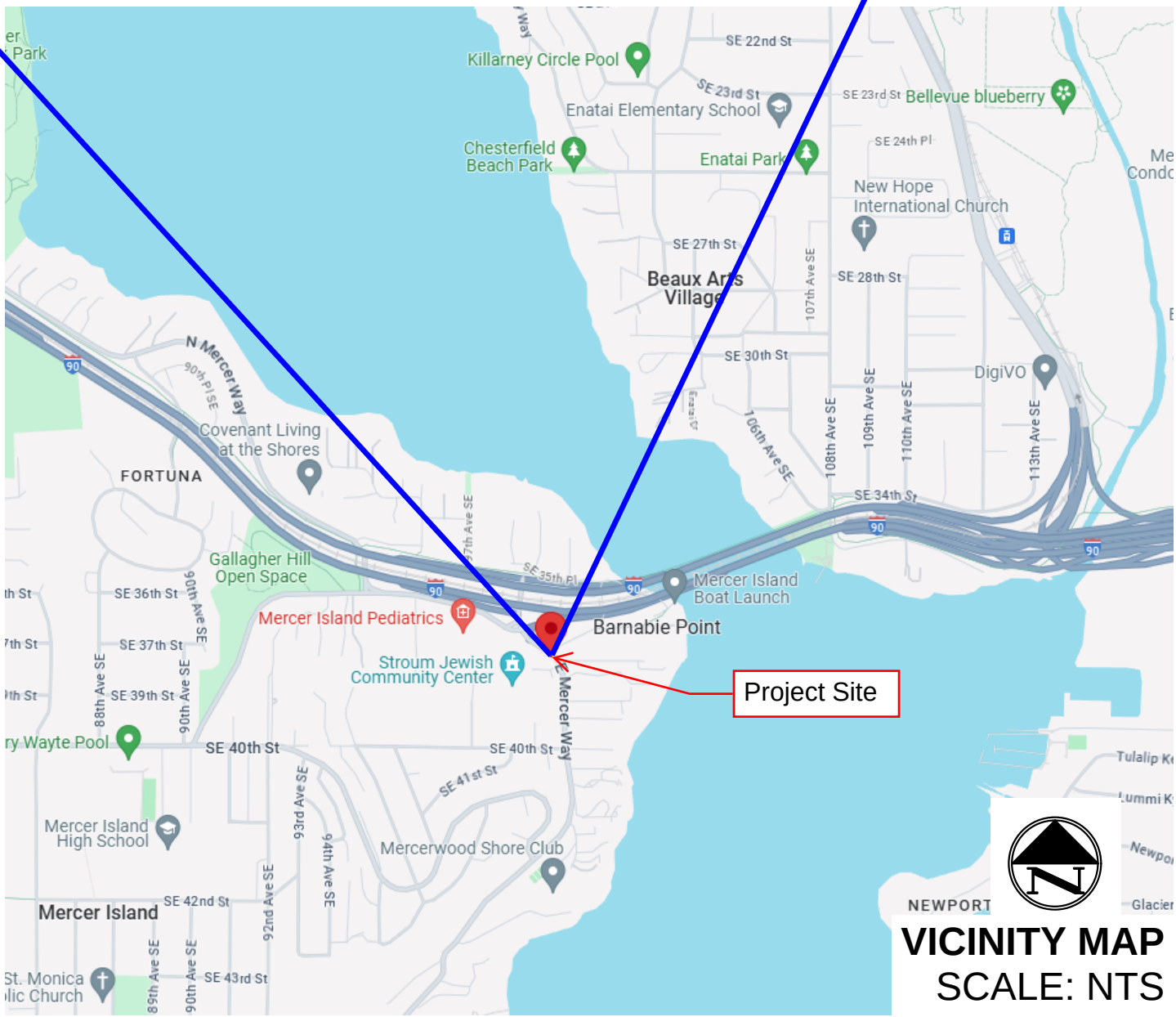
Appendix/Glossary

A. Site Map
B. BMP Detail
C. Correspondence - N/A
D. Site Inspection Form
E. Construction Stormwater General Permit (CSWGP)
F. 303(d) List Waterbodies / TMDL Waterbodies Information – N/A
G. Contaminated Site Information - N/A
H. Engineering Calculations

Appendix A – Site Map

JACOBSON
CONSULTING ENGINEERS





VICINITY MAP
SCALE: NTS

Appendix B – BMP Details

BMP C107: Construction Road / Parking Area Stabilization

Purpose

Stabilizing roads, parking areas, and other on-site vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or stormwater runoff.

Conditions of Use

Roads and parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

BMP C103: High-Visibility Fence shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for road base stabilization, pH monitoring and BMP C252: Treating and Disposing of High pH Water is necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation that water can flow through, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands or their buffers. If runoff is allowed to sheet flow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the drainage system (see BMP C220: Inlet Protection).

Maintenance Standards

Inspect stabilized areas regularly, especially after large storm events.

Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

- Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days. See II-2.5 Element 5: Stabilize Soils for specific timelines for stabilizing exposed soils.
- See Table II-4.4: Seeding Windows in Western Washington (continued) for appropriate seeding windows.
- Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.
- Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP T5.13: Post-Construction Soil Quality and Depth.

Table II-4.4: Seeding Windows in Western Washington

Month	Seeding Recommendations
January	Seeding requires a cover of mulch or an erosion control blanket until 75% grass cover is established
February	
March	

Table II-4.4: Seeding Windows in Western Washington (continued)

Month	Seeding Recommendations
April	Optimum seeding window
May	
June	
July	Seeding requires irrigation until 75% grass cover is established
August	
September	Optimum seeding window
October	Seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established
November	
December	

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix (BFM). For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish a 75% vegetation cover. If vegetated channels cannot be established by seed before water flow, install sod or prevegetated mats in the channel bottom over top of hydromulch and erosion control blankets.
- Confirm the installation of all required stormwater control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre (lb/acre) of mulch with 3% tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only, and not landscaping, may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See BMP T5.13: Post-Construction Soil Quality and Depth.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Vegetation establishment can be enhanced by one of the following two approaches:
    - Approach 1: Enhance vegetation establishment by dividing the hydromulch operation into two phases:

        - Phase 1 – Install all seed and fertilizer with 25% to 30% mulch and tackifier onto the soil in the first lift.
        - Phase 2 – Install the remaining mulch and tackifier over the first lift.
    - Approach 2: Vegetation can also be enhanced by:
        - Installing the mulch, seed, fertilizer, and tackifier in one lift;
        - Spreading or blowing straw over the top of the hydromulch at a rate of about 800 to 1,000 lb/acre; or
        - Holding straw in place with a standard tackifier.

    Both of these approaches (Approach 1 and Approach 2) will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

    - Irrigation,
    - Reapplication of mulch, and
    - Repair of failed slope surfaces.

    Either of these approaches can use standard hydromulch (1,500 lb/acre minimum) and BFM/mechanically bonded fiber matrix (MBFM) (3,000 lb/acre minimum).

- Seed may be installed by hand if it is:
    - Temporary and covered by straw, mulch, or topsoil; or
    - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- Consult the local suppliers and/or the local conservation district for their recommendations for appropriate seed mixes and application rates. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic.
- In addition to meeting erosion control functions and not hindering maintenance operations, selection of long-lived, successional growth native vegetation that can compete against or exclude weeds and grow with minimal maintenance after plant establishment is preferred. Provide diversity to the greatest extent possible and plan for a succession of flowering times to improve pollinator habitat.
- The seed mixes listed in Table II-4.5: Temporary and Permanent Seed Mixes for Western Washington (continued) include recommended mixes for both temporary and permanent seeding. Alternative seed mixes approved by the local jurisdiction may also be used.
- Apply the mixes in Table II-4.5: Temporary and Permanent Seed Mixes for Western Washington (continued), with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a rate of 60 pounds per acre.

Table II-4.5: Temporary and Permanent Seed Mixes for Western Washington

Common Name	Latin Name	% Weight	% Purity	% Germination
Temporary Erosion Control Seed Mix A standard mix for areas requiring a temporary vegetative cover.				
Chewings or annual blue grass	*Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye	*Lolium perenne*	50	98	90
Redtop or colonial bentgrass	*Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover	*Trifolium repens*	5	98	90
Landscaping Seed Mix A recommended mix for landscaping seed.				
Perennial rye blend	*Lolium perenne*	70	98	90
Chewings and red fescue blend	*Festuca rubra var. commutata* or *Festuca rubra*	30	98	90
Low-Growing Turf Seed Mix A turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.				
Dwarf tall fescue (several varieties)	*Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay)	*Lolium perenne var. barclay*	30	98	90
Red fescue	*Festuca rubra*	20	98	90
Colonial bentgrass	*Agrostis tenuis*	5	98	90
Bioswale Seed Mix A seed mix for bioswales and other intermittently wet areas.				
Tall or meadow fescue	*Festuca arundinacea* or *Festuca elatior*	75-80	98	90
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	92	85
Redtop bentgrass	*Agrostis alba* or *Agrostis gigantea*	5-10	90	80
Wet Area Seed Mix				

Table II-4.5: Temporary and Permanent Seed Mixes for Western Washington (continued)

Common Name	Latin Name	% Weight	% Purity	% Germination
A low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.				
Tall or meadow fescue	*Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	98	85
Meadow foxtail	*Alepocurus pratensis*	10-15	90	80
Alsike clover	*Trifolium hybridum*	1-6	98	90
Redtop bentgrass	*Agrostis alba*	1-6	92	85
Meadow Seed Mix A recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.				
Redtop or Oregon bentgrass	*Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue	*Festuca rubra*	70	98	90
White dutch clover	*Trifolium repens*	10	98	90

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple, single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall receive soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches, complete the rototilling process in multiple lifts, or prepare the soil amendments per the specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer needed is recommended. This will prevent the overapplication of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
- In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre.
- Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available to take the place of chemical fertilizers, including several with seaweed extracts that are beneficial to soil microbes and organisms. If 100% cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes, use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10% tackifier. Achieve a minimum of 95% soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall, and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include the following:
    - BFM and MBFMs do not require surface preparation.
    - Helicopters can assist in installing BFM and MBFMs in remote areas.
    - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
    - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.

Maintenance Standards

- Reseed any seeded areas that fail to establish at least 75% cover (100% cover for areas that receive sheet or concentrated flows) of all seeded areas after 3 months of active growth following germination during the growing season. If reseeding is ineffective, use an alternate method, such as sodding, mulching, or nets/blankets. If winter weather prevents

adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are a variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

For seeded areas, mulch may be made up of 100 percent:

- Cottonseed meal;
- Fibers made of wood, recycled cellulose, hemp, or kenaf;

- Compost;
- Or blends of these.

Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.

Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Recycled cellulose may contain polychlorinated biphenyl (PCBs). Ecology recommends that products should be evaluated for PCBs prior to use.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

Any mulch or tackifier product used shall be installed per the manufacturer's instructions.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table II-4.7: Mulch Standards and Guidelines (continued). Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of "Compost" is selected, it should be a coarse compost that meets the size gradations listed in Table II-4.6: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult the Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Table II-4.6: Size Gradations of Compost as Mulch Material

Sieve Size	Percent Passing
3"	100%
1"	90% - 100%
3/4"	70% - 100%
1/4"	40% - 100%

Table II-4.7: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
Straw	**Quality Stand-**	Air-dried; free from undesirable seed and coarse material.

Table II-4.7: Mulch Standards and Guidelines (continued)

Mulch Material	Guideline	Description
	ards	
	Application Rates	2" to 3" thick; 5 bales per 1,000 sf or 2 to 3 tons per acre
	Remarks	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas, straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier because even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species, and it has no significant long-term benefits. Straw should only be used if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	Quality Standards	No growth inhibiting factors.
	Application Rates	Approx. 35-45 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre
	Remarks	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about 3/4 - 1 inch clog hydromulch equipment. Fibers should be kept to less than 3/4 inch.
Compost	Quality Standards	No visible water or dust during handling. Must be produced per WAC 173-350, Solid Waste Handling Standards, but may have up to 35% biosolids.
	Application Rates	2" thick minimum; approximately 100 tons per acre (approximately 750 lbs per cubic yard)
	Remarks	More effective control can be obtained by increasing thickness to 3". Compost makes an excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Compost used for mulch has a coarser size gradation than compost used for BMP C125: Topsoiling / Composting or BMP T5.13: Post-Construction Soil Quality and Depth. It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use compost near wetlands if biosolids are included. Do not use compost near phosphorous impaired water bodies.
Chipped Site Vegetation	Quality Standards	Gradations from fines to 6 inches in length for texture, variation, and interlocking properties. Include a mix of various sizes so that the

Table II-4.7: Mulch Standards and Guidelines (continued)

Mulch Material	Guideline	Description
		average size is between 2 and 4 inches.
	Application Rates	2" thick minimum.
	Remarks	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approximately 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If permanent seeding or planting is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment. Note: Thick application of this material over existing grass, herbaceous species, and some groundcovers could smother and kill vegetation.
Wood-Based Mulch	**Quality Standards**	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.
	Application Rates	2" thick minimum; approximately 100 tons per acre (approximately 750 lbs. per cubic yard).
	Remarks	This material is often called "wood straw" or "hog fuel". The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	**Quality Standards**	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.
	Application Rates	2" thick minimum.
	Remarks	Cost-effective protection when applied with adequate thickness. A minimum of 95% of the wood strand shall have lengths between 2 and 10 inches, with a width and thickness between 1/16 and 0.5 inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. See specification 9-14.4(4) from the *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2016)

Maintenance Standards

The thickness of the mulch cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

BMP C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage systems during high flows.

Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (e.g. coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control netting and blankets shall be made of natural plant fibers unaltered by synthetic materials.

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap.

Disadvantages of nets and blankets include:

- Surface preparation is required.
- On slopes steeper than 2.5H:1V, net and blanket installers may need to be roped and harnessed for safety.
- They cost at least $4,000 - $6,000 per acre installed.

Advantages of nets and blankets include:

- Installation without mobilizing special equipment.
- Installation by anyone with minimal training

- Installation in stages or phases as the project progresses.
- Installers can hand place seed and fertilizer as they progress down the slope.
- Installation in any weather.
- There are numerous types of nets and blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

An alternative to nets and blankets in some limited conditions is BMP C202: Riprap Channel Lining. Ensure that BMP C202: Riprap Channel Lining is appropriate before using it as a substitute for nets and blankets.

Design and Installation Specifications

- See Figure II-4.3: Channel Installation (Clackamas County et al., 2008) and Figure II-4.4: Slope Installation for typical orientation and installation of nets and blankets used in channels and as slope protection. Note: these are typical only; all nets and blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Install nets and blankets on slopes per the following steps:

    1. Complete final grade and track walk up and down the slope. Soils should be raked and uniform prior to installing nets or blankets. To be effective, nets and blankets must have good adhesion to the soil.
    2. Install hydromulch with seed and fertilizer.
    3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
    4. Install the leading edge of the net/blanket into the small trench and staple approximately every 18 inches.

        NOTE: Staples are metal, "U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.

    5. Roll the net/blanket slowly down the slope as the installer walks backward.

        NOTE: The net/blanket rests against the installer's legs. Staples are installed as the net/blanket is unrolled. It is critical that the proper staple pattern is used for the net/blanket being installed. The net/blanket is not to be allowed to roll down the slope on its own as this stretches the net/blanket, making it impossible to maintain soil contact. In addition, no one is allowed to walk on the net/blanket after it is in place.

    6. If the net/blanket is not long enough to cover the entire slope length, the trailing edge of the upper net/blanket should overlap the leading edge of the lower net/blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.

- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the designer consult the manufacturer's information and that a site visit takes place in order to ensure that the product specified is appropriate. Information is also available in WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Division 8-01 and Division 9-14 (WSDOT, 2016).
- Use jute matting in conjunction with mulch (BMP C121: Mulching). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning it breaks down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Maintain good contact with the ground. Erosion must not occur beneath the net or blanket.
- Repair and staple any areas of the net or blanket that are damaged or not in close contact with the ground.
- Fix and protect eroded areas if erosion occurs due to poorly controlled drainage.

Figure II-4.3: Channel Installation

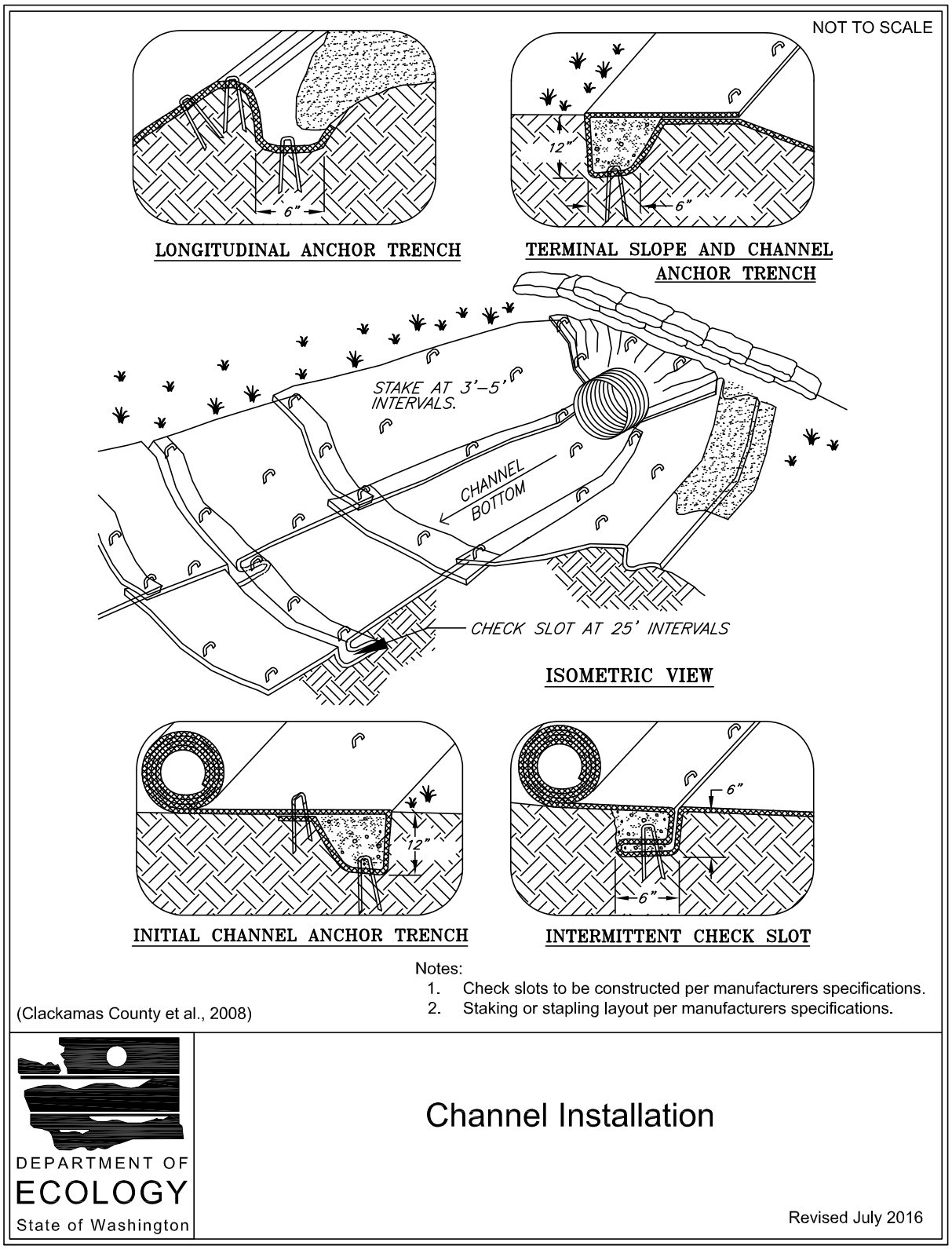
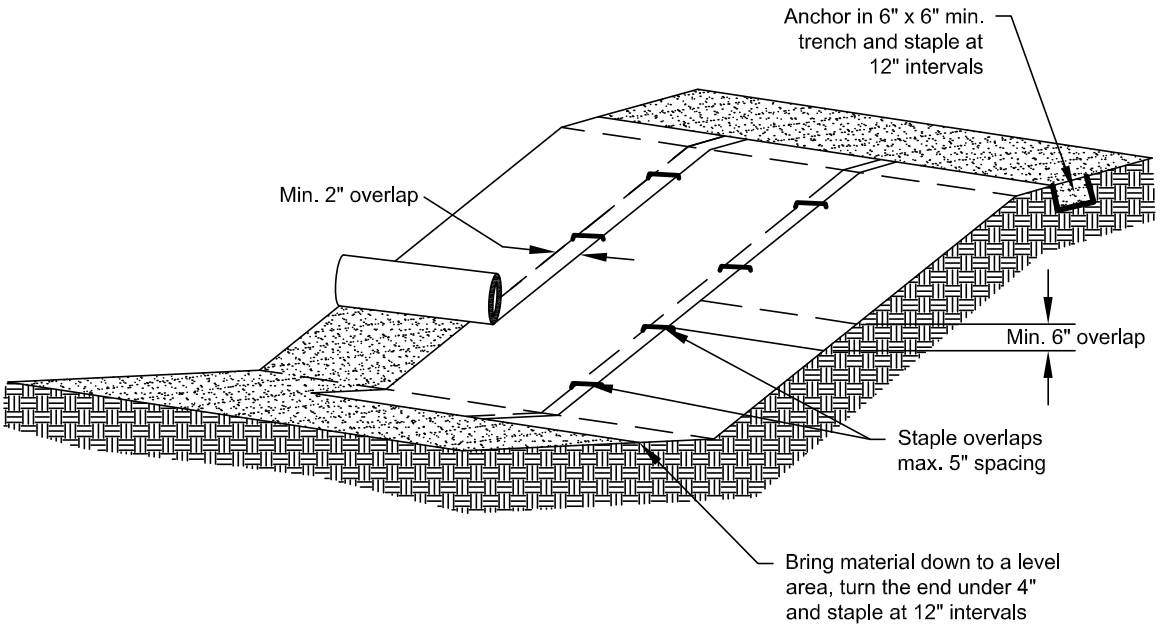


Figure II-4.4: Slope Installation



Notes:

1. Slope surface shall be smooth before placement for proper soil contact.
2. Stapling pattern as per manufacturer's recommendations.
3. Do not stretch blankets/mattings tight - allow the rolls to mold to any irregularities.
4. For slopes less than 3H:1V, rolls may be placed in horizontal strips.
5. If there is a berm at the top of the slope, anchor upslope of the berm.
6. Lime, fertilize, and seed before installation. Planting of shrubs, trees, etc. should occur after installation.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Slope Installation

Revised June 2016

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
    3. Provide a minimum of 8-inch overlap at the seams.
    4. On long or wide slopes, or slopes subject to wind, tape all seams.
    5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
    6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
    7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
    8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C124: Sodding

Purpose

The purpose of sodding is to establish turf for immediate erosion protection and to stabilize drainage paths where concentrated overland flow will occur.

Conditions of Use

Sodding may be used in the following areas:

- Disturbed areas that require short-term or long-term cover.
- Disturbed areas that require immediate vegetative cover.
- All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.

Design and Installation Specifications

Sod shall be free of weeds, have a uniform thickness (approximately 1-inch thick), and have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

1. Shape and smooth the surface to final grade in accordance with the approved grading plan. Consider any areas (such as swales) that need to be overexcavated below design elevation to allow room for placing soil amendment and sod.
2. Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. See Ecology's Compost web page for further information:

   https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost
3. Fertilize according to the sod supplier's recommendations.
4. Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
5. Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
6. Roll the sodded area and irrigate.
7. When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy ground cover. If it is impossible to establish a healthy ground cover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket (BMP C122: Nets and Blankets).

BMP C125: Topsoiling / Composting

Purpose

Topsoiling and composting provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling and composting are an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Use this BMP in conjunction with other BMPs such as BMP C120: Temporary and Permanent Seeding, BMP C121: Mulching, or BMP C124: Sodding.

Implementation of this BMP may meet the post-construction requirements of BMP T5.13: Post-Construction Soil Quality and Depth.

Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but also serve as effective biofilters for urban pollutants and, by supporting more vigorous plant growth, reduce the water, fertilizer, and/or pesticides needed to support installed landscapes. Topsoil does not include any subsoils but only the material from the top several inches including organic debris.

Conditions of Use

- Permanent landscaped areas shall contain healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetative health and vitality, improves hydrologic characteristics, and reduces the need for irrigation.
- Leave native soils and the duff layer undisturbed to the maximum extent practicable. Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. Preserve existing soil systems in undisturbed and uncompacted conditions if functioning properly.
- Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.
- Restore, to the maximum extent practical, native soils disturbed during clearing and grading to a condition equal to or better than the original site condition's moisture-holding capacity. Use on-site native topsoil, incorporate amendments into on-site soil, or import blended topsoil to meet this requirement.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.

- Beware of where the topsoil comes from, and what vegetation was on site before disturbance. Invasive plant seeds may be included and could cause problems for establishing native plants, landscaped areas, or grasses.
- Topsoil from the site will contain mycorrhizal bacteria that are necessary for healthy root growth and nutrient transfer. These native mycorrhizae are acclimated to the site and will provide optimum conditions for establishing grasses. Use commercially available mycorrhizae products when using off-site topsoil.

Design and Installation Specifications

Meet the following requirements for disturbed areas where topsoil will be applied (e.g. for disturbed areas that will be developed as lawn or other landscape):

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil shall have:
    - A minimum depth of 8 inches. Scarify subsoils below the topsoil layer at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible. Ripping or re-structuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system. The decision to either layer topsoil over a subgrade or incorporate topsoil into the underlying layer may vary depending on the planting specified.
    - A minimum organic content of 10% dry weight in planting beds, and 5% organic matter content in turf areas. Incorporate organic amendments to a minimum 8 inch depth except where tree roots or other natural features limit the depth of incorporation.
    - A pH between 6.0 and 8.0 or matching the pH of the undisturbed soil.
    - If blended topsoil is imported, then fines should be limited to 25% passing through a 200 sieve.
- Mulch planting beds with 2 inches of organic material
- Accomplish the required organic content, depth, and pH by returning native topsoil to the site, importing topsoil of sufficient organic content, and/or incorporating organic amendments. When using the option of incorporating amendments to meet the organic content requirement, use compost that meets the compost specification for Bioretention (See BMP T7.30: Bioretention), with the exception that the compost may have up to 35% biosolids or manure.
- The final composition and construction of the soil system will result in a natural selection or favoring of certain plant species over time. For example, incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- Allow sufficient time in scheduling for topsoil spreading prior to seeding, sodding, or planting.

- Take care when applying topsoil to subsoils with contrasting textures. Sandy topsoil over clayey subsoil is a particularly poor combination, as water creeps along the junction between the soil layers and causes the topsoil to slough. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method to promote bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- Field exploration of the site shall be made to determine if there is surface soil of sufficient quantity and quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, and/or clay loam). Avoid areas of natural groundwater recharge.
- Stripping shall be confined to the immediate construction area. A 4 to 6 inch stripping depth is common, but depth may vary depending on the particular soil. All surface runoff control structures shall be in place prior to stripping.
- Do not place topsoil while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.
- In any areas requiring grading, remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas. Reapply stockpiled topsoil to other portions of the site where feasible.
- Locate the topsoil stockpile so that it meets specifications and does not interfere with work on the site. It may be possible to locate more than one pile in proximity to areas where topsoil will be used.
- Stockpiling of topsoil shall occur in the following manner:
    - Side slopes of the stockpile shall not exceed 2H:1V.
    - Between October 1 and April 30:
        - An interceptor dike with gravel outlet and silt fence shall surround all topsoil stockpiles.
        - Within 2 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.
    - Between May 1 and September 30:
        - An interceptor dike with gravel outlet and silt fence shall surround all topsoil stockpiles if the stockpile will remain in place for a longer period of time than active construction grading.
        - Within 7 days complete erosion control seeding, or covering stockpiles with clear plastic, or other mulching materials.
- When native topsoil is to be stockpiled and reused, the following should apply to ensure that the mycorrhizal bacteria, earthworms, and other beneficial organisms will not be destroyed:

- Reinstall topsoil within 4 to 6 weeks.
- Do not allow the saturation of topsoil with water.
- Do not use plastic covering.

Maintenance Standards

- Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.
- Establish soil quality and depth toward the end of construction and once established, protect from compaction, such as from large machinery use, and from erosion.
- Plant and mulch soil after installation.
- Leave plant debris or its equivalent on the soil surface to replenish organic matter.
- Reduce and adjust, where possible, the use of irrigation, fertilizers, herbicides and pesticides, rather than continuing to implement formerly established practices.

BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection

Purpose

Polyacrylamide (PAM) is used on construction sites to prevent soil erosion.

Applying PAM to bare soil in advance of a rain event significantly reduces erosion and controls sediment in two ways. First, PAM increases the soil's available pore volume, thus increasing infiltration and reducing the quantity of stormwater runoff. Second, it increases flocculation of suspended particles and aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

Conditions of Use

PAM shall not be directly applied to water or allowed to enter a water body. Stormwater runoff from areas where PAM has been applied shall pass through BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary) (depending on the size of the drainage area) prior to discharging to surface waters.

PAM use shall be reviewed and approved by the local jurisdiction.

Loss of sediment and PAM may be a basis for penalties per RCW 90.48.080.

PAM can be applied to bare soil under the following conditions:

- During rough grading operations.
- In staging areas.
- In balanced cut and fill earthwork.

steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas. When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.

- PAM may affect the treatment efficiency of chitosan flocculent systems.

BMP C130: Surface Roughening

Purpose

Surface roughening aids in the establishment of vegetative cover, reduces runoff velocity, increases infiltration, and provides for sediment trapping through the provision of a rough soil surface. Horizontal depressions are created by operating a tiller or other suitable equipment on the contour or by leaving slopes in a roughened condition by not fine grading them.

Use this BMP in conjunction with other BMPs such as BMP C120: Temporary and Permanent Seeding, BMP C121: Mulching, or BMP C124: Sodding.

Conditions for Use

- All slopes steeper than 3H:1V and greater than 5 vertical feet require surface roughening to a depth of 2 to 4 inches prior to seeding.
- Areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
- Slopes with a stable rock face do not require roughening.
- Slopes where mowing is planned should not be excessively roughened.

Design and Installation Specifications

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends on the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure II-4.5: Surface Roughening by Tracking and Contour Furrows. Factors to be considered in choosing a roughening method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

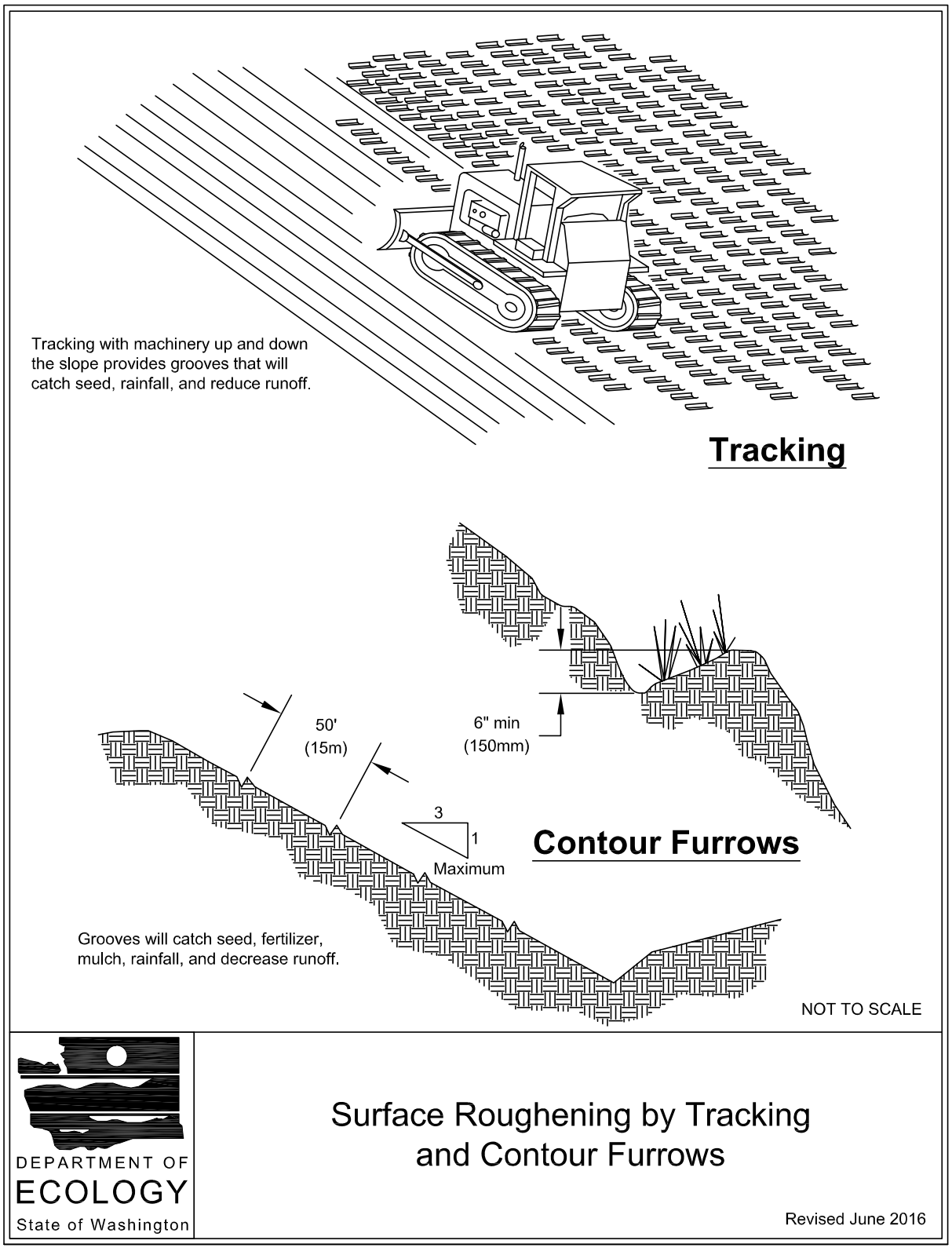
- Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.
- Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material that sloughs from above, and provides a level site where vegetation can become established. Stairs should be wide enough to work with standard earth moving equipment. Stair steps must be on contour or gullies will form on the slope.
- Areas that will be mowed (these areas should have slopes less steep than 3H:1V) may have small furrows left by disking, harrowing, raking, or seed-planting machinery operated on the contour.

- Graded areas with slopes steeper than 3H:1V but less than 2H:1V should be roughened before seeding. This can be accomplished in a variety of ways, including "track walking", or driving a crawler tractor up and down the slope, leaving a pattern of cleat imprints parallel to slope contours.
- Tracking is done by operating equipment up and down the slope to leave horizontal depressions in the soil.

Maintenance Standards

- Areas that are surface roughened should be seeded as quickly as possible.
- Regular inspections should be made of the area. If rills appear, they should be re-roughened and re-seeded immediately.

Figure II-4.5: Surface Roughening by Tracking and Contour Furrows



BMP C131: Gradient Terraces

Purpose

Gradient terraces reduce erosion damage by intercepting surface runoff and conveying it to a stable outlet at a non-erosive velocity.

Conditions of Use

Gradient terraces are normally limited to bare land having a water erosion problem. They should not be constructed on deep sands or on soils that are too stony, steep, or shallow to permit practical and economical installation and maintenance. Gradient terraces may only be used where suitable outlets are or will be made available.

Design and Installation Specifications

- The maximum vertical spacing of gradient terraces should be determined by the following method:

  $$VI = (0.8)s + y$$

  Where:

  VI = vertical interval in feet

  s = land rise per 100 feet, expressed in feet

  y = a soil and cover variable with values from 1.0 to 4.0

  Values of “y” are influenced by soil erodibility and cover practices. The lower values are applicable to erosive soils where little to no residue is left on the surface. The higher value is applicable only to erosion-resistant soils where a large amount of residue (1.5 tons of straw per acre equivalent) is on the surface.

- The minimum constructed cross-section should meet the design dimensions.
- The top of the constructed ridge should not be lower at any point than the design elevation plus the specified overfill for settlement. The opening at the outlet end of the terrace should have a cross section equal to that specified for the terrace channel.
- Channel grades may be either uniform or variable with a maximum grade of 0.6 feet per 100 feet length (0.6%). For short distances, terrace grades may be increased to improve alignment. The channel velocity should not exceed that which is nonerosive for the soil type.
- All gradient terraces should have adequate outlets. Such an outlet may be a grassed waterway, vegetated area, or tile outlet. In all cases the outlet must convey runoff from the terrace or terrace system to a point where the outflow will not cause damage. Vegetative cover and energy dissipators should be used in the outlet channel.
- The design elevation of the water surface of the terrace should not be lower than the design elevation of the water surface in the outlet at their junction, when both are operating at

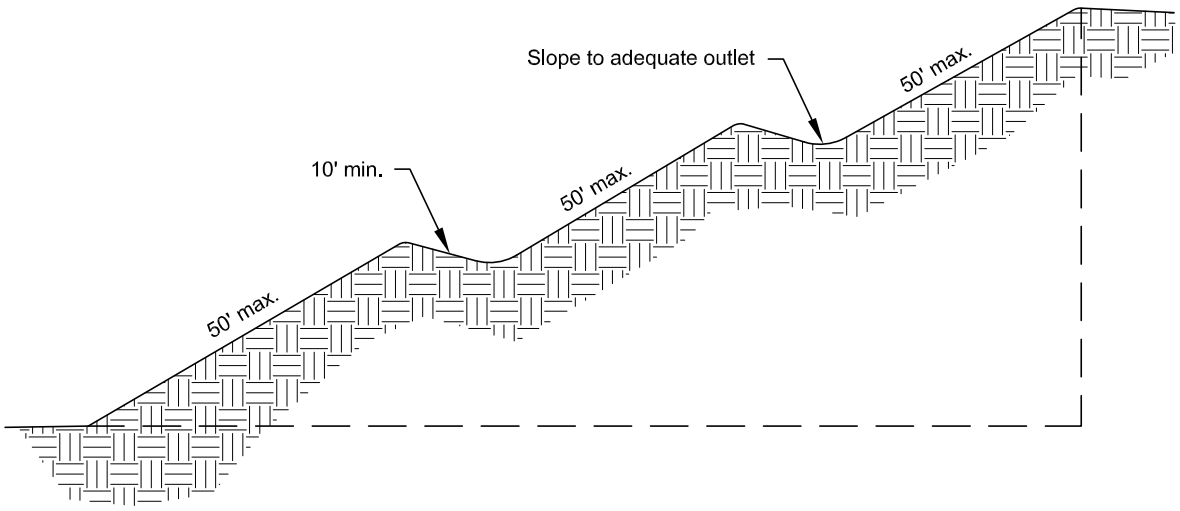
design flow.

- Vertical spacing determined by the above methods may be increased as much as 0.5 feet or 10 percent, whichever is greater, to provide better alignment or location, to avoid obstacles, to adjust for equipment size, or to reach a satisfactory outlet. The contributing drainage area above the terrace should not exceed the area that would be drained by a terrace with normal spacing.
- The terrace should have enough capacity to handle the peak runoff expected from a 2-year, 24-hour design storm without overtopping.
- The terrace cross-section should be proportioned to fit the land slope.
- The ridge height should include a reasonable settlement factor.
- The ridge should have a minimum top width of 3 feet at the design height.
- The minimum cross-sectional area of the terrace channel should be 8 square feet for land slopes of 5 percent or less, 7 square feet for slopes from 5 to 8 percent, and 6 square feet for slopes steeper than 8 percent. The terrace can be constructed wide enough to be maintained using a small vehicle.

Maintenance Standards

Maintenance should be performed as needed. Terraces should be inspected regularly; at least once per year, and after large storm events.

Figure II-4.6: Gradient Terraces



NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Gradient Terraces

Revised June 2016

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, into drainage systems, and into surface waters.

Conditions of Use

Use dust control in areas (including roadways) subject to surface and air movement of dust where on-site or off-site impacts to roadways, drainage systems, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until the surface is wet. Repeat as needed. To prevent carryout of mud onto the street, refer to BMP C105: Stabilized Construction Access and BMP C106: Wheel Wash.
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local jurisdictions may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may reduce the quantity of water needed for dust control.

  Note that the application rate specified here applies to this BMP, and is not the same application rate that is specified in BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection, but the downstream protections still apply.

  Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body. PAM use shall

be reviewed and approved by the local permitting authority and discharge of PAM may be a basis for penalties per RCW 90.48.080.

- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP. See the following website for more information:

  https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Clean-air-agencies

- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
  - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
  - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
  - Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
  - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
  - Encourage the use of alternate, paved routes, if available.
  - Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
  - Limit dust-generating work on windy days.
  - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel “T” posts.
- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw bales for mulching
- Quarry spalls
- Washed gravel
- Geotextile fabric
- Catch basin inserts
- Steel "T" posts
- Silt fence material
- Straw wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials as needed.

BMP C151: 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 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 project components include, but are not limited to:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Off-site disposal
2. Concrete wash-out areas (see BMP C154: Concrete Washout Area)
3. De minimus washout to formed areas awaiting concrete

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.

- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.
- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contain fine particles and have a high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created by sawcutting or surfacing from entering waters of the State.

Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to:

- Sawing
- Coring
- Grinding
- Roughening
- Hydro-demolition
- Bridge and road surfacing

Design and Installation Specifications

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate groundwater or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening, or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose of process water in a manner that does not violate groundwater or surface water quality standards.
- Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and/or vacuum trucks.

BMP C153: 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

Use at 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

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (October 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.

- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days.
- Secondary containment facilities shall be covered at all times, except when in active use.
- Keep material storage areas clean, organized, and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1 - Water resistant nylon bag
    - 3 - Oil absorbent socks 3”x 4’
    - 2 - Oil absorbent socks 3”x 10’
    - 12 - Oil absorbent pads 17”x19”
    - 1 - Pair splash resistant goggles
    - 3 - Pairs nitrile gloves
    - 10 - Disposable bags with ties
    - Instructions

Maintenance Standards

- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Re-stock spill kit materials as needed.

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants from concrete waste to stormwater by conducting washout off-site, or performing on-site washout in a designated area.

Conditions of Use

Concrete washout areas 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 truck drums are washed on-site.

  Note that auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheel-barrows) may be washed into formed areas awaiting concrete pour.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved off-site location or in designated concrete washout areas only.
- Do not wash out concrete onto non-formed areas, or into storm drains, open ditches, streets, or streams.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas as allowed above.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.

- Arrange for the contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each concrete washout area to inform concrete equipment operators to utilize the proper facilities.

Contracts

Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement

- Locate concrete washout areas at least 50 feet from sensitive areas such as storm drains, open ditches, water bodies, or wetlands.
- Allow convenient access to the concrete washout area for concrete trucks, preferably near the area where the concrete is being poured.
- If trucks need to leave a paved area to access the concrete washout area, prevent track-out with a pad of rock or quarry spalls (see BMP C105: Stabilized Construction Access). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The number of concrete washout areas you install should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, concrete washout areas should be placed in multiple locations for ease of use by concrete truck drivers.

Concrete Truck Washout Procedures

- Washout of concrete truck drums shall be performed in designated concrete washout areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of off-site.

Concrete Washout Area Installation

- Concrete washout areas should be constructed as shown in the figures below, with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
- Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
- Lath and flagging should be commercial type.
- Liner seams shall be installed in accordance with manufacturers' recommendations.

- Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.
- During periods of concrete work, inspect the concrete washout areas daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed concrete washout areas, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Maintain the concrete washout areas to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Concrete washout areas must be cleaned, or new concrete washout areas must be constructed and ready for use once the concrete washout area is 75% full.
- If the concrete washout area is nearing capacity, vacuum and dispose of the waste material in an approved manner.
    - Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
    - Do not discharge to the sanitary sewer without local approval.
    - Place a secure, non-collapsing, non-water collecting cover over the concrete washout area prior to predicted wet weather to prevent accumulation and overflow of precipitation.
    - Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.
- When you remove materials from a self-installed concrete washout area, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Removal of Concrete Washout Areas

- When concrete washout areas are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.
- Materials used to construct concrete washout areas shall be removed from the site of the work and disposed of or recycled.
- Holes, depressions or other ground disturbance caused by the removal of the concrete washout areas shall be backfilled, repaired, and stabilized to prevent erosion.

Figure II-4.7: Concrete Washout Area with Wood Planks

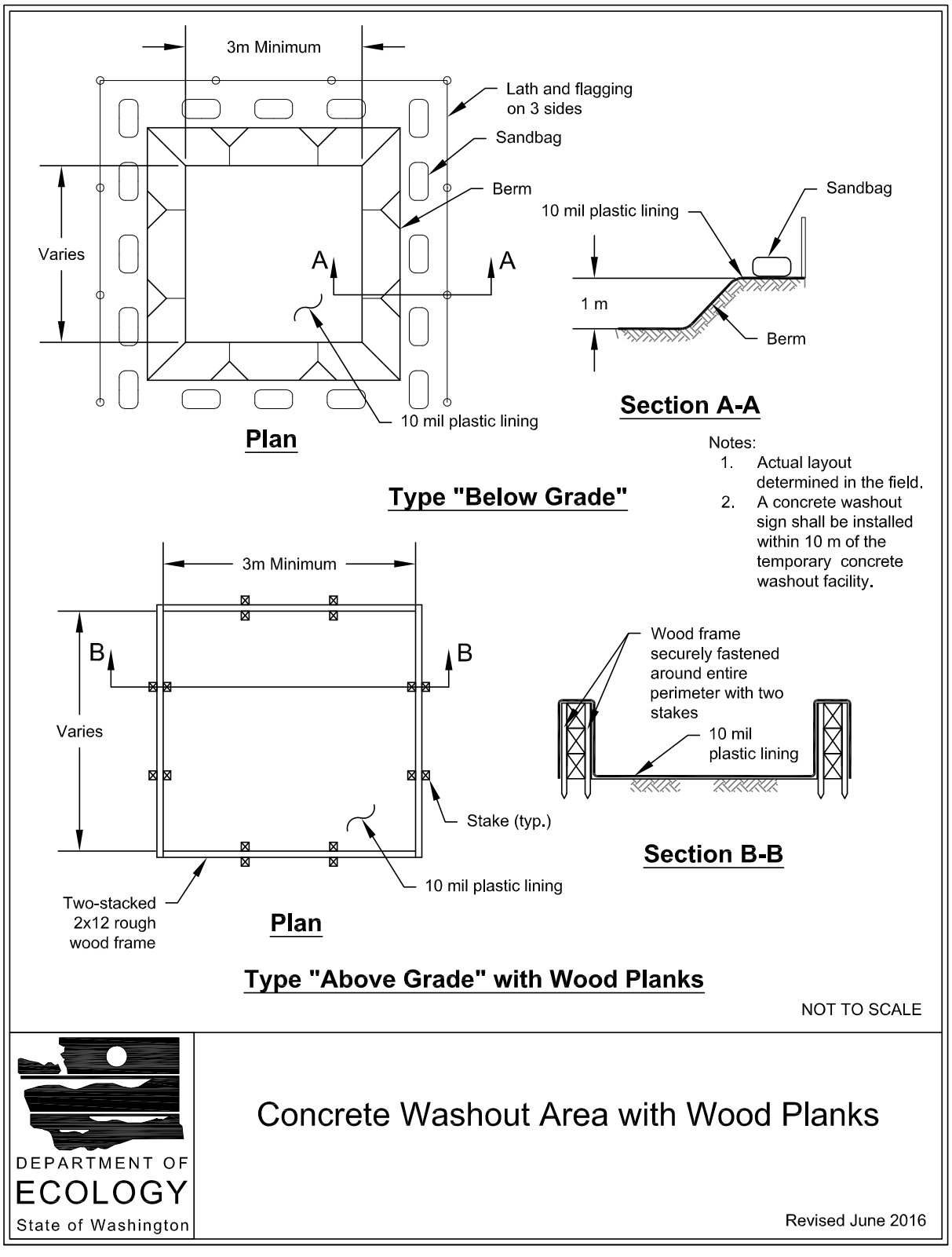


Figure II-4.8: Concrete Washout Area with Straw Bales

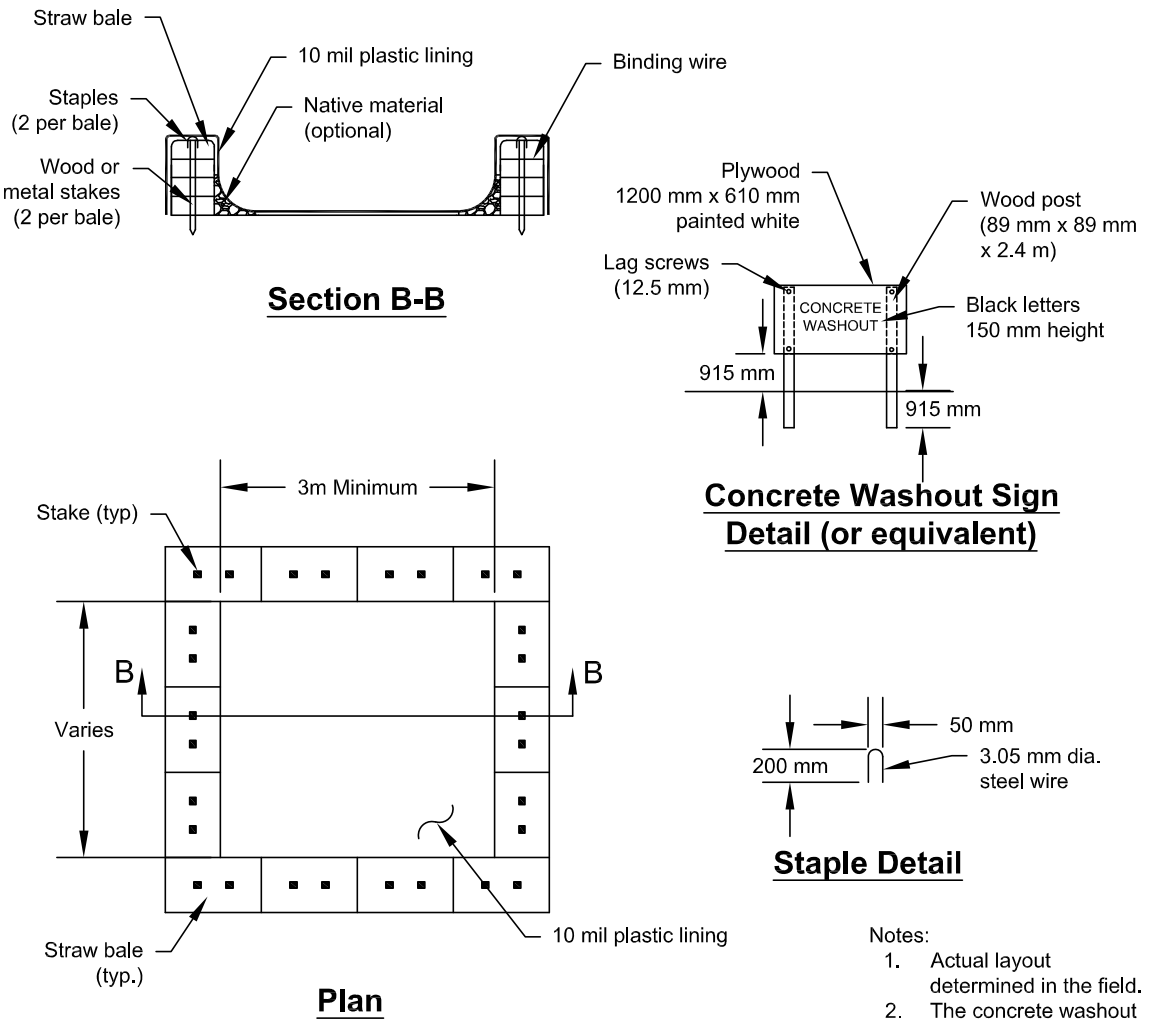
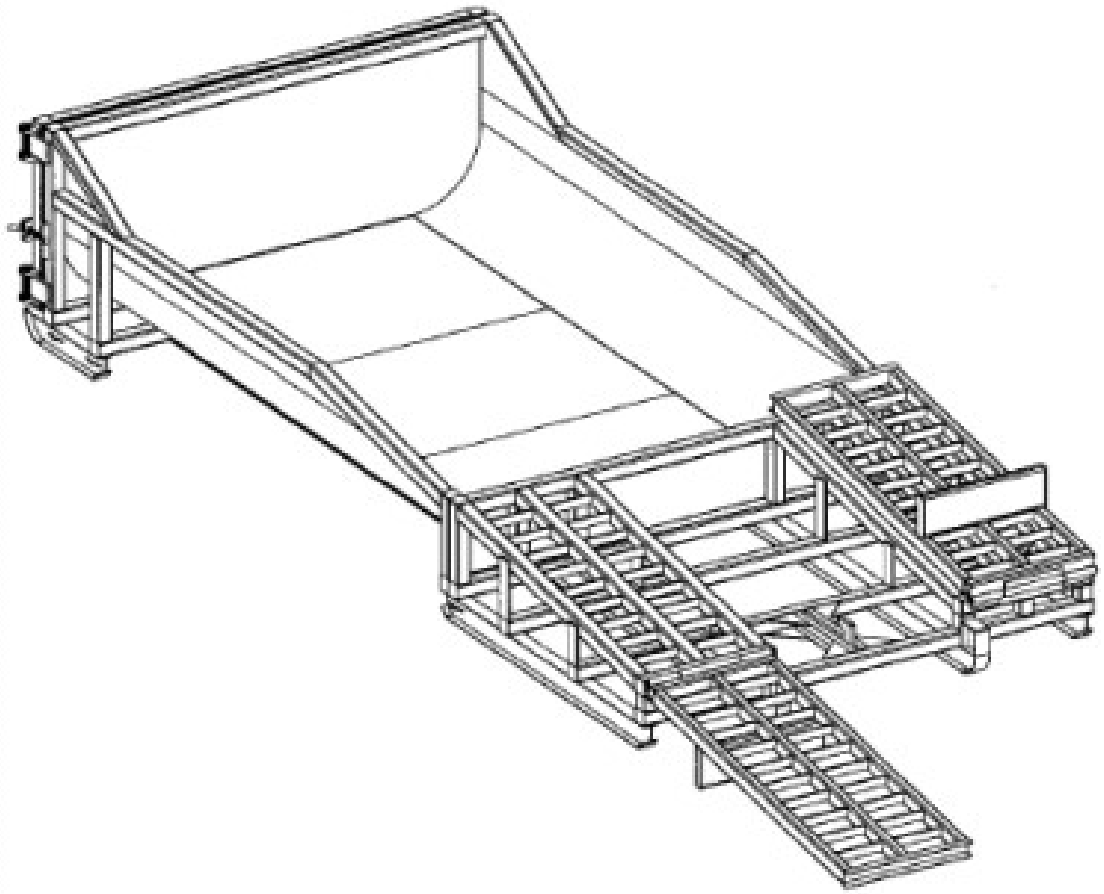


Figure II-4.9: Prefabricated Concrete Washout Container with Ramp



NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Prefabricated Concrete Washout Container with Ramp

Revised June 2016

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC) and water quality protection. The designated person shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements. Construction sites one acre or larger that discharge to waters of the State must designate a Certified Erosion and Sediment Control Lead (CESCL) as the responsible representative.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections.

The CESCL shall:

- Have a current certificate proving attendance in an ESC training course that meets the minimum ESC training and certification requirements established by Ecology.

  Ecology has provided the minimum requirements for CESCL course training, as well as a list of ESC training and certification providers at:

  https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control

  OR

- Be a Certified Professional in Erosion and Sediment Control (CPESC). For additional information go to:

  http://www.envirocertintl.org/cpesc/

Specifications

- CESCL certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL. See II-3 Construction Stormwater Pollution Prevention Plans (Construction SWPPPs).
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region, but must be on site whenever earthwork activities are occurring that could generate release of turbid water.

- Duties and responsibilities of the CESCL shall include, but are not limited to, the following:
    - Maintaining a permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
    - Directing BMP installation, inspection, maintenance, modification, and removal.
    - Updating all project drawings and the Construction SWPPP with changes made.
    - Completing any sampling requirements including reporting results using electronic Discharge Monitoring Reports (WebDMR).
    - Facilitating, participating in, and taking corrective actions resulting from inspections performed by outside agencies or the owner.
    - Keeping daily logs and inspection reports. Inspection reports should include:
        - Inspection date/time.
        - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
        - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
        - Any water quality monitoring performed during inspection.
        - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
        - A summary or list of all BMPs implemented, including observations of all ESC structures or practices. The following shall be noted:
            1. Locations of BMPs inspected.
            2. Locations of BMPs that need maintenance.
            3. Locations of BMPs that failed to operate as designed or intended.
            4. Locations of where additional or different BMPs are required.

BMP C162: Scheduling

Purpose

Sequencing a construction project can reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sediment control (ESC) measures planned for the

project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to erosion. Construction sequencing that limits land clearing, provides timely installation of ESC BMPs, and restores protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

II-4.3 Construction Runoff BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a dike of compacted soil or a swale at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Use an interceptor dike or swale where runoff from an exposed site or disturbed slope must be conveyed to an erosion control BMP that can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering the disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment trapping BMP (e.g. BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary)).

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Steep grades require channel protection and check dams.

- Review construction for areas where overtopping may occur.
- Can be used at the top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Contributing area for an individual dike or swale should be one acre or less.
- Design the dike and/or swale to contain flows calculated by one of the following methods:
    - Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm for the worst-case land cover condition.

      OR

    - Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step for the worst-case land cover condition.

  Worst-case land cover conditions (i.e. producing the most runoff) should be used for analysis. In most cases, this would be the land cover conditions just prior to final landscaping.

Interceptor Dikes

Interceptor dikes shall meet the following criteria:

- Top Width: 2 feet minimum.
- Height: 1.5 feet minimum on berm.
- Side Slope: 2H:1V or flatter.
- Grade: Depends on topography; however, dike system minimum is 0.5%, and maximum is 1%.
- Compaction: Minimum of 90% ASTM D698 standard proctor.
- Stabilization: Depends on velocity and reach. Inspect regularly to ensure stability.
- Ground Slopes less than 5%: Seed and mulch applied within 5 days of dike construction (see BMP C121: Mulching).
- Ground Slopes from 5% to 40%: Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap, or other measures to avoid erosion.
- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping BMP.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

- See Table II-4.9: Horizontal Spacing of Interceptor Dikes Along Ground Slope for recommended horizontal spacing between dikes.

Table II-4.9: Horizontal Spacing of Interceptor Dikes Along Ground Slope

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3 - 5%	300 feet
(10 to 20)H:1V	5 - 10%	200 feet
(4 to 10)H:1V	10 - 25%	100 feet
(2 to 4)H:1V	25 - 50%	50 feet

Interceptor Swales

Interceptor swales shall meet the following criteria:

- Bottom Width: 2 feet minimum; the cross-section bottom shall be level.
- Depth: 1 foot minimum.
- Side Slope: 2H:1V or flatter.
- Grade: Maximum 5%, with positive drainage to a suitable outlet (such as BMP C241: Sediment Pond (Temporary)).
- Stabilization: Seed per BMP C120: Temporary and Permanent Seeding, or BMP C202: Riprap Channel Lining, 12 inches thick riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

Maintenance Standards

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.
- Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C201: Grass-Lined Channels

Purpose

To provide a channel with a vegetative lining for conveyance of runoff. The purpose of the vegetative lining is to prevent transport of sediment and erosion.

Conditions of Use

This practice applies to construction sites where concentrated runoff needs to be directed to prevent erosion or flooding.

- Use this BMP when a vegetative lining can provide sufficient stability for the channel cross section and at lower velocities of water (normally dependent on grade). This means that the channel slopes are generally less than 5% and space is available for a relatively large cross section.
- Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage ditches in low areas.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a bonded fiber matrix (BFM). The vegetation should be well established (i.e. 75% cover) before water is allowed to flow in the ditch unless BMP C122: Nets and Blankets is used to protect the channel. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch in lieu of hydromulch and blankets.

Design and Installation Specifications

See Figure II-4.10: Typical Grass-Lined Channels

Locate channels where they can conform to the topography and other features such as roads. Use natural drainage systems to the greatest extent possible

- Avoid sharp changes in alignment or bends and changes in grade.
- Do not reshape the landscape to fit the drainage channel.
- The maximum design velocity shall be based on soil conditions, type of vegetation, and method of revegetation, but at no time shall velocity exceed 5 feet/second. The channel shall not be overtopped by the peak volumetric flow rate calculated by one of the following methods:
    - Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm for the worst-case land cover condition.

      OR

    - Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step for the worst-case land cover condition.

  Worst-case land cover conditions (i.e. producing the most runoff) should be used for analysis (in most cases, this would be the land cover conditions just prior to final landscaping).
- Where the grass-lined channel will also function as a permanent stormwater conveyance facility, consult the drainage conveyance requirements of the local jurisdiction.

- An established grass or vegetated lining is required before the channel can be used to convey stormwater, unless stabilized with nets or blankets (see BMP C122: Nets and Blankets).
- If design velocity of a channel to be vegetated by seeding exceeds 2 ft/sec, a temporary channel liner is required. Geotextile or special mulch protection such as fiberglass roving or straw and netting provides stability until the vegetation is fully established. See Figure II-4.11: Temporary Channel Liners.
- Check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4%. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- If vegetation is established by sodding, the permissible velocity for established vegetation may be used and no temporary liner is needed.
- Do not subject the grass-lined channel to sedimentation from disturbed areas. Use sediment-trapping BMPs upstream of the channel.
- V-shaped grass channels generally apply where the quantity of water is small, such as in short reaches along roadsides. The V-shaped cross section is least desirable because it is difficult to stabilize the bottom where velocities may be high.
- Trapezoidal grass channels are used where runoff volumes are large and slope is low so that velocities are nonerosive to vegetated linings.

  Note: it is difficult to construct small parabolic shaped channels.
- Subsurface drainage or riprap channel bottoms may be necessary on sites that are subject to prolonged wet conditions due to long duration flows or a high water table.
- Provide outlet protection at culvert ends and at channel intersections.
- Grass channels, at a minimum, should carry peak runoff for temporary construction drainage facilities from the 10-year, 24-hour storm for the worst case land cover condition without eroding. Where flood hazard exists, increase the capacity according to the potential damage.
- Grassed channel side slopes generally are constructed 3H:1V or flatter to aid in the establishment of vegetation and for maintenance.
- Construct channels a minimum of 0.2 foot larger around the periphery to allow for soil bulking during seedbed preparations and sod buildup.

Maintenance Standards

During the establishment period, check grass-lined channels after every rainfall.

- After grass is established, periodically check the channel; check it after every heavy rainfall event. Immediately make repairs.
- Check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes.

- Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

Figure II-4.10: Typical Grass-Lined Channels

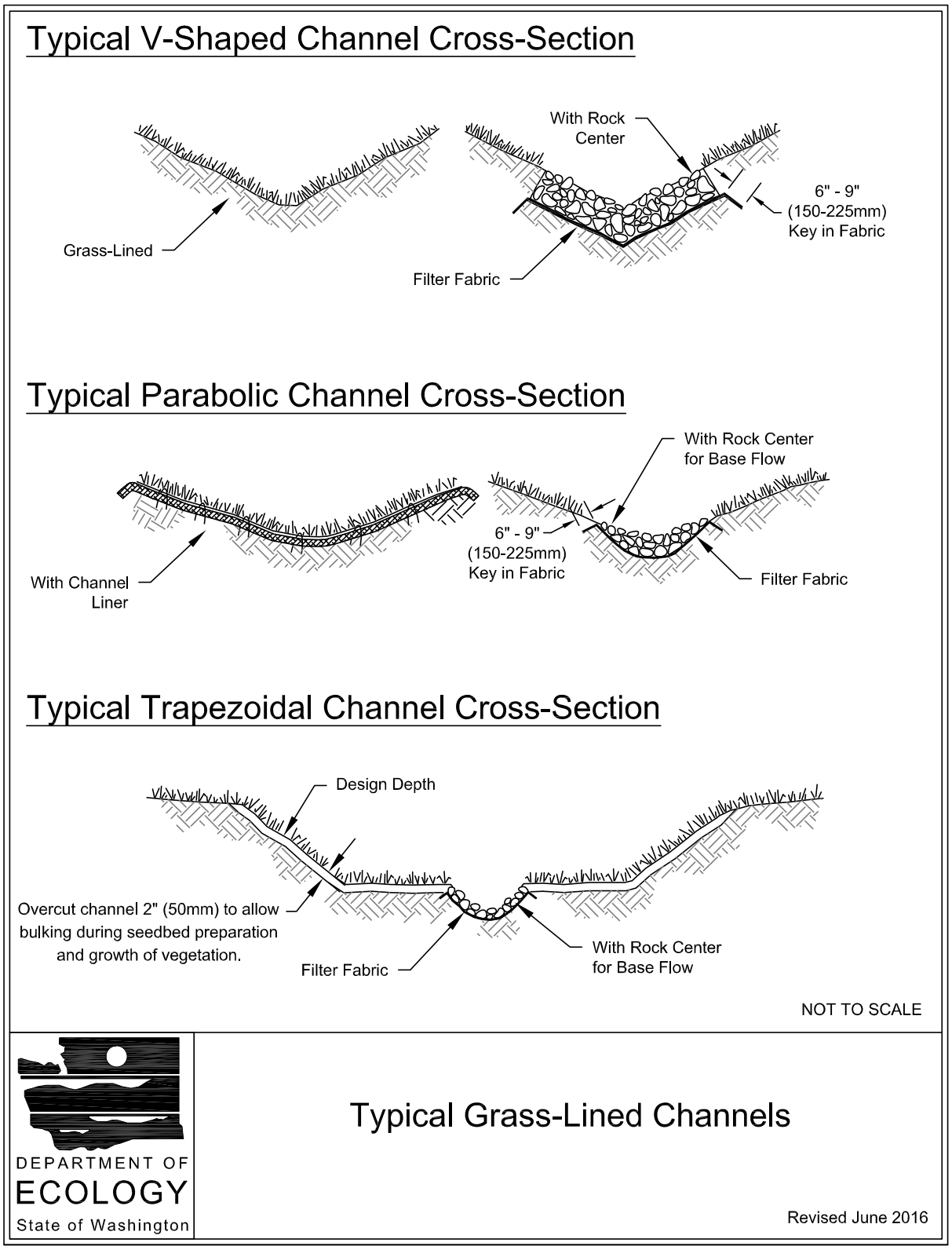
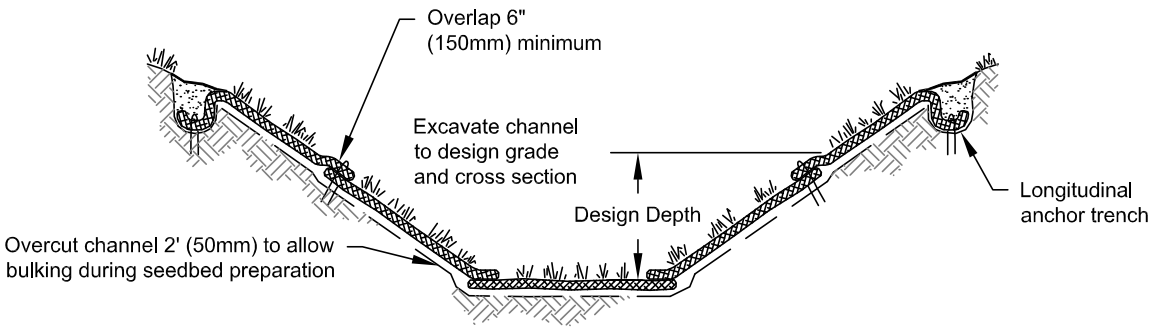
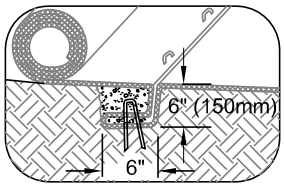


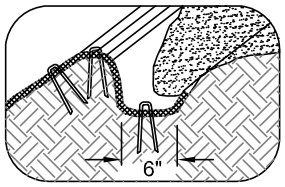
Figure II-4.11: Temporary Channel Liners



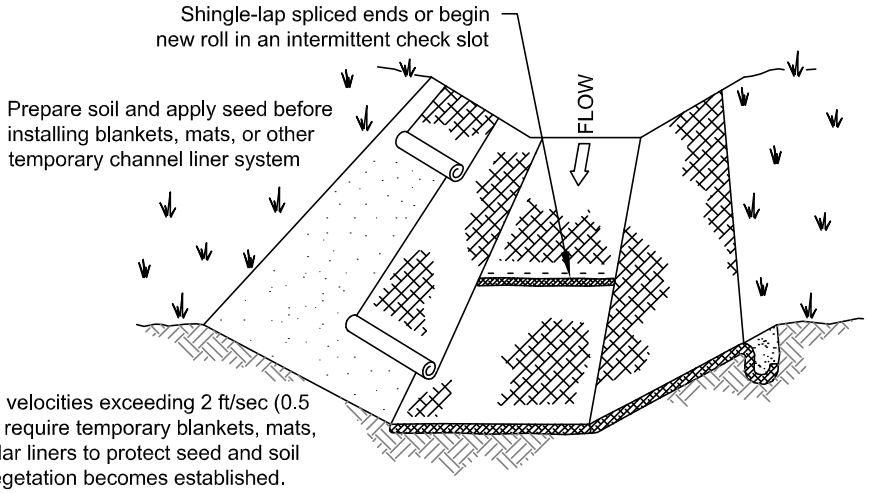


Intermittent Check Slot

Typical installation with
erosion control blankets
or turf reinforcement mats



Longitudinal Anchor Trench



Notes:

1. Design velocities exceeding 2 ft/sec (0.5 m/sec) require temporary blankets, mats, or similar liners to protect seed and soil until vegetation becomes established.
2. Grass-lined channels with design velocities exceeding 6 ft/sec (2 m/sec) should include turf reinforcement mats.

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ECOLOGY
State of Washington

Temporary Channel Liners

Revised July 2016

BMP C207: Check Dams

Purpose

Construction of check dams across a swale or ditch reduces the velocity of concentrated flow and dissipates energy at the check dam.

Conditions of Use

Use check dams where temporary or permanent channels are not yet vegetated, channel lining is infeasible, and/or velocity checks are required.

- Check dams may not be placed in streams unless approved by the State Department of Fish and Wildlife.
- Check dams may not be placed in wetlands without approval from a permitting agency.
- Do not place check dams below the expected backwater from any salmonid bearing water between October 1 and May 31 to ensure that there is no loss of high flow refuge habitat for overwintering juvenile salmonids and emergent salmonid fry.

Design and Installation Specifications

- Construct rock check dams from appropriately sized rock. The rock used must be large enough to stay in place given the expected design flow through the channel. The rock must be placed by hand or by mechanical means (do not dump the rock to form the dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges.
- Check dams may also be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose. They tend to be re-usable, quick and easy to install, effective, and cost efficient.
- Place check dams perpendicular to the flow of water.
- The check dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the check dam rather than falling directly onto the ditch bottom.
- Before installing check dams, impound and bypass upstream water flow away from the work area. Options for bypassing include pumps, siphons, or temporary channels.
- Check dams combined with sumps work more effectively at slowing flow and retaining sediment than a check dam alone. A deep sump should be provided immediately upstream of the check dam.
- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.

- The maximum spacing between check dams shall be such that the downstream toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Keep the maximum height at 2 feet at the center of the check dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2H:1V or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.
- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, filter fabric is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4%. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.
- See Figure II-4.16: Rock Check Dam.

Maintenance Standards

Check dams shall be monitored for performance and sediment accumulation during and after each rainfall that produces runoff. Sediment shall be removed when it reaches one half the sump depth.

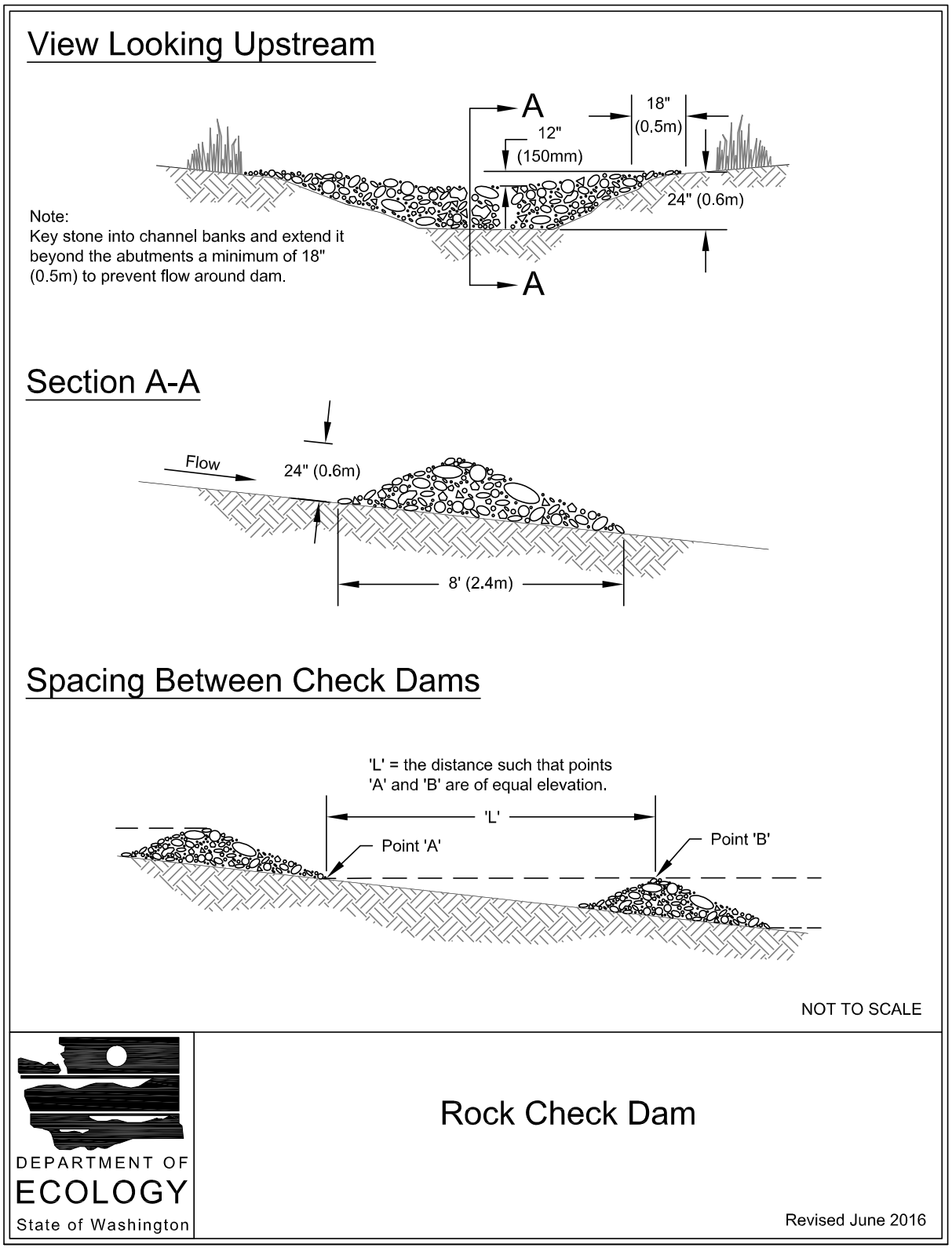
- Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam.
- If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel. See BMP C202: Riprap Channel Lining.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

Figure II-4.16: Rock Check Dam



- The leading edge of the TSD must be secured with rocks, sandbags, or a small key slot and staples.
- In the case of grass-lined ditches and swales, check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4%. The area beneath the check dams shall be seeded and mulched immediately after dam removal.

Maintenance Standards

- Inspect TSDs for performance and sediment accumulation during and after each rainfall that produces runoff. Remove sediment when it reaches one half the height of the TSD.
- Anticipate submergence and deposition above the TSD and erosion from high flows around the edges of the TSD. Immediately repair any damage or any undercutting of the TSD.

BMP C209: Outlet Protection

Purpose

Outlet protection prevents scour at conveyance outlets and minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

Conditions of Use

Use outlet protection at the outlets of all ponds, pipes, ditches, or other conveyances that discharge to a natural or constructed drainage feature such as a stream, wetland, lake, or ditch.

Design and Installation Specifications

- The receiving channel at the outlet of a pipe shall be protected from erosion by lining a minimum of 6 feet downstream and extending up the channel sides a minimum of 1 foot above the maximum tailwater elevation, or 1 foot above the crown, whichever is higher. For pipes larger than 18 inches in diameter, the outlet protection lining of the channel shall be four times the diameter of the outlet pipe.
- Standard wingwalls, tapered outlets, and paved channels should also be considered when appropriate for permanent culvert outlet protection (WSDOT, 2015).
- BMP C122: Nets and Blankets or BMP C202: Riprap Channel Lining provide suitable options for lining materials.
- With low flows, BMP C201: Grass-Lined Channels can be an effective alternative for lining material.
- The following guidelines shall be used for outlet protection with riprap:
  - If the discharge velocity at the outlet is less than 5 fps, use 2-inch to 8-inch riprap. Minimum thickness is 1 foot.

- For a 5 to 10 fps discharge velocity at the outlet, use 24-inch to 48-inch riprap. Minimum thickness is 2 feet.
- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.

- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.14 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-4.11: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-4.11: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved / Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1 to 2 feet as measured from the crest of the inlet structure.
- Side slopes of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

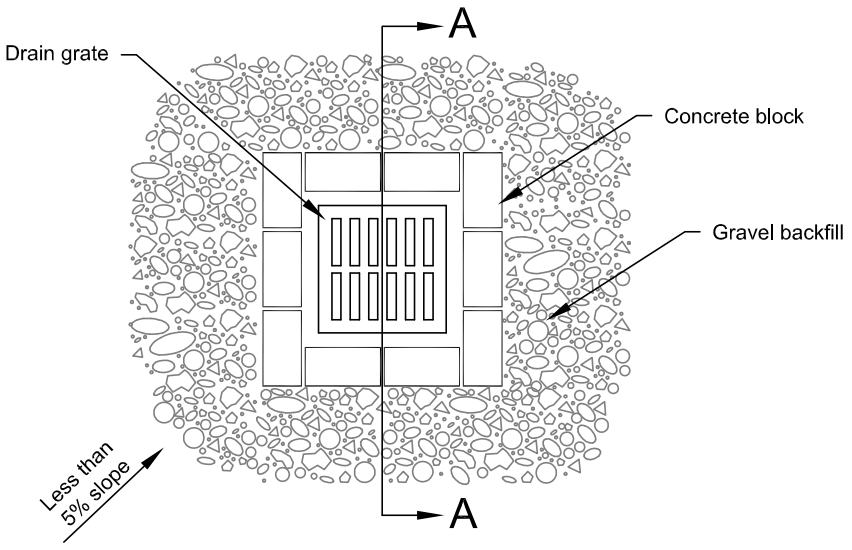
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

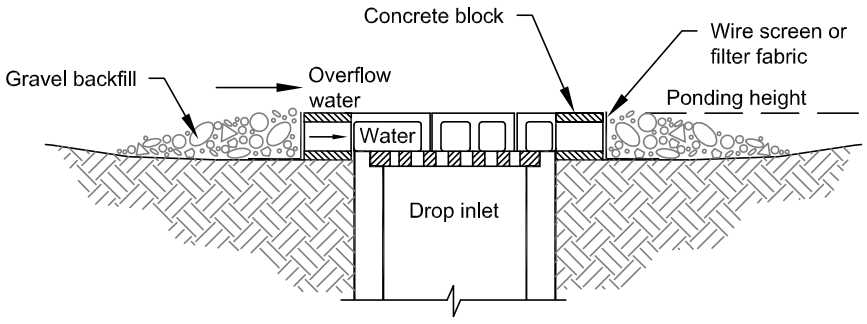
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-4.17: Block and Gravel Filter. Design and installation specifications for block and gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood (2x4) through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with 0.5-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
    - Provide a slope of 3H:1V on the upstream side of the berm.
    - Provide a slope of 2H:1V on the downstream side of the berm.
    - Provide a 1-foot wide level rock area between the gravel berm and the inlet.
    - Use rocks 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel 0.5 to 0.75 inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-4.17: Block and Gravel Filter



Plan View



Section A-A

Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

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State of Washington

Block and Gravel Filter

Revised June 2016

Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with 0.5 inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

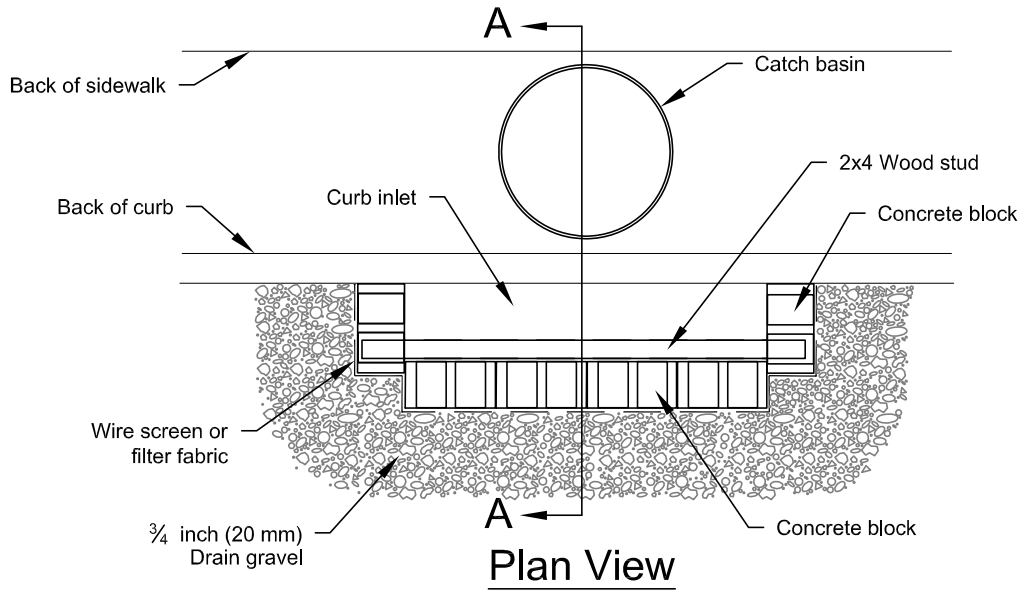
- Use wire mesh with 0.5 inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

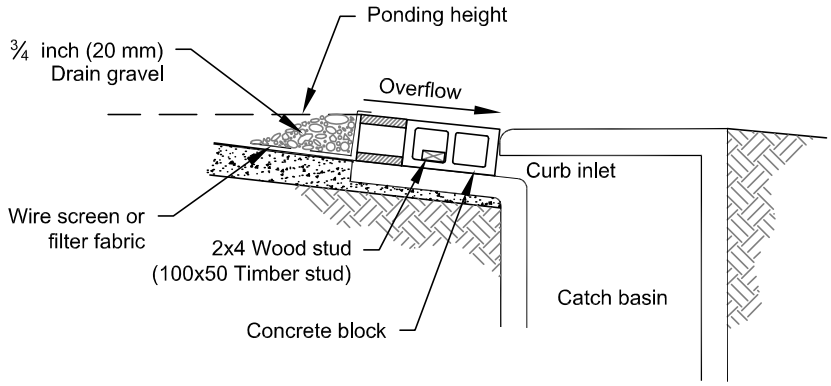
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-4.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with 0.5 inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure II-4.18: Block and Gravel Curb Inlet Protection



Plan View



Section A-A

Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

NOT TO SCALE

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Block and Gravel Curb Inlet Protection

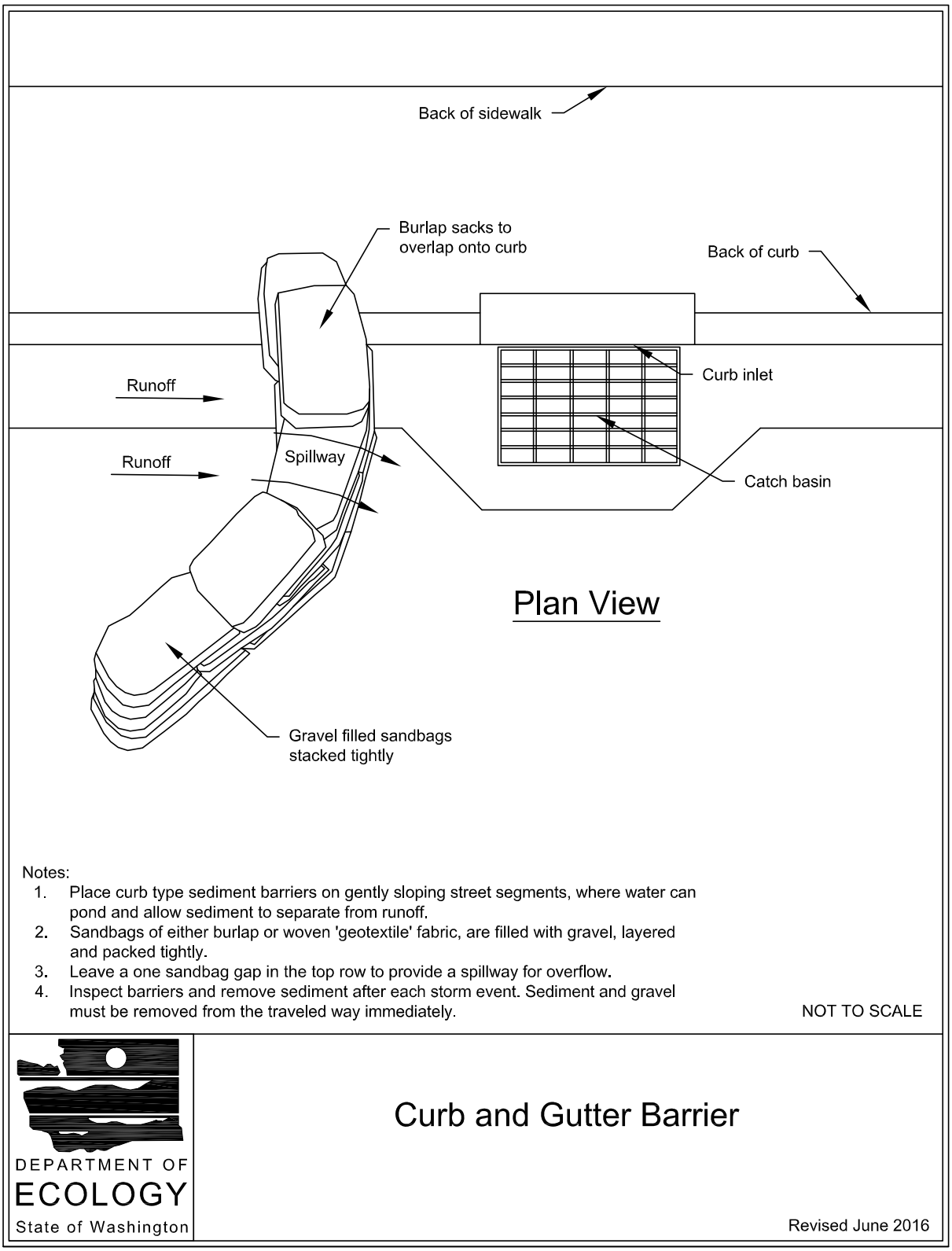
Revised June 2016

Curb and Gutter Sediment Barrier

A curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-4.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barriers include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-4.19: Curb and Gutter Barrier



Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C231: Brush Barrier

Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Brush barriers may be used downslope of disturbed areas that are less than one-quarter acre.
- Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be directed to a sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment trapping BMP, is when the area draining to the barrier is small.
- Brush barriers should only be installed on contours.

Design and Installation Specifications

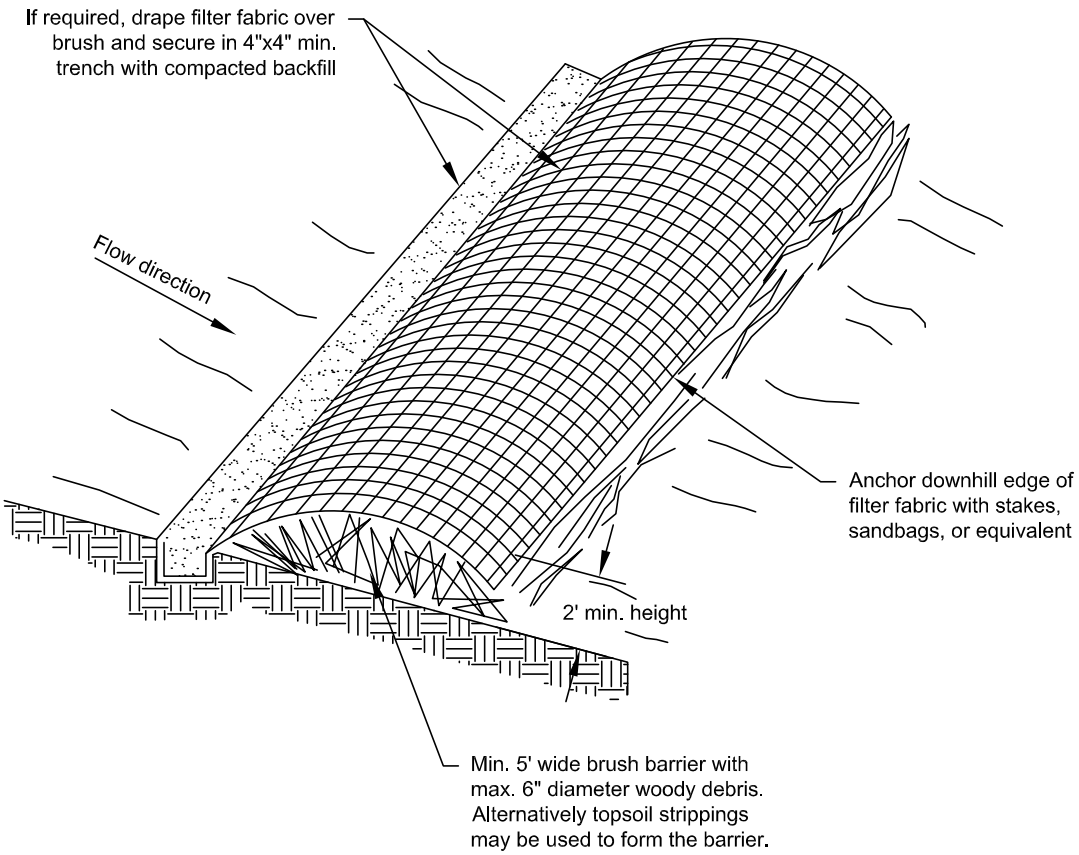
- Height: 2 feet (minimum) to 5 feet (maximum).
- Width: 5 feet at base (minimum) to 15 feet (maximum).

- Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.
- Chipped site vegetation, composted mulch, or wood-based mulch (hog fuel) are acceptable materials to construct brush barriers.
- A 100% biodegradable installation can be constructed using 10-ounce burlap held in place by wooden stakes.
- Figure II-4.20: Brush Barrier depicts a typical brush barrier.

Maintenance Standards

- There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.
- The dimensions of the barrier must be maintained.

Figure II-4.20: Brush Barrier



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Brush Barrier

Revised July 2017

BMP C208: Triangular Silt Dike (TSD)

Purpose

Triangular silt dikes (TSDs) may be used as check dams, for perimeter protection, for temporary soil stockpile protection, for drop inlet protection, or as a temporary interceptor dike.

Conditions of Use

- TSDs may be used on soil or pavement with adhesive or staples.
- TSDs have been used to build the following temporary BMPs:
    - BMP C241: Sediment Pond (Temporary);
    - BMP C200: Interceptor Dike and Swale;
    - BMP C154: Concrete Washout Area;
    - BMP C203: Water Bars;
    - BMP C206: Level Spreader;
    - BMP C220: Inlet Protection;
    - BMP C207: Check Dams
    - curbing; and
    - berms.

Design and Installation Specifications

- TSDs are made of urethane foam sewn into a woven geosynthetic fabric.
- TSDs are triangular, 10 to 14 inches high in the center, with a 20 to 28 inch base. A 2 foot apron extends beyond both sides of the triangle along its standard section of 7 feet. A sleeve at one end allows attachment of additional sections as needed.
- Install with ends curved up to prevent water from flowing around the ends.
- The fabric flaps and check dam units are attached to the ground with wire staples. Wire staples should be No. 11 gauge wire and 200 to 300 mm in length.
- When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled.
- When TSDs are used as check dams, the following guidelines apply:
    - TSDs should be located and installed as soon as construction will allow.
    - TSDs should be placed perpendicular to the flow of water.

BMP C233: Silt Fence

Purpose

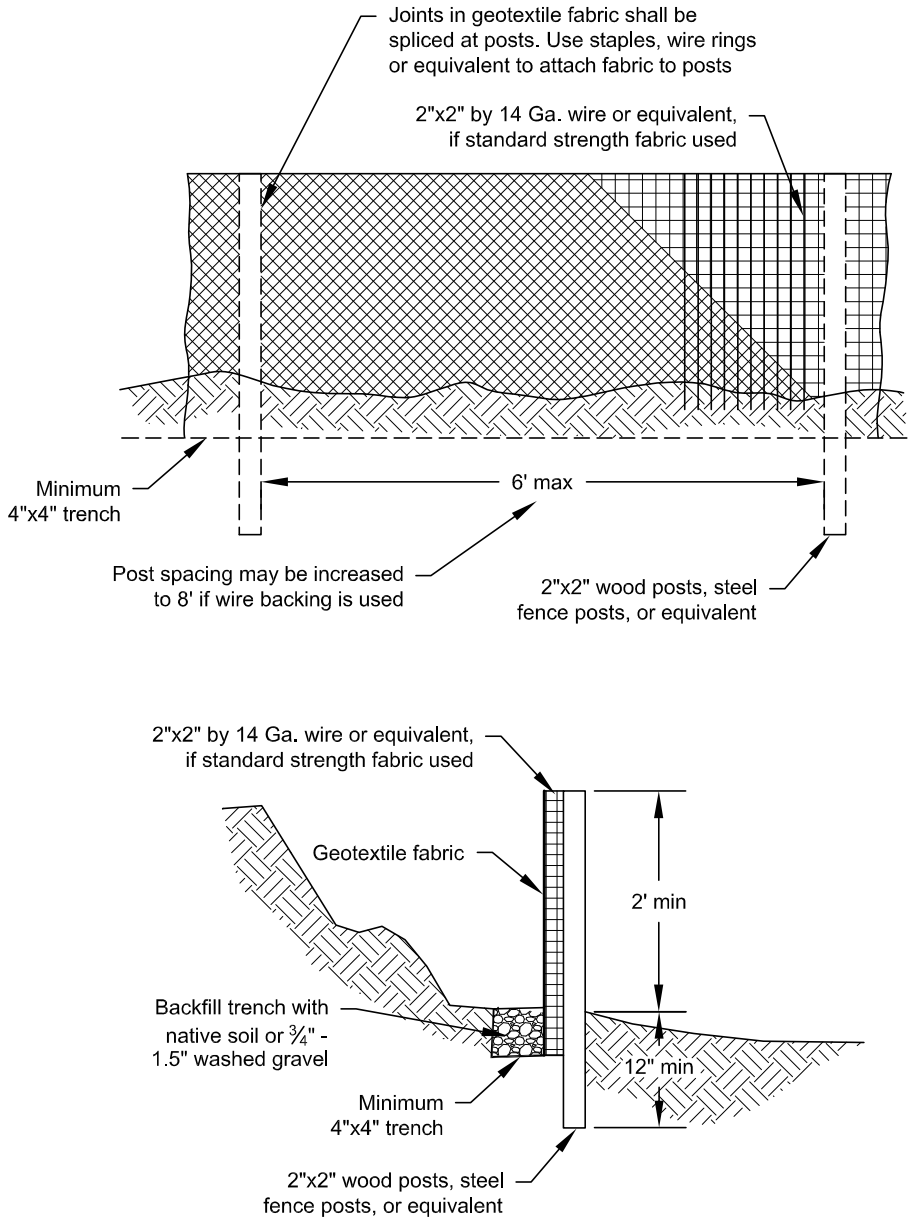
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure II-4.22: Silt Fence



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State of Washington

Silt Fence

Revised July 2017

Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e. the test result for any sampled roll in a lot shall meet or exceed the values shown in Table II-4.12: Geotextile Fabric Standards for Silt Fence):

Table II-4.12: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.
- 100% biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure II-4.22: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:

    1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.

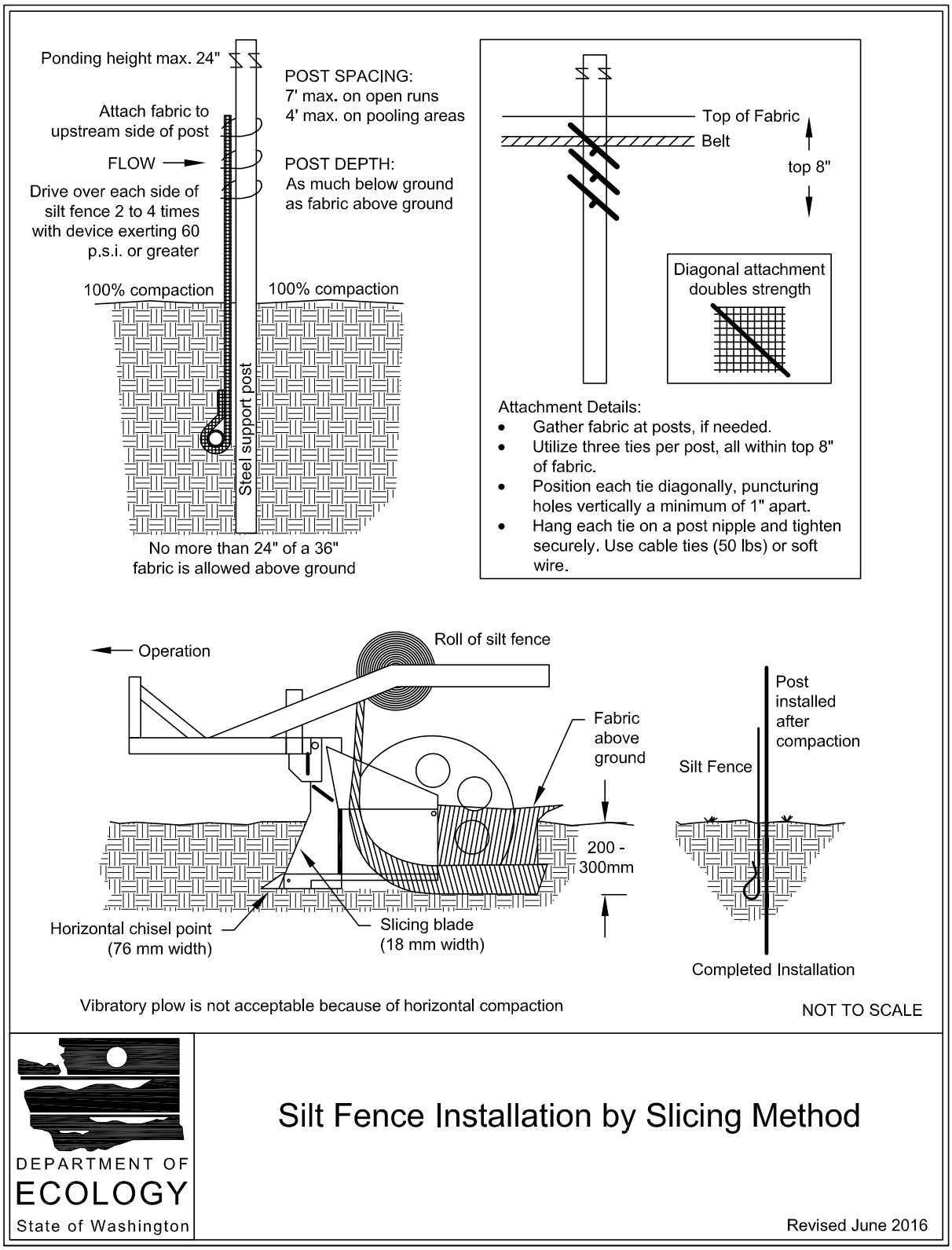
2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
3. The silt fence shall have a 2-foot min. and a 2.5-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
9. Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6 feet. Posts shall consist of one of the following:
    - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.

- Other steel posts having equivalent strength and bending resistance to the post sizes listed above.

11. Locate silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
    - Check dams shall be approximately 1 foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
    - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Refer to Figure II-4.23: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:
    1. The base of both end posts must be at least 2 to 4 inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    2. Install posts 3 to 4 feet apart in critical retention areas and 6 to 7 feet apart in standard applications.
    3. Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
    4. Install posts with the nipples facing away from the geotextile fabric.
    5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    6. Wrap approximately 6 inches of the geotextile fabric around the end posts and secure with 3 ties.
    7. No more than 24 inches of a 36 inch geotextile fabric is allowed above ground level.
    8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure II-4.23: Silt Fence Installation by Slicing Method



Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

BMP C234: Vegetated Strip

Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to BMP C241: Sediment Pond (Temporary) or other sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a vegetated strip, rather than by a sediment trapping BMP, is when the following criteria are met (see Table II-4.13: Contributing Drainage Area for Vegetated Strips):

Table II-4.13: Contributing Drainage Area for Vegetated Strips

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

Design and Installation Specifications

- The vegetated strip shall consist of a continuous strip of dense vegetation with topsoil for a minimum length of 25 feet along the flow path. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the vegetated strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the vegetated strip, stormwater runoff controls must be installed to reduce the flows entering the vegetated strip, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

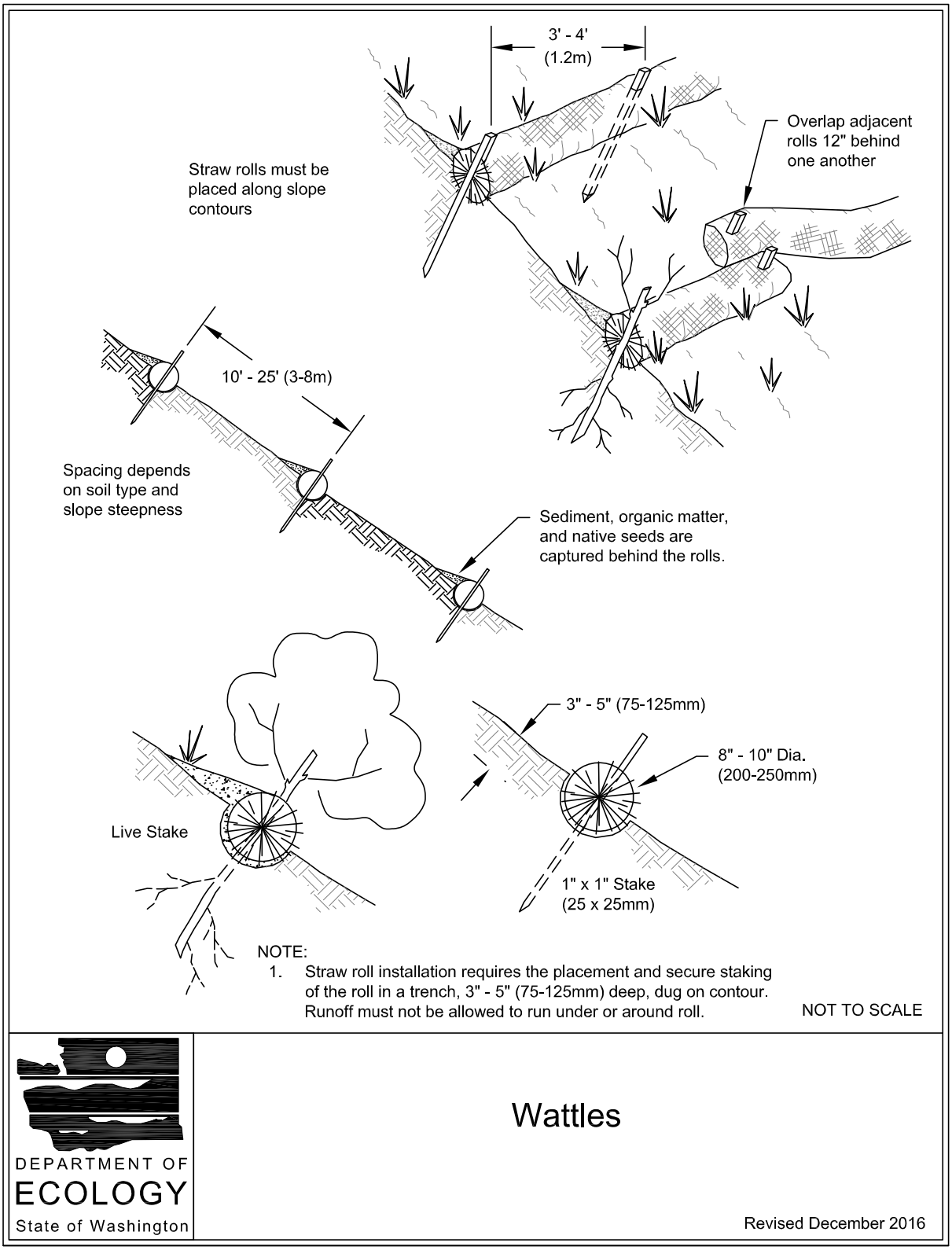
Conditions of Use

- Use wattles:
    - In disturbed areas that require immediate erosion protection.
    - On exposed soils during the period of short construction delays, or over winter months.
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.
- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- See Figure II-4.24: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3 to 5 inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5 to 7 inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10 to 25 feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4 foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches minimum. Willow cuttings or 3/8 inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-4.24: Wattles



Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C236: Vegetative Filtration

Purpose

Vegetative filtration as a BMP is used in conjunction with detention storage in the form of portable tanks or BMP C241: Sediment Pond (Temporary), BMP C206: Level Spreader, and a pumping system with surface intake. Vegetative filtration improves turbidity levels of stormwater discharges by filtering runoff through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every 5 acres of disturbed soil, use 1 acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, groundwater table height, and other site conditions.
- Wetlands shall not be used for vegetative filtration.
- Do not use this BMP in areas with a high groundwater table, or in areas that will have a high seasonal groundwater table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated filtration area if standing water or erosion results.

Maintenance Standards

- Monitor the spray field on a daily basis to ensure that over saturation of any portion of the field does not occur at any time. The presence of standing puddles of water or creation of concentrated flows visually signify that over saturation of the field has occurred.
- Monitor the vegetated spray field all the way down to the nearest surface water, or farthest spray area, to ensure that the water has not caused overland or concentrated flows, and has not created erosion around the spray nozzle(s).
- Do not exceed water quality standards for turbidity.
- Ecology recommends that a separate inspection log be developed, maintained, and kept with the existing site logbook to aid the operator conducting inspections. This separate "Field Filtration Logbook" can also aid in demonstrating compliance with permit conditions.
- Inspect the spray nozzles daily, at a minimum, for leaks and plugging from sediment particles.
- If erosion, concentrated flows, or over saturation of the field occurs, rotate the use of branches or spray heads or move the branches to a new field location.
- Check all branches and the manifold for unintended leaks.

BMP C240: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the contributing drainage area.

Conditions of Use

- Sediment traps are intended for use on sites where the contributing drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of 6 months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the contributing drainage area is permanently protected against erosion by vegetation and/or structures.
- Sediment traps are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.
- Projects that are constructing permanent Flow Control BMPs, or permanent Runoff Treatment BMPs that use ponding for treatment, may use the rough-graded or final-graded permanent BMP footprint for the temporary sediment trap. When permanent BMP footprints are used as temporary sediment traps, the surface area requirement of the sediment trap must be met. If the surface area requirement of the sediment trap is larger than the surface area of the permanent BMP, then the sediment trap shall be enlarged beyond the

permanent BMP footprint to comply with the surface area requirement.

- A floating pond skimmer may be used for the sediment trap outlet if approved by the Local Permitting Authority.
- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Design and Installation Specifications

- See Figure II-4.26: Cross Section of Sediment Trap and Figure II-4.27: Sediment Trap Outlet for details.
- To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS * (Q_2/V_s)$$

where:

SA = Design surface area of the trap (square feet)

FS = A safety factor of 2 to account for non-ideal settling.

Q_2 = The peak volumetric flow rate (cubic feet per second), calculated using one of the following options:

  - Option 1 - Single Event Hydrograph Method

    The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 2-year, 24-hour frequency storm for the developed condition. The 10-year peak volumetric flow rate shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection.

  - Option 2 - The Rational Method

    For construction sites that are less than 1 acre, the peak volumetric flow rate calculated using the Rational Method.

V_s = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm3 has been selected as the particle of interest and has a settling velocity (V_s) of 0.00096 ft/sec.

Therefore, the equation for computing sediment trap surface area becomes:

$$SA = 2 \times Q_2/0.00096$$

or

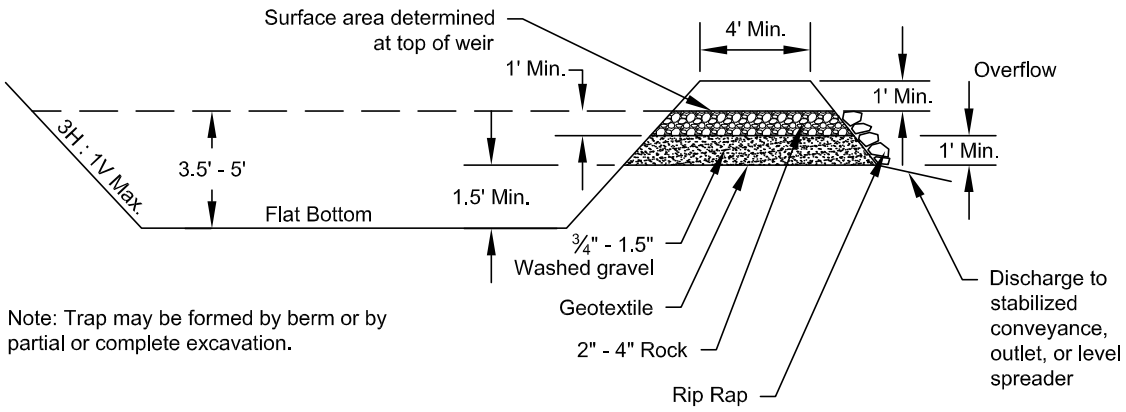
2080 square feet per cfs of inflow

- Sediment trap depth shall be 3.5 feet minimum from the bottom of the trap to the top of the overflow weir.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1 foot above the bottom of the trap.
- Design the discharge from the sediment trap by using the guidance for discharge from temporary sediment ponds in BMP C241: Sediment Pond (Temporary).

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1 foot in depth.
- Any damage to the trap embankments or slopes shall be repaired.

Figure II-4.26: Cross Section of Sediment Trap



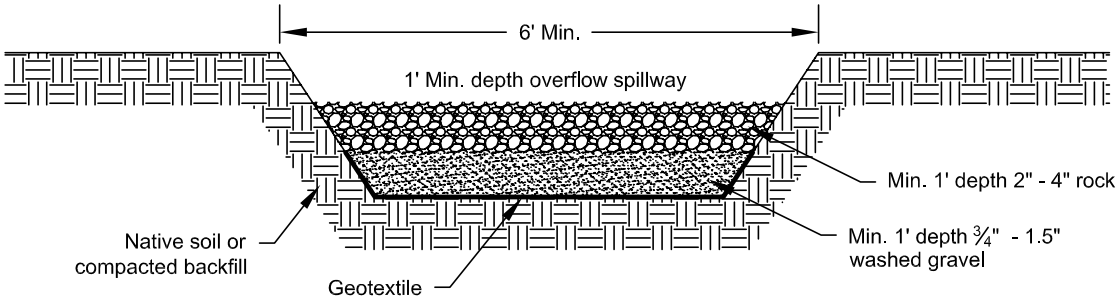
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Cross Section of Sediment Trap

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Figure II-4.27: Sediment Trap Outlet



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Sediment Trap Outlet

Revised June 2016

treatment system flow rate for an 8-hour period. For a chitosan-enhanced sand filtration system, the filtration treatment system flow rate should be sized using a hydraulic loading rate between 6 and 8 gpm/ft^2. Other hydraulic loading rates may be more appropriate for other systems. Bypass should be provided around the filtration treatment system to accommodate extreme storm events. Runoff volume shall be calculated using the methods presented in III-2.3 Single Event Hydrograph Method. Worst-case land cover conditions (i.e., producing the most runoff) should be used for analyses (in most cases, this would be the land cover conditions just prior to final landscaping).

If the filtration treatment system design does not allow you to discharge at the rates as required by II-2.3 Element 3: Control Flow Rates, and if the site has a permanent Flow Control BMP that will serve the planned development, the discharge from the filtration treatment system may be directed to the permanent Flow Control BMP to comply with II-2.3 Element 3: Control Flow Rates. In this case, all discharge (including water passing through the treatment system and stormwater bypassing the treatment system) will be directed into the permanent Flow Control BMP. If site constraints make locating the untreated stormwater storage pond difficult, the permanent Flow Control BMP may be divided to serve as the untreated stormwater storage pond and the post-treatment temporary flow control pond. A berm or barrier must be used in this case so the untreated water does not mix with the treated water. Both untreated stormwater storage requirements, and adequate post-treatment flow control must be achieved. The designer must document in the Construction SWPPP how the permanent Flow Control BMP is able to attenuate the discharge from the site to meet the requirements of II-2.3 Element 3: Control Flow Rates. If the design of the permanent Flow Control BMP was modified for temporary construction flow control purposes, the construction of the permanent Flow Control BMP must be finalized, as designed for its permanent function, at project completion.

Maintenance Standards

- Rapid sand filters typically have automatic backwash systems that are triggered by a preset pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the untreated stormwater stored in the holding pond or tank, backwash return to the untreated stormwater pond or tank may be appropriate. However, other means of treatment and disposal may be necessary.
- Screen, bag, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.
- Disposal of filtration equipment must comply with applicable local, state, and federal regulations.

BMP C252: Treating and Disposing of High pH Water

Purpose

When pH levels in stormwater rise above 8.5, it is necessary to lower the pH levels to the acceptable range of 6.5 to 8.5 prior to discharge to surface or groundwater. A pH level range of 6.5 to 8.5

is typical for most natural watercourses, and this neutral pH range is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms may become stressed and may die.

Conditions of Use

- The water quality standard for pH in Washington State is in the range of 6.5 to 8.5. Stormwater with pH levels exceeding water quality standards may be either neutralized on site or disposed of to a sanitary sewer or concrete batch plant with pH neutralization capabilities.
- Neutralized stormwater may be discharged to surface waters under the Construction Stormwater General Permit.
- Passive percolation of a limited volume of pH-affected stormwater is acceptable, with the understanding it does not "pond" or result in runoff from the project boundary or to waters of the state. Any visible accumulations of such water must be considered pH-affected and managed to protect waters of the state.

  NOTE: this only applies to high pH stormwater or conditionally authorized non-stormwater, it does not apply to process water, which may be subject to numeric effluent limits under certain permits, or otherwise not authorized for discharge to waters of the state.
- Neutralized process water such as concrete truck washout, hydrodemolition, or sawcutting slurry must be managed to prevent discharge to surface waters. Any stormwater contaminated during concrete work is considered process wastewater and must not be discharged to waters of the State or stormwater collection systems.
- The process used for neutralizing and/or disposing of high pH stormwater from the site must be documented in the Construction SWPPP.
- There are other options for neutralizing or managing high pH stormwater beyond what Ecology provides formal guidance on. Regardless of the stormwater management methods selected, the resulting pH-affected stormwater must be managed in a way that meets permit conditions for discharge.

  NOTE: If the proposed option to neutralize high-pH stormwater involves a chemical treatment beyond what is described in this BMP, additional authorization for the chemical treatment may be necessary.

Causes of High pH

High pH at construction sites is most commonly caused by the contact of stormwater with poured or recycled concrete, cement, mortars, and other Portland cement or lime containing construction materials. See BMP C151: Concrete Handling for more information on concrete handling procedures. The principal caustic agent in cement is calcium hydroxide (free lime).

Calcium hardness can contribute to high pH values and cause toxicity that is associated with high pH conditions. A high level of calcium hardness in waters of the state is not allowed. Groundwater standard for calcium and other dissolved solids in Washington State is less than 500 mg/l.

Treating High pH Stormwater by Carbon Dioxide Sparging

Advantages of Carbon Dioxide Sparging

- Rapidly neutralizes high pH water.
- Cost effective and safer to handle than acid compounds.
- CO_2 is self-buffering. It is difficult to overdose and create harmfully low pH levels.
- Material is readily available.

The Chemical Process of Carbon Dioxide Sparging

When carbon dioxide (CO_2) is added to water (H_2O), carbonic acid (H_2CO_3) is formed which can further dissociate into a proton (H+) and a bicarbonate anion (HCO_3-) as shown below:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H+ + HCO_3-$$

The free proton is a weak acid that can lower the pH. Water temperature has an effect on the reaction as well. The colder the water temperature is, the slower the reaction occurs. The warmer the water temperature is, the quicker the reaction occurs. Most construction applications in Washington State have water temperatures in the 50°F or higher range so the reaction is almost simultaneous.

The Treatment Process of Carbon Dioxide Sparging

High pH water may be treated using continuous treatment, continuous discharge systems. These manufactured systems continuously monitor influent and effluent pH to ensure that pH values are within an acceptable range before being discharged. All systems must have fail safe automatic shut off switches in the event that pH is not within the acceptable discharge range. Only trained operators may operate manufactured systems. System manufacturers often provide trained operators or training on their devices.

The following procedure may be used when not using a continuous discharge system:

1. Prior to treatment, the appropriate jurisdiction should be notified in accordance with the regulations set by the jurisdiction.
2. Every effort should be made to isolate the potential high pH water in order to treat it separately from other stormwater on-site.
3. Water should be stored in an acceptable storage facility, detention pond, or containment cell prior to pH treatment.
4. Transfer water to be treated for pH to the pH treatment structure. Ensure that the pH treatment structure size is sufficient to hold the amount of water that is to be treated. Do not fill the pH treatment structure completely, allow at least 2 feet of freeboard.
5. The operator samples the water within the pH treatment structure for pH and notes the clarity of the water. As a rule of thumb, less CO_2 is necessary for clearer water. The results of

the samples and water clarity observations should be recorded.

6. In the pH treatment structure, add CO_2 until the pH falls into the range of 6.9 to 7.1. Adjusting pH to within 0.2 pH units of receiving water (background pH) is recommended. It is unlikely that pH can be adjusted to within 0.2 pH units using dry ice. Compressed carbon dioxide gas should be introduced to the water using a carbon dioxide diffuser located near the bottom of the pH treatment structure, this will allow carbon dioxide to bubble up through the water and diffuse more evenly.
7. Slowly discharge the water, making sure water does not get stirred up in the process. Release about 80% of the water from the pH treatment structure leaving any sludge behind. If turbidity remains above the maximum allowable, consider adding filtration to the treatment train. See BMP C251: Construction Stormwater Filtration.
8. Discharge treated water through a pond or drainage system.
9. Excess sludge needs to be disposed of properly as concrete waste. If several batches of water are undergoing pH treatment, sludge can be left in the treatment structure for the next batch treatment. Dispose of sludge when it fills 50% of the treatment structure volume.
10. Disposal must comply with applicable local, state, and federal regulations.

Treating High pH Stormwater by Food Grade Vinegar

Food grade vinegar that meets FDA standards may be used to neutralize high pH water. Food grade vinegar is only 4% to 18% acetic acid with the remainder being water. Food grade vinegar may be used if dosed just enough to lower pH sufficiently. Use a treatment process as described above for CO_2 sparging, but add food grade vinegar instead of CO_2.

This treatment option for high pH stormwater does not apply to anything but food grade vinegar. Acetic acid does not equal vinegar. Any other product or waste containing acetic acid must go through the evaluation process in Appendix G of *Whole Effluent Toxicity Testing Guidance and Test Review Criteria* (Marshall, 2016).

Disposal of High pH Stormwater

Sanitary Sewer Disposal

Local sewer authority approval is required prior to disposal via the sanitary sewer.

Concrete Batch Plant Disposal

- Only permitted facilities may accept high pH water.
- Contact the facility to ensure they can accept the high pH water.

Maintenance Standards

Safety and materials handling:

- All equipment should be handled in accordance with OSHA rules and regulations.
- Follow manufacturer guidelines for materials handling.

Each operator should provide:

- A diagram of the monitoring and treatment equipment.
- A description of the pumping rates and capacity the treatment equipment is capable of treating.

Each operator should keep a written record of the following:

- Client name and phone number.
- Date of treatment.
- Weather conditions.
- Project name and location.
- Volume of water treated.
- pH of untreated water.
- Amount of CO_2 or food grade vinegar needed to adjust water to a pH range of 6.9 to 7.1.
- pH of treated water.
- Discharge point location and description.

A copy of this record should be given to the client/contractor who should retain the record for 3 years.

Appendix D – Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

Appendix E – Construction Stormwater General Permit (CSWGP)

Issuance Date: November 18, 2020
Effective Date: January 1, 2021
Expiration Date: December 31, 2025

CONSTRUCTION STORMWATER GENERAL PERMIT

National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity

State of Washington
Department of Ecology
Olympia, Washington 98504

In compliance with the provisions of
Chapter 90.48 Revised Code of Washington
(State of Washington Water Pollution Control Act)
and
Title 33 United States Code, Section 1251 et seq.
The Federal Water Pollution Control Act (The Clean Water Act)

Until this permit expires, is modified, or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions that follow.



Vincent McGowan, P.E.
Water Quality Program Manager
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions within this permit for additional submittal requirements. Appendix A provides a list of definitions. Appendix B provides a list of acronyms.

Table 1 Summary of Required Submittals

Permit Section	Submittal	Frequency	First Submittal Date
S5.A and S8	High Turbidity/Transparency Phone Reporting	As Necessary	Within 24 hours
S5.B	Discharge Monitoring Report	Monthly*	Within 15 days following the end of each month
S5.F and S8	Noncompliance Notification – Telephone Notification	As necessary	Within 24 hours
S5.F	Noncompliance Notification – Written Report	As necessary	Within 5 Days of non-compliance
S9.D	Request for Chemical Treatment Form	As necessary	Written approval from Ecology is required prior to using chemical treatment (with the exception of dry ice, CO_2 or food grade vinegar to adjust pH)
G2	Notice of Change in Authorization	As necessary	
G6	Permit Application for Substantive Changes to the Discharge	As necessary	
G8	Application for Permit Renewal	1/permit cycle	No later than 180 days before expiration
S2.A	Notice of Permit Transfer	As necessary	
G19	Notice of Planned Changes	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	

NOTE: *Permittees must submit electronic Discharge Monitoring Reports (DMRs) to the Washington State Department of Ecology monthly, regardless of site discharge, for the full duration of permit coverage. Refer to Section S5.B of this General Permit for more specific information regarding DMRs.

Table 2 Summary of Required On-site Documentation

Document Title	Permit Conditions
Permit Coverage Letter	See Conditions S2, S5
Construction Stormwater General Permit (CSWGP)	See Conditions S2, S5
Site Log Book	See Conditions S4, S5
Stormwater Pollution Prevention Plan (SWPPP)	See Conditions S5, S9
Site Map	See Conditions S5, S9

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Permit Area

This Construction Stormwater General Permit (CSWGP) covers all areas of Washington State, except for federal operators and Indian Country as specified in Special Condition S1.E.3 and 4.

B. Operators Required to Seek Coverage Under this General Permit

1. Operators of the following construction activities are required to seek coverage under this CSWGP:

    a. Clearing, grading and/or excavation that results in the disturbance of one or more acres (including off-site disturbance acreage related to construction-support activity as authorized in S1.C.2) and discharges stormwater to surface waters of the State; and clearing, grading and/or excavation on sites smaller than one acre that are part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one acre or more and discharge stormwater to surface waters of the State.

        i. This category includes forest practices (including, but not limited to, class IV conversions) that are part of a construction activity that will result in the disturbance of one or more acres, and discharge to surface waters of the State (that is, forest practices that prepare a site for construction activities); and

    b. Any size construction activity discharging stormwater to waters of the State that the Washington State Department of Ecology (Ecology):

        i. Determines to be a significant contributor of pollutants to waters of the State of Washington.

        ii. Reasonably expects to cause a violation of any water quality standard.

2. Operators of the following activities are not required to seek coverage under this CSWGP (unless specifically required under Special Condition S1.B.1.b, above):

    a. Construction activities that discharge all stormwater and non-stormwater to groundwater, sanitary sewer, or combined sewer, and have no point source discharge to either surface water or a storm sewer system that drains to surface waters of the State.

    b. Construction activities covered under an Erosivity Waiver (Special Condition S1.F).

    c. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

C. Authorized Discharges

1. ***Stormwater Associated with Construction Activity.*** Subject to compliance with the terms and conditions of this permit, Permittees are authorized to discharge stormwater associated with construction activity to surface waters of the State or to a storm sewer system that drains to surface waters of the State. (Note that "surface waters of the

State" may exist on a construction site as well as off site; for example, a creek running through a site.)

2. ***Stormwater Associated with Construction Support Activity.*** This permit also authorizes stormwater discharge from support activities related to the permitted construction site (for example, an on-site portable rock crusher, off-site equipment staging yards, material storage areas, borrow areas, etc.) provided:

    a. The support activity relates directly to the permitted construction site that is required to have an NPDES permit; and

    b. The support activity is not a commercial operation serving multiple unrelated construction projects, and does not operate beyond the completion of the construction activity; and

    c. Appropriate controls and measures are identified in the Stormwater Pollution Prevention Plan (SWPPP) for the discharges from the support activity areas.

3. ***Non-Stormwater Discharges.*** The categories and sources of non-stormwater discharges identified below are authorized conditionally, provided the discharge is consistent with the terms and conditions of this permit:

    a. Discharges from fire-fighting activities.

    b. Fire hydrant system flushing.

    c. Potable water, including uncontaminated water line flushing.

    d. Hydrostatic test water.

    e. Uncontaminated air conditioning or compressor condensate.

    f. Uncontaminated groundwater or spring water.

    g. Uncontaminated excavation dewatering water (in accordance with S9.D.10).

    h. Uncontaminated discharges from foundation or footing drains.

    i. Uncontaminated or potable water used to control dust. Permittees must minimize the amount of dust control water used.

    j. Routine external building wash down that does not use detergents.

    k. Landscape irrigation water.

The SWPPP must adequately address all authorized non-stormwater discharges, except for discharges from fire-fighting activities, and must comply with Special Condition S3. At a minimum, discharges from potable water (including water line flushing), fire hydrant system flushing, and pipeline hydrostatic test water must undergo the following: dechlorination to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units (su), if necessary.

D. Prohibited Discharges

The following discharges to waters of the State, including groundwater, are prohibited:

1. Concrete wastewater

2. Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.

3. Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.2 (See Appendix A of this permit).

4. Slurry materials and waste from shaft drilling, including process wastewater from shaft drilling for construction of building, road, and bridge foundations unless managed according to Special Condition S9.D.9.j.

5. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.

6. Soaps or solvents used in vehicle and equipment washing.

7. Wheel wash wastewater, unless managed according to Special Condition S9.D.9.

8. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to Special Condition S9.D.10.

E. Limits on Coverage

Ecology may require any discharger to apply for and obtain coverage under an individual permit or another more specific general permit. Such alternative coverage will be required when Ecology determines that this CSWGP does not provide adequate assurance that water quality will be protected, or there is a reasonable potential for the project to cause or contribute to a violation of water quality standards.

The following stormwater discharges are not covered by this permit:

1. Post-construction stormwater discharges that originate from the site after completion of construction activities and the site has undergone final stabilization.

2. Non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance, from which there is natural runoff as excluded in 40 CFR Subpart 122.

3. Stormwater from any federal operator.

4. Stormwater from facilities located on ***Indian Country*** as defined in 18 U.S.C.§1151, except portions of the Puyallup Reservation as noted below.

   Indian Country includes:

   a. All land within any Indian Reservation notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation. This includes all federal, tribal, and Indian and non-Indian privately owned land within the reservation.

   b. All off-reservation Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

   c. All off-reservation federal trust lands held for Native American Tribes.

Puyallup Exception: Following the *Puyallup Tribes of Indians Land Settlement Act of 1989*, 25 U.S.C. §1773; the permit does apply to land within the Puyallup Reservation except for discharges to surface water on land held in trust by the federal government.

5. Stormwater from any site covered under an existing NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

6. Stormwater from a site where an applicable Total Maximum Daily Load (TMDL) requirement specifically precludes or prohibits discharges from construction activity.

F. Erosivity Waiver

Construction site operators may qualify for an Erosivity Waiver from the CSWGP if the following conditions are met:

1. The site will result in the disturbance of fewer than five (5) acres and the site is not a portion of a common plan of development or sale that will disturb five (5) acres or greater.

2. Calculation of Erosivity "R" Factor and Regional Timeframe:

    a. The project's calculated rainfall erosivity factor ("R" Factor) must be less than five (5) during the period of construction activity, (See the CSWGP homepage http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html for a link to the EPA's calculator and step by step instructions on computing the "R" Factor in the *EPA Erosivity Waiver Fact Sheet*). The period of construction activity starts when the land is first disturbed and ends with final stabilization. In addition:

    b. The entire period of construction activity must fall within the following timeframes:

        i. For sites west of the Cascades Crest: June 15 – September 15.

        ii. For sites east of the Cascades Crest, excluding the Central Basin: June 15 – October 15.

        iii. For sites east of the Cascades Crest, within the Central Basin: no timeframe restrictions apply. The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches. For a map of the Central Basin (Average Annual Precipitation Region 2), refer to: http://www.ecy.wa.gov/programs/wq/stormwater/construction/resourcesguidance.html.

3. Construction site operators must submit a complete Erosivity Waiver certification form at least one week before disturbing the land. Certification must include statements that the operator will:

    a. Comply with applicable local stormwater requirements; and

    b. Implement appropriate erosion and sediment control BMPs to prevent violations of water quality standards.

4. This waiver is not available for facilities declared significant contributors of pollutants as defined in Special Condition S1.B.1.b or for any size construction activity that could

reasonably expect to cause a violation of any water quality standard as defined in Special Condition S1.B.1.b.ii.

5. This waiver does not apply to construction activities which include non-stormwater discharges listed in Special Condition S1.C.3.

6. If construction activity extends beyond the certified waiver period for any reason, the operator must either:

   a. Recalculate the rainfall erosivity "R" factor using the original start date and a new projected ending date and, if the "R" factor is still under 5 *and* the entire project falls within the applicable regional timeframe in Special Condition S1.F.2.b, complete and submit an amended waiver certification form before the original waiver expires; *or*

   b. Submit a complete permit application to Ecology in accordance with Special Condition S2.A and B before the end of the certified waiver period.

S2. APPLICATION REQUIREMENTS

A. Permit Application Forms

1. *Notice of Intent Form*

a. Operators of new or previously unpermitted construction activities must submit a complete and accurate permit application (Notice of Intent, or NOI) to Ecology.

b. Operators must apply using the electronic application form (NOI) available on Ecology's website (http://ecy.wa.gov/programs/wq/stormwater/construction/index.html). Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

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PO Box 47696
Olympia, Washington 98504-7696

c. The operator must submit the NOI at least 60 days before discharging stormwater from construction activities and must submit it prior to the date of the first public notice (See Special Condition S2.B, below, for details). The 30-day public comment period begins on the publication date of the second public notice. Unless Ecology responds to the complete application in writing, coverage under the general permit will automatically commence on the 31st day following receipt by Ecology of a *completed* NOI, or the issuance date of this permit, whichever is later; unless Ecology specifies a later date in writing as required by WAC173-226-200(2). See S8.B for Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters.

d. If an applicant intends to use a Best Management Practice (BMP) selected on the basis of Special Condition S9.C.4 ("demonstrably equivalent" BMPs), the applicant must notify Ecology of its selection as part of the NOI. In the event the applicant selects BMPs after submission of the NOI, the applicant must provide notice of the

selection of an equivalent BMP to Ecology at least 60 days before intended use of the equivalent BMP.

e. Applicants must notify Ecology if they are aware of contaminated soils and/or groundwater associated with the construction activity. Provide detailed information with the NOI (as known and readily available) on the nature and extent of the contamination (concentrations, locations, and depth), as well as pollution prevention and/or treatment BMPs proposed to control the discharge of soil and/or groundwater contaminants in stormwater. Examples of such detail may include, but are not limited to:

   i. List or table of all known contaminants with laboratory test results showing concentration and depth,

   ii. Map with sample locations,

   iii. Related portions of the Stormwater Pollution Prevention Plan (SWPPP) that address the management of contaminated and potentially contaminated construction stormwater and dewatering water,

   iv. Dewatering plan and/or dewatering contingency plan.

2. ***Transfer of Coverage Form***

The Permittee can transfer current coverage under this permit to one or more new operators, including operators of sites within a Common Plan of Development, provided:

   i. The Permittee submits a complete Transfer of Coverage Form to Ecology, signed by the current and new discharger and containing a specific date for transfer of permit responsibility, coverage and liability (including any Administrative Orders associated with the permit); and

   ii. Ecology does not notify the current discharger and new discharger of intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the written agreement.

When a current discharger (Permittee) transfers a portion of a permitted site, the current discharger must also indicate the remaining permitted acreage after the transfer. Transfers do not require public notice.

3. ***Modification of Coverage Form***

Permittees must notify Ecology regarding any changes to the information provided on the NOI by submitting an Update/Modification of Permit Coverage form in accordance with General Conditions G6 and G19. Examples of such changes include, but are not limited to:

   i. Changes to the Permittee's mailing address,

   ii. Changes to the on-site contact person information, and

   iii. Changes to the area/acreage affected by construction activity.

B. Public Notice

For new or previously unpermitted construction activities, the applicant must publish a public notice at least one time each week for two consecutive weeks, at least 7 days apart, in a newspaper with general circulation in the county where the construction is to take place. The notice must be run after the NOI has been submitted and must contain:

1. A statement that "*The applicant is seeking coverage under the Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit*."
2. The name, address, and location of the construction site.
3. The name and address of the applicant.
4. The type of construction activity that will result in a discharge (for example, residential construction, commercial construction, etc.), and the total number of acres to be disturbed over the lifetime of the project.
5. The name of the receiving water(s) (that is, the surface water(s) to which the site will discharge), or, if the discharge is through a storm sewer system, the name of the operator of the system and the receiving water(s) the system discharges to.
6. The statement: *Any persons desiring to present their views to the Washington State Department of Ecology regarding this application, or interested in Ecology's action on this application, may notify Ecology in writing no later than 30 days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320. Comments can be submitted to: Department of Ecology, PO Box 47696, Olympia, Washington 98504-7696 Attn: Water Quality Program, Construction Stormwater*.

S3. COMPLIANCE WITH STANDARDS

A. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), groundwater quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the Federal water quality criteria applicable to Washington. (40 CFR Part 131.45) Discharges that are not in compliance with these standards are prohibited.

B. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply All Known, Available, and Reasonable methods of prevention, control, and Treatment (AKART). This includes the preparation and implementation of an adequate SWPPP, with all appropriate BMPs installed and maintained in accordance with the SWPPP and the terms and conditions of this permit.

C. Ecology presumes that a Permittee complies with water quality standards unless discharge monitoring data or other site-specific information demonstrates that a discharge causes or contributes to a violation of water quality standards, when the Permittee complies with the following conditions. The Permittee must fully:

1. Comply with all permit conditions, including; planning, sampling, monitoring, reporting, and recordkeeping conditions.

2. Implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent to BMPs contained in stormwater management manuals published or approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate BMPs for on-site pollution control. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the *Phase I Municipal Stormwater Permit* are approved by Ecology.)

D. Where construction sites also discharge to groundwater, the groundwater discharges must also meet the terms and conditions of this CSWGP. Permittees who discharge to groundwater through an injection well must also comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

S4. MONITORING REQUIREMENTS, BENCHMARKS, AND REPORTING TRIGGERS

A. Site Log Book

The Permittee must maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements, including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

B. Site Inspections

Construction sites one (1) acre or larger that discharge stormwater to surface waters of the State must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Sites less than one (1) acre may have a person without CESCL certification conduct inspections. (See Special Conditions S4.B.3 and B.4, below, for detailed requirements of the Permittee's CESCL.)

Site inspections must include all areas disturbed by construction activities, all BMPs, and all stormwater discharge points under the Permittee's operational control.

1. The Permittee must have staff knowledgeable in the principles and practices of erosion and sediment control. The CESCL (sites one acre or more) or inspector (sites less than one acre) must have the skills to assess the:

    a. Site conditions and construction activities that could impact the quality of stormwater; and

    b. Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. The SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times. The CESCL (sites one (1) acre or more) must obtain this certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology. (See BMP C160 in the manual, referred to in Special Condition S9.C.1 and 2.)

2. The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. BMP effectiveness must be evaluated to

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, the Permittee must correct the problems identified, by:

a. Reviewing the SWPPP for compliance with Special Condition S9 and making appropriate revisions within 7 days of the inspection.

b. Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs, within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

c. Documenting BMP implementation and maintenance in the site log book.

3. 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 (1) day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one (1) inspection is required that week.) Inspection frequency may be reduced to once every calendar month for inactive sites that are temporarily stabilized.

4. The Permittee must summarize the results of each inspection in an inspection report or checklist and enter the report/checklist into, or attach it to, the site log book. At a minimum, each inspection report or checklist must include:

   a. Inspection date and time.

   b. Weather information.

   c. The general conditions during inspection.

   d. The approximate amount of precipitation since the last inspection.

   e. The approximate amount of precipitation within the last 24 hours.

   f. A summary or list of all implemented BMPs, including observations of all erosion/sediment control structures or practices.

   g. A description of:

      i. BMPs inspected (including location).

      ii. BMPs that need maintenance and why.

      iii. BMPs that failed to operate as designed or intended, and

      iv. Where additional or different BMPs are needed, and why.

   h. A description of stormwater discharged from the site. The Permittee must note the presence of suspended sediment, turbidity, discoloration, and oil sheen, as applicable.

i. Any water quality monitoring performed during inspection.

j. General comments and notes, including a brief description of any BMP repairs, maintenance, or installations made following the inspection.

k. An implementation schedule for the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

l. A summary report of the inspection.

m. The name, title, and signature of the person conducting the site inspection, a phone number or other reliable method to reach this person, and the following statement: *I certify that this report is true, accurate, and complete to the best of my knowledge and belief.*

Table 3 Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	CESCL Required for Inspections?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

[1] Soil disturbance is calculated by adding together all areas that will be affected by construction activity. Construction activity means clearing, grading, excavation, and any other activity that disturbs the surface of the land, including ingress/egress from the site.

[2] If construction activity results in the disturbance of 1 acre or more, and involves significant concrete work (1,000 cubic yards of concrete or recycled concrete placed or poured over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer stormwater collection system that drains to other surface waters of the State, the Permittee must conduct pH sampling in accordance with Special Condition S4.D.

[3] Sites with one or more acres, but fewer than 5 acres of soil disturbance, must conduct turbidity or transparency sampling in accordance with Special Condition S4.C.4.a or b.

[4] Sites equal to or greater than 5 acres of soil disturbance must conduct turbidity sampling using a turbidity meter in accordance with Special Condition S4.C.4.a.

C. Turbidity/Transparency Sampling Requirements

1. Sampling Methods

    a. If construction activity involves the disturbance of five (5) acres or more, the Permittee must conduct turbidity sampling per Special Condition S4.C.4.a, below.

    b. If construction activity involves one (1) acre or more but fewer than five (5) acres of soil disturbance, the Permittee must conduct either transparency sampling *or* turbidity sampling per Special Condition S4.C.4.a or b, below.

2. Sampling Frequency

    a. The Permittee must sample all discharge points at least once every calendar week when stormwater (or authorized non-stormwater) discharges from the site or enters any on-site surface waters of the state (for example, a creek running through a site); sampling is not required on sites that disturb less than an acre.

    b. Samples must be representative of the flow and characteristics of the discharge.

    c. Sampling is not required when there is no discharge during a calendar week.

    d. Sampling is not required outside of normal working hours or during unsafe conditions.

    e. If the Permittee is unable to sample during a monitoring period, the Permittee must include a brief explanation in the monthly Discharge Monitoring Report (DMR).

    f. Sampling is not required before construction activity begins.

    g. The Permittee may reduce the sampling frequency for temporarily stabilized, inactive sites to once every calendar month.

3. Sampling Locations

    a. Sampling is required at all points where stormwater associated with construction activity (or authorized non-stormwater) is discharged off site, including where it enters any on-site surface waters of the state (for example, a creek running through a site).

    b. The Permittee may discontinue sampling at discharge points that drain areas of the project that are fully stabilized to prevent erosion.

    c. The Permittee must identify all sampling point(s) in the SWPPP and on the site map and clearly mark these points in the field with a flag, tape, stake or other visible marker.

    d. Sampling is not required for discharge that is sent directly to sanitary or combined sewer systems.

    e. The Permittee may discontinue sampling at discharge points in areas of the project where the Permittee no longer has operational control of the construction activity.

4. Sampling and Analysis Methods

   a. The Permittee performs turbidity analysis with a calibrated turbidity meter (turbidimeter) either on site or at an accredited lab. The Permittee must record the results in the site log book in nephelometric turbidity units (NTUs).

   b. The Permittee performs transparency analysis on site with a 1¾ inch diameter, 60 centimeter (cm)-long transparency tube. The Permittee will record the results in the site log book in centimeters (cm).

Table 4 Monitoring and Reporting Requirements

Parameter	Unit	Analytical Method	Sampling Frequency	Benchmark Value
Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs
Transparency	Cm	Manufacturer instructions, or Ecology guidance	Weekly, if discharging	33 cm

5. Turbidity/Transparency Benchmark Values and Reporting Triggers

   The benchmark value for turbidity is 25 NTUs. The benchmark value for transparency is 33 centimeters (cm). Note: Benchmark values do not apply to discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus; these discharges are subject to a numeric effluent limit for turbidity. Refer to Special Condition S8 for more information and follow S5.F – Noncompliance Notification for reporting requirements applicable to discharges which exceed the numeric effluent limit for turbidity.

   a. Turbidity 26 – 249 NTUs, or Transparency 32 – 7 cm:

      If the discharge turbidity is 26 to 249 NTUs; or if discharge transparency is 32 to 7 cm, the Permittee must:

      i. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs, and no later than 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

      ii. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

      iii. Document BMP implementation and maintenance in the site log book.

   b. Turbidity 250 NTUs or greater, or Transparency 6 cm or less:

      If a discharge point's turbidity is 250 NTUs or greater, or if discharge transparency is less than or equal to 6 cm, the Permittee must complete the reporting and adaptive

management process described below. For discharges which are subject to a numeric effluent limit for turbidity, see S5.F – Noncompliance Notification.

i. Within 24 hours, telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) number (or through Ecology's Water Quality Permitting Portal [WQWebPortal] – Permit Submittals when the form is available), in accordance with Special Condition S5.A.

- **Central Region** (Okanogan, Chelan, Douglas, Kittitas, Yakima, Klickitat, Benton): (509) 575-2490
- **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
- **Northwest Region** (Kitsap, Snohomish, Island, King, San Juan, Skagit, Whatcom): (425) 649-7000
- **Southwest Region** (Grays Harbor, Lewis, Mason, Thurston, Pierce, Clark, Cowlitz, Skamania, Wahkiakum, Clallam, Jefferson, Pacific): (360) 407-6300

These numbers and a link to the ERTS reporting page are also listed at the following website: http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html.

ii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iii. Sample discharges daily until:

a) Turbidity is 25 NTUs (or lower); or

b) Transparency is 33 cm (or greater); or

c) The Permittee has demonstrated compliance with the water quality standard for turbidity:

1) No more than 5 NTUs over background turbidity, if background is less than 50 NTUs, or

2) No more than 10% over background turbidity, if background is 50 NTUs or greater; or

*Note: background turbidity in the receiving water must be measured immediately upstream (upgradient) or outside of the area of influence of the discharge.

d) The discharge stops or is eliminated.

iv. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within seven (7) days of the date the discharge exceeded the benchmark.

v. Document BMP implementation and maintenance in the site log book.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with permit benchmarks.

D. pH Sampling Requirements – Significant Concrete Work or Engineered Soils

If construction activity results in the disturbance of 1 acre or more, *and* involves significant concrete work (significant concrete work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer system that drains to surface waters of the State, the Permittee must conduct pH sampling as set forth below. Note: In addition, discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for high pH are subject to a numeric effluent limit for pH; refer to Special Condition S8.

1. The Permittee must perform pH analysis on site with a calibrated pH meter, pH test kit, or wide range pH indicator paper. The Permittee must record pH sampling results in the site log book.

2. During the applicable pH monitoring period defined below, the Permittee must obtain a representative sample of stormwater and conduct pH analysis at least once per week.

    a. For sites with significant concrete work, the Permittee must begin the pH sampling period when the concrete is first placed or poured and exposed to precipitation, and continue weekly throughout and after the concrete placement, pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 (su).

    b. For sites with recycled concrete where monitoring is required, the Permittee must begin the weekly pH sampling period when the recycled concrete is first exposed to precipitation and must continue until the recycled concrete is fully stabilized with the stormwater pH in the range of 6.5 to 8.5 (su).

    c. For sites with engineered soils, the Permittee must begin the pH sampling period when the soil amendments are first exposed to precipitation and must continue until the area of engineered soils is fully stabilized.

3. The Permittee must sample pH in the sediment trap/pond(s) or other locations that receive stormwater runoff from the area of significant concrete work or engineered soils before the stormwater discharges to surface waters.

4. The benchmark value for pH is 8.5 standard units. Anytime sampling indicates that pH is 8.5 or greater, the Permittee must either:

    a. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters of the state; *or*

    b. If necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO_2) sparging, dry ice or food grade vinegar. The Permittee must obtain written approval from Ecology before using any form of chemical treatment other than CO_2 sparging, dry ice or food grade vinegar.

S5. REPORTING AND RECORDKEEPING REQUIREMENTS

A. High Turbidity Reporting

Anytime sampling performed in accordance with Special Condition S4.C indicates turbidity has reached the 250 NTUs or more (or transparency less than or equal to 6 cm), high turbidity reporting level, the Permittee must notify Ecology within 24 hours of analysis either by calling the applicable Ecology Region's Environmental Report Tracking System (ERTS) number by phone or by submitting an electronic ERTS report (through Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals when the form is available). See the CSWGP website for links to ERTS and the WQWebPortal. (http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html) Also, see phone numbers in Special Condition S4.C.5.b.i.

B. Discharge Monitoring Reports (DMRs)

Permittees required to conduct water quality sampling in accordance with Special Conditions S4.C (Turbidity/Transparency), S4.D (pH), S8 (303[d]/TMDL sampling), and/or G12 (Additional Sampling) must submit the results to Ecology.

Permittees must submit monitoring data using Ecology's WQWebDMR web application accessed through Ecology's Water Quality Permitting Portal.

Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper copy DMR at:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

Permittees who obtain a waiver not to use WQWebDMR must use the forms provided to them by Ecology; submittals must be mailed to the address above. Permittees must submit DMR forms to be received by Ecology within 15 days following the end of each month.

If there was no discharge during a given monitoring period, all Permittees must submit a DMR as required with "no discharge" entered in place of the monitoring results. DMRs are required for the full duration of permit coverage (from the first full month following the effective date of permit coverage up until Ecology has approved termination of the coverage). For more information, contact Ecology staff using information provided at the following website: www.ecy.wa.gov/programs/wq/permits/paris/contacts.html.

C. Records Retention

The Permittee must retain records of all monitoring information (site log book, sampling results, inspection reports/checklists, etc.), Stormwater Pollution Prevention Plan, copy of the permit coverage letter (including Transfer of Coverage documentation) and any other documentation of compliance with permit requirements for the entire life of the construction project and for a minimum of five (5) years following the termination of permit coverage. Such information must include all calibration and maintenance records, and records of all data used to complete the application for this permit. This period of retention must be extended during

the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

D. Recording Results

For each measurement or sample taken, the Permittee must record the following information:

1. Date, place, method, and time of sampling or measurement.
2. The first and last name of the individual who performed the sampling or measurement.
3. The date(s) the analyses were performed.
4. The first and last name of the individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee samples or monitors any pollutant more frequently than required by this permit using test procedures specified by Special Condition S4 of this permit, the sampling results for this monitoring must be included in the calculation and reporting of the data submitted in the Permittee's DMR.

F. Noncompliance Notification

In the event the Permittee is unable to comply with any part of the terms and conditions of this permit, and the resulting noncompliance may cause a threat to human health or the environment (such as but not limited to spills or fuels or other materials, catastrophic pond or slope failure, and discharges that violate water quality standards), or exceed numeric effluent limitations (see S8 – Discharges to 303(d) or TMDL Waterbodies), the Permittee must, upon becoming aware of the circumstance:

1. Notify Ecology within 24 hours of the failure to comply by calling the applicable Regional office ERTS phone number (refer to Special Condition S4.C.5.b.i, or go to https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue to find contact information for the regional offices.)
2. Immediately take action to prevent the discharge/pollution, or otherwise stop or correct the noncompliance, and, if applicable, repeat sampling and analysis of any noncompliance immediately and submit the results to Ecology within five (5) days of becoming aware of the violation (See S5.F.3, below, for details on submitting results in a report).
3. Submit a detailed written report to Ecology within five (5) days of the time the Permittee becomes aware of the circumstances, unless requested earlier by Ecology. The report must be submitted using Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals, unless a waiver from electronic reporting has been granted according to S5.B. The report must contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Permittee must report any unanticipated bypass and/or upset that exceeds any effluent limit in the permit in accordance with the 24-hour reporting requirement contained in 40 C.F.R. 122.41(l)(6).

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply. Upon request of the Permittee, Ecology may waive the requirement for a written report on a case-by-case basis, if the immediate notification is received by Ecology within 24 hours.

G. Access to Plans and Records

1. The Permittee must retain the following permit documentation (plans and records) on site, or within reasonable access to the site, for use by the operator or for on-site review by Ecology or the local jurisdiction:

    a. General Permit

    b. Permit Coverage Letter

    c. Stormwater Pollution Prevention Plan (SWPPP)

    d. Site Log Book

    e. Erosivity Waiver (if applicable)

2. The Permittee must address written requests for plans and records listed above (Special Condition S5.G.1) as follows:

    a. The Permittee must provide a copy of plans and records to Ecology within 14 days of receipt of a written request from Ecology.

    b. The Permittee must provide a copy of plans and records to the public when requested in writing. Upon receiving a written request from the public for the Permittee's plans and records, the Permittee must either:

        i. Provide a copy of the plans and records to the requester within 14 days of a receipt of the written request; *or*

        ii. Notify the requester within 10 days of receipt of the written request of the location and times within normal business hours when the plans and records may be viewed; and provide access to the plans and records within 14 days of receipt of the written request; *or*

            Within 14 days of receipt of the written request, the Permittee may submit a copy of the plans and records to Ecology for viewing and/or copying by the requester at an Ecology office, or a mutually agreed location. If plans and records are viewed and/or copied at a location other than at an Ecology office, the Permittee will provide reasonable access to copying services for which a reasonable fee may be charged. The Permittee must notify the requester within 10 days of receipt of the request where the plans and records may be viewed and/or copied.

S6. PERMIT FEES

The Permittee must pay permit fees assessed by Ecology. Fees for stormwater discharges covered under this permit are established by Chapter 173-224 WAC. Ecology continues to assess permit fees until the permit is terminated in accordance with Special Condition S10 or revoked in accordance with General Condition G5.

S7. SOLID AND LIQUID WASTE DISPOSAL

The Permittee must handle and dispose of solid and liquid wastes generated by construction activity, such as demolition debris, construction materials, contaminated materials, and waste materials from maintenance activities, including liquids and solids from cleaning catch basins and other stormwater facilities, in accordance with:

A. Special Condition S3, Compliance with Standards.

B. WAC 173-216-110.

C. Other applicable regulations.

S8. DISCHARGES TO 303(d) OR TMDL WATERBODIES

A. Sampling and Numeric Effluent Limits For Certain Discharges to 303(d)-Listed Water Bodies

1. Permittees who discharge to segments of water bodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, high pH, or phosphorus, must conduct water quality sampling according to the requirements of this section, and Special Conditions S4.C.2.b-f and S4.C.3.b-d, and must comply with the applicable numeric effluent limitations in S8.C and S8.D.

2. All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current listing by Ecology of impaired waters (Category 5) that exists on January 1, 2021, or the date when the operator's complete permit application is received by Ecology, whichever is later.

B. Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters

Construction sites that discharge to a TMDL or 303(d)-listed waterbody are not eligible for coverage under this permit *unless* the operator:

1. Prevents exposing stormwater to pollutants for which the waterbody is impaired, and retains documentation in the SWPPP that details procedures taken to prevent exposure on site; *or*

2. Documents that the pollutants for which the waterbody is impaired are not present at the site, and retains documentation of this finding within the SWPPP; *or*

3. Provides Ecology with data indicating the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retains such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrate:

    a. For discharges to waters without an EPA-approved or -established TMDL, that the discharge of the pollutant for which the water is impaired will meet in-stream water quality criteria at the point of discharge to the waterbody; *or*

    b. For discharges to waters with an EPA-approved or -established TMDL, that there is sufficient remaining wasteload allocation in the TMDL to allow construction stormwater discharge and that existing dischargers to the waterbody are subject to compliance schedules designed to bring the waterbody into attainment with water quality standards.

    Operators of construction sites are eligible for coverage under this permit only after Ecology makes an affirmative determination that the *discharge will not cause or contribute to the existing impairment or exceed the TMDL.*

C. Sampling and Numeric Effluent Limits for Discharges to Water Bodies on the 303(d) List for Turbidity, Fine Sediment, or Phosphorus

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus must conduct turbidity sampling in accordance with Special Condition S4.C.2 and comply with either of the numeric effluent limits noted in Table 5 below.

2. As an alternative to the 25 NTUs effluent limit noted in Table 5 below (applied at the point where stormwater [or authorized non-stormwater] is discharged off-site), Permittees may choose to comply with the surface water quality standard for turbidity. The standard is: no more than 5 NTUs over background turbidity when the background turbidity is 50 NTUs or less, or no more than a 10% increase in turbidity when the background turbidity is more than 50 NTUs. In order to use the water quality standard requirement, the sampling must take place at the following locations:

    a. Background turbidity in the 303(d)-listed receiving water immediately upstream (upgradient) or outside the area of influence of the discharge.

    b. Turbidity at the point of discharge into the 303(d)-listed receiving water, inside the area of influence of the discharge**.**

3. Discharges that exceed the numeric effluent limit for turbidity constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

Table 5 Turbidity, Fine Sediment & Phosphorus Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Sampling Frequency	Numeric Effluent Limit[1]
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs, at the point where stormwater is discharged from the site; ***OR*** In compliance with the surface water quality standard for turbidity (S8.C.2.a)

[1] Permittees subject to a numeric effluent limit for turbidity may, at their discretion, choose either numeric effluent limitation based on site-specific considerations including, but not limited to, safety, access and convenience.

D. Discharges to Water Bodies on the 303(d) List for High pH

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for high pH must conduct pH sampling in accordance with the table below, and comply with the numeric effluent limit of pH 6.5 to 8.5 su (Table 6).

Table 6 pH Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled/Units	Analytical Method	Sampling Frequency	Numeric Effluent Limit
High pH	pH /Standard Units	pH meter	Weekly, if discharging	In the range of 6.5 – 8.5 su

2. At the Permittee's discretion, compliance with the limit shall be assessed at one of the following locations:

   a. Directly in the 303(d)-listed waterbody segment, inside the immediate area of influence of the discharge; *or*

   b. Alternatively, the Permittee may measure pH at the point where the discharge leaves the construction site, rather than in the receiving water.

3. Discharges that exceed the numeric effluent limit for pH (outside the range of 6.5 – 8.5 su) constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

E. Sampling and Limits for Sites Discharging to Waters Covered by a TMDL or another Pollution Control Plan

1. Discharges to a waterbody that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL. Refer to http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html for more information on TMDLs.

    a. Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges must be consistent with any specific waste load allocations or requirements established by the applicable TMDL.

        i. The Permittee must sample discharges weekly, unless otherwise specified by the TMDL, to evaluate compliance with the specific waste load allocations or requirements.

        ii. Analytical methods used to meet the monitoring requirements must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136.

        iii. Turbidity and pH methods need not be accredited or registered unless conducted at a laboratory which must otherwise be accredited or registered.

    b. Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but has not identified specific requirements, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    c. Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    d. Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

S9. STORMWATER POLLUTION PREVENTION PLAN

The Permittee must prepare and properly implement an adequate Stormwater Pollution Prevention Plan (SWPPP) for construction activity in accordance with the requirements of this permit beginning with initial soil disturbance and until final stabilization.

A. The Permittee's SWPPP must meet the following objectives:

1. To identify best management practices (BMPs) which prevent erosion and sedimentation, and to reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. To prevent violations of surface water quality, groundwater quality, or sediment management standards.

3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

1. The SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

    a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

    b. Potential erosion problem areas.

    c. The 13 elements of a SWPPP in Special Condition S9.D.1-13, including BMPs used to address each element.

    d. Construction phasing/sequence and general BMP implementation schedule.

    e. The actions to be taken if BMP performance goals are not achieved—for example, a contingency plan for additional treatment and/or storage of stormwater that would violate the water quality standards if discharged.

    f. Engineering calculations for ponds, treatment systems, and any other designed structures. When a treatment system requires engineering calculations, these calculations must be included in the SWPPP. Engineering calculations do not need to be included in the SWPPP for treatment systems that do not require such calculations.

2. The Permittee must modify the SWPPP if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee must then:

    a. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the inspection or investigation.

    b. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than 10 days from the inspection or investigation. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

    c. Document BMP implementation and maintenance in the site log book.

    The Permittee must modify the SWPPP whenever there is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

C. Stormwater Best Management Practices (BMPs)

BMPs must be consistent with:

1. *Stormwater Management Manual for Western Washington* (most current approved edition at the time this permit was issued), for sites west of the crest of the Cascade Mountains; *or*

2. *Stormwater Management Manual for Eastern Washington* (most current approved edition at the time this permit was issued), for sites east of the crest of the Cascade Mountains; *or*

3. Revisions to the manuals listed in Special Condition S9.C.1 & 2, or other stormwater management guidance documents or manuals which provide an equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230; *or*

4. Documentation in the SWPPP that the BMPs selected provide an equivalent level of pollution prevention, compared to the applicable stormwater management manuals, including:

    a. The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.

    b. An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

D. SWPPP – Narrative Contents and Requirements

The Permittee must include each of the 13 elements below in Special Condition S9.D.1-13 in the narrative of the SWPPP and implement them unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits

    a. Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.

    b. Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access

    a. Limit construction vehicle access and exit to one route, if possible.

    b. Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking sediment onto roads.

    c. Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

    d. If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pickup and transport of the sediment to a controlled sediment disposal area.

    e. Conduct street washing only after sediment removal in accordance with Special Condition S9.D.2.d.

    f. Control street wash wastewater by pumping back on site or otherwise preventing it from discharging into systems tributary to waters of the State.

3. Control Flow Rates

    a. Protect properties and waterways downstream of construction sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site, as required by local plan approval authority.

    b. Where necessary to comply with Special Condition S9.D.3.a, construct stormwater infiltration or detention BMPs as one of the first steps in grading. Assure that detention BMPs function properly before constructing site improvements (for example, impervious surfaces).

    c. If permanent infiltration ponds are used for flow control during construction, protect these facilities from sedimentation during the construction phase.

4. Install Sediment Controls

    The Permittee must design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, the Permittee must:

    a. Construct sediment control BMPs (sediment ponds, traps, filters, infiltration facilities, etc.) as one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.

    b. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

    c. Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Special Condition S9.D.3.a.

    d. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

    e. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.

    f. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

5. Stabilize Soils

    a. The Permittee must stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion

control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.

b. The Permittee must control stormwater volume and velocity within the site to minimize soil erosion.

c. The Permittee must control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

d. Depending on the geographic location of the project, the Permittee must not allow soils to remain exposed and unworked for more than the time periods set forth below to prevent erosion.

West of the Cascade Mountains Crest
During the dry season (May 1 - September 30): 7 days
During the wet season (October 1 - April 30): 2 days

East of the Cascade Mountains Crest, except for Central Basin*
During the dry season (July 1 - September 30): 10 days
During the wet season (October 1 - June 30): 5 days

The Central Basin*, East of the Cascade Mountains Crest
During the dry Season (July 1 - September 30): 30 days
During the wet season (October 1 - June 30): 15 days

***Note: The Central Basin** is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

e. The Permittee must stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

f. The Permittee must stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

g. The Permittee must minimize the amount of soil exposed during construction activity.

h. The Permittee must minimize the disturbance of steep slopes.

i. The Permittee must minimize soil compaction and, unless infeasible, preserve topsoil.

6. Protect Slopes

a. The Permittee must design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).

b. The Permittee must divert off-site stormwater (run-on) or groundwater away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.

c. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.

i. West of the Cascade Mountains Crest: Temporary pipe slope drains must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Temporary pipe slope drains must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

d. Place excavated material on the uphill side of trenches, consistent with safety and space considerations.

e. Place check dams at regular intervals within constructed channels that are cut down a slope.

7. Protect Drain Inlets

a. Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

b. Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

8. Stabilize Channels and Outlets

a. Design, construct and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:

i. West of the Cascade Mountains Crest: Channels must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

b. Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of all conveyance systems.

9. Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The Permittee must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. Minimize storage of hazardous materials on-site. Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume of the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, recycled concrete stockpiles, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. (Also refer to the definition for "concrete wastewater" in Appendix A – Definitions.)

g. Adjust the pH of stormwater or authorized non-stormwater if necessary to prevent an exceedance of groundwater and/or surface water quality standards.

h. Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete truck drums onto the ground, or into storm drains, open ditches, streets, or streams. Washout of small concrete handling equipment may be disposed of in a formed area awaiting concrete where it will not contaminate surface or groundwater. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge directly to groundwater or surface waters of the State is

prohibited. At no time shall concrete be washed off into the footprint of an area where an infiltration BMP will be installed.

i. Obtain written approval from Ecology before using any chemical treatment, with the exception of CO_2, dry ice or food grade vinegar, to adjust pH.

j. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, in conjunction with BMPs to reduce sedimentation before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point groundwater, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other dewatering treatment or disposal options may include:

i. Infiltration

ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.

iii. Ecology-approved on-site chemical treatment or other suitable treatment technologies (See S9.D.9.i, regarding chemical treatment written approval).

iv. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

v. Use of a sedimentation bag with discharge to a ditch or swale for small volumes of localized dewatering.

d. Permittees must handle highly turbid or contaminated dewatering water separately from stormwater.

11. Maintain BMPs

a. Permittees must 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.

b. Permittees must remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

12. Manage the Project

    a. Phase development projects to the maximum degree practicable and take into account seasonal work limitations.

    b. Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with Special Condition S4.

    c. Maintain, update, and implement the SWPPP in accordance with Special Conditions S3, S4, and S9.

13. Protect Low Impact Development (LID) BMPs

    The primary purpose of on-site LID Stormwater Management is to reduce the disruption of the natural site hydrology through infiltration. LID BMPs are permanent facilities.

    a. Permittees must protect all LID BMPs (including, but not limited to, Bioretention and Rain Garden facilities) from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden facilities. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the facility must include removal of sediment and any sediment-laden bioretention/ rain garden soils, and replacing the removed soils with soils meeting the design specification.

    b. Permittees must maintain the infiltration capabilities of LID BMPs by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

    c. Permittees must 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 or base materials.

    d. Permittees must clean permeable pavements fouled with sediments or no longer passing an initial infiltration test using local stormwater manual methodology or the manufacturer's procedures.

    e. Permittees must keep all heavy equipment off existing soils under LID BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

E. SWPPP – Map Contents and Requirements

The Permittee's SWPPP must also include a vicinity map or general location map (for example, a USGS quadrangle map, a portion of a county or city map, or other appropriate map) with enough detail to identify the location of the construction site and receiving waters within one mile of the site.

The SWPPP must also include a legible site map (or maps) showing the entire construction site. The following features must be identified, unless not applicable due to site conditions.

1. The direction of north, property lines, and existing structures and roads.

2. Cut and fill slopes indicating the top and bottom of slope catch lines.

3. Approximate slopes, contours, and direction of stormwater flow before and after major grading activities.

4. Areas of soil disturbance and areas that will not be disturbed.

5. Locations of structural and nonstructural controls (BMPs) identified in the SWPPP.

6. Locations of off-site material, stockpiles, waste storage, borrow areas, and vehicle/equipment storage areas.

7. Locations of all surface water bodies, including wetlands.

8. Locations where stormwater or non-stormwater discharges off-site and/or to a surface waterbody, including wetlands.

9. Location of water quality sampling station(s), if sampling is required by state or local permitting authority.

10. Areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

11. Location or proposed location of LID facilities.

S10. NOTICE OF TERMINATION

Partial terminations of permit coverage are not authorized.

A. The site is eligible for termination of coverage when it has met any of the following conditions:

1. The site has undergone final stabilization, the Permittee has removed all temporary BMPs (except biodegradable BMPs clearly manufactured with the intention for the material to be left in place and not interfere with maintenance or land use), and all stormwater discharges associated with construction activity have been eliminated; *or*

2. All portions of the site that have not undergone final stabilization per Special Condition S10.A.1 have been sold and/or transferred (per Special Condition S2.A), and the Permittee no longer has operational control of the construction activity; *or*

3. For residential construction only, the Permittee has completed temporary stabilization and the homeowners have taken possession of the residences.

B. When the site is eligible for termination, the Permittee must submit a complete and accurate Notice of Termination (NOT) form, signed in accordance with General Condition G2, to:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

When an electronic termination form is available, the Permittee may choose to submit a complete and accurate Notice of Termination (NOT) form through the Water Quality Permitting Portal rather than mailing a hardcopy as noted above.

The termination is effective on the 31st calendar day following the date Ecology receives a complete NOT form, unless Ecology notifies the Permittee that termination request is denied because the Permittee has not met the eligibility requirements in Special Condition S10.A.

Permittees are required to comply with all conditions and effluent limitations in the permit until the permit has been terminated.

Permittees transferring the property to a new property owner or operator/Permittee are required to complete and submit the Notice of Transfer form to Ecology, but are not required to submit a Notice of Termination form for this type of transaction.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit must be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the general permit must constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications must bear a certification of correctness to be signed:

1. In the case of corporations, by a responsible corporate officer.
2. In the case of a partnership, by a general partner of a partnership.
3. In the case of sole proprietorship, by the proprietor.
4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology (including NOIs, NOTs, and Transfer of Coverage forms) must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records are kept under the terms and conditions of this permit.

B. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.

C. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved, or

D. When information is obtained that indicates cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

Pursuant to Chapter 43.21B RCW and Chapter 173-226 WAC, the Director may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

A. Violation of any term or condition of this permit.

B. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

D. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

E. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

F. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

G. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

The Director may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee must submit a new application, or a supplement to the previous application, whenever a material change to the construction activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application must be submitted at least sixty (60) days prior to any proposed changes. Filing a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit will be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal at least 180 days prior to the specified expiration date of this permit. The Permittee must reapply using the electronic application form (NOI) available on Ecology's website. Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

G9. REMOVED SUBSTANCE

The Permittee must not re-suspend or reintroduce collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information that Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment at the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G14. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Special Condition S5.F, and; 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G15. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G16. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G17. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G18. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four (4) years, or both.

G19. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, give notice to Ecology of planned physical alterations, modifications or additions to the permitted construction activity. The Permittee should be aware that, depending on the nature and size of the changes to the original permit, a new public notice and other permit process requirements may be required. Changes in activities that require reporting to Ecology include those that will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant change in the nature or an increase in quantity of pollutants discharged, including but not limited to: a 20% or greater increase in acreage disturbed by construction activity.

C. A change in or addition of surface water(s) receiving stormwater or non-stormwater from the construction activity.

D. A change in the construction plans and/or activity that affects the Permittee's monitoring requirements in Special Condition S4.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G20. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it must promptly submit such facts or information.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee must give advance notice to Ecology by submission of a new application or supplement thereto at least forty-five (45) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of

operation and degradation of effluent quality, must be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G22. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit. The discharger must submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons will fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director will either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to the construction stormwater general permit, the applicability of the construction stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G23. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW, and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit's applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G24. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G25. BYPASS PROHIBITED

A. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited for stormwater events below the design criteria for stormwater management. Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, 3 or 4) is applicable.

1. Bypass of stormwater is consistent with the design criteria and part of an approved management practice in the applicable stormwater management manual.

2. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health.

3. Bypass of stormwater is unavoidable, unanticipated, and results in noncompliance of this permit.

   This bypass is permitted only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

   c. Ecology is properly notified of the bypass as required in Special Condition S5.F of this permit.

4. A planned action that would cause bypass of stormwater and has the potential to result in noncompliance of this permit during a storm event.

   The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

   a. A description of the bypass and its cause

   b. An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.

   c. A cost-effectiveness analysis of alternatives including comparative resource damage assessment.

   d. The minimum and maximum duration of bypass under each alternative.

   e. A recommendation as to the preferred alternative for conducting the bypass.

   f. The projected date of bypass initiation.

   g. A statement of compliance with SEPA.

   h. A request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated.

   i. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

5. For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during

preparation of the Stormwater Pollution Prevention Plan (SWPPP) and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Ecology will consider the following before issuing an administrative order for this type bypass:

a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve, conditionally approve, or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

B. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

APPENDIX A – DEFINITIONS

AKART is an acronym for "**A**ll **K**nown, **A**vailable, and **R**easonable methods of prevention, control, and **T**reatment." AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus, which was completed and approved by EPA before January 1, 2021, or before the date the operator's complete permit application is received by Ecology, whichever is later. TMDLs completed after a complete permit application is received by Ecology become applicable to the Permittee only if they are imposed through an administrative order by Ecology, or through a modification of permit coverage.

Applicant means an *operator* seeking coverage under this permit.

Benchmark means a pollutant concentration used as a permit threshold, below which a pollutant is considered unlikely to cause a water quality violation, and above which it may. When pollutant concentrations exceed benchmarks, corrective action requirements take effect. Benchmark values are not water quality standards and are not numeric effluent limitations; they are indicator values.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control stormwater associated with construction activity, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer means an area designated by a local jurisdiction that is contiguous to and intended to protect a sensitive area.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Calendar Day A period of 24 consecutive hours starting at 12:00 midnight and ending the following 12:00 midnight.

Calendar Week (same as **Week**) means a period of seven consecutive days starting at 12:01 a.m. (0:01 hours) on Sunday.

Certified Erosion and Sediment Control Lead (CESCL) means a person who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (See BMP C160 in the SWMM).

Chemical Treatment means the addition of chemicals to stormwater and/or authorized non-stormwater prior to filtration and discharge to surface waters.

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Common Plan of Development or Sale means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Composite Sample means a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increases while maintaining a constant time interval between the aliquots.

Concrete Wastewater means any water used in the production, pouring and/or clean-up of concrete or concrete products, and any water used to cut, grind, wash, or otherwise modify concrete or concrete products. Examples include water used for or resulting from concrete truck/mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing). When stormwater comingles with concrete wastewater, the resulting water is considered concrete wastewater and must be managed to prevent discharge to waters of the State, including groundwater.

Construction Activity means land disturbing operations including clearing, grading or excavation which disturbs the surface of the land (including off-site disturbance acreage related to construction-support activity). Such activities may include road construction, construction of residential houses, office buildings, or industrial buildings, site preparation, soil compaction, movement and stockpiling of topsoils, and demolition activity.

Construction Support Activity means off-site acreage that will be disturbed as a direct result of the construction project and will discharge stormwater. For example, off-site equipment staging yards, material storage areas, borrow areas, and parking areas.

Contaminant means any hazardous substance that does not occur naturally or occurs at greater than natural background levels. See definition of “hazardous substance” and WAC 173-340-200.

Contaminated soil means soil which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Contaminated groundwater means groundwater which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater BMPs is documented within a SWPPP, including:

1. The method and reasons for choosing the stormwater BMPs selected.
2. The pollutant removal performance expected from the BMPs selected.

3. The technical basis supporting the performance claims for the BMPs selected, including any available data concerning field performance of the BMPs selected.
4. An assessment of how the selected BMPs will comply with state water quality standards.
5. An assessment of how the selected BMPs will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Department means the Washington State Department of Ecology.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Dewatering means the act of pumping groundwater or stormwater away from an active construction site.

Director means the Director of the Washington State Department of Ecology or his/her authorized representative.

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such groundwater infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

Engineered Soils means the use of soil amendments including, but not limited, to Portland cement treated base (CTB), cement kiln dust (CKD), or fly ash to achieve certain desirable soil characteristics.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to groundwater than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, sediment traps, and ponds. Erosion and sediment control BMPs are synonymous with stabilization and structural BMPs.

Federal Operator is an entity that meets the definition of "Operator" in this permit and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, performing construction activity for any such department, agency, or instrumentality.

Final Stabilization (same as **fully stabilized** or **full stabilization**) means the completion of all soil disturbing activities at the site and the establishment of permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See the applicable Stormwater Management Manual for more information on vegetative cover expectations and equivalent permanent stabilization measures.

Groundwater means water in a saturated zone or stratum beneath the land surface or a surface waterbody.

Hazardous Substance means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under chapter 70.105 RCW; any hazardous sub-stance as defined in RCW 70.105.010(14) or any hazardous substance as defined by rule under chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101(14) of the federal cleanup law, 42U.S.C., Sec. 9601(14); petroleum or petroleum products; and any substance or category of substances, including solid waste decomposition products, determined by the director by rule to present a threat to human health or the environment if released into the environment. The term hazardous substance does not include any of the following when contained in an underground storage tank from which there is not a release: crude oil or any fraction thereof or petroleum, if the tank is in compliance with all applicable federal, state, and local law.

Injection Well means a well that is used for the subsurface emplacement of fluids. (See **Well**.)

Jurisdiction means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology.

Notice of Intent (NOI) means the application for, or a request for coverage under this general permit pursuant to WAC 173-226-200.

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S10 of this permit.

Operator means any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

Permittee means individual or entity that receives notice of coverage under this general permit.

pH means a liquid's measure of acidity or alkalinity. A pH of 7 is defined as neutral. Large variations above or below this value are considered harmful to most aquatic life.

pH Monitoring Period means the time period in which the pH of stormwater runoff from a site must be tested a minimum of once every seven days to determine if stormwater pH is between 6.5 and 8.5.

Point Source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the State. This term does not include return flows from irrigated agriculture. (See the Fact Sheet for further explanation)

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the CWA, nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the CWA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Process Wastewater means any non-stormwater which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. If stormwater commingles with process wastewater, the commingled water is considered process wastewater.

Receiving Water means the waterbody at the point of discharge. If the discharge is to a storm sewer system, either surface or subsurface, the receiving water is the waterbody to which the storm system discharges. Systems designed primarily for other purposes such as for groundwater drainage, redirecting stream natural flows, or for conveyance of irrigation water/return flows that coincidentally convey stormwater are considered the receiving water.

Representative means a stormwater or wastewater sample which represents the flow and characteristics of the discharge. Representative samples may be a grab sample, a time-proportionate *composite sample*, or a flow proportionate sample. Ecology's Construction Stormwater Monitoring Manual provides guidance on representative sampling.

Responsible Corporate Officer for the purpose of signatory authority means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sanitary Sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation means the depositing or formation of sediment.

Sensitive Area means a waterbody, wetland, stream, aquifer recharge area, or channel migration zone.

SEPA (State Environmental Policy Act) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention or treatment; or an amount of a pollutant that has a reasonable potential to cause a violation of surface or groundwater quality or sediment management standards.

Significant Concrete Work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project.

Significant Contributor of Pollutants means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State of Washington.

Site means the land or water area where any "facility or activity" is physically located or conducted.

Source Control BMPs means physical, structural or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Stabilization means the application of appropriate BMPs to prevent the erosion of soils, such as, temporary and permanent seeding, vegetative covers, mulching and matting, plastic covering and sodding. See also the definition of Erosion and Sediment Control BMPs.

Storm Drain means any drain which drains directly into a *storm sewer system*, usually found along roadways or in parking lots.

Storm Sewer System means a means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains designed or used for collecting or conveying stormwater. This does not include systems which are part of *a combined sewer* or Publicly Owned Treatment Works (POTW), as defined at 40 CFR 122.2.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.

Stormwater Management Manual (SWMM) or **Manual** means the technical Manual published by Ecology for use by local governments that contain descriptions of and design criteria for BMPs to prevent, control, or treat pollutants in stormwater.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Temporary Stabilization means the exposed ground surface has been covered with appropriate materials to provide temporary stabilization of the surface from water or wind erosion. Materials include, but are not limited to, mulch, riprap, erosion control mats or blankets and temporary cover crops. Seeding alone is not considered stabilization. Temporary stabilization is not a substitute for the more permanent “final stabilization.”

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations must include a "margin of safety" to ensure that the waterbody can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation must also account for seasonable variation in water quality.

Transfer of Coverage (TOC) means a request for transfer of coverage under this general permit as specified by Special Condition S2.A of this permit.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Transparency means a measurement of water clarity in centimeters (cm), using a 60 cm transparency tube. The transparency tube is used to estimate the relative clarity or transparency of water by noting the depth at which a black and white Secchi disc becomes visible when water is released from a value in the bottom of the tube. A transparency tube is sometimes referred to as a “turbidity tube.”

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTUs) and measured with a calibrated turbidimeter.

Uncontaminated means free from any contaminant. See definition of “contaminant” and WAC 173-340-200.

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

Waste Load Allocation (WLA) means the portion of a receiving water’s loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2[h]).

Water-Only Based Shaft Drilling is a shaft drilling process that uses water only and no additives are involved in the drilling of shafts for construction of building, road, or bridge foundations.

Water Quality means the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Waters of the State includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which include lakes, rivers, ponds, streams, inland waters, underground waters, salt

waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Well means a bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension. (See **Injection Well**.)

Wheel Wash Wastewater means any water used in, or resulting from the operation of, a tire bath or wheel wash (BMP C106: Wheel Wash), or other structure or practice that uses water to physically remove mud and debris from vehicles leaving a construction site and prevent track-out onto roads. When stormwater comingles with wheel wash wastewater, the resulting water is considered wheel wash wastewater and must be managed according to Special Condition S9.D.9.

APPENDIX B – ACRONYMS

AKART	All Known, Available, and Reasonable Methods of Prevention, Control, and Treatment
BMP	Best Management Practice
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
cm	Centimeters
CPD	Common Plan of Development
CTB	Cement-Treated Base
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
FR	Federal Register
LID	Low Impact Development
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USC	United States Code
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WQ	Water Quality
WWHM	Western Washington Hydrology Model

Appendix H – Engineering Calculations

TESC Sediment Trap Sizing (BMP C240)

$$\mathbf{SA = FS\ (Q_2 / V_S)}$$

SA = Surface Area (ft^2)
FS = Factor of Safety = 2
Q_2 = 2-year, 24-hour storm flow rate (ft^3/s)
V_S = Settling Velocity = 0.00096 ft/s

Total Site:

Pervious Area	0.21 ac
Impervious Area	1.16 ac
Total Area	1.37 ac

Per MGS Flood TESC Sizing Report:
2-year, 24-hour storm event **Q_2 = 0.586 ft^3/s**

Surface Area Calculation:
SA = FS (Q2 / VS)
SA = 2 (0.586 / 0.00096)
SA = 1,220.83 ft^2

V_R = SA * 3.5 ft minimum storage depth
V_R = 1,220.83 * 3.5
V_R = 4,273 ft^3 Storage Volume Required

V_R = 4,272.92 ft^3 * (7.48 gal/ 1 ft^3)
V_R = 31,961 Gallons Required

Volume Provided:
(2) 18,900 Gallon sediment storage tanks
V = 37,800 Gallons Provided

TESC BAKER TANK SIZING

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.64
Program License Number: 201910001
Project Simulation Performed on: 05/29/2025 2:54 PM
Report Generation Date: 05/29/2025 3:00 PM

Input File Name: Barnabie Point.fld
Project Name: Barnabie Point
Analysis Title:
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 1
Precipitation Station : 95003205 Puget West 32 in_5min 10/01/1939-10/01/2097
Evaporation Station : 951032 Puget West 32 in MAP

Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	1.370	1.370
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	1.370	1.370

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
SIDEWALKS/MOD	1.370

Subbasin Total 1.370

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
SIDEWALKS/MOD 1.370

Subbasin Total 1.370

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	0.000
Total:	0.000

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	0.000
Total:	0.000

Total Predevelopment Recharge Equals Post Developed

TESC BAKER TANK SIZING

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.000 ac-ft/year, Post Developed: 0.000 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.586	2-Year	0.586
5-Year	0.778	5-Year	0.778
10-Year	0.944	10-Year	0.944
25-Year	1.119	25-Year	1.119
50-Year	1.343	50-Year	1.343
100-Year	1.709	100-Year	1.709
200-Year	1.927	200-Year	1.927
500-Year	2.215	500-Year	2.215

TESC DESIGN STORM

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

APPENDIX C

STORM REPAIR PLANS – FOR REFERENCE ONLY

A PORTION OF SECTION 8, TOWNSHIP 24 N, RANGE 5 E, W.M.

HERZL-NER TAMID

STORM SYSTEM REPAIR

GENERAL NOTES

1. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH CURRENT CITY OF MERCER ISLAND DEVELOPMENT STANDARDS; THE CURRENT EDITION OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION; AND THE ADOPTED EDITION OF THE WASHINGTON STATE DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON.
2. ALL WORK WITHIN THE PLAT AND CITY RIGHT-OF-WAY SHALL BE SUBJECT TO THE INSPECTION OF THE CITY.
3. PRIOR TO ANY SITE CONSTRUCTION INCLUDING CLEARING/LOGGING OR GRADING, THE SITE CLEARING LIMITS SHALL BE LOCATED AND FIELD IDENTIFIED BY THE PROJECT SURVEYOR (OR PROJECT ENGINEER) AS REQUIRED BY THESE PLANS. THE PROJECT SURVEYOR'S NAME AND PHONE NUMBER IS BRANDON WINTERS, 206.297.0996.
4. THE DEVELOPER, CONTRACTOR AND PROJECT ENGINEER IS RESPONSIBLE FOR WATER QUALITY AS DETERMINED BY THE MONITORING PROGRAM ESTABLISHED BY THE PROJECT ENGINEER.
5. PRIOR TO ANY SITE WORK, THE CONTRACTOR SHALL CONTACT THE CITY OF MERCER ISLAND COMMUNITY DEVELOPMENT DEPARTMENT AT 425-263-8000 TO SCHEDULE A PRECONSTRUCTION CONFERENCE.
6. ENGINEERED AS-BUILT DRAWINGS IN ACCORDANCE WITH THE CURRENT ADOPTED INTERNATIONAL BUILDING CODE SHALL BE REQUIRED PRIOR TO FINAL SITE APPROVAL.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS FOR UTILITY, ROAD, AND RIGHT-OF-WAY CONSTRUCTION.
8. THE CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPP) FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPROVED SWPPP PLANS PRIOR TO ANY GRADING OR LAND CLEARING. THESE FACILITIES MUST BE SATISFACTORILY MAINTAINED UNTIL CONSTRUCTION AND LANDSCAPING IS COMPLETED AND THE POTENTIAL FOR ON-SITE EROSION HAS PASSED. SEDIMENT LADEN WATERS SHALL NOT ENTER THE NATURAL DRAINAGE SYSTEM.
9. A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL) OR SWPPP SUPERVISOR SHALL BE RESPONSIBLE FOR MAINTAINING THE CONSTRUCTION SWPP FACILITIES, AS OUTLINED IN THE APPROVED SWPPP, OR AS MODIFIED FROM TIME TO TIME. CONTACT INFORMATION FOR THE CESCL (OR SWPPP SUPERVISOR) FOR THE PROJECT SHALL BE GIVEN TO THE CITY.
10. NONCOMPLIANCE WITH THE REQUIREMENTS FOR EROSION CONTROLS, WATER QUALITY AND CLEARING LIMITS MAY RESULT IN REVOCATION OF PROJECT PERMITS, PLAN APPROVAL, AND BOND FORECLOSURES.
11. TRENCH BACKFILL OF NEW UTILITIES AND STORM DRAINAGE FACILITIES SHALL BE COMPACTED TO 95% MAXIMUM DENSITY (MODIFIED PROCTOR) UNDER ROADWAYS AND 90% MAXIMUM DENSITY (MODIFIED PROCTOR) OFF ROADWAYS. COMPACTION SHALL BE PERFORMED IN ACCORDANCE WITH SECTIONS 7-08.3(3) AND 2-03.3(14) D OF THE WSDOT STANDARD SPECIFICATIONS.
12. THE OWNER AND CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING UTILITIES PRIOR TO BEGINNING CONSTRUCTION. LOCATION OF UTILITIES SHOWN ON CONSTRUCTION PLANS ARE BASED ON BEST RECORDS AVAILABLE AND ARE SUBJECT TO VARIATION. FOR ASSISTANCE IN UTILITY LOCATION, CALL 811.
13. PRIOR TO CONSTRUCTION THE OWNER AND/OR CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER AND THE PUBLIC WORKS DIRECTOR WHEN CONFLICTS EXIST BETWEEN THE PLANS AND FIELD CONDITIONS. CONFLICTS SHALL BE RESOLVED (INCLUDING PLAN AND PROFILE REVISIONS) AND RESUBMITTED FOR APPROVAL PRIOR TO PROCEEDING WITH CONSTRUCTION.
14. THE CONTRACTOR SHALL KEEP TWO SETS OF PLANS ON SITE AT ALL TIMES FOR RECORDING AS-BUILT INFORMATION; ONE SET SHALL BE SUBMITTED TO THE PROJECT ENGINEER, AND ONE SET SHALL BE SUBMITTED TO THE CITY AT COMPLETION OF CONSTRUCTION AND PRIOR TO FINAL ACCEPTANCE OF WORK.
15. A GRADING PERMIT ISSUED PURSUANT TO THE CURRENT ADOPTED INTERNATIONAL BUILDING CODE, AND APPROVAL OF THE TEMPORARY EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE OBTAINED FROM THE COMMUNITY DEVELOPMENT DEPARTMENT PRIOR TO ANY ON-SITE GRADING WORK NOT EXPRESSLY EXEMPT BY THE CURRENT ADOPTED INTERNATIONAL BUILDING CODE.

LEGAL DESCRIPTION

PARCEL A: (TAX PARCEL NO. 082405-9045-07)

THAT PORTION OF GOVERNMENT LOT 11, SECTION 8, TOWNSHIP 24 NORTH, RANGE 5 EAST, W.M., IN KING COUNTY, WASHINGTON; TOGETHER WITH THAT PORTION OF THE SOUTHEAST QUARTER OF SECTION 7, TOWNSHIP 24 NORTH, RANGE 5 EAST, W.M., IN KING COUNTY, WASHINGTON, DESCRIBED AS FOLLOWS:
BEGINNING AT THE INTERSECTION OF THE WEST LINE OF GOVERNMENT LOT 11 WITH THE NORTH LINE OF DOYLE-HANSEN ADDITION, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 75 OF PLATS, PAGE 24, RECORDS OF KING COUNTY, WASHINGTON; THENCE SOUTH 89°09'34" EAST ALONG THE NORTH OF SAID DOYLE-HANSEN ADDITION, A DISTANCE OF 253.49 FEET TO THE WEST LINE OF LOT 7 OF CHANNEL CREST, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 72 OF PLATS, PAGE 63, RECORDS OF KING COUNTY, WASHINGTON;
THENCE NORTH 01°12'29" EAST ALONG SAID WEST LINE, A DISTANCE OF 111.48 FEET TO THE SOUTH LINE OF TRACT "A" OF SAID CHANNEL CREST;
THENCE SOUTH 85°39'49" WEST ALONG SAID SOUTH LINE 173.15 FEET TO SOUTHEASTERLY LINE OF LAND CONVEYED TO STATE OF WASHINGTON TOLL BRIDGE AUTHORITY UNDER RECORDING NO. 3032009; THENCE SOUTH 65°24'55" WEST ALONG SAID SOUTHEASTERLY LINE TO THE EASTERLY MARGIN OF EAST MERCER WAY, AS CONVEYED TO KING COUNTY UNDER RECORDING NO. 923897;
THENCE SOUTH 01°02'29" WEST TO THE NORTH LINE OF SAID DOYLE-HANSEN ADDITION; THENCE SOUTH 89°09'34" EAST ALONG SAID NORTH LINE 70.61 FEET TO THE POINT OF BEGINNING.

PARCEL B: (TAX PARCEL NO. 210700-0010-06)

LOTS 1 THROUGH 5, INCLUSIVE, DOYLE-HANSEN ADDITION, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 75 OF PLATS, PAGE 24, RECORDS OF KING COUNTY, WASHINGTON.

PARCEL C: (TAX PARCEL NO. 151560-0010-01)

LOTS 1 THROUGH 7, INCLUSIVE, CHANNEL CREST, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 72 OF PLATS, PAGE 63, RECORDS OF KING COUNTY, WASHINGTON;TOGETHER WITH AN UNDIVIDED 7/8THS INTEREST IN TRACT "A" OF SAID PLAT. SITUATE IN THE COUNTY OF KING, STATE OF WASHINGTON.

VERTICAL DATUM

VERTICAL DATUM = NAVD'88, AS PER DIRECT OBSERVATIONS USING GPS EQUIPMENT ON SEPTEMBER 14TH, 2023.

HORIZONTAL DATUM

HORIZONTAL DATUM = NAD 83/11 (EPOCH 2010).

SITE DATA

SITE ADDRESS:	3700 E MERCER WAY, MERCER ISLAND, WA 98040
TAX PARCEL NUMBER:	0824059045, 2107000010, 1515600010, 1515601RCT
ZONING:	B AND R-9.6

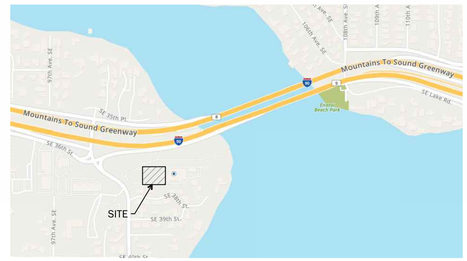
OWNER: HERZL-NER-TAMID
CONSERVATIVE CONGREGATION

ARCHITECT: ANJALI GRANT DESIGN
3427 BEACON AVE S
SEATTLE, WA 98144
CONTACT: ANJALI GRANT
ANJALI@AGRANTDESIGN.COM
206.512.4209

ENGINEER: JACOBSON CONSULTING ENGINEERS
255 S. KING STREET, SUITE #800
SEATTLE, WA 98104
CONTACT: ALAN JACOBSON
ALAN@JACOBSONENGINEERS.COM
206.399.6233

GENERAL CONTRACTOR: EXXEL PACIFIC
11820 NORTHUP WAY SUITE #300
BELLEVUE, WA 98005
CONTACT: SAM STEVENS
SAMS@EXXELPACIFIC.COM
206.715.1782

VICINITY MAP



Sheet List Table

C0.00	COVER SHEET
C0.11	OVERALL STORM REPAIR PLAN
C0.12	STORM REPAIR PLAN
C0.13	STORM REPAIR PLAN
C0.20	STORM REPAIR PROFILES
C0.21	STORM REPAIR PROFILES
C0.30	STORM REPAIR DETAILS
C0.31	STORM REPAIR DETAILS

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anjali grant design LLC

JEFFREY D. A. JACOBSON
STATE OF WASHINGTON
43667
REGISTERED PROFESSIONAL ENGINEER
6/11/2025

3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

NO.	DATE	DESCRIPTION
		11 JUNE 2025
		LOWER STORM BID SET

PROJECT:
COVER SHEET

C0.00

FOR REFERENCE ONLY

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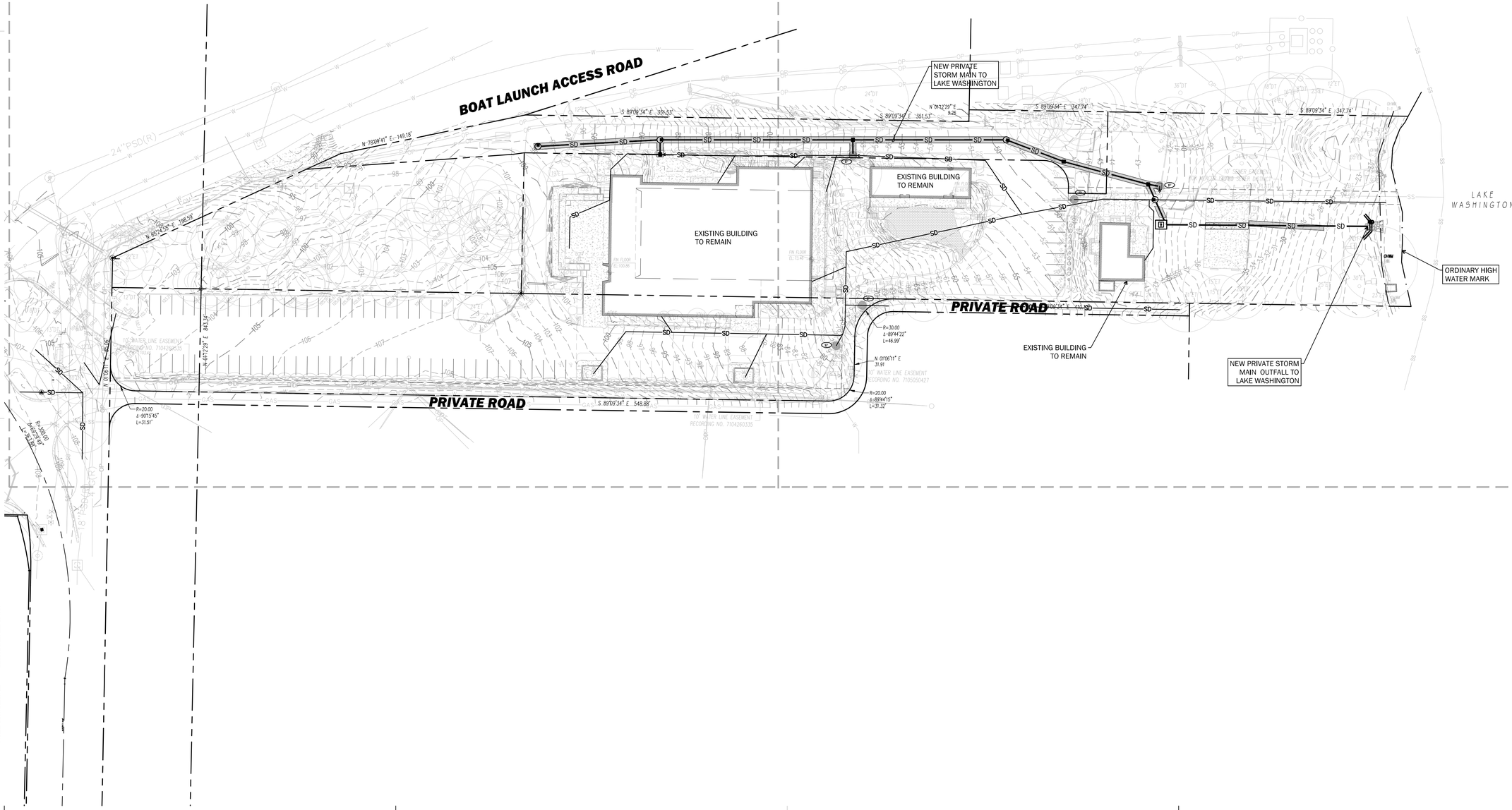
N

0 20 40 80
SCALE 1"=40'

Call before you Dig. 8-1-1
or 1-800-424-5555
UNDERGROUND SERVICE (USA)
811

C0.12

C0.13



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6/11/2025

3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

NO.	DATE	DESCRIPTION
		11 JUNE 2025 LOWER STORM BID SET

PROJECT:
OVERALL STORM REPAIR PLAN

C0.11

FOR REFERENCE ONLY

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0 10 20 40
SCALE 1"=20'

LEGEND

- PROPERTY LINE — N 79°33'06" E – 46.81'
- INLET PROTECTION — IP
- CONTOUR (INDEX) — 110
- CONTOUR — 109
- STORM DRAINAGE PIPE — SD
- FRENCH DRAIN
- CO/YD/CB/CB2/MH
- ASPHALT PAVEMENT

BOAT LAUNCH ACCESS ROAD

ACCESS ROAD

PRIVATE ROAD

E MERCER

NO ADDRESS
TAX NO. 0824059310

CATCH BASIN (TYPE 2)
RIM:86.41
IE(SW)12":81.27
IE(W)36"CMP: 78.91
IE(E)36"CMP: 72.49

CATCH BASIN (TYPE 1)
RIM:89.44
*UNABLE TO OPEN

N 78°09'41" E 149.18'

24"PSD(R)

4"G(R)

SD A7 CB TYPE II - 48"
RIM 87.53
IE 84.15 12"(IN)W
IE 82.31 12"(IN)S
IE 84.15 12"(OUT)E

ASPHALT TRENCHING FOR STORM REPAIR SEE DETAIL 4/D-3.7

S 89°09'34" E 351.53'

12 LF 12" SD @ 2.8%

153 LF 12" SD @ 18.2%

97 LF 12" SD @ 3.9%

CUT AND CAP EX SD

SD A6 CB TYPE II - 48"
RIM 87.89
IE 87.89 12"(OUT)E

RESTORE EX CONCRETE

SD A6A CB TYPE I
RIM 87.64
IE 82.64 (IN)W EX (ASSUMED)
IE 82.64 12"(OUT)N

POTHOLE TO DETERMINE EXISTING INVERT ELEVATION AND INTERCEPT EXISTING DOWNSPOUT TIGHTLINE AND CONNECT TO NEW CB

3650 E MERCER WAY
TAX NO. 1515600080

PARCEL A
NO ADDRESS
TAX NO. 0824059045

PARCEL C
3700 E MERCER WAY
TAX NO. 1515600010

PARCEL B
NO ADDRESS
TAX NO. 2107000010

NO ADDRESS
TAX NO. 210700TRCT

CATCH BASIN (TYPE 2)
RIM:102.57
IE(S)12":101.77

10' WATER LINE EASEMENT RECORDING NO. 7104260335

12"SD(R)

N 01°12'29" E 843.34'

CATCH BASIN (TYPE 2)
RIM:104.05
IE(NW)4"CPEP: 102.53
IE(S)18"CMP: 100.25
IE(N)24"CMP: 98.05

R=20.00
Δ=90°15'45"
L=31.51'

CH BASIN (TYPE 2)
M:105.64
MP: 95.24
MP: 94.34
S)36"CMP TAINABLE

R=30.00
Δ=89°44'15"
L=47.00'

S 89°09'34" E 548.88'

MATCHLINE - SEE SHEET C0.13

NOTE: CONTRACTOR TO LOCATE AND POTHOLE ALL EXISTING UTILITIES ALONG ENTIRE STORM SYSTEM REPAIR ROUTE PRIOR TO ANY STORM SYSTEM INSTALLATION

NOTE: CONTRACTOR TO INSTALL CB PROTECTION ON NEW STORM SYSTEM AS SOON AS FEASIBLE

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REGISTERED PROFESSIONAL ENGINEER
6/11/2025

3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

NO.	DATE	DESCRIPTION
	11 JUNE 2025	LOWER STORM BID SET

PROJECT:
STORM REPAIR PLAN

C0.12

FOR REFERENCE ONLY

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NOTE: CONTRACTOR TO LOCATE AND POTHOLE ALL EXISTING UTILITIES ALONG ENTIRE STORM SYSTEM REPAIR ROUTE PRIOR TO ANY STORM SYSTEM INSTALLATION

NOTE: CONTRACTOR TO INSTALL CB PROTECTION ON NEW STORM SYSTEM AS SOON AS FEASIBLE

NOTE: CONTRACTOR TO REMOVE ALL INVASIVE PLANTS AND METAL PIPE/VEHICLE AXLE ON THE SHORELINE. CONTRACTOR TO PROTECT PIECES OF WOOD ACCUMULATING AT THE WATER'S EDGE.

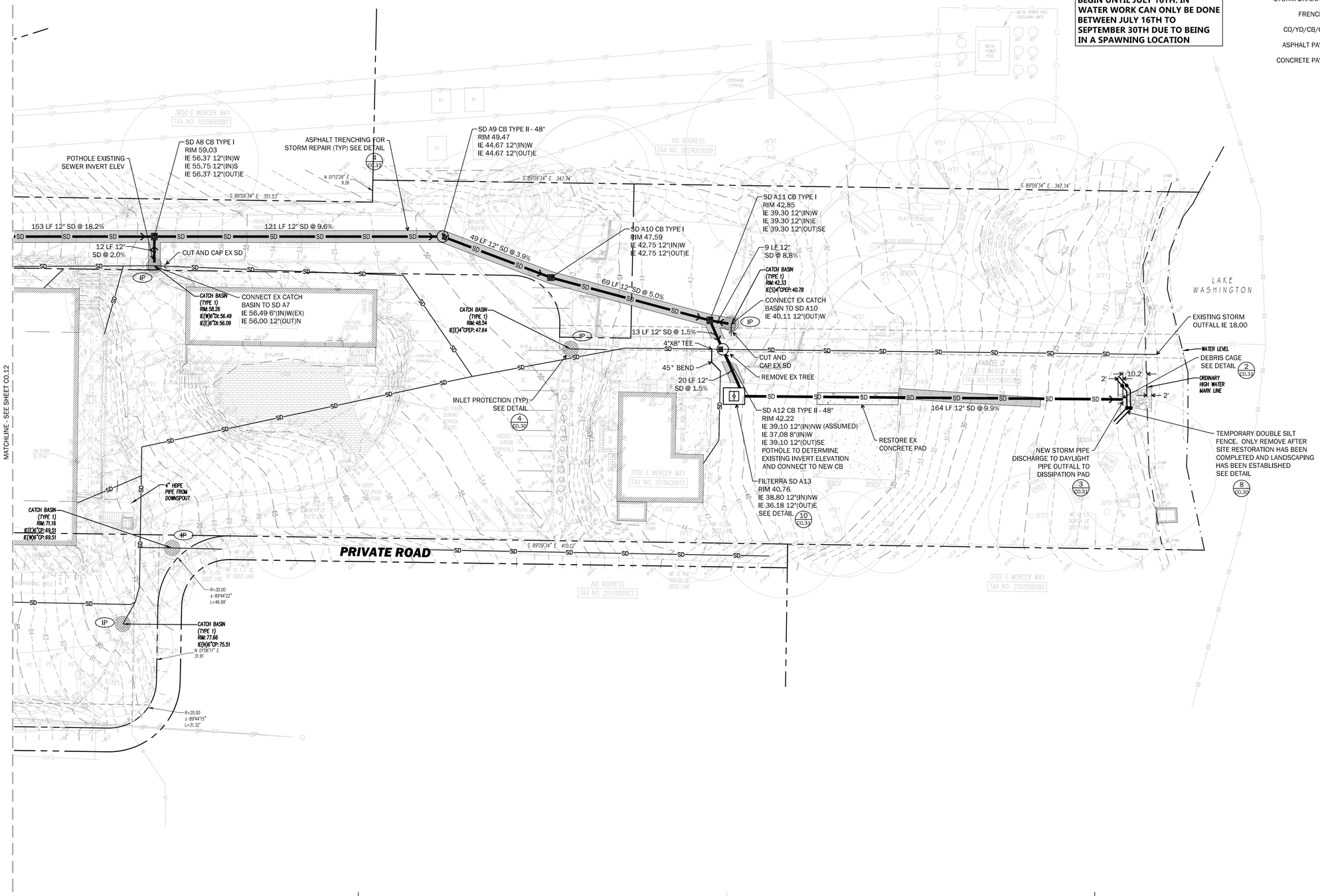
NOTE: WATER WORK SHALL NOT BEGIN UNTIL JULY 16TH. IN WATER WORK CAN ONLY BE DONE BETWEEN JULY 16TH TO SEPTEMBER 30TH DUE TO BEING IN A SPAWNING LOCATION

0 10 20 40
SCALE 1"=20'

Call before you Dig. 8-1-1 or 1-800-424-5555 UNDERGROUND SERVICE (USA)

LEGEND

- PROPERTY LINE — N 79°33'06" E – 46.81'
- (SF) SILT FENCE
- INLET PROTECTION (IP)
- CONTOUR (INDEX) — 110
- CONTOUR — 109
- STORM DRAINAGE PIPE — SD
- FRENCH DRAIN
- CO/YD/CB/CB2/MH
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT



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6/11/2025

3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

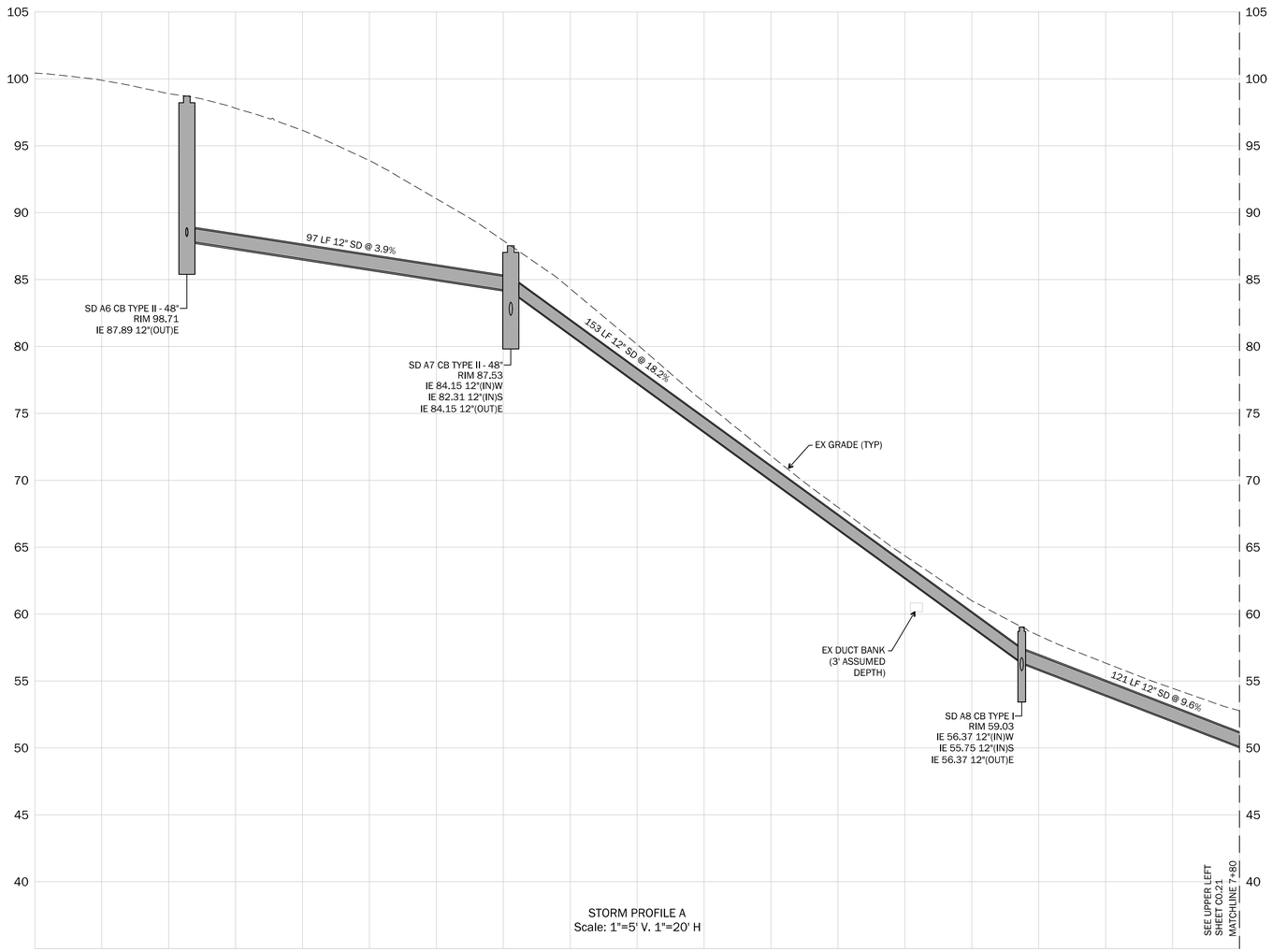
NO.	DATE	DESCRIPTION
		11 JUNE 2025 LOWER STORM BID SET

PROJECT:
STORM REPAIR PLAN

C0.13

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STORM PROFILE A
Scale: 1"=5' V. 1"=20' H

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3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

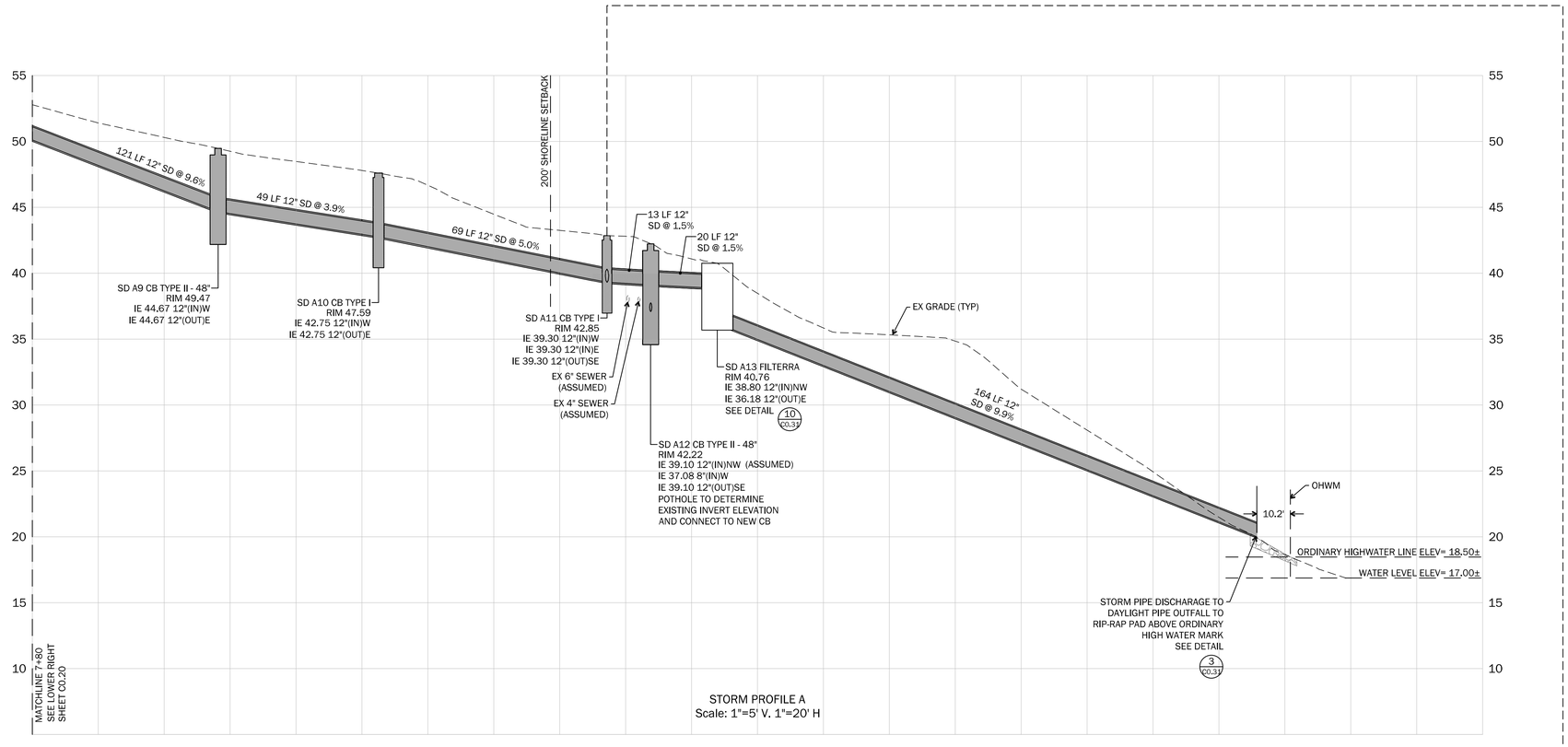
NO.	DATE	DESCRIPTION
		11 JUNE 2025
		LOWER STORM BID SET

PROJECT:
STORM REPAIR PROFILES

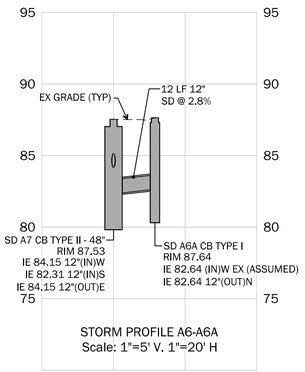
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FOR REFERENCE ONLY

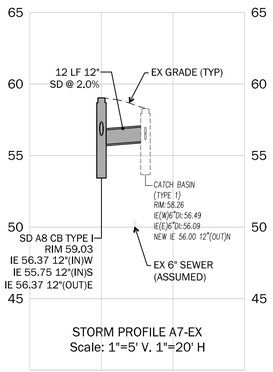
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© ANJALI GRANT DESIGN LLC ORIGINAL SHEET SIZE: 22" X 34"



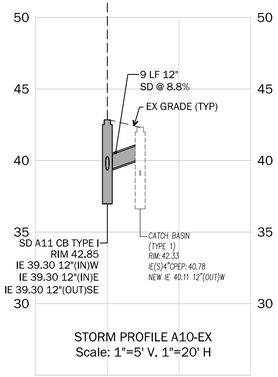
STORM PROFILE A
Scale: 1"=5' V. 1"=20' H



STORM PROFILE A6-A6A
Scale: 1"=5' V. 1"=20' H



STORM PROFILE A7-EX
Scale: 1"=5' V. 1"=20' H



STORM PROFILE A10-EX
Scale: 1"=5' V. 1"=20' H

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JEFFREY D. A. JACOBSON
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43667
REGISTERED PROFESSIONAL ENGINEER
6/11/2025

3700 EAST MERCER WAY
HERZL-NER-TAMID STORM SYSTEM REPAIR

NO.	DATE	DESCRIPTION
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PROJECT:
STORM REPAIR PROFILES

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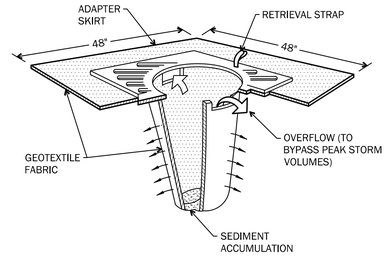
FOR REFERENCE ONLY

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NTS
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Not Used 3



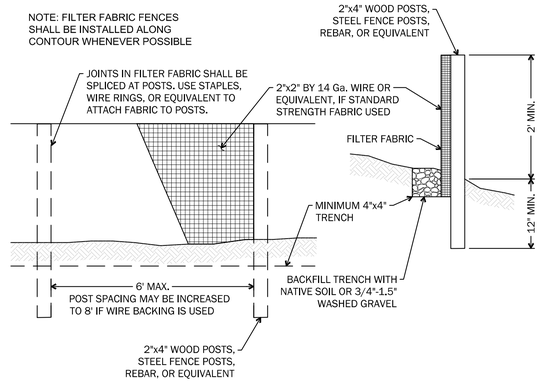
INLET PROTECTION NOTE:
FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACES WHEN 1/3 FULL.

NTS
Inlet Protection 4

NTS
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Not Used 6

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HERZL-NER-TAMID STORM SYSTEM REPAIR

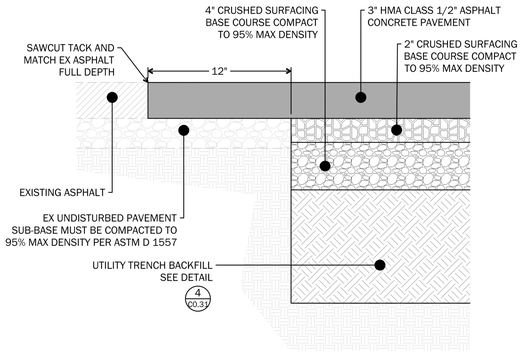
NO.	DATE	DESCRIPTION
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PROJECT:
STORM REPAIR DETAILS

C0.30

FOR REFERENCE ONLY

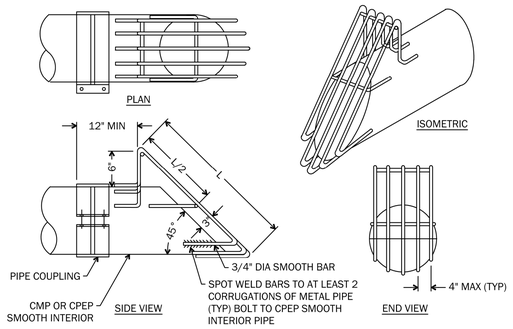
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NOTES:

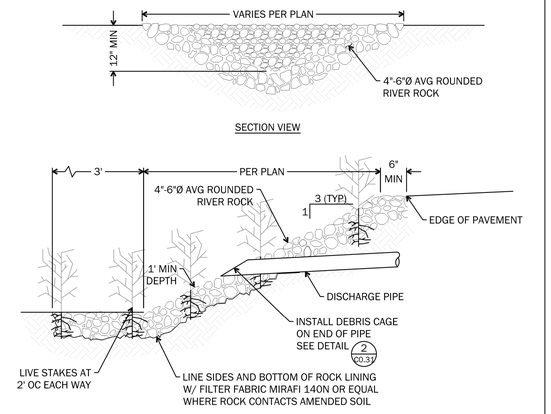
1. ASPHALT PAVEMENT SHALL BE PLACED IN (2) LIFTS. FINAL LIFT SHALL BE CONSTRUCTED WITH THE OVERLAY OF THE EXISTING ASPHALT ONLY AFTER BUILDING IMPROVEMENTS ARE COMPLETE

NTS **Heavy Asphalt** 1



NOTE:
1. THIS DEBRIS BARRIER IS FOR USE OUTSIDE ROADWAYS ON PIPES 36" DIA. AND SMALLER
2. ALL STEEL PARTS MUST BE GALVANIZED AND ASPHALT COATED. (TREATMENT 1 OR BETTER).
3. CPEP-SMOOTH INTERIOR PIPE REQUIRES BOLTS TO SECURE DEBRIS BARRIER TO PIPE.

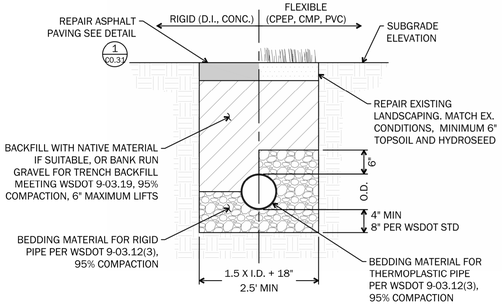
NTS **Debris Cage** 2



NOTE:

1. PLANT LIVE STAKES (RED OSIER DOGWOOD) AT LEAST ONE-HALF INCH IN DIAMETER AND AT LEAST ONE FEET DEEP IN DISSIPATION PAD PLACED 2' OC
2. TOTAL ROUNDED ROCK REQUIRED FOR OUTFALL: 5 CY

NTS **Dissipation Pad** 3



NOTE:

BACKFILL MATERIAL SHALL NOT HAVE PARTICLE SIZE GREATER THAN 1" WITHIN 6" OF THE PIPE OR THE CONTRACTOR HAS THE OPTION TO USE GRAVEL BACKFILL PIPE ZONE BEDDING CONFORMING TO WSDOT 9-03.12(3)

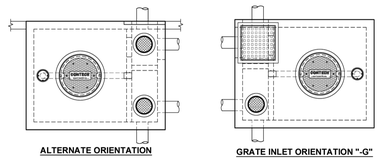
NTS **Pipe Bedding and Backfill** 4

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING UPON OUTLET LOCATION

FTPD-UGS CONFIGURATION
(OPTIONS: THROAT INLET "-T", PIPE INLET "-P", GRATE INLET "-G", THROAT & PIPE INLET "-TP", GRATE & PIPE INLET "-GP", ALTERNATE HATCH "-H")

MODEL NAME	PART NUMBER	SHALLOW CONFIG AVAILABILITY	MEDIA AREA (SF)	MEDIA BAY SIZE	VAULT SIZE (W x L)	WEIR / CURB LENGTH	ACCESS CONFIG IN-OUT BAY / MEDIA BAY†	GRATE SIZE WITH "-G" CONFIG
FTPD-UGS 4x4 (4x6 VAULT)	FTPD0404-UGS	ALL	16	4 x 4	4 x 6	1'-8"	(2) Ø12" / Ø30" & Ø7"	12"
FTPD-UGS 4x6 (4x8 VAULT)	FTPD0406-UGS	ALL (EXCEPT DE, MD, NJ, PA, VA, WV)	24	4 x 6	4 x 8	1'-8"	(2) Ø12" / Ø30" & Ø7"	12"
FTPD-UGS 6x4 (6x6 VAULT)	FTPD0604-UGS	ALL (EXCEPT CA, TX)	24	6 x 4	6 x 6	1'-8"	(2) Ø12" / Ø30" & Ø7"	24"
FTPD-UGS 4.5X5.8 (4.5x7.8 VAULT)	FTPD045058-UGS	DE, MD, NJ, PA, VA, WV ONLY	26	4.5 x 5.83	4.5 x 7.83	1'-8"	(2) Ø12" / Ø30" & Ø7"	24"
FTPD-UGS 6x6 (6x8 VAULT)	FTPD0606-UGS	ALL	36	6 x 6	6 x 8	1'-8"	(2) Ø12" / Ø30" & Ø7"	24"
FTPD-UGS 6x8 (6x10 VAULT)	FTPD0608-UGS	ALL (EXCEPT CA, TX)	48	6 x 8	6 x 10	1'-8"	(2) Ø12" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 8x7 (8x10 VAULT)	FTPD0807-UGS	ALL (EXCEPT OR, WA)	56	8 x 7	8 x 10	2'-6"	(2) Ø24" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 6x10 (6x12 VAULT)	FTPD0610-UGS	ALL (EXCEPT CA, TX)	60	6 x 10	6 x 12	1'-8"	(2) Ø12" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 7x10 (7x13 VAULT)	FTPD0710-UGS	ALL (EXCEPT CA, TX)	70	7 x 10	7 x 13	2'-6"	(2) Ø12" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 8x9 (8x12 VAULT)	FTPD0809-UGS	ALL (EXCEPT OR, WA)	72	8 x 9	8 x 12	2'-6"	(2) Ø24" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 8x10.5 (8x14 VAULT)	FTPD08105-UGS	ALL	84	8 x 10.5	8 x 14	3'-0"	(2) Ø24" / 3'x3' HATCH & Ø7"	24"
FTPD-UGS 8x12.5 (8x16 VAULT)	FTPD08125-UGS	ALL (EXCEPT OR, WA)	100	8 x 12.5	8 x 16	3'-0"	(2) Ø24" / (2) 3'x3' HATCH & Ø7"	24"
FTPD-UGS 9x11.5 (9x15 VAULT)	FTPD09115-UGS	OR, WA ONLY	103	9 x 11.5	9 x 15	3'-0"	(2) Ø24" / (2) 3'x3' HATCH & Ø7"	24"

SITE SPECIFIC ANALYSIS IS REQUIRED TO DETERMINE BYPASS CAPACITY.
† IF REQUIRED BY LOCAL JURISDICTION, ON SIZES WITHOUT A HATCH AS STANDARD, ACCESS OVER THE MEDIA BAY MAY BE ALTERNATED WITH A 36"x36" HATCH FOR AN ADDITIONAL CHARGE.



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FILTERRA PEAK DIVERSION - UNDERGROUND SHALLOW (FTPD-UGS)
6'-6" OR LESS RIM TO OUTLET
CONFIGURATION DETAIL

filterra
FOR OUTLET INFORMATION, SEE FILTERRA PEAK DIVERSION

NTS **Filterra Vault** 10

NOTES:

1. CATCH BASINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M 199 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE WSDOT/APWA STANDARD SPECIFICATIONS.
2. AS AN ACCEPTABLE ALTERNATIVE TO REBAR, WELDED WIRE FABRIC HAVING A MIN. AREA OF 0.12 SQ. IN. PER FT. MAY BE USED. WELDED WIRE FABRIC SHALL COMPLY TO ASTM A497 (AASHTO M 221). WIRE FABRIC SHALL NOT BE PLACED IN KNOCKOUTS.
3. ALL REINFORCED CAST-IN-PLACE CONCRETE SHALL BE CLASS 4000.
4. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2 IN. MIN. ALL PIPE SHALL BE INSTALLED IN FACTORY PROVIDED KNOCKOUTS. UNUSED KNOCKOUTS NEED NOT BE GROUTED IF WALL IS LEFT INTACT.
5. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAM. PLUS CATCH BASIN WALL THICKNESS.
6. ROUND KNOCKOUTS MAY BE ON ALL 4 SIDES, WITH MAX. DIAM. OF 20 IN. KNOCKOUTS MAY BE EITHER ROUND OR "D" SHAPE.
7. THE MAX. DEPTH FROM THE FINISHED GRADE TO THE PIPE INVERT IS 5 FT.
8. THE TAPER ON THE SIDES OF THE PRECAST BASE SECTION AND RISER SECTION SHALL NOT EXCEED 1/2" PER FT.
9. CATCH BASIN FRAME AND GRATE SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS AND MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621E. MATING SURFACES SHALL BE FINISHED TO ASSURE NON-ROCKING FIT WITH ANY COVER POSITION.
10. FRAME AND GRATE MAY BE INSTALLED WITH FLANGE DOWN OR CAST INTO RISER.
11. FOR CATCH BASINS IN PARKING LOTS REFER TO WSDOT/APWA STANDARD DWG. B-5.60-01.
12. EDGE OF RISER OR BRICK SHALL NOT BE MORE THAN 2 IN. FROM VERTICAL EDGE OF CATCH BASIN WALL.
13. SEE THE WSDOT/APWA STANDARD SPECIFICATIONS SECTION 9-05.15 FOR METAL CASTINGS REQUIREMENTS.

NTS **Type I Catch Basin** 11

NOTES:

1. CATCH BASINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M 199 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE WSDOT/APWA STANDARD SPECIFICATIONS.
2. HANDHOLDS IN ADJUSTMENT SECTION SHALL HAVE 3" MIN. CLEARANCE. STEPS IN CATCH BASIN SHALL HAVE 6" MIN. CLEARANCE. SEE FIG. 7-006, CATCH BASIN DETAILS. HANDHOLDS SHALL BE PLACED IN ALTERNATING GRADE RINGS OR LEVELING BRICK COURSE WITH A MIN. OF ONE HANDHOLD BETWEEN THE LAST STEP AND TOP OF THE MANHOLE.
3. ALL REINFORCED CAST-IN-PLACE CONCRETE SHALL BE CLASS 4000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
4. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE WALL THICKNESS OF 2 IN. MIN. UNUSED KNOCKOUTS NEED NOT BE GROUTED IF WALL IS LEFT INTACT. PIPES SHALL BE INSTALLED ONLY IN FACTORY KNOCKOUTS UNLESS OTHERWISE APPROVED BY THE ENGINEER.
5. KNOCKOUT OR CUTOUT HOLE SIZE SHALL EQUAL PIPE OUTER DIAM. PLUS CATCH BASIN WALL THICKNESS. MAX. HOLE SIZE SHALL BE 36 IN. FOR 48 IN. CATCH BASIN, 42 IN. FOR 54 IN. C.B., 48 IN. FOR 60 IN. C.B., 60 IN. FOR 72 IN. C.B., 84 IN. FOR 96 IN. C.B. MIN. DISTANCE BETWEEN HOLES SHALL BE 8 IN. FOR 48 IN., 54 IN,, AND 60 IN. C.B.; 12 IN. FOR 72 IN. AND 96 IN. C.B.
6. CATCH BASIN FRAMES AND GRATES OR COVERS SHALL BE IN ACCORDANCE WITH SEC. 7.05 AND MEET THE STRENGTH REQUIREMENTS OF FEDERAL SPECIFICATION RR-F-621E. MATING SURFACES SHALL BE FINISHED TO ASSURE NON-ROCKING FIT WITH ANY COVER POSITION.
7. ALL BASE REINFORCING STEEL SHALL HAVE A MIN. YIELD STRENGTH OF 60,000 PSI AND BE PLACED IN THE UPPER HALF OF THE BASE WITH 1 IN. MIN. CLEARANCE.
8. MIN. SOIL BEARING VALUE SHALL EQUAL 3,300 POUNDS PER SQUARE FOOT.
9. FOR DETAILS SHOWING LADDER, STEPS, HANDRAILS AND TOP SLABS. SEE FIG. 7-006.
10. SEE THE WSDOT/APWA STANDARD SPECIFICATIONS SEC. 7-05.3 FOR JOINT REQUIREMENTS.
11. SEE THE WSDOT/APWA STANDARD SPECIFICATIONS SECTION 9-05.15 FOR METAL CASTINGS REQUIREMENTS.

NTS **Type II Catch Basin** 12

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HERZL-NER-TAMID STORM SYSTEM REPAIR

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STORM REPAIR DETAILS

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