WILSON COMMERCIAL BUILDING

PRELIMINARY DRAINAGE REPORT (PDR)

OCTOBER 2022

RB Engineering

DESIGN → PERMIT → MANAGE

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Project Engineer

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Reference:	2019 WSDOE Stormwater Manual

Project Engineers Certification

"I hereby certify that this Drainage and Erosion Control Plan for **Wilson Commercial Building** has been prepared by me or under my supervision and meets minimum standards the **Stormwater Management Manual for Western Washington** and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me."

Project Engineers Stamp

SECTION 1 – PROJECT OVERVIEW

Permit Requested:	Drainage and Grading
Other Permits Required:	Building Permit, SEPA Checklist Grading/Earthwork Permit
Agency Permit No.:	Pending
Site Address:	2510 & 2520 Kresky Avenue NE Chehalis, WA 98532
Total Site Area:	2.21 Acres
Zoning:	CG – General Commercial
WaterShed:	WRIA 23 – Upper Chehalis https://waecy.maps.arcgis.com/apps/webappviewer/index.html?id=996e6b21ae394cc3a3b63c6da0c3aa0a

Project Overall Description

The proposal is to combine two lots (1.33 acres and 0.87 acres) into a single 2.21-acre lot. The project will consist of a new 11,700 sf professional office building with associated driveways and parking areas. The project will also provide frontage improvements along Kresky Avenue and Hampe Way, consisting of curb, gutter, and sidewalk.

Proposed Flow Control Improvements

The flow control facilities proposed for this project were designed and modeled using the latest edition of the Western Washington Hydrology Manual Continuous Simulation Program. The site will utilize a detention pond for the developments Threshold Discharge Areas (TDA).

Proposed Water Quality Improvements

The water quality improvements for the project site runoff consist of a Bio-filtration Swale for the developments Threshold Discharge Areas (TDA).

Proposed Conveyance System

The proposed conveyance systems will consist of concrete catch basins and conveyance pipe in various sizes to collect and convey stormwater to the proposed bio-swale and flow control pond. The pond will outlet through a control structure into the existing drainage path ultimately leading to the adjacent wetlands. The proposed conveyance system will be sized to accommodate a minimum of the 25-year storm event.

Proposed Discharge Location

The project site will discharge runoff from the developed areas to the existing wetlands on the western end of the proposed site which eventually reach Salzer Creek and ultimately the Chehalis River.

Downstream Condition

The natural drainage leaves the site at the western property line and drains to the adjacent wetland eventually reaching Salzer Creek and ultimately the Chehalis River.

Onsite Soils and Geology

An onsite soils report was completed for this project site. A copy of that report in included in Appendix 3 of this report.

NRCS Soil Survey

RBE staff reviewed the onsite soils information provided by NRCS. Appendix 3 includes copies of the site map and soil descriptions that make up the property geology. In addition to the NRCS information,

Hydrologic Soil Group: Melbourne Loam – Class C Soils

Project Topography

Based on the site topography, the project site has flat to steep slopes, with a steepest slope of about 70% in the southwest corner.

Land Use and Ground Cover

The existing land use is commercial, with temporary gravel parking built on a previously filled portion of the site.

Natural Drainage Patterns

The site has natural drainage to the west where it enters a wetland near the property's western line eventually reach Salzer Creek and ultimately the Chehalis River.

Tributary and Discharge Points of Flow

The site has no tributary points of flow; however, it currently takes a portion of the roadway runoff from Kresky Avenue.

Historical Drainage Problems

There are no know drainage problems associated with the project site.

Existing Utilities (Storm, Sewer, Water)

The existing utilities available to the site include sanitary sewer, water, gas, power and phone services.

Erosion Potential

The site has a **medium** erosion potential based on the NRCS Soil Survey. As part of the development plans a detailed Erosion Control Plan and Storm Water Pollution Prevention Plan will be prepared for use during site construction to minimize erosion and migration of sediment within and off the site. A NPDES Stormwater Construction Permit **is** required by WSDOE for this project.

Critical Areas Onsite

The site **is not** located within a Critical Aquifer Recharge Area (CARA).

Existing Fuel Storage Tanks

Review of the onsite parcels resulted in no evidence of existing fuel storage tanks above or below ground for this property.

Groundwater Wells

The property does not include any onsite ground water wells.

Septic Systems

The site does not include any onsite septic systems.

Wellhead Protection Area

The site **is not** within any wellhead protection areas.

100-Year Flood Plain

The site **is** partially within the 100-year flood plain.

Section 2 – APPLICABLE MINIMUM REQUIREMENTS

Manual Exemptions

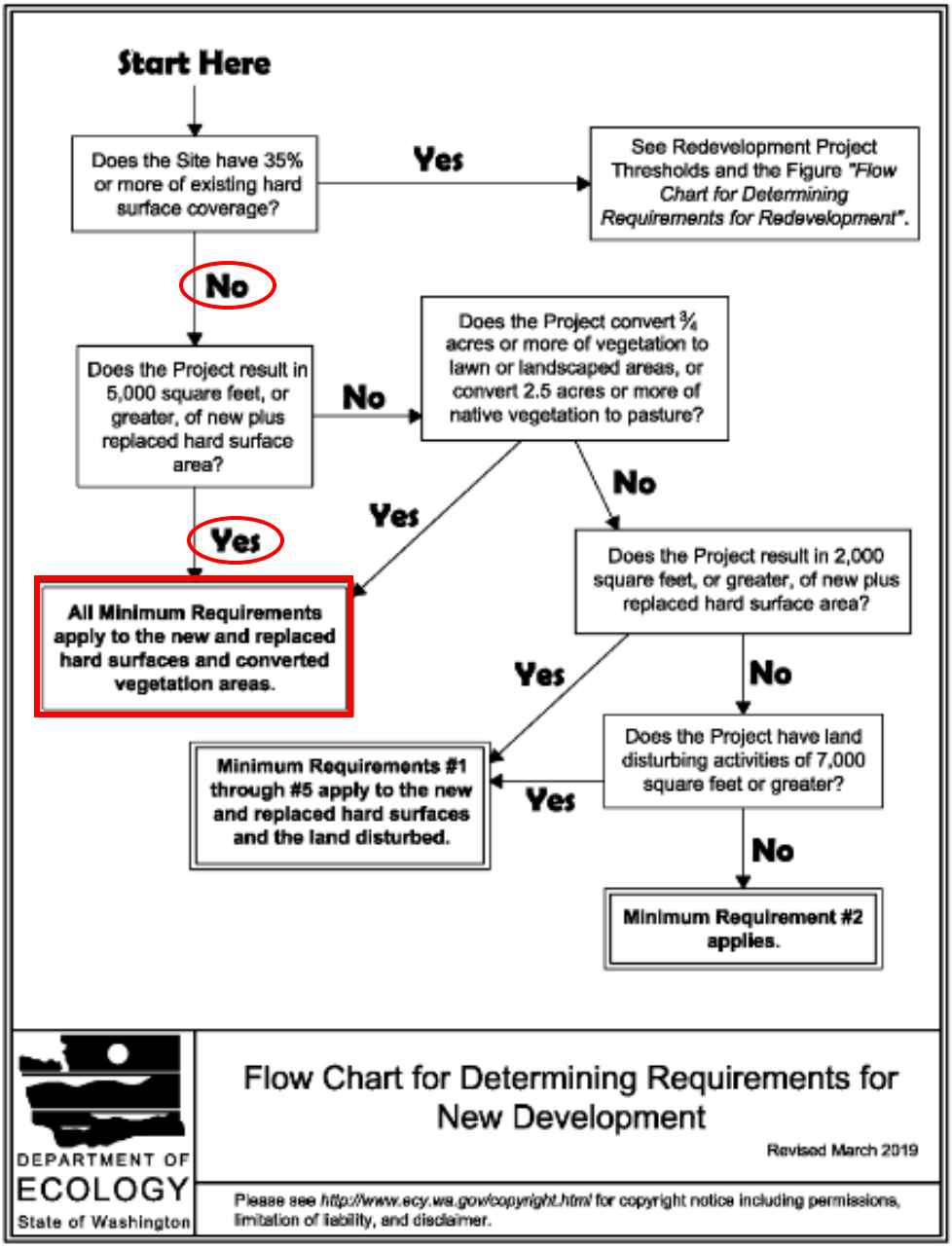
Exemptions	Applicable to Project
Forest Practices (Title 222 WAC)	No
Commercial Agriculture	No
Oil & Gas Field Activities or Operations	No
Pavement Maintenance	No
Underground Utility Projects	No

New Development and Re-Development Review

The minimum requirements for stormwater development and redevelopment sites are listed in Volume I of the 2019 SMMWW. Not all minimum requirements of this section apply to all projects. Determination of applicable minimum requirements is also based in part on Section 1-3 of the Manual. See detailed area calculations in Section 5 of this report.

Applicable Criteria	Areas
Total Site Area	2.21 AC
Existing Site Impervious Coverage	0 AC
New Plus Replaced Impervious Surface	0.93 AC
Vegetation Area Converted to Lawn or Landscaped Area	1.24 AC
Land Disturbing Area	2.17 AC
Percent of Existing Impervious Surface	0 %

Figure I-3.1: Flow Chart for Determining Requirements for New Development



Section 2.1 – Minimum Requirements

Based on the thresholds given in Figures 1-3.1 and/or 1-3.2 of Volume I of the Manual, the proposed project must address or comment on **Minimum Requirements #1 through #9**. These requirements as they apply to the project are discussed in more detail below.

Minimum Requirement (MR) #1 – Stormwater Site Plans:

> All projects meeting the thresholds in I-3.3 Applicability of the Minimum Requirements shall prepare a Stormwater Site Plan for local government review. Stormwater Site Plans shall use site-appropriate development principles, as required and encouraged by local development codes, to retain native vegetation and minimize impervious surfaces to the extent feasible. Stormwater Site Plans shall be prepared in accordance with III-3 Stormwater Site Plans

The proposed project will create over 5,000 square feet of new impervious surfacing, and therefore a Stormwater Site Plan complying with minimum requirements #1 through #9 is required.

MR #2 – Construction Storm Water Pollution Prevention Plan:

> All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters.
>
> Projects which result in 2,000 square feet or more of new plus replaced hard surface area, or which disturb 7,000 square feet or more of land must prepare a Construction Stormwater Pollution Prevention Plan (SWPPP) as part of the Stormwater Site Plan (see I-3.4.1 MR1: Preparation of Stormwater Site Plans).
>
> Projects below those thresholds (listed above) are not required to prepare a Construction SWPPP, but must consider all of the Construction SWPPP Elements (listed below) and develop controls for all Construction SWPPP Elements that pertain to the project site.

The proposed project exceeds the thresholds of Section 2.5 and therefore a Construction Storm Water Pollution Prevention Plan is required for this project. The site **does** disturb more than 1 acre of land and discharges to waters of the state. Therefore, a NPDES stormwater construction permit **is** required. A SWPPP has been created as a standalone document for this project and included in Appendix 5 of this TIR.

MR #3 – Source Control of Pollution:

> All known, available and reasonable Source Control BMPs must be applied to all projects. Source Control BMPs must be selected, designed, and maintained in accordance with this Manual.

All known, available and reasonable source control BMPs shall be applied to the project to limit pollutants encountering stormwater. The Source Control BMPs for this project will be incorporated into the project's Final Operation and Maintenance Plan.

MR #4 – Preservation of Natural Drainage Systems/Outfalls:

Natural drainage patterns shall be maintained, and discharges from the Project Site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the Project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.

Proposed stormwater discharges from the project site shall be treated and detained and then released to the original natural drainage location. The natural site drainage outfall will be maintained but will have a reduced flow due to the onsite drainage design facility.

MR #5 – On-Site Stormwater Management:

Projects shall employ Stormwater Management BMPs in accordance with the following thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on site to the extent feasible without causing flooding or erosion impacts.

All projects that require Minimum Requirement #5 (as detailed in I-3.3 Applicability of the Minimum Requirements) must employ Stormwater Management BMPs as detailed below. The compliance options for the project depend on the amount of improvements proposed, the locationof the project, the size of the parcel the project is on, and whether or not the project is Flow Control exempt.

Note that the site may contain multiple parcels. The designer may choose different compliance methods for different parcels, depending on the proposed design and the options for each parcel as detailed below.

Projects that Trigger Only Minimum Requirements #1 - #5
Projects that are not Flow Control exempt that trigger only Minimum Requirements #1 through #5 (per I-3.3 Applicability of the Minimum Requirements) shall either:

Use the LID BMPs from List #1 for all surfaces within each type of surface in List #1; or
Use any Flow Control BMP(s) desired to achieve the LID Performance Standard, and apply BM P T5.13: Post-Construction Soil Quality and Depth.

Projects that Trigger Minimum Requirements #1 - #9
Projects that are not Flow Control exempt that trigger Minimum Requirements #1 through #9 (per I-3.3 Applicability of the Minimum Requirements) have the compliance options shown in Table I-3.1: Minimum Requirement #5 Compliance Options for Projects Triggering Minimum Requirements #1 - #9.

Projects triggering Minimum Requirements #1 through #9, must meet the requirements in Table I-3.1.

Table I-3.1: Minimum Requirement #5 Compliance Options for Projects Triggering Minimum Requirements #1 - #9

Project Location and Parcel Size	Minimum Requirement #5 Compliance Options
Projects inside the UGA, on any size parcel	• Use the LID BMPs from List #2 for all surfaces within each type of surface in List #2; or • Use any Flow Control BMPs desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.
Projects outside the UGA, on a parcel smaller than 5 acres	
Projects outside the UGA, on a parcel 5 acres or larger	Use any Flow Control BMPs desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.
Note: This text refers to the Urban Growth Area (UGA) as designated under the Growth Management Act (GMA) (Chapter 36.70A RCW) of the State of Washington. If the project is located in a county that is not subject to planning under the GMA, the city limits shall be used instead.	

Flow Control Exempt Projects

Projects qualifying as Flow Control exempt in accordance with the TDA Exemption in I-3.4.7 MR7: Flow Control shall either:

- Use the LID BMPs from List #3 for all surfaces within each type of surface in List #3;

  or

- Use any Flow Control BMP(s) desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.

If the project has multiple TDAs, all TDAs must be Flow Control exempt per the TDA Exemption in I-3.4.7 MR7: Flow Control for the project to use the options listed here.

The text in this box originates from one or more of the following Permits:
Appendix 1 of the Phase I / Phase II Municipal Stormwater Permits
Construction Stormwater General Permit

Figure I-3.3: Flow Chart for Determining MR #5 Requirements

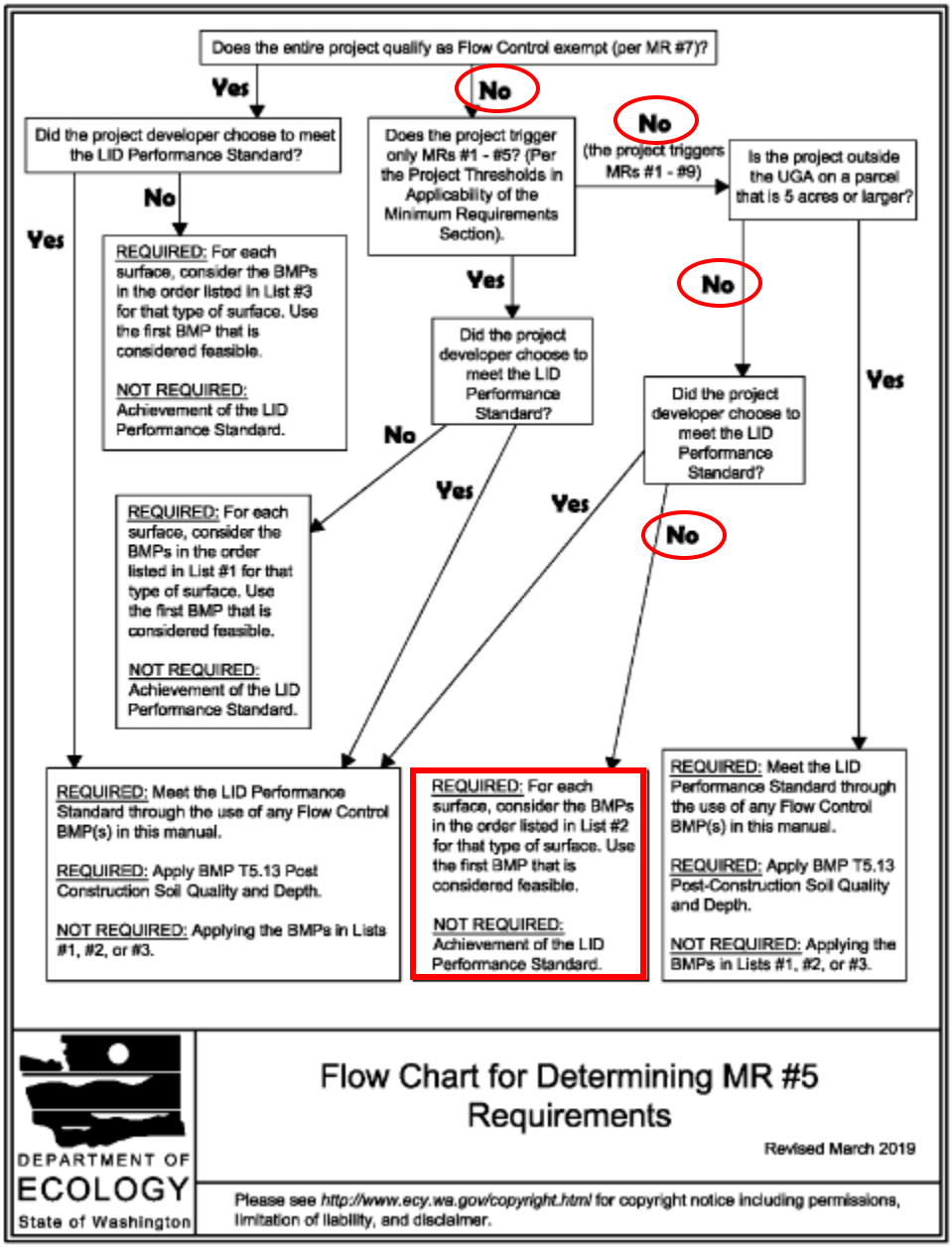


Table I-3.2: The List Approach for MR5 Compliance

List #1 (For MR #1 - #5 Projects That Are Not Flow Control Exempt)	List #2 (For MR #1 - #9 Projects That Are Not Flow Control Exempt)	List #3 (For Flow Control Exempt Projects)
Surface Type: Lawn and Landscaped Areas		
BMP T5.13: Post-Construction Soil Quality and Depth	BMP T5.13: Post-Construction Soil Quality and Depth	BMP T5.13: Post-Construction Soil Quality and Depth
	Surface Type: Roofs	
1. BMP T5.30: Full Dispersion or BMP T5.10A: Downspout Full Infiltration	1. BMP T5.30: Full Dispersion or BMP T5.10A: Downspout Full Infiltration	1. BMP T5.10A: Downspout Full Infiltration
2. BMP T5.14: Rain Gardens or BMP T7.30: Bioretention	2. BMP T7.30: Bioretention	2. BMP T5.10B: Downspout Dispersion Systems
3. BMP T5.10B: Downspout Dispersion Systems	3. BMP T5.10B: Downspout Dispersion Systems	3. BMP T5.10C: Perforated Stub-out Connections
4. BMP T5.10C: Perforated Stub-out Connections	4. BMP T5.10C: Perforated Stub-out Connections	
	Surface Type: Other Hard Surfaces	
1. BMP T5.30: Full Dispersion	1. BMP T5.30: Full Dispersion	
2. BMP T5.15: Permeable Pavements or BMP T5.14: Rain Gardens or BMP T7.30: Bioretention	2. BMP T5.15: Permeable Pavements	BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion
3. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion	3. BMP T7.30: Bioretention	
	4. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion	

Table I-3.2: The List Approach for MR5 Compliance (continued)

List #1 (For MR #1 - #5 Projects That Are Not Flow Control Exempt)	List #2 (For MR #1 - #9 Projects That Are Not Flow Control Exempt)	List #3 (For Flow Control Exempt Projects)
ing to it. 2. When the designer encounters BMP T5.15: Permeable Pavements in the List Approach, it is not a requirement to pave these surfaces. Where pavement is proposed, it must be permeable to the extent feasible unless BMP T5.30: Full Dispersion is employed.		

Low Impact Development Performance Standard:

The project **has not** chosen to utilize the LID performance standards for this project. The project will match the pre-developed durations for 50% for the 2-year peak flow up to the full 50-year flow. See MR# 6 and 7 for BMP's utilized for treatment and flow control.

List #2: Onsite Stormwater Management BMPs for Projects Triggering Minimum Requirements #1 through #9

Lawn and landscape Runoff:

Post construction soil quality BMP T5.13 will be used for disturbed landscape areas.

Roof Runoff:

Where roof downspout controls are planned, the following types must be considered in descending order of preference.

1) **Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 in Chapter 3 of Volume III**

   Full Dispersion per BMP T5.30 is not feasible due to limited site area.

   BMP T5.10A is not feasible due to poorly infiltrating soils.

2) **Bio-retention (See Chapter 7 of Volume V) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface are drainage to it.**

   A Bio-Retention BMP is not feasible due to poorly infiltration soils.

3) **Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 in Chapter 3 of Volume III**

   BMP T5.10B is not feasible due to limited site area.

4) **Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3 in Chapter 3 of Volume III**

   BMP T5.10C is not feasible due to poorly infiltration soils.

Other Hard Surfaces:

1) **Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V.**

   Full Dispersion per BMP T5.30 is not feasible due to limited site area.

2) **Permeable pavement in accordance with BMP T5.15 in chapter 5 of Volume V.**

   BMP T5.15 is not feasible due to poorly infiltrating soils.

3) **Bioretention BMP's (See chapter 7, Volume V of the SMMWW) that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.**

   The Bio-retention facility is not feasible due to poorly infiltrating soils.

4) **Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 6 of Volume V.**

   Sheet flow and concentrated flow dispersion are not feasible due to limited site area.

MR #6 – Runoff Treatment:

Projects shall employ Runoff Treatment BMPs in accordance with the following thresholds, standards, and requirements to remove pollutants from stormwater runoff.

The following require construction of stormwater treatment facilities:

1) **Projects in which the total of, pollution-generating hard surface (PGHS) is 5,000 square feet or more in a threshold discharge area of the project, or**

   The proposed project **will** develop more than 5,000 square feet of openly exposed pollution generating impervious surface and therefore meets the threshold requirements of this section. See Chapter 5.2 for selected water quality treatment method.

Determine the Receiving Waters/Pollutants of Concern Based on Offsite Analyses

Pollutants of Concern

Step 2: Oil Control Facility

This project will require oil control facility based on the analysis below.

Oil Control Determination Chart	
ADT 100 Vehicles or Greater per 1000 SF Building Area	Yes or **No**
Site Subject to Petroleum Storage or Transfer Greater than 1500 Gallons per year.	Yes or **No**
Site have Parking, Storage or maintenance of 25 or more vehicles over 25 Tons gross weight. (Trucks, Buses, Trains, Heavy Equipment)	Yes or **No**
Road Intersection with measured ADT of 25000 vehicles or more on main roadway and 15000 vehicles or more on intersection roadway.	Yes or **No**

Step 3: Is Infiltration Practicable for pollutant removal?

No

Step 4: Phosphorus Control Required

Phosphorus Control Determination Chart	
Local Government Require Phosphorus control	**No**

Step 5: Enhanced Treatment Required

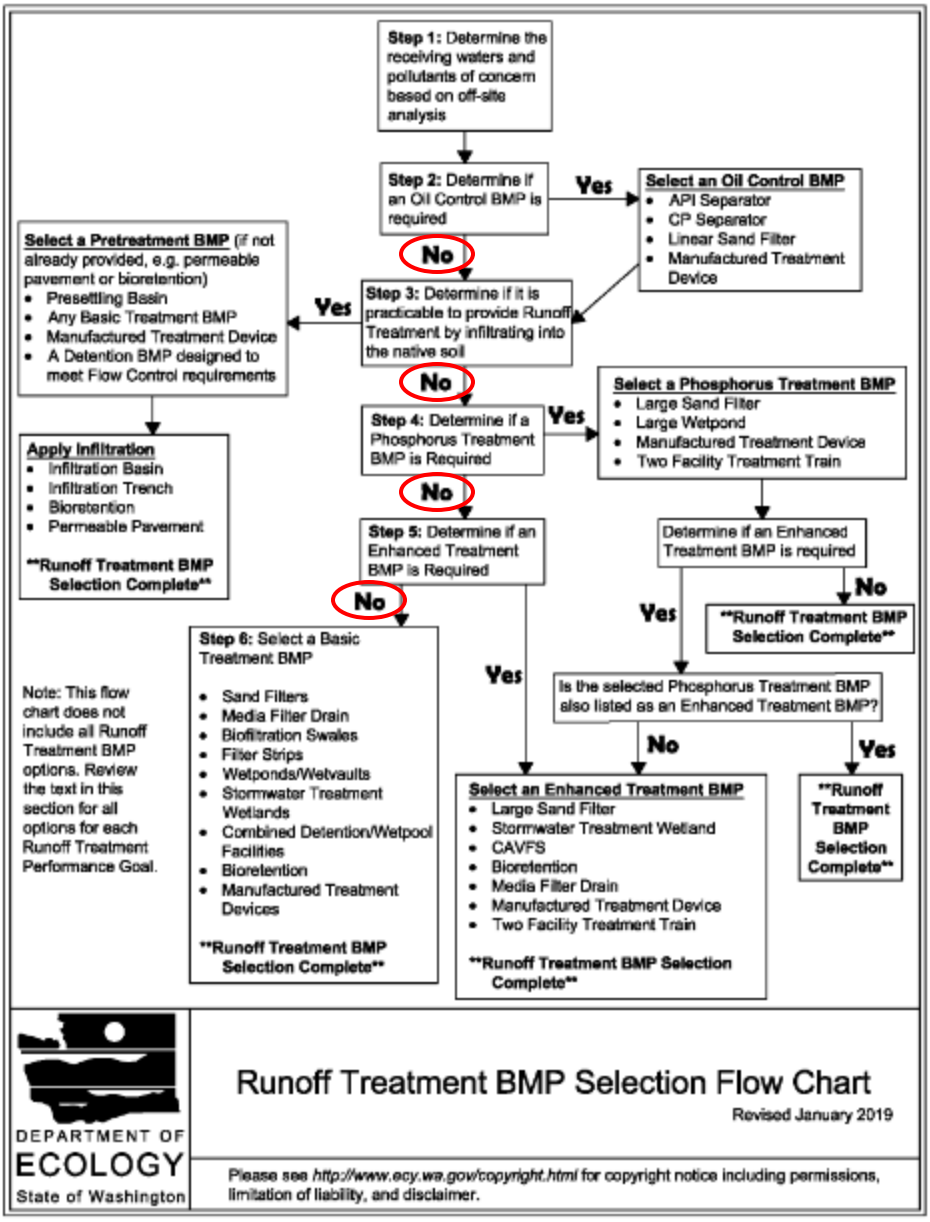
Oil Control Determination Chart	
Site discharge directly to fresh waters or conveyance systems tributary to fresh waters?	**No**
Site uses infiltration strictly for flow control and the discharge is within 1.4 mile of fresh water designate for aquatic life?	**No**

Site an industrial project site?	**No**
Site a commercial project site?	**Yes**
Site a multi-family residential project site	**No**
UGA – Fully controlled and partially controlled limited access highways with AADT 15000 or greater	No
UGA - All other roads with and AADT of 7500 or greater.	No
Outside UGA - Roads with and AADT of 15,000 or greater unless discharging to a Strahler order Stream or large	No
Outside UGA - Road with an AADT of 30,000 or greater if discharging to a 4th Strahler order stream or larger.	No

Step 6: Select Basic/Enhanced Treatment Facility

Based on the above determinations, the treatment BMP's selected for this project were determined from figure III-1.1 on the following page.

Figure III-1.1: Runoff Treatment BMP Selection Flow Chart



Water Quality BMP's

The drainage basins delineated for this project will have openly exposed pollution generating hard surfaces. These tributary areas will be treated using the BMP technologies identified on Figure III-1.1: Runoff Treatment BMP Selection Flow Chart located on the previous page. A summary of the selected BMP's per the associated TDA is listed below.

Basin ID / TDA	BMP Used	Treatment Level
D1/TDA1	Biofiltration Swale	Basic

Underground Injection Control (UIC) Program

Depending on the type and size of the proposed project, different combinations of the Minimum Requirements or UIC Program regulations apply. Information on the UIC program regulations can be found at Section I-4 UIC of the Manual.

Project UIC Compliance:

This project does not use infiltration for stormwater control.

MR #7 – Flow Control:

Projects shall employ Flow Control BMPs in accordance with the following thresholds, stand ards, and requirements to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions.

Flow Control is not required for TDAs that discharge directly to, or indirectly through an MS4 to a water listed in Appendix I-A of the WSDOE
Manual: Flow Control Exempt Receiving Waters, subject to all of the fol-lowing restrictions.

TDA Threshold

When assessing a TDA against the following thresholds, only consider the types of surfaces (e.g. new hard surfaces, replaced hard surfaces, converted vegetation areas) that are subject to Minimum Requirement #7, per the Project Thresholds in I-3.3 Applicability of the Minimum Requirements.

The following circumstances require achievement of the standard flow control requirement for western Washington:

Projects in which the total of effective impervious surfaces is10,000 square feet or more in a threshold discharge area, or

This project **does** create more than 10,000 square feet of effective impervious surface in its threshold discharge area.

Those impervious surfaces that are connected via sheet flow or discrete conveyance to a drain-age system. Impervious surfaces are considered ineffective if:

1. The runoff is dispersed through at least one hundred feet of native vegetation in accordance with BMP T5.30: Full Dispersion;

2. Residential roof runoff is infiltrated in accordance with BMP T5.10A: Downspout Full Infiltration; or

3. Approved continuous runoff modeling methods indicate that the entire runoff file is infiltrated

Basin ID / TDA	BMP Used	Effective Impervious Surface Area
D1/TDA1	Detention Pond	40,480 sf

Standard Flow Control Requirement
The project **will** provide flow control as outlined in Section 5.1 of this report.

MR #8 – Wetlands Protection:

Projects shall employ Stormwater Management BMPs in accordance with the following thresholds, standards, and requirements to reduce the impacts of stormwater runoff to wetlands.

There are wetlands within the proposed project limits; a wetland delineation was obtained and a 100-ft structure setback has been maintained for the proposed project.

MR #9 – Operation & Maintenance:

An operation and maintenance manual that is consistent with the provisions in Volume V shall be provided for proposed Runoff Treatment and Flow Control BMPs. The party (or parties) responsible for maintenance and operation shall be identified in the operation and maintenance manual. At private facilities, a copy of the operation and maintenance manual shall be retained.

A Stormwater Maintenance Agreement and Operation and Maintenance Manual is included in Appendix 4 of this TIR.

Section 2.2 - Additional Protective Measures (APM)

APM1 - Financial Liability

Performance Bonding for this project's stormwater facility improvements **is not** required by the jurisdiction.

APM2 – Offsite Analysis and Mitigation

The initial qualitative analysis shall extend along the flow path from the project site to the receivi ng water, for a distance up to one mile. If the receiving water is within one-quarter mile from the project site, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream form the project site to a point where there are no backwater effects created by the project, and the designer can determine all areas contributing run-on to the project. Impacts to be evaluated should include:

1. Conveyance System Capacity Problems

2. Localized Flooding

3. Erosion, including landslide hazards and erosion along streambanks and at the outfall location

4. Violations of surface water quality standards as identified in the Basin Plan or a TMDL, or violations of ground water quality standards in a wellhead protection area.

The objective of the off-site analysis report is to identify, evaluate, and determine measures to prevent off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by the proposed project. "Aggravated" shall mean increasing the frequency of occurrence and /or severity of a problem.

Qualitative Analysis

TDA 1 - Basin D1 – Developed Basin

The natural drainage path for this TDA is undefined. The western property line lies within the delineated wetland boundary. As a result, runoff that leaves the site immediately enters the wetland field which has minimal slope and no defined channels or drainage paths. Due to the proposed stormwater management and treatment facilities, this project does adversely impact the wetland or downstream creek connection.

Mitigation Measures

The offsite analysis for this project **did not** yield any mitigation for this project.

Section 2.3 – Adjustments and Exceptions/Variances to the MRs

Adjustments to the Minimum Requirements may be granted prior to permit approval and construction. The jurisdiction may grant an adjustment provided that written findings of fact are prepared that address the following:

1. The adjustment provides substantially equivalent environmental protection and

2. Based on sound Engineering practices, the objectives of safety, function, environmental protection, and facility maintenance are met.

Adjustments:

No adjustments have been requested for this project.

Exceptions and Variances:

No exceptions or variances have been requested for this project.

SECTION 3 – SOURCE CONTROL BMPS

The following permanent source control BMPs that apply to all sites:

IV – 1 Source Control BMPs Applicable to All Sites:

S410 BMPs for Correcting Illicit Discharges to Storm Drains.
S453 BMPs for Formation of a Pollution Prevention Team.
S545 BMPs for Preventive Maintenance / Good Housekeeping.
S455 BMPs for Spill Prevention and Cleanup.
S457 BMPs for Inspections.
S458 BMPs for Record Keeping – Vol. IV – Page 503.

The following permanent source control BMPs will be utilized for this project and will be included in the final Operation and Maintenance Manual submitted prior to final project acceptance by the Review Agency.

IV-2 – Cleaning or Washing Source Control BMPs

S410 BMPs for Correcting Illicit Discharges to Storm Drains.

IV-3 – Roads, Ditches, and Parking Lot Source Control BMP's

S410 BMPs for Correcting Illicit Discharges to Storm Drains.
S416 BMPs for Maintenance of Roadside Ditches.
S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems.

IV-4 – Soil Erosion, Sediment Control and Landscaping

S411 BMPs for Landscaping and Lawn/Vegetation Management.
S435 BMPs for Pesticides and an Integrated Pest Management Plan.
S450 BMPs for Irrigation

IV-5 – Storage and Stockpiling Source Control

N/A

IV-6 – Storage and Stockpiling Source Control

N/A

IV-7 – Other Source Control BMPs

S424 BMPs for Roof / Building Drains at Manufacturing and Commercial Buildings.
S442 BMPs for Labeling Storm Drain Inlets On Your Property.

SECTION 4 – SITE SUITABILITY CRITERIA (SSC)

This section outlines the criteria used to help select the stormwater type of flow control and treatment facility for this project. Based on our review of the criteria below we have selected the following type of facilities for this project.

Basin ID / TDA	Flow Control	Water Quality
D1/TDA1	Detention	Bio-Swale

SSC – 1 Setback Criteria

Setback requirements for this project for the following stormwater facilities that include retention, treatment and detention facilities are:

Facility Id	Foundation	Property Line	Water Well	Septic Drain Field	Right of Way / Easement
Detention Pond	20 ft	20 ft	100 ft	100 ft	20 ft
Wetpond	20 ft	20 ft	100 ft	100 ft	10 ft

Infiltration will not be used for stormwater control; therefor further investigation was not required.

SECTION 5 – PERMANENT STORMWATER CONTROL PLAN

Existing Site Hydrology

Existing site hydrology is based on our site investigation, field topographic survey, aerial topographic mapping and completed soils review for the subject project. The site consists of the basins outlined below.

Pre-developed Basin (P1)

The existing site consists of commercial gravel parking lot on previously filled land. The pre-developed condition will be modeled as Forested per WSDOE standards.

Current Land Use: Residential
Modeled Land Use: Forested

TDA No. 1 Basin ID	Land Use Assumptions and Site Parameters				
	Land Use Cover	Slope	Acres	Hydrologic Group	Comments
P1	Forested	Mod	2.17	C	

Developed Site Hydrology (D1)

The proposed project will consist of a 11,700 sf professional office building with associated parking area.

Basin Summary

Proposed and Modeled Land Use: As follows

TDA No. 1 Basin ID	Land Use Assumptions and Site Parameters				
	Land Use Cover	Slope	Acres	Hydrologic Group	Comments
D1	Lawn	Mod	1.24	C	
	Roof Tops	Flat	0.269		
	Driveways	Mod	0.084		
	Sidewalks	Flat	0.092		
	Parking	Flat	0.485		
Total Area			2.17		

Basin Maps

The following figures are included in Appendix 1 of this report:

Basin Map

SECTION 5.1 – FLOW CONTROL

Flow Control System Design & Analysis

The proposed stormwater facility was designed using the latest version of the WWHM stormwater model created for WSDOE. A copy of the WWHM Data Output Report is included in Appendix 2 of this TIR.

Flow Control for TDA No. 1

Basin D1 - Detention Pond (DP) DP No. 1

The auto-pond function in WWHM was used to size the detention pond facility. That model passed resulted in the following pond parameters:

Bottom Pond Area (sf)	Pond Storage Depth (ft)	Free Board Provided (ft)	Side Slopes	Control Structure Type
5100	4	1 ft	2:1	Wier/Orifice

The following detention pond facility designed meets or exceeds the modeled pond parameters:

Bottom Pond Area Provided (sf)	Pond Storage Depth (ft)	Free Board Provided (ft)	Side Slopes	Control Structure Type
5354	4	1 ft	2:1	Wier/Orifice

Detention Pond Stage Storage Summary

Pond Stage Storage	Elevation (ft)	Detention Volume (ac-ft)
Emergency Overflow	172	N/A
Design Water Surface	172	8,897 CF / 0.20 ac-ft
Bottom Live Storage	168	0 ac-ft
WWHM Required Storage	N/A	0 ac-ft

The new pond will be constructed with an impervious clay or synthetic membrane liner to prevent infiltration in the pond.

SECTION 5.2 – WATER QUALITY DESIGN

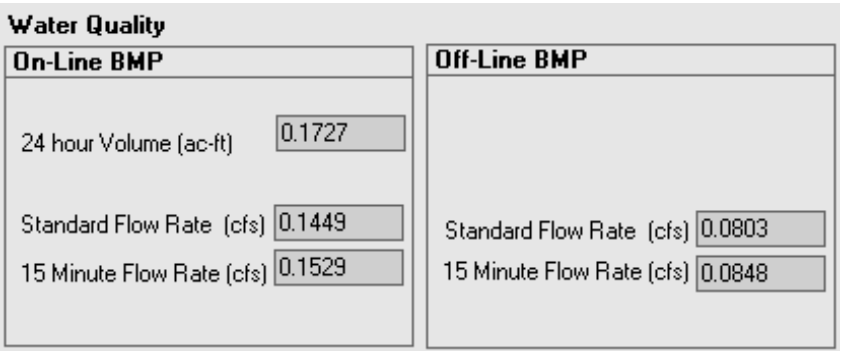
Water Quality System Design & Analysis

The drainage basins delineated for this project will have openly exposed pollution generating impervious surfaces. These tributary areas will be treated using the following treatment technologies listed under the associated drainage basins.

TDA No. 1

Basin D1 - BMP T9.10 – Basic Bio-filtration Swale

RBE has selected this treatment method for water quality control for the new PGIS associated with the project. Below is a copy of the Water Quality Analysis from WWHM and Summary of the Swale Design.



Swale Length (ft)	Swale Bottom Width (ft)	Swale Longitudinal Slope (%)	Swale Side Slope	Design Flow Depth (in)	WWHM Design Flow (cfs)	Design Flow Velocity (ft/s)
100	2	2.0	3:1	3	0.0848	0.12

Objective: Determine biofiltration swale or filter strip size for stormwater treatment per DOE Stormwater Management Manual Volume V Chapter 9

Solution:			Notes:
15 min. Water Quality Design Flow (Q) =	0.0848	cfs	91% Runoff Volume per WWHM analysis
Mowed Frequently or Infrequently?	Infrequently		
Design Depth of Flow (y) =	0.25	ft	4-inches max
Mannings Value (n) =	0.24		0.24
Swale Shape =	TRAP		
Slope (S) =	0.02	ft/ft	1.5% min. to 2.5% max.*
Bottom Width (b) =	2	ft	2' minimum; 10' maximum**
Side Slope H:V (Z) =	3	ft/ft	3H:1V min; 4H:1V preferred
Top Width (T) =	3.5	ft	
SBUH Peak/WWHM 15min WQ Flow (K) =	1		Figure 9.6a: On-line; Figure 9.6b: Off-line
CO-1 Residence Time =	9	min	9 minutes min (18 minutes for continuous inflow)
Swale Length (L) =	100	ft	100 ft minimum
Area (A) =	0.69	sq. ft.	
Velocity =	0.12	ft/sec	1.0 fps max

Stability Check:

The bio-filtration swale has been designed as an offline swale. Therefore, the swale has the following full flow capacity that exceeds the unmitigated basins 100 yr flow rate calculated by WWHM.

Objective: **Design swale cross section to transport stormwater runoff from the 100-yr storm event**

Solution:

$$Q = \frac{1.49}{\eta} * A * R^{2/3} * S^{1/2}$$

Q =	28.85	*Discharge (cfs)*	
η =	0.026	*Mannings Number (Roughness Coefficient)*	
A =	5.00	*Area (ft^2)*	
w =	2	(ft)	
y =	1.00	(ft)	
Z =	3	:1	
P =	8.32	*Wetted Permieter (ft)*	
R =	0.60	*Hydraulic Radius (ft)*	
S =	0.0200	*Slope (ft/ft)*	

Flow Frequency	
Flow(cfs)	0701 hr
2 Year =	0.3232
5 Year =	0.4250
10 Year =	0.4904
25 Year =	0.5712
50 Year =	0.6304
100 Year =	0.6888

Mannings # (Roughness Coefficient)	
Lined Canals	η
Cement Plaster	0.011
Untreated gunite	0.016
Wood, planed	0.012
Wood, unplaned	0.013
Concrete, troweled	0.012
Concrete, wood forms, unfinished	0.015
Rubble in cment	0.020
Asphalt, smooth	0.013
Asphalt, rough	0.016
Natural Channels	η
Gravel beds, straight	0.025
Gravel beds plus large boulders	0.040
Earth, straight, with some grass	0.026
Earth, winding, no vegetation	0.030
Earth, winding	0.050

SECTION 5.3 – CONVEYANCE SYSTEM DESIGN

Pipe Conveyance Design

All onsite storm conveyance systems will be sized to accommodate the 25-year storm flows. All proposed onsite storm drain pipe will be 12 inches in diameter and the minimum slope shall not be less than 0.5%. The minimum required pipe size at 0.5% slope to convey the 100-year event for the onsite developed area is 8-inch pipe per Field's Hydraulic Calculator.

WWHM Un-Mitigated Flow Rates for Basin D1

Listed below are the flow frequency date generated by WWHM for the developed basin D1.

```
Flow Frequency
Flow(cfs)       Pre        Post       Mitigated
2 Year   =    0.0640     0.3232     0.0399
5 Year   =    0.1019     0.4250     0.0627
10 Year  =    0.1235     0.4904     0.0802
25 Year  =    0.1466     0.5712     0.1051
50 Year  =    0.1609     0.6304     0.1256
100 Year =    0.1731     0.6888     0.1480
```

Overflow Spillway Design

The flow control facility has been outfitted with an emergency overflow spillway per the construction and sizing requirements of *Section 3.2.1, Volume III of the WSDOE Stormwater Management Manual for Western Washington, 2012.* WWHM modeling's 100-year peak (unmitigated) flow rate were calculated for use in sizing the spillway. See the civil construction plans for design full details.

Structure ID	25 Year Unmitigated Flow (cfs)	100 Year Unmitigated Flow (cfs)	Overflow Spillway Width (ft)
DP-1	0.5712	0.6888	6

Sediment Pond Sizing

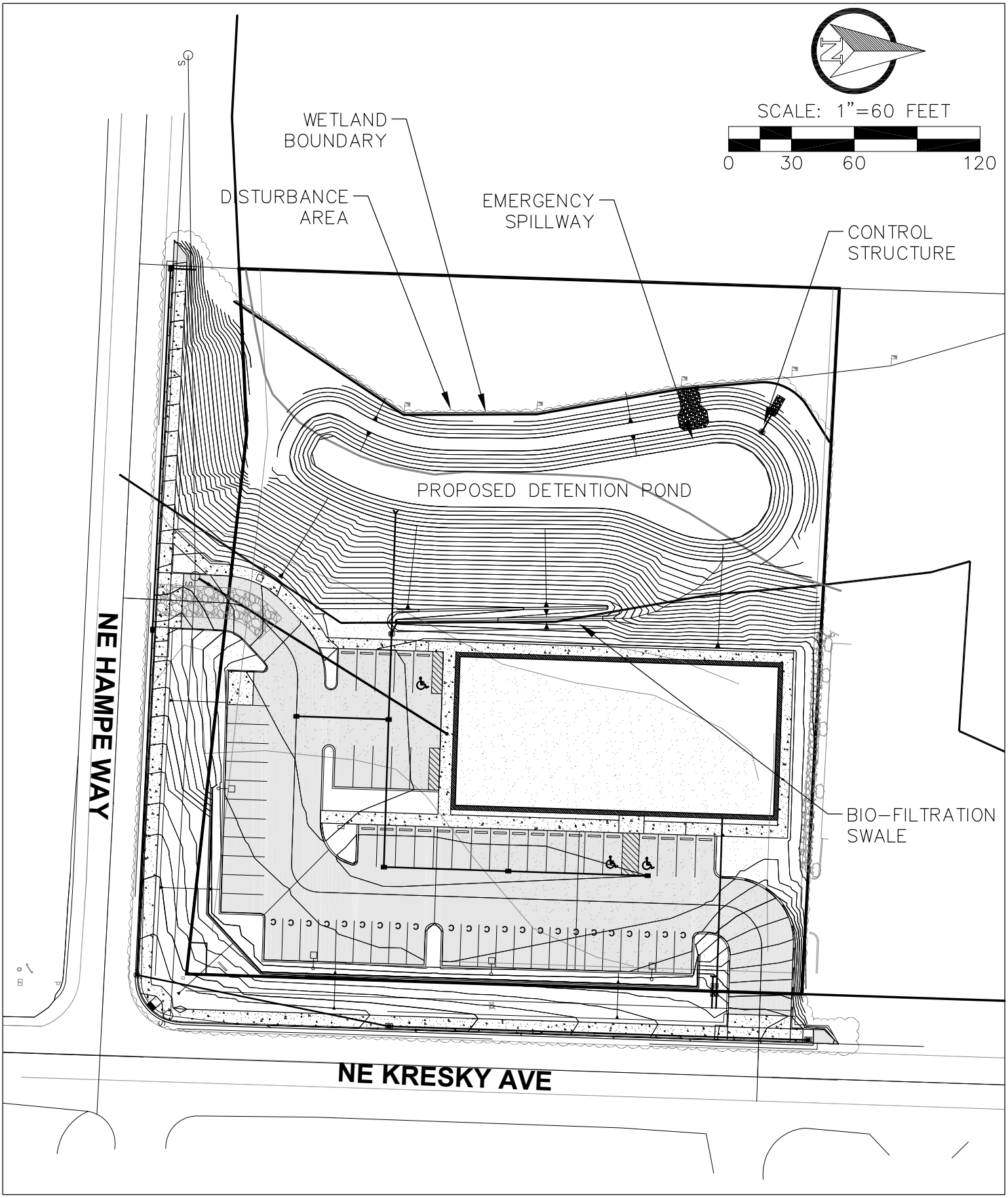
Listed below is the minimum sediment pond size per the WSDOE stormwater manual.

Structure ID	2 Year Unmitigated Flow (cfs)	Required Sediment Pond Surface Area (sf)
Sediment Pond D1	0.3232	257

APPENDIX 1 – MAP SUBMITTALS

TDA No. 1

Basin Map



RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 923
CHEHALIS, WA 98532
OFF: (360) 740-8919
FAX: (360) 740-8912

WILSON COMMERCIAL BUILDING

BASIN MAP

JOB NUMBER 21116

DRAWING NAME Z3D_FG_21116

FIGURE BM

APPENDIX 2 – DRAINAGE DESIGN CALCULATIONS AND MODELING

TDA No. 1

Basin D1 WWHM Flow Control and Water Quality Modeling

WWHM2012
PROJECT REPORT

Project Name: 21116 - Wilson Commercial Prelim
Site Name: Wilson Kresky Commercial
Site Address: 2510/2520 NE Kresky Avenue
City : Centralia
Report Date: 10/4/2022
Gage : Olympia
Data Start : 1955/10/01
Data End : 2008/09/30
Precip Scale: 0.80
Version Date: 2021/08/18
Version : 4.2.18

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : P1 - Predeveloped
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	2.17
Pervious Total	2.17

Impervious Land Use	acre
Impervious Total	0
Basin Total	2.17

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : D1 - Postdeveloped
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Mod	1.24
Pervious Total	1.24

Impervious Land Use	acre
ROOF TOPS FLAT	0.269
DRIVEWAYS MOD	0.084
SIDEWALKS FLAT	0.092
PARKING FLAT	0.485
Impervious Total	0.93
Basin Total	2.17

Element Flows To:

Surface	Interflow	Groundwater
Detention Pond	Detention Pond	

Name : Detention Pond
Bottom Length: 255.00 ft.
Bottom Width: 20.00 ft.
Depth: 5 ft.
Volume at riser head: 0.6907 acre-feet.
Side slope 1: 2 To 1
Side slope 2: 2 To 1
Side slope 3: 2 To 1
Side slope 4: 2 To 1
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.021 ft.
Notch Height: 1.500 ft.
Orifice 1 Diameter: 0.815 in. **Elevation:** 0 ft.

Element Flows To:

Outlet 1	Outlet 2

Pond Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.117	0.000	0.000	0.000
0.0556	0.118	0.006	0.004	0.000
0.1111	0.119	0.013	0.006	0.000
0.1667	0.121	0.019	0.007	0.000
0.2222	0.122	0.026	0.008	0.000
0.2778	0.124	0.033	0.009	0.000
0.3333	0.125	0.040	0.010	0.000

0.3889	0.127	0.047	0.011	0.000
0.4444	0.128	0.054	0.012	0.000
0.5000	0.129	0.061	0.012	0.000
0.5556	0.131	0.069	0.013	0.000
0.6111	0.132	0.076	0.014	0.000
0.6667	0.134	0.083	0.014	0.000
0.7222	0.135	0.091	0.015	0.000
0.7778	0.136	0.098	0.015	0.000
0.8333	0.138	0.106	0.016	0.000
0.8889	0.139	0.114	0.017	0.000
0.9444	0.141	0.121	0.017	0.000
1.0000	0.142	0.129	0.018	0.000
1.0556	0.144	0.137	0.018	0.000
1.1111	0.145	0.145	0.019	0.000
1.1667	0.147	0.154	0.019	0.000
1.2222	0.148	0.162	0.019	0.000
1.2778	0.149	0.170	0.020	0.000
1.3333	0.151	0.178	0.020	0.000
1.3889	0.152	0.187	0.021	0.000
1.4444	0.154	0.195	0.021	0.000
1.5000	0.155	0.204	0.022	0.000
1.5556	0.157	0.213	0.022	0.000
1.6111	0.158	0.221	0.022	0.000
1.6667	0.160	0.230	0.023	0.000
1.7222	0.161	0.239	0.023	0.000
1.7778	0.163	0.248	0.024	0.000
1.8333	0.164	0.257	0.024	0.000
1.8889	0.166	0.267	0.024	0.000
1.9444	0.167	0.276	0.025	0.000
2.0000	0.169	0.285	0.025	0.000
2.0556	0.170	0.295	0.025	0.000
2.1111	0.172	0.304	0.026	0.000
2.1667	0.173	0.314	0.026	0.000
2.2222	0.175	0.323	0.026	0.000
2.2778	0.176	0.333	0.027	0.000
2.3333	0.178	0.343	0.027	0.000
2.3889	0.179	0.353	0.027	0.000
2.4444	0.181	0.363	0.028	0.000
2.5000	0.182	0.373	0.028	0.000
2.5556	0.184	0.383	0.029	0.000
2.6111	0.185	0.394	0.031	0.000
2.6667	0.187	0.404	0.034	0.000
2.7222	0.188	0.414	0.036	0.000
2.7778	0.190	0.425	0.039	0.000
2.8333	0.191	0.435	0.042	0.000
2.8889	0.193	0.446	0.046	0.000
2.9444	0.194	0.457	0.049	0.000
3.0000	0.196	0.468	0.053	0.000
3.0556	0.197	0.479	0.057	0.000
3.1111	0.199	0.490	0.060	0.000
3.1667	0.200	0.501	0.064	0.000
3.2222	0.202	0.512	0.068	0.000
3.2778	0.203	0.523	0.072	0.000
3.3333	0.205	0.535	0.076	0.000
3.3889	0.206	0.546	0.080	0.000
3.4444	0.208	0.558	0.085	0.000
3.5000	0.210	0.569	0.089	0.000

3.5556	0.211	0.581	0.094	0.000
3.6111	0.213	0.593	0.099	0.000
3.6667	0.214	0.605	0.104	0.000
3.7222	0.216	0.617	0.109	0.000
3.7778	0.217	0.629	0.115	0.000
3.8333	0.219	0.641	0.120	0.000
3.8889	0.220	0.653	0.126	0.000
3.9444	0.222	0.665	0.162	0.000
4.0000	0.224	0.678	0.170	0.000
4.0556	0.225	0.690	0.379	0.000
4.1111	0.227	0.703	0.758	0.000
4.1667	0.228	0.715	1.245	0.000
4.2222	0.230	0.728	1.808	0.000
4.2778	0.231	0.741	2.420	0.000
4.3333	0.233	0.754	3.054	0.000
4.3889	0.235	0.767	3.682	0.000
4.4444	0.236	0.780	4.276	0.000
4.5000	0.238	0.793	4.811	0.000
4.5556	0.239	0.807	5.270	0.000
4.6111	0.241	0.820	5.641	0.000
4.6667	0.242	0.833	5.927	0.000
4.7222	0.244	0.847	6.148	0.000
4.7778	0.246	0.861	6.423	0.000
4.8333	0.247	0.874	6.643	0.000
4.8889	0.249	0.888	6.855	0.000
4.9444	0.250	0.902	7.061	0.000
5.0000	0.252	0.916	7.261	0.000
5.0556	0.254	0.930	7.455	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:2.17
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.24
Total Impervious Area:0.93

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.064046
5 year	0.101894
10 year	0.123531
25 year	0.146569
50 year	0.160877
100 year	0.173074

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.039902
5 year	0.062689
10 year	0.080186
25 year	0.105058
50 year	0.125624
100 year	0.147963

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.078	0.055
1957	0.121	0.042
1958	0.035	0.021
1959	0.040	0.031
1960	0.090	0.092
1961	0.064	0.046
1962	0.019	0.023
1963	0.105	0.073
1964	0.073	0.045
1965	0.067	0.027
1966	0.031	0.025
1967	0.073	0.036
1968	0.053	0.025
1969	0.024	0.025
1970	0.058	0.053
1971	0.075	0.055
1972	0.118	0.100
1973	0.057	0.069
1974	0.045	0.041
1975	0.033	0.024
1976	0.083	0.056
1977	0.008	0.017
1978	0.075	0.061
1979	0.070	0.024
1980	0.055	0.048
1981	0.083	0.042
1982	0.053	0.049
1983	0.094	0.032
1984	0.077	0.025
1985	0.021	0.023
1986	0.116	0.051
1987	0.145	0.072
1988	0.035	0.027
1989	0.042	0.022
1990	0.125	0.059
1991	0.171	0.102
1992	0.033	0.029
1993	0.024	0.020
1994	0.024	0.020
1995	0.074	0.039
1996	0.123	0.057
1997	0.065	0.064
1998	0.063	0.025
1999	0.084	0.070

2000	0.081	0.044
2001	0.009	0.017
2002	0.083	0.079
2003	0.030	0.024
2004	0.049	0.052
2005	0.058	0.025
2006	0.092	0.046
2007	0.104	0.105
2008	0.168	0.132

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1711	0.1315
2	0.1684	0.1046
3	0.1448	0.1015
4	0.1246	0.1004
5	0.1230	0.0924
6	0.1214	0.0790
7	0.1176	0.0727
8	0.1156	0.0717
9	0.1050	0.0698
10	0.1041	0.0693
11	0.0943	0.0639
12	0.0915	0.0614
13	0.0904	0.0585
14	0.0839	0.0570
15	0.0831	0.0563
16	0.0826	0.0554
17	0.0826	0.0549
18	0.0806	0.0534
19	0.0779	0.0517
20	0.0767	0.0507
21	0.0752	0.0492
22	0.0748	0.0480
23	0.0736	0.0463
24	0.0728	0.0462
25	0.0727	0.0448
26	0.0696	0.0436
27	0.0668	0.0424
28	0.0649	0.0420
29	0.0641	0.0413
30	0.0628	0.0390
31	0.0581	0.0361
32	0.0578	0.0323
33	0.0570	0.0307
34	0.0550	0.0291
35	0.0532	0.0272
36	0.0531	0.0270
37	0.0487	0.0254
38	0.0450	0.0254
39	0.0423	0.0251
40	0.0401	0.0249
41	0.0349	0.0247
42	0.0349	0.0245
43	0.0335	0.0243

44	0.0331	0.0242
45	0.0311	0.0237
46	0.0299	0.0233
47	0.0244	0.0231
48	0.0242	0.0224
49	0.0238	0.0212
50	0.0209	0.0205
51	0.0191	0.0197
52	0.0092	0.0174
53	0.0081	0.0168

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0320	4354	4279	98	Pass
0.0333	4009	3930	98	Pass
0.0346	3683	3621	98	Pass
0.0359	3366	3325	98	Pass
0.0372	3121	3010	96	Pass
0.0385	2865	2739	95	Pass
0.0398	2627	2443	92	Pass
0.0411	2408	2181	90	Pass
0.0424	2213	1916	86	Pass
0.0437	2059	1683	81	Pass
0.0450	1905	1494	78	Pass
0.0463	1768	1324	74	Pass
0.0476	1630	1191	73	Pass
0.0489	1485	1082	72	Pass
0.0502	1354	977	72	Pass
0.0515	1236	890	72	Pass
0.0528	1144	809	70	Pass
0.0541	1063	738	69	Pass
0.0555	976	666	68	Pass
0.0568	907	609	67	Pass
0.0581	835	565	67	Pass
0.0594	787	518	65	Pass
0.0607	730	478	65	Pass
0.0620	679	438	64	Pass
0.0633	631	411	65	Pass
0.0646	592	386	65	Pass
0.0659	548	362	66	Pass
0.0672	499	336	67	Pass
0.0685	466	305	65	Pass
0.0698	430	265	61	Pass
0.0711	405	248	61	Pass
0.0724	375	223	59	Pass
0.0737	348	212	60	Pass
0.0750	325	203	62	Pass
0.0763	304	196	64	Pass
0.0776	286	185	64	Pass
0.0789	270	176	65	Pass
0.0802	258	168	65	Pass

0.0815	239	162	67	Pass
0.0828	224	155	69	Pass
0.0841	213	146	68	Pass
0.0854	201	138	68	Pass
0.0867	194	129	66	Pass
0.0880	181	119	65	Pass
0.0893	171	115	67	Pass
0.0906	160	110	68	Pass
0.0919	152	100	65	Pass
0.0932	144	91	63	Pass
0.0945	135	84	62	Pass
0.0958	128	79	61	Pass
0.0971	123	72	58	Pass
0.0984	115	66	57	Pass
0.0997	107	57	53	Pass
0.1010	99	47	47	Pass
0.1023	94	40	42	Pass
0.1036	89	36	40	Pass
0.1049	85	30	35	Pass
0.1062	81	30	37	Pass
0.1075	77	29	37	Pass
0.1088	72	28	38	Pass
0.1101	67	27	40	Pass
0.1114	61	26	42	Pass
0.1127	60	26	43	Pass
0.1140	56	24	42	Pass
0.1153	54	23	42	Pass
0.1166	46	22	47	Pass
0.1179	44	20	45	Pass
0.1192	41	18	43	Pass
0.1205	39	15	38	Pass
0.1218	37	14	37	Pass
0.1231	34	12	35	Pass
0.1244	33	11	33	Pass
0.1257	31	8	25	Pass
0.1270	30	7	23	Pass
0.1283	28	7	25	Pass
0.1296	27	4	14	Pass
0.1309	26	2	7	Pass
0.1322	26	0	0	Pass
0.1335	24	0	0	Pass
0.1348	23	0	0	Pass
0.1361	23	0	0	Pass
0.1374	22	0	0	Pass
0.1388	21	0	0	Pass
0.1401	20	0	0	Pass
0.1414	20	0	0	Pass
0.1427	18	0	0	Pass
0.1440	17	0	0	Pass
0.1453	16	0	0	Pass
0.1466	15	0	0	Pass
0.1479	14	0	0	Pass
0.1492	14	0	0	Pass
0.1505	13	0	0	Pass
0.1518	13	0	0	Pass
0.1531	11	0	0	Pass
0.1544	10	0	0	Pass

0.1557	9	0	0	Pass
0.1570	8	0	0	Pass
0.1583	8	0	0	Pass
0.1596	6	0	0	Pass
0.1609	6	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.1727 **acre-feet**
On-line facility target flow: 0.1449 **cfs.**
Adjusted for 15 min: 0.1529 **cfs.**
Off-line facility target flow: 0.0803 **cfs.**
Adjusted for 15 min: 0.0848 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Percent Water Quality Infiltrated	Volume Treated	Comment
Detention Pond POC	N	203.20			N	0.00		
Total Volume Infiltrated		203.20	0.00	0.00		0.00	0.00	0% No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

APPENDIX 3 – SPECIAL REPORTS AND STUDIES

1. NRCS Soil Survey Data
2. Geotechnical Report –South Sound Geotechnical Consulting


122° 57' 26" W
122° 57' 17" W
46° 41' 20" N
46° 41' 16" N
503270
503280
503290
503300
503310
503320
503330
503340
503350
503360
503370
503380
503390
503400
503410
503420
503430
503440
5170610
5170600
5170590
5170580
5170570
5170560
5170550
5170540
5170530
5170520
5170510
5170500
130
Kresky
Ne Kresky Ave
Soil Map may not be valid at this scale.
Map Scale: 1:826 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0
10
20
40
60
Feet
0
40
80
160
240
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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: Lewis County Area, Washington
Survey Area Data: Version 22, Sep 8, 2022

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

Date(s) aerial images were photographed: Nov 21, 2021—Nov 22, 2021

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
130	Melbourne loam, 0 to 8 percent slopes	C	2.3	100.0%
Totals for Area of Interest			**2.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Lewis County Area, Washington

130—Melbourne loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2h91
Elevation: 200 to 1,200 feet
Mean annual precipitation: 40 to 70 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Melbourne and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melbourne

Setting

Landform: Terraces
Parent material: Residuum from siltstone

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 18 inches: clay loam
H3 - 18 to 42 inches: clay
H4 - 42 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Soils with Few Limitations (G001XY502WA)
Other vegetative classification: Soils with Few Limitations (G001XY502WA)
Hydric soil rating: No

Minor Components

Lacamas, undrained
Percent of map unit: 5 percent
Landform: Terraces
Other vegetative classification: Wet Soils (G002XV102WA)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Lewis County Area, Washington
Survey Area Data: Version 22, Sep 8, 2022

September 13, 2022

RB Engineering
91 SW 13th Street
Chehalis, WA 98532

Attention: Mr. Robert Balmelli, P.E.

Subject: Geotechnical Engineering Report
Wilson Commercial Development
2510 NE Kresky Avenue
Centralia, Washington
SSGC Project No. 22066

Mr. Balmelli,

South Sound Geotechnical Consulting (SSGC) has completed a geotechnical assessment for the planned Wilson Commercial development on the above addressed property in Centralia, Washington. Our services have been completed in general conformance with our proposal P22066 (dated July 11, 2022) and authorized per signature of our agreement for services. Our scope of services included completion of six test pits on the site, engineering analyses, and preparation of this report.

PROJECT INFORMATION

A new 12,000 square foot single-story commercial building is planned on the property northwest of the intersection of NE Kresky Avenue and NE Hampe Way. The site is currently undeveloped and used as parking.

SUBSURFACE CONDITIONS

Subsurface conditions were characterized by completing six test pits on the site on July 21, 2022. Explorations were advanced to depths between about 4 and 15 feet below existing ground surface. Approximate locations of the test holes are shown on Figure 1, Exploration Plan. A summary description of observed subgrade conditions is provided below. Logs of the test holes are provided in Appendix A.

Soil Conditions

Fill was observed in all of the test pits, with thicker fill in the western portion of the site. Fill consisted of three principal types:

1) Mixed silt, sand with variable gravel in a loose to medium dense condition in the northern and western portion of the site. This fill extended to depths between 2 and 6.5 feet.

2) Silty sand with gravel and occasional cobble below the above described fill in the western test pits. This fill was in a medium dense condition and extended to depths between 7 and 10.5 feet.

3) Clayey silt in the two test pits in the southeast portion of the site. This fill was in a soft condition and extended to depths between 1 to 4 feet.

Native soil below the fills was silt with clay and variable gravel to clayey silt. These soils were in a soft to stiff condition and extended to the termination depth of the test pits.

Groundwater Conditions

Groundwater was not observed in test pits at the time of excavation. Native soils are considered impermeable and can create perched groundwater, particularly during the wetter seasons of the year. Groundwater levels will vary throughout the year based on seasonal precipitation and on- and off-site drainage patterns.

Geologic Setting

Native soils are mapped as "Melbourne loam" per the USDA Soil Conservation Service of Lewis County. This soil reportedly formed in residuum from siltstone. Native soils in the test pits appear to conform to the mapped soil type.

GEOTECHNICAL DESIGN CONSIDERATIONS

Planned development of the site is considered feasible based on observed soil conditions in the test holes. However, construction over undocumented fill creates conditions that make structures susceptible to settlement. Typically, substantial over-excavation of fill and replacement with a zone of granular structural fill would be used for support of buildings using conventional spread footing foundations, or the use of deeper foundation elements (pile, piers). Considering the type of development planned for this site, lesser amounts of soil removal and replacement could be considered utilizing reinforced structural concrete mat-type foundations provided the owner is willing to accept the risk of possible limited future settlement.

Recommendations presented in the following sections should be considered general and may require modifications when earthwork and grading occur. They consider that reinforced mat foundations will be used for support of the storage buildings. They are based upon the subsurface conditions observed in the test pits and the assumption that finish site grades will be similar to existing grades, or slightly higher. It should be noted that subsurface conditions across the site may vary from those depicted on the exploration logs and can change with time. Therefore, proper site preparation will depend upon the weather and soil conditions encountered at the time of construction. We recommend that SSGC review final plans and further assess subgrade conditions at the time of construction, as warranted.

General Site Preparation

Site grading and earthwork should include procedures to control surface water runoff. Grading the site without adequate drainage control measures may negatively impact site soils, resulting in increased export of impacted soil and import of fill materials, potentially increasing the cost of the earthwork and subgrade preparation phases of the project.

Site grading should include removal (stripping) of topsoil and debris rich fill in building and pavement areas. Subgrades should consist of firm debris-less soils following stripping. Stripping depth will vary across the site. Final stripping depths can only be determined at the time of construction.

General Subgrade Preparation

Subgrades in building and pavement areas should consist of firm soil. We recommend exposed subgrades in building and pavement areas are proofrolled using a large roller, loaded dump truck, or other mechanical equipment to assess subgrade conditions following stripping. Proofrolling efforts should result in the upper 1 foot of subgrade soils achieving a firm and unyielding condition and a compaction level of at least 92 percent of the maximum dry density (MDD) per the ASTM D1557 test method. Wet, loose, or soft subgrades that cannot achieve a firm and unyielding condition should be removed (over-excavated) and replaced with structural fill. The depth of over-excavation should be based on soil conditions at the time of construction. A representative of SSGC should be present to assess subgrade conditions during proofrolling.

Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Allowing surface water into cut or fill areas, utility trenches, and building footprints should be prevented.

Structural Fill Materials

The suitability of soil for use as structural fill will depend on the gradation and moisture content of the soil when it is placed. Soils with higher fines content (soil fraction passing the U.S. No. 200 sieve) will become sensitive with higher moisture content. It is often difficult to achieve adequate compaction if soil moisture is outside of optimum ranges for soils that contain more than about 5 percent fines.

> Site Soils: Granular fill observed in the test pits could potentially be used for structural fill, but should be evaluated at the time of construction. Native soils are fine grained (principally silt and clay) making them are moisture sensitive and would be difficult to use as structural fill unless conditioned to optimum moisture content. Optimum moisture is considered within about +/- 2 percent of the moisture content required to achieve the maximum density per the ASTM D-1557

test method. If moisture content is higher or lower than optimum, soils would need to be dried or wetted prior to placement as structural fill.

Import Fill Materials: We recommend import structural fill placed during dry weather periods consist of material which meets the specifications for *Gravel Borrow* as described in Section 9-03.14(1) of the Washington State Department of Transportation (WSDOT) Specifications for Road, Bridge, and Municipal Construction (Publication M41-10). Gravel Borrow should be protected from disturbance if exposed to wet conditions after placement.

During wet weather, or for backfill on wet subgrades, import soil suitable for compaction in wetter conditions should be provided. Imported fill for use in wet conditions should generally conform to specifications for *Select Borrow* as described in Section 9-03.14(2), or *Crushed Surfacing* per Section 9-03.9(3) of the WSDOT M41-10 manual, with the modification that a maximum of 5 percent by weight shall pass the U.S. No. 200 sieve.

It should be noted that structural fill placement and compaction is weather-dependent. Delays due to inclement weather are common, even when using select granular fill. We recommend site grading and earthwork be scheduled for the drier months of the year. Structural fill should not consist of frozen material.

Structural Fill Placement

We recommend structural fill is placed in lifts not exceeding about 10 inches in loose measure. It may be necessary to adjust lift thickness based on site and fill conditions during placement and compaction. Finer grained soil used as structural fill and/or lighter weight compaction equipment may require significantly thinner lifts to attain required compaction levels. Granular soil with lower fines contents could potentially be placed in thicker lifts if they can be adequately compacted. Structural fill should be compacted to attain the recommended levels presented in Table 1, Compaction Criteria.

Table 1. Compaction Criteria

Fill Application	Compaction Criteria*
Footing areas (below structures and retaining walls)	95 %
Upper 2 feet in pavement areas, slabs and sidewalks, and utility trenches	95 %
Below 2 feet in pavement areas, slabs and sidewalks, and utility trenches	92 %
Utility trenches or general fill in non-paved or -building areas	90 %

*Per the ASTM D 1557 test method.

Trench backfill within about 2 feet of utility lines should not be over-compacted to reduce the risk of damage to the line. In some instances, the top of the utility line may be within 2 feet of the surface. Backfill in these circumstances should be compacted to a firm and unyielding condition.

We recommend fill procedures include maintaining grades that promote drainage and do not allow ponding of water within the fill area. The contractor should protect compacted fill subgrades from disturbance during wet weather. In the event of rain during structural fill placement, the exposed fill surface should be allowed to dry prior to placement of additional fill. Alternatively, the wet soil can be removed. We recommend consideration be given to protecting haul routes and other high traffic areas with free-draining granular fill material (i.e. sand and gravel containing less than 5 percent fines) or quarry spalls to reduce the potential for disturbance to the subgrade during inclement weather.

We recommend a separation fabric (such as Mirafi 140N) is placed on prepared subgrades prior to placement of the structural fill section. The purpose of the fabric is to provide segregation between new granular structural fill and the finer grained native (or soft fill) soil. Without the fabric, the new structural fill will have the tendency to migrate into the softer/looser subgrade soil over time, which can compromise the structural integrity of the structural fill zone leading to premature distress of the fill section.

Earthwork Procedures

Conventional earthmoving equipment should be suitable for earthwork at this site. Earthwork may be difficult during periods of wet weather or if elevated soil moisture is present. Excavated site soils may not be suitable as structural fill depending on the soil moisture content and weather conditions at the time of earthwork. If soils are stockpiled and wet weather is anticipated, the stockpile should be protected with securely anchored plastic sheeting. If stockpiled soils become unusable, it may become necessary to import clean, granular soils to complete wet weather site work.

Wet or disturbed subgrade soils should be over-excavated to expose firm, non-yielding, non-organic soils and backfilled with compacted structural fill. We recommend the earthwork portion of this project be completed during extended periods of dry weather. If earthwork is completed during the wet season (typically late October through May) it may be necessary to take extra measures to protect subgrade soils.

If earthwork takes place during freezing conditions, we recommend exposed subgrades are allowed to thaw and re-compacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen soil can be removed to unfrozen soil and replaced with structural fill.

The contractor is responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of excavation sides and bottoms. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. Temporary excavation cuts should be sloped at inclinations of 1H:1.5V (Horizontal:Vertical) or flatter, unless the contractor can demonstrate the safety of steeper

inclinations. Shoring may be required in deeper excavations (below 4 feet) as soft soils may cave into open excavations.

A geotechnical engineer and accredited material testing laboratory should be retained during the construction phase of the project to observe earthwork operations and perform necessary tests and observations during subgrade preparation, placement and compaction of structural fill, and backfilling of excavations.

Foundations

We recommend foundations are placed on a zone of granular structural fill above prepared subgrade soils prepared as described in this report. This zone should be a minimum of two feet thick (including existing fill thickness) and compacted to a firm and unyielding condition. The purpose of the structural fill pad and mat foundation is to limit differential settlement across the footprint of the building. We recommend a separation fabric (such as Mirafi 140N or equivalent) is placed on the prepared subgrade prior to fill placement. The following recommendations are for reinforced mat foundations:

Bearing Capacity (net allowable):	1,500 pounds per square foot (psf) for reinforced mat foundations supported on a zone of compacted granular fill over native soils prepared as described in this report.
Footing Width (Minimum):	18 inches (Strip) 24 inches (Column)
Embedment Depth (Minimum):	18 inches (Exterior) 12 inches (Interior)
Settlement:	Total: < 1.5 inch Differential: < 1/2 inch (over 30 feet)
Allowable Lateral Passive Resistance:	300 psf/ft* (below 18 inches)
Allowable Coefficient of Friction:	0.35*

*These values include a factor of safety of approximately 1.5.

The net allowable bearing pressures presented above may be increased by one-third to resist transient, dynamic loads such as wind or seismic forces. Lateral resistance to footings should be ignored in the upper 12-inches from exterior finish grade. Although conventional spread footings could be used for support of the building, the owner should be aware that additional differential settlement could occur.

Foundation Construction Considerations

All foundation subgrades should be free of water and loose soil prior to placing concrete and should be prepared as recommended in this report. Concrete should be placed soon after excavating and compaction to reduce disturbance to bearing soils. Should soils at foundation level become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed prior to placing concrete. We recommend SSGC observe all foundation subgrades prior to placement of concrete.

Foundation Drainage

Ground surface adjacent foundations should be sloped away from the building. We recommend footing drains are installed around perimeter thickened edge footings. Footing drains should include a minimum 4-inch diameter perforated rigid plastic drain line installed at the base of the footing. The perforated drain lines should be connected to a tight line pipe that discharges to an approved storm drain receptor. The drain line should be surrounded by a zone of clean, free-draining granular material having less than 5 percent passing the No. 200 sieve or meeting the requirements of section 9-03.12(2) "Gravel Backfill for Walls" in the 2018 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction manual (M41-10). The free-draining aggregate zone should be at least 12 inches wide and wrapped in filter fabric. The granular fill should extend to within 6 inches of final grade where it should be capped with compacted fill containing sufficient fines to reduce infiltration of surface water into the footing drains. Cleanouts are recommended for maintenance of the drain system.

On-Grade Floor Slabs

On-grade floor slabs should be placed on prepared subgrades as described in this report. We recommend a modulus subgrade reaction of 125 pounds per square inch per inch (psi/in) for floor slabs on subgrade soils.

We recommend a capillary break is provided between the prepared subgrade and bottom of slab. Capillary break material should be a minimum of 4 inches thick and consist of compacted clean, free-draining, well graded coarse sand and gravel. The capillary break material should contain less than 5 percent fines, based on that soil fraction passing the U.S. No. 4 sieve. Alternatively, a clean angular gravel such as No. 7 aggregate per Section 9-03.1(4)C of the 2018 WSDOT (M41-10) manual could be used for this purpose.

Seismic Considerations

Seismic parameters and values in Table 2 are recommended based on the 2018 International Building Code (IBC).

Table 2. Seismic Parameters

PARAMETER	VALUE
2018 International Building Code (IBC) Site Classification[1]	E
S_s Spectral Acceleration for a Short Period	1.195
S_1 Spectral Acceleration for a 1-Second Period	0.487g

[1] Note: In general accordance with the *2018 International Building Code*, for risk categories I,II,III. IBC Site Class is based on the estimated characteristics of the upper 100 feet of the subsurface profile.

Liquefaction

Soil liquefaction is a condition where loose, typically granular soils located below the groundwater surface lose strength during ground shaking, and is often associated with earthquakes. The risk of liquefaction at this site is considered low due to the overall fine-grained nature of native site soils. However, some deformation of underlying soft soils at this site should be expected. Although structural failure of foundations is not anticipated, some limited structural damage could occur during a seismic event.

Conventional Asphalt Pavement Sections

Subgrades for conventional pavement areas should be prepared as described in the "*Subgrade Preparation*" section of this report. Subgrades below pavement sections should be graded or crowned to promote drainage and not allow for ponding of water beneath the section. If drainage is not provided and ponding occurs, subgrade soils could become saturated, lose strength, and result in premature distress or failure of the section. In addition, the pavement surfacing should also be graded to promote drainage and reduce the potential for ponding of water on the pavement surface.

We recommend a separation fabric (such as Mirafi 140N) is placed on new pavement subgrades that consist of native clayey silt prior to placement of structural or pavement section fill. The purpose of the fabric is to provide segregation between new granular structural fill and the finer grained subgrade soil. Without the fabric, the new granular fill will have the tendency to migrate into the softer/looser subgrade soil over time, which can compromise the structural integrity of the structural fill zone leading to premature distress of the pavement section. A separation fabric is not considered necessary for pavement subgrades that consist of existing granular fill.

Minimum recommended pavement sections for conventional asphalt pavements are presented in Table 3. New pavement sections in public right-of-ways should conform to City of Centralia standards.

Table 3. Minimum Pavement Sections

Traffic Area	Minimum Recommended Pavement Section Thickness (inches)			
	Asphalt Concrete Surface[1]	Portland Cement Concrete[2]	Aggregate Base Course[3,4]	Subbase Aggregate[5]
Heavy Traffic	3	6	4	12
Parking Areas	2	5	4	12

[1] 1/2 –inch nominal aggregate hot-mix asphalt (HMA) per WSDOT 9-03.8(1)

[2] A 28-day minimum compressive strength of 4,000 psi and an allowable flexural strength of at least 250 psi

[3] Crushed Surfacing Base Course per WSDOT 9-03.9(3)

[4]Although not required for structural support under concrete pavements, a minimum four-inch-thick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade "pumping" through joints

[5] 95% compacted native subgrade or Gravel Borrow per WSDOT 9-03.14(1) or Crushed Surfacing Base Course WSDOT 9-03.9(3)

Conventional Pavement Maintenance

The performance and lifespan of pavements can be significantly impacted by future maintenance. The above pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be completed. Proper maintenance will slow the rate of pavement deterioration and will improve pavement performance and life. Preventive maintenance consists of both localized maintenance (crack and joint sealing and patching) and global maintenance (surface sealing). Added maintenance measures should be anticipated over the lifetime of the pavement section if any fill or topsoil is left in-place beneath pavement sections.

REPORT CONDITIONS

This report has been prepared for the exclusive use of RB Engineering for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No warranties, either express or implied, are intended or made. The analysis and recommendations presented in this report are based on observed soil conditions and test results at the indicated locations, and from other geologic information discussed. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

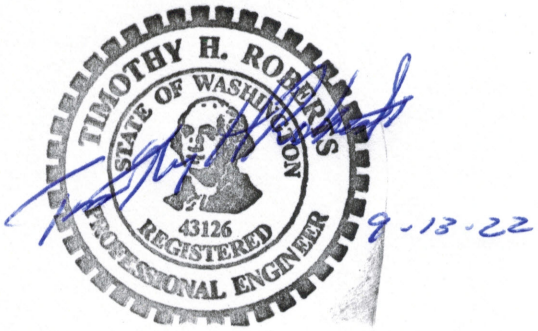
This report was prepared for the planned type of development of the site as discussed herein. It is not valid for third party entities or alternate types of development on the site without the express written consent of SSGC. If development plans change, we should be notified to review those changes and modify our recommendations as necessary.

The scope of services for this project does not include any environmental or biological assessment of the site including identification or prevention of pollutants, hazardous materials, or conditions. Other studies should be completed if the owner is concerned about the potential for contamination or pollution.

We appreciate the opportunity to work with you on this project. Please contact us if additional information is required or we can be of further assistance.

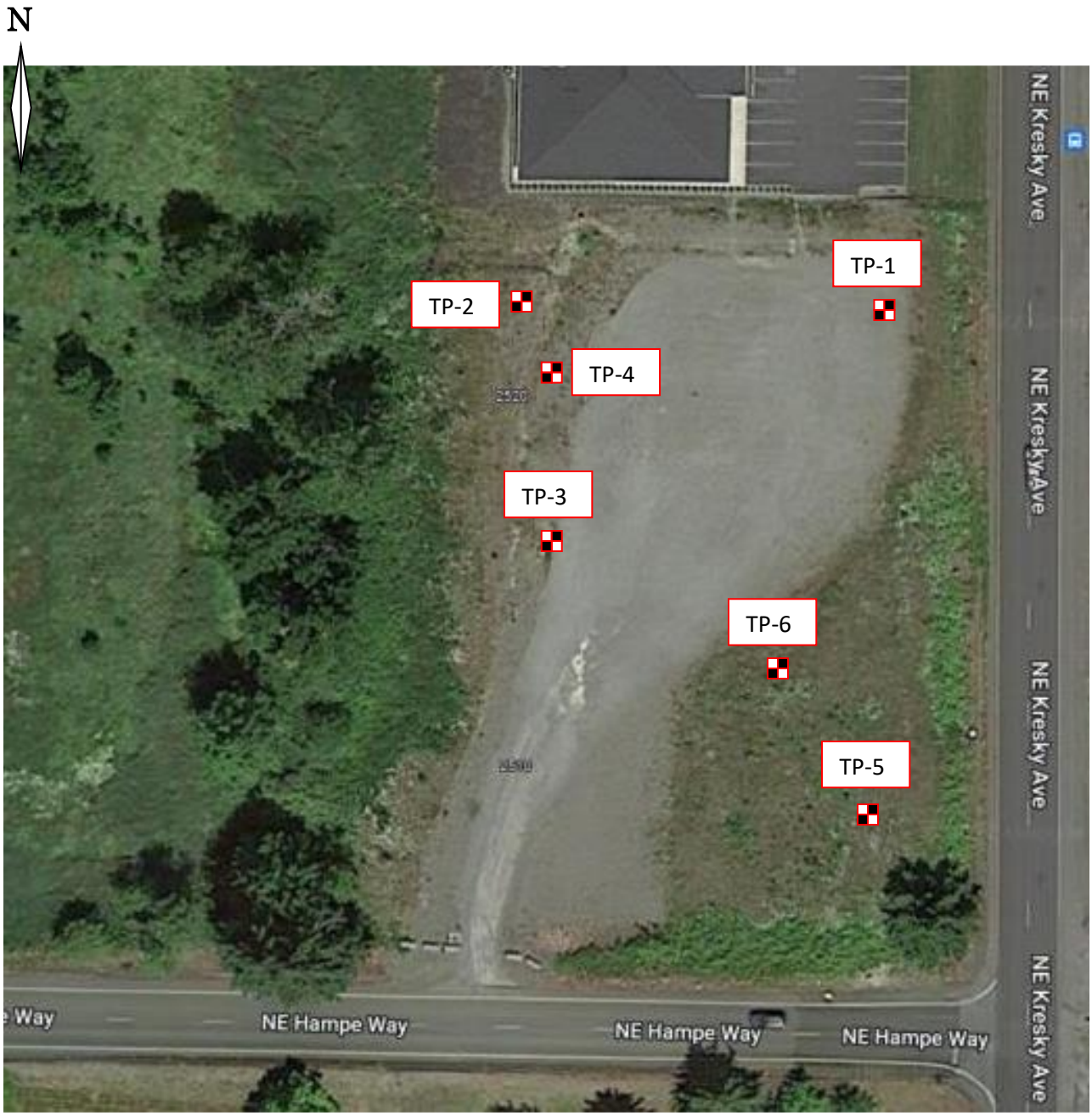
Respectfully,

South Sound Geotechnical Consulting



Timothy H. Roberts, P.E.
Member/Geotechnical Engineer

Attachments: Figure 1 – Exploration Plan
Appendix A – Field Exploration Procedures and Test Pit Logs
Unified Soil Classification System



Legend

TP - 1

Approximate Test Pit Location

Base map from Google Maps.

Scale: NTS

South Sound Geotechnical Consulting
P.O. Box 39500
Lakewood, WA 98496
(253) 973-0515

Figure 1 – Exploration Plan

Wilson Commercial
Centralia, Washington

SSGC Project #22066

Appendix A

Field Exploration Procedures and Test Pit Logs

Field Exploration Procedures

Our field exploration for this project included six test pits completed on July 21, 2022. The approximate locations of the explorations are shown on Figure 1, Exploration Plan. Exploration locations were determined by pacing from site features. Test pit locations should be considered accurate only to the degree implied by the means and methods used.

A private excavation contractor dug the test pits. Select soil samples were collected and stored in moisture tight containers for further assessment and laboratory testing. Explorations were backfilled with excavated soils and tamped when completed. Please note that backfill in the explorations may settle with time. Backfill material located in building or pavement areas should be re-excavated and recompacted, or replaced with structural fill.

The following logs indicate the observed lithology of soils and other materials observed in the explorations at the time of excavation. Where a soil contact was observed to be gradational, our log indicates the average contact depth. Our logs also indicate the approximate depth to groundwater (where observed at the time of excavation), along with sample numbers and approximate sample depths. Soil descriptions on the logs are based on the Unified Soil Classification System.

Test Pit TP-1

Depth (feet)	Material Description
0 – 2	**Fill:** Surface gravel over mixed silt, sand, with occasional gravel: Loose to medium dense, damp, brown.
2 – 8	SILT with clay, sand, and gravel: Stiff, moist, rust brown. (ML)
	Test pit completed at approximately 5 feet on 7/21/22. Groundwater not observed at feet at time of excavation.

Test Pit TP-2

Depth (feet)	Material Description
0 – 6.5	**Fill:** Mixed silt, sand, with occasional gravel: Loose to medium dense, damp, brown.
6.5 – 10.5	**Fill:** Silty sand with gravel and cobbles: Medium dense, moist, dark brown to black.
10.5 – 15	Clayey SILT: Soft to stiff, wet, grayish green with orange mottling.(ML)
	Test pit completed at approximately 15 feet on 7/21/22. Groundwater not observed at time of excavation.

Test Pit TP-3

Depth (feet)	Material Description
0 – 3.5	**Fill:** Mixed silt, sand, with occasional gravel: Loose to medium dense, damp, brown.
3.5 – 9	**Fill:** Silty sand with gravel and cobbles: Medium dense, moist, dark brown to black.
9 – 10.5	Clayey SILT with roots: Soft, wet, dark gray.(ML)
10.5 – 12	Clayey SILT: Soft to stiff, wet, grayish green with orange mottling. (ML)
	Test pit completed at approximately 12 feet on 7/21/22. Groundwater not observed at time of excavation.

Test Pit TP-4

Depth (feet)	Material Description
0 – 4	**Fill:** Mixed silt, sand, with occasional gravel: Loose to medium dense, damp, brown.
4 – 7	**Fill:** Silty sand with gravel and cobbles: Medium dense, moist, dark brown to black.
7 – 8.5	Clayey SILT with roots: Soft, wet, dark gray. (ML)
8.5 – 10	Clayey SILT: Soft to stiff, wet, grayish green with orange mottling**.** (ML)
	Test pit completed at approximately 10 feet on 7/21/22. Groundwater not observed at time of excavation.

Test Pit TP-5

Depth (feet)	Material Description
0 – 4	**Fill:** Clayey SILT: Soft, moist, brown to gray.
4 – 6	SILT with clay, sand, and gravel: Stiff, moist, gray with orange mottling. (ML)
	Test pit completed at approximately 6 feet on 7/21/22. Groundwater not observed at time of excavation.

Test Pit TP-6

Depth (feet)	Material Description
0 – 1	**Fill:** Clayey SILT: Soft, moist, brown to gray.
1 – 4	SILT with clay, sand, and gravel: Stiff, moist, gray with orange mottling. (ML)
	Test pit completed at approximately 4 feet on 7/21/22. Groundwater not observed at time of excavation.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried			Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OH	Organic clay[K,L,M,P]
			Liquid limit - not dried			Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

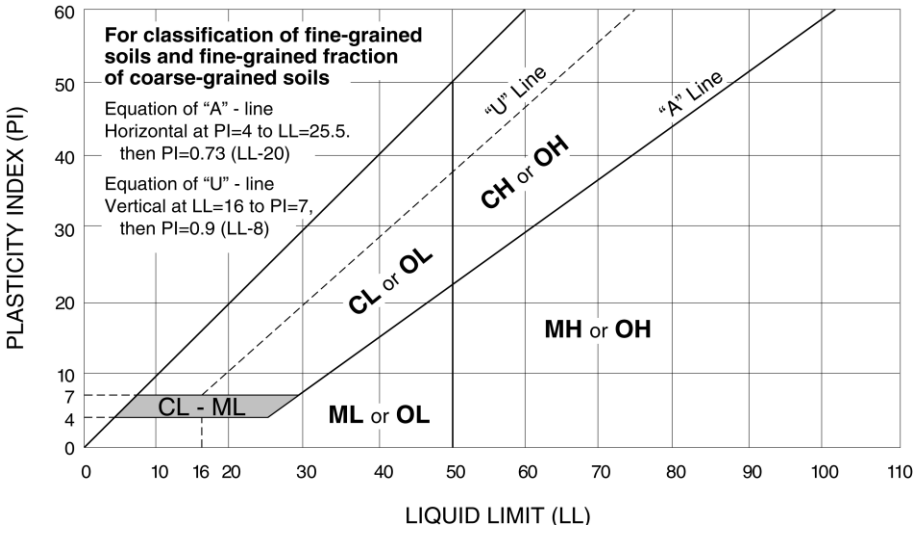
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



APPENDIX 4 – OPERATION AND MAINTENANCE MANUAL

An Operation and Maintenance plan will be provided in the Final Drainage Report.

APPENDIX 5 – CONSTRUCTION SWPPP

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Wilson Commercial

Prepared for:

The Washington State Department of Ecology

SW Regional Office

Permittee / Owner	Developer	Operator / Contractor
Kim Wilson	Pending	Pending

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
Pending	Pending	Pending

SWPPP Prepared By

Name	Organization	Contact Phone Number
Robert Balmelli	RB Engineering	(360) 740-8919

SWPPP Preparation Date

10.04.22

Project Construction Dates

Activity / Phase	Start Date	End Date
Pending	Pending	Pending

PROJECT OVERVIEW

WAR No. : Pending

Site Address: 2510 & 2520 NE Kresky Avenue
Centralia, WA 98531

Applicable Criteria	Areas
Total Site Area	2.21 AC
Land Disturbing Area	2.17 AC

Existing land cover: Gravel parking and lawn areas

Drainage Patterns: Natural drainage leaves the site to the west of the property.

Critical Areas: Wetlands are present onsite.

Steep Slopes: Slopes onsite are flat to steep with slopes ranging from 1-70%.

Receiving Water Body: Salzer Creek and eventually reaching Chehalis River

WaterShed: WRIA 23 – Upper Chehalis
https://waecy.maps.arcgis.com/apps/webappviewer/index.html?id=996e6b21ae394cc3a3b63c6da0c3aa0a

Description of Construction Activities (example: site preparation, demolition, excavation):

Project includes the construction of a new 11,700 sf professional office building, utilities, and associated parking. Typical construction activities include excavation, paving, etc.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Drainage and Erosion Control Plan:

The site has no tributary points of flow; however, it currently takes a portion of the roadway runoff from Kresky Avenue. The site has natural drainage to the west where it enters a wetland near the property's western line eventually reach Salzer Creek and ultimately the Chehalis River.

Description of Final Stabilization (example: extent of revegetation, paving, landscaping):

Project final stabilization will include installation of new impervious hard surfaces and landscaping.

CONSTRUCTION SWPPP

All new development and redevelopment shall comply with Construction SWPPP Elements #1 through #12 listed below. The suggested BMPs underlined and in **bold** are proposed for use in all phases of construction. Copies of the details for each of the recommended BMPs are included.

Element 1: Mark Clearing Limits

- Prior to 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. These shall be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts.
- Plastic, metal, or stake wire fence may be used to mark the clearing limits.
- Suggested BMPs:

  BMP C101: Preserving Natural Vegetation
  BMP C102: Buffer Zones
  BMP C103: High-Visibility Fence
  BMP C233: Silt Fence

Element 2: Establish Construction Access

- Construction vehicle access and exit shall be limited to one route if possible, or two for linear projects such as roadways where one access is necessary for large equipment maneuvering.
- Access points shall be stabilized with quarry spall or crushed rock to minimize the tracking of sediment onto public roads.
- Wheel wash or tire baths should be located onsite, if applicable.
- Roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area. Street washing will be allowed only after sediment is removed in this manner.
- Street wash wastewater shall be controlled by pumping back onsite or otherwise be prevented from discharging into systems tributary to state surface waters.
- Construction access restoration shall be equal to or better than the pre-construction condition.
- Suggested BMPs:

  BMP C105: Stabilized Construction Access
  BMP C106: Wheel Wash
  BMP C107: Construction Road/Parking Area Stabilization

Element 3: Control Flow Rates

- Properties and waterways downstream from development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site, as required by local plan approval authority.
- Downstream analysis is necessary if changes in offsite flows could impair or alter conveyance systems, streambanks, bed sediment, or aquatic habitat.
- Where necessary to comply with Minimum Requirement #7, stormwater detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g. impervious surfaces).
- Suggested BMPs:

  BMP C203: Water Bars
  BMP C207: Check Dams
  BMP C209: Outlet Protection
  BMP C235: Wattles
  BMP C240: Sediment Trap
  BMP C241: Sediment Pond (Temporary)
  See also, V-12 Detention BMPs

Element 4: Install Sediment Controls

- The duff layer, native top soil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable.
- Prior to leaving a construction site or prior to discharge to an infiltration facility, stormwater runoff from disturbed areas shall pass through a sediment pond or other appropriate sediment removal BMP. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Element #3, bullet #1. Full stabilization means concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion. The local permitting authority shall inspect and approve areas fully stabilized by means other than pavement or quarry spalls.
- BMPs intended to trap sediment on site shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.
- Earthen structures such as dams, dikes, and diversions shall be seeded and mulched according to the timing indicated in Element #5.
- BMPs intended to trap sediment on site must be located in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages, often during non-storm events, in response to rain event changes in stream elevation or wetted area.
- Suggested BMPs

  BMP C231: Brush Barrier
  BMP C232: Gravel Filter Berm

BMP C233: Silt Fence
BMP C234: Vegetated Strip
BMP C235: Wattles
BMP C240: Sediment Trap
BMP C241: Sediment Pond (Temporary)
BMP C250: Construction Stormwater Chemical Treatment
BMP C251: Construction Stormwater Filtration

Element 5: Stabilize Soils

- Exposed and unworked soils shall be stabilized by application of effective BMPs that protect the soil from the erosive forces of raindrops, flowing water, and wind.
- From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This stabilization requirement applies to all soils on site, whether at final grade or not. These time limits may be adjusted by the local permitting authority if it can be shown that the average time between storm events justifies a different standard.
- Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.
- Applicable practices 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.
- Selected soil stabilization measures shall be appropriate for the time of year, site conditions, estimated duration of use, and the water quality impacts that stabilization agents may have on downstream waters or ground water.
- Soil stockpiles must be stabilized and protected with sediment trapping measures.
- Linear construction activities such as right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall be conducted to meet the soil stabilization requirement. Contractors shall install the bedding materials, roadbeds, structures, pipelines, or utilities and re-stabilize the disturbed soils so that:

– from October 1 through April 30 no soils shall remain exposed and unworked for more than 2 days and

– from May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days.

- Suggested BMPs:

BMP C120: Temporary and Permanent Seeding
BMP C121: Mulching
BMP C122: Nets and Blankets
BMP C123: Plastic Covering
BMP C124: Sodding
BMP C125: Topsoiling / Composting

BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection
BMP C130: Surface Roughening
BMP C131: Gradient Terraces
BMP C140: Dust Control

Element 6: Protect Slopes

- Design, construct, and phase cut and fill slopes in a manner that will minimize erosion.
- Consider soil type and its potential for erosion.
- Reduce slope runoff velocities by reducing continuous length of slope with terracing and diversions, reduce slope steepness, and roughen slope surface.
- Divert upslope drainage and run-on waters with interceptors at top of slope. Stormwater from off site should be handled separately from stormwater generated on the site. Diversion of offsite stormwater around the site may be a viable option. Diverted flows shall be redirected to the natural drainage location at or before the property boundary.
- Contain downslope collected flows in pipes, slope drains, or protected channels. Check dams shall be used within channels that are cut down a slope.
- Provide drainage to remove ground water intersecting the slope surface of exposed soil areas.
- Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.
- Stabilize soils on slopes, as specified in Element #5.
- Suggested BMPs

  BMP C120: Temporary and Permanent Seeding
  BMP C121: Mulching
  BMP C122: Nets and Blankets
  BMP C123: Plastic Covering
  BMP C124: Sodding
  BMP C130: Surface Roughening
  BMP C131: Gradient Terraces
  BMP C200: Interceptor Dike and Swale
  BMP C201: Grass-Lined Channels
  BMP C203: Water Bars
  BMP C204: Pipe Slope Drains
  BMP C205: Subsurface Drains
  BMP C206: Level Spreader
  BMP C207: Check Dams
  BMP C208: Triangular Silt Dike (TSD)

Element 7: Protect Drain Inlets

- Storm drain inlets operable during construction shall be protected so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

- Approach roads shall be kept clean. Sediment and street wash water shall not be allowed to enter storm drains without prior and adequate treatment unless treatment is provided before the storm drain discharges to waters of the state.

- Inlets should be inspected weekly at a minimum and daily during storm events. Inlet protection devices should be cleaned or removed and replaced before six inches of sediment can accumulate.

- Suggested BMPs:

  BMP C220: Inlet Protection

Element 8: Stabilize Channels and Outlets

- Temporary onsite conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected flow velocity of a 2-year, 24-hour frequency storm for the developed condition.
- Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.
- Suggested BMPs:

  BMP C122: Nets and Blankets
  BMP C202: Riprap Channel Lining
  BMP C207: Check Dams
  BMP C209: Outlet Protection

Element 9: Control Pollutants

- All pollutants, including waste materials and demolition debris, that occur on site during construction shall be handled and disposed of in a manner that does not cause contamination of stormwater. Woody debris may be chopped and spread on site.
- Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste).
- Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed onsite using temporary plastic placed beneath and, if raining, over the vehicle.

- Wheel wash or tire bath wastewater shall be discharged to a separate onsite treatment system or to the sanitary sewer.
- Application of agricultural chemicals including fertilizers and pesticides shall be conducted in a manner and at application rate that will not result in loss of chemicals to stormwater runoff. Manufacturer recommendations for application rates and procedures shall be followed.
- BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters. Stormwater discharges shall not cause a violation of the water quality standard for pH in the receiving water.
- Suggested BMPs:

BMP C151: Concrete Handling
BMP C152: Sawcutting and Surfacing Pollution Prevention
BMP C153: Material Delivery, Storage, and Containment
BMP C154: Concrete Washout Area
BMP C250: Construction Stormwater Chemical Treatment
BMP C251: Construction Stormwater Filtration
BMP C252: Treating and Disposing of High pH Water
Also see, the Source Control BMPs detailed in Volume IV

Element 10: Control De-Watering

- Foundation, vault, and trench de-watering water shall be discharged into a controlled conveyance system prior to discharge to a sediment pond. Channels must be stabilized, as specified in Element #8.
- Clean, non-turbid de-watering water, such as well-point ground water, can be discharged to systems tributary to state surface waters, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of receiving waters. These clean waters should not be routed through stormwater sediment ponds.
- Highly turbid or contaminated dewatering water from construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam shall be handled separately from stormwater.
- Other disposal options, depending on site constraints, may include:

1. infiltration,
2. transport off site in vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters,
3. onsite treatment using chemical treatment or other suitable treatment technologies,
4. sanitary sewer discharge with local sewer district approval, or

5. use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

- Suggested BMPs:

  BMP C203: Water Bars
  BMP C236: Vegetative Filtration

Element 11: Maintain BMPs

- Temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with BMPs.
- Sediment control BMPs shall be inspected weekly or after a runoff-producing storm event during the dry season and daily during the wet season. The inspection frequency for stabilized, inactive sites shall be determined by the local permitting authority based on the level of soil stability and potential for adverse environmental impacts.
- Temporary erosion and sediment control 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 removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

- Suggested BMPs:

  BMP C150: Materials on Hand
  BMP C160: Certified Erosion and Sediment Control Lead

Element 12: Manage the Project

- Phasing of Construction

  Development projects shall be phased where feasible in order to prevent, to the maximum extent practicable, the transport of sediment from the development site during construction. Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities for any phase.

  Clearing and grading activities for development shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing these permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance and compaction of native soils except as needed for building purposes. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions, shall be delineated on the site plans and the development site.

- Seasonal Work Limitations

  From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that the

transport of sediment from the construction site to receiving waters will be prevented through a combination of the following:

1. Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and
2. Limitations on activities and the extent of disturbed areas; and
3. Proposed erosion and sediment control measures.

Based on the information provided and local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance. The local permitting authority shall take enforcement action - such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:

- If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard; or
- If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.

Local governments may restrict clearing and grading activities where site conditions may present a significant risk of impact to property or critical areas. Contact the local government permitting authority for information on specific site restrictions.

The following activities are exempt from the seasonal clearing and grading limitations:

1. Routine maintenance and necessary repair of erosion and sediment control BMPs,
2. Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil, and
3. Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

- Coordination with Utilities and Other Contractors

  The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.

- Inspection and Monitoring

  All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function.

  A certified professional in erosion and sediment control shall be identified in the Construction SWPPP and shall be onsite or on-call at all times.

  Sampling and analysis of the stormwater discharges from a construction site may be necessary on a case-by-case basis to ensure compliance with standards. The local permitting authority may establish monitoring and reporting requirements when necessary.

Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, the SWPPP shall be modified, as appropriate, in a timely manner.

- Maintenance of the Construction SWPPP

  The Construction SWPPP shall be retained onsite or within reasonable access to the site. The Construction SWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance of any BMP.

- Suggested BMPs:

  BMP C150: Materials on Hand
  BMP C160: Certified Erosion and Sediment Control Lead
  BMP C162: Scheduling

Element #13: Protect Low Impact Development BMPs

Municipal Stormwater Permits Requirements

Protect all Bioretention and Rain Garden BMPs 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 BMPs. Restore the BMP so their fully functioning condition if they accumulate sediment during construction. Re-storing the BMP must include removal of sediment and any sediment-laden Bioretention/rain garden soils, and replacing the removed soils with soils meeting the design specification.

Prevent compacting Bioretention and rain garden BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

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.

Pavements fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures from the local stormwater manual or the manufacturer's procedures.

Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

Additional Guidance

See Chapter 5: Precision Site Preparation, Construction & Inspection of LID Facilities in the

LID Technical Guidance Manual for Puget Sound (2012) for more detail on pro-tecting LID integrated management practices.

Note that the LID Technical Guidance Manual for Puget Sound (2012) is for additional informational purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the LID Technical Guidance Manual for Puget Sound 2012).

- Suggested BMPs:

BMP C102: Buffer Zones

BMP C103: High-Visibility Fence

BMP C200: Interceptor Dike and Swale

BMP C201: Grass-Lined Channels

BMP C207: Check Dams

BMP C208: Triangular Silt Dike (TSD)

BMP C231: Brush Barrier

BMP C233: Silt Fence

BMP C234: Vegetated Strip

Project Specific Construction BMPs

BMP C102: Buffer Zones
BMP C105: Stabilized Construction Access
BMP C120: Temporary and Permanent Seeding
BMP C130: Surface Roughening
BMP C140: Dust Control
BMP C151: Concrete Handling
BMP C152: Sawcutting and Surfacing Pollution Prevention
BMP C154: Concrete Washout Area
BMP C160: Certified Erosion and Sediment Control Lead
BMP C209: Outlet Protection
BMP C220: Inlet Protection
BMP C233: Silt Fence

BMP C102: Buffer Zones

Purpose

Creation of an undisturbed area or strip of natural vegetation or an established suitable planting that will provide a living filter to reduce soil erosion and stormwater runoff velocities.

Conditions of Use

Buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Contractors can use vegetative buffer zone BMPs to protect natural swales and they can incorporate them into the natural landscaping of an area.

Do not use critical-areas buffer zones as sediment treatment areas. These areas shall remain completely undisturbed. The local permitting authority may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.

The types of buffer zones can change the level of protection required as shown below:

Designated Critical Area Buffers - buffers that protect Critical Areas, as defined by the Washington State Growth Management Act, and are established and managed by the local permitting authority. These should not be disturbed and must protected with sediment control BMPs to prevent impacts. The local permitting authority may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.

Vegetative Buffer Zones - areas that may be identified in undisturbed vegetation areas or managed vegetation areas that are outside any Designated Critical Area Buffer. They may be utilized to provide an additional sediment control area and/or reduce runoff velocities. If being used for preservation of natural vegetation, they should be arranged in clumps or strips. They can be used to protect natural swales and incorporated into the natural landscaping area.

Design and Installation Specifications

- Preserving natural vegetation or plantings in clumps, blocks, or strips is generally the easiest and most successful method.
- Leave all unstable steep slopes in natural vegetation.
- Mark clearing limits and keep all equipment and construction debris out of the natural areas and buffer zones. Steel construction fencing is the most effective method to protect sensitive areas and buffers. Alternatively, wire-backed silt fence on steel posts is marginally effective. Flagging alone is typically not effective.
- Keep all excavations outside the dripline of trees and shrubs.
- Do not push debris or extra soil into the buffer zone area because it will cause damage by burying and smothering vegetation.

- Vegetative buffer zones for streams, lakes or other waterways shall be established by the local permitting authority or other state or federal permits or approvals.

Maintenance Standards

Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed. Replace all damaged flagging immediately. Remove all materials located in the buffer area that may impede the ability of the vegetation to act as a filter.

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure II-3.1: Stabilized Construction Access for details. Note: the 100' minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').

Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table II-3.2: Stabilized Construction Access Geotextile Standards.

Table II-3.2: Stabilized Construction Access Geotextile Standards

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.

Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the Quarry Spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between Dually truck tires, and then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the Stabilized Construction Access remains effective. To remain effective, the BMP must prevent sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized Construction Accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table II-3.3: Stabilized Construction Access Alternative Material Requirements.

Table II-3.3: Stabilized Construction Access Alternative Material Requirements

Sieve Size	Percent Passing
2½″	99-100
2″	65-100
¾″	40-80
No. 4	5 max.
No. 100	0-2
% Fracture	75 min.

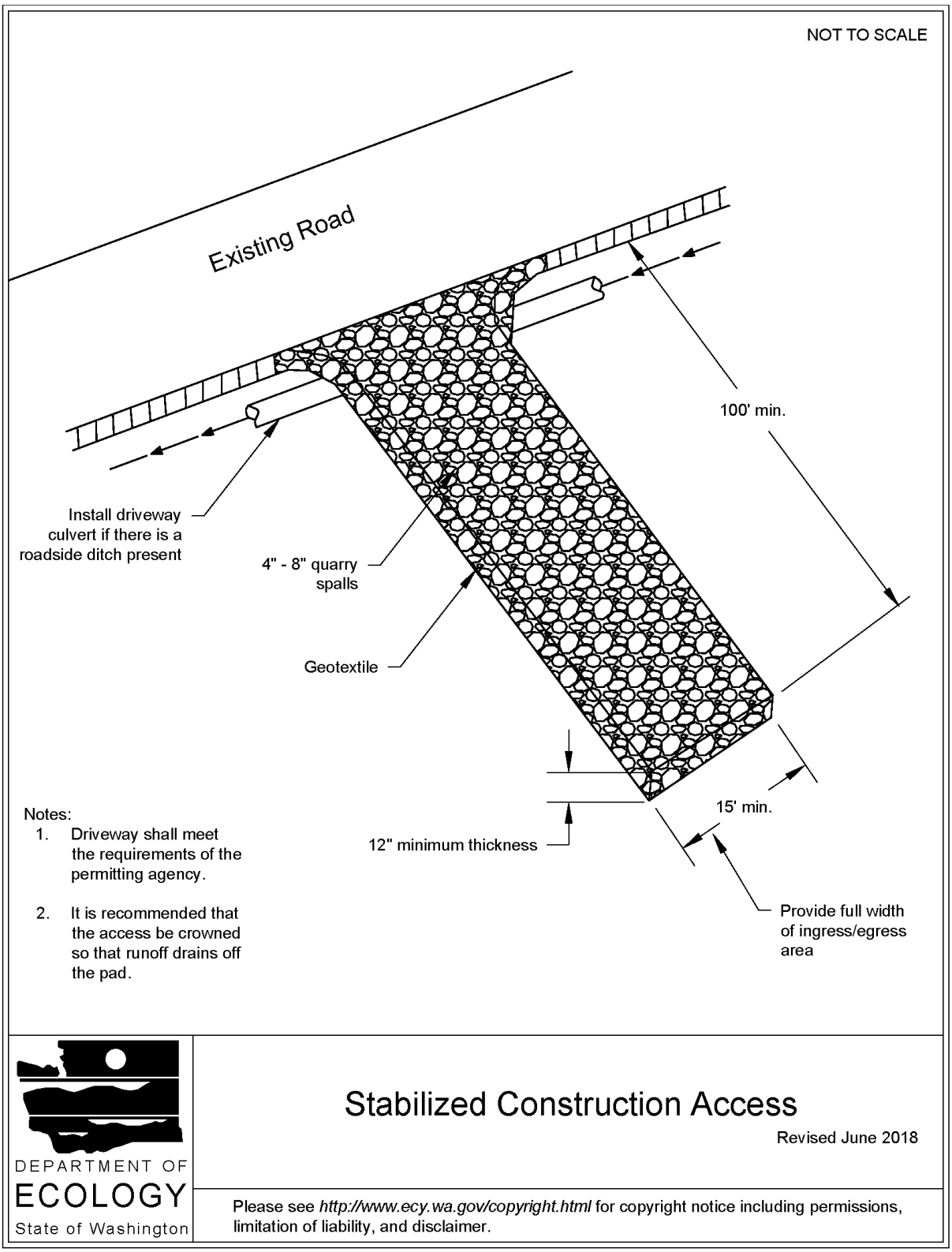
- All percentages are by weight.
- The sand equivalent value and dust ratio requirements do not apply.
- The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

Maintenance Standards

Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Figure II-3.1: Stabilized Construction Access



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 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.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

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.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. 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 75 percent vegetation cover. If vegetated channels cannot be established by seed before water flow; install sod in the channel bottom — over top of hydromulch and erosion con- trol blankets.
- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent 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.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:
    - Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
    - Phase 2- Install the rest of the mulch and tackifier over the first lift.

  Or, enhance vegetation by:
    - Installing the mulch, seed, fertilizer, and tackifier in one lift.
    - Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
    - Hold straw in place with a standard tackifier.

Both of these approaches 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.
- Repair of failed slope surfaces.

This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bon- ded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).

- Seed may be installed by hand if:
    - Temporary and covered by straw, mulch, or topsoil.
    - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in Table II-3.4: Temporary and Permanent Seed Mixes include recommended mixes for both temporary and permanent seeding.
- Apply these mixes, 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.
- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used,

depending on the soil type and hydrology of the area.

Table II-3.4: Temporary and Permanent Seed Mixes

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 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.				

Table II-3.4: Temporary and Permanent Seed Mixes (continued)

Common Name	Latin Name	% Weight	% Purity	% Germination
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 use soil amendments to achieve organic matter and permeability per- formance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application 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 that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent 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 percent tackifier. Achieve a minimum of 95 percent 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:
    - 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 percent cover (100 percent cover for areas

that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, nets, or blankets.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes run-off.

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:

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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

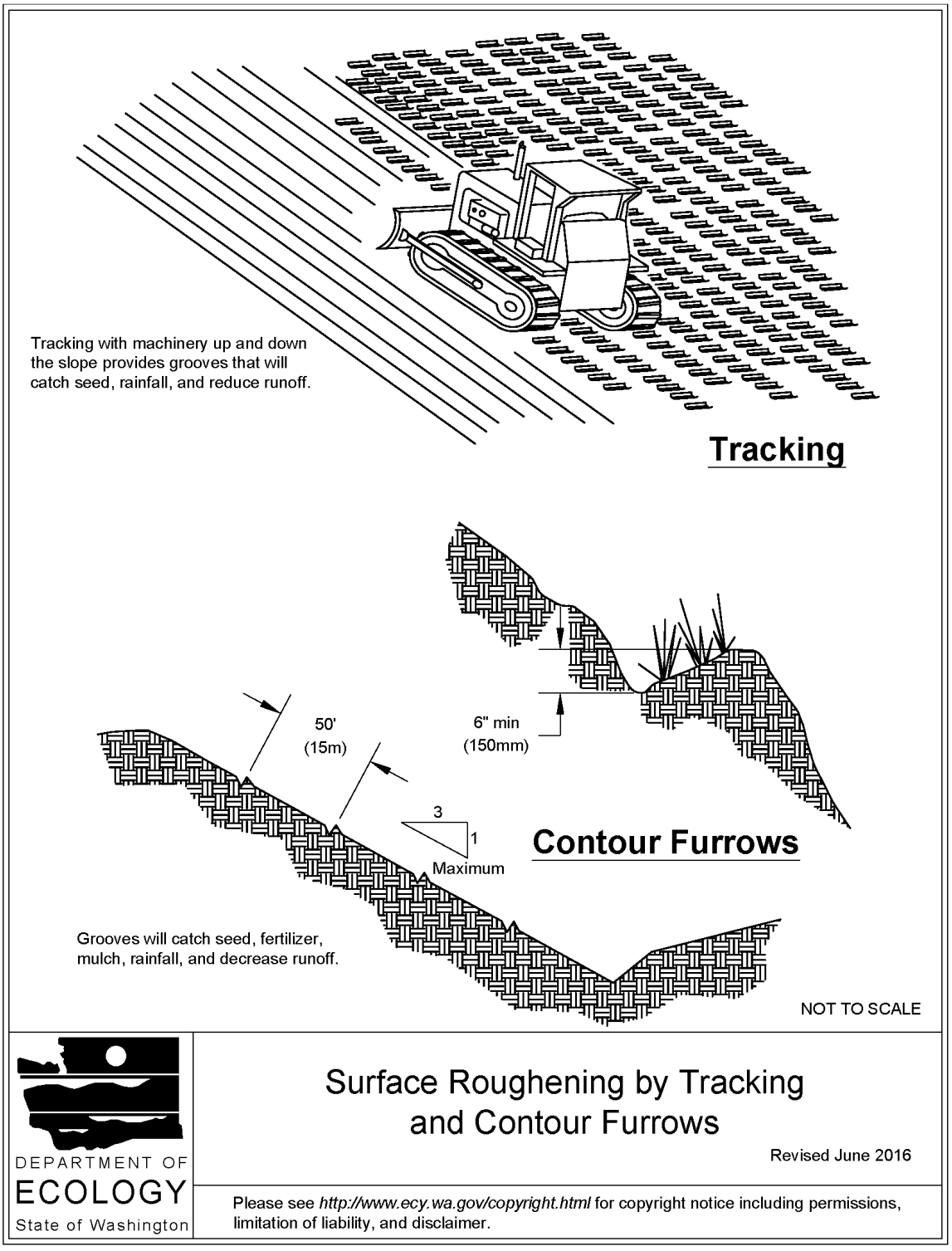
There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure II-3.5: Surface Roughening by Tracking and Contour 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-3.5: Surface Roughening by Tracking and Contour Furrows



BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and 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 ways, 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 governments 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 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.

- Contact your local Air Pollution Control Authority for guidance and training on other dust con-

trol measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

- 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-causing 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 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 contains fine particles and 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 through 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 ground water 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 ground water 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 vacuumtrucks.

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 reg- ulations. 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-3.7: Concrete Washout Area with Wood Planks

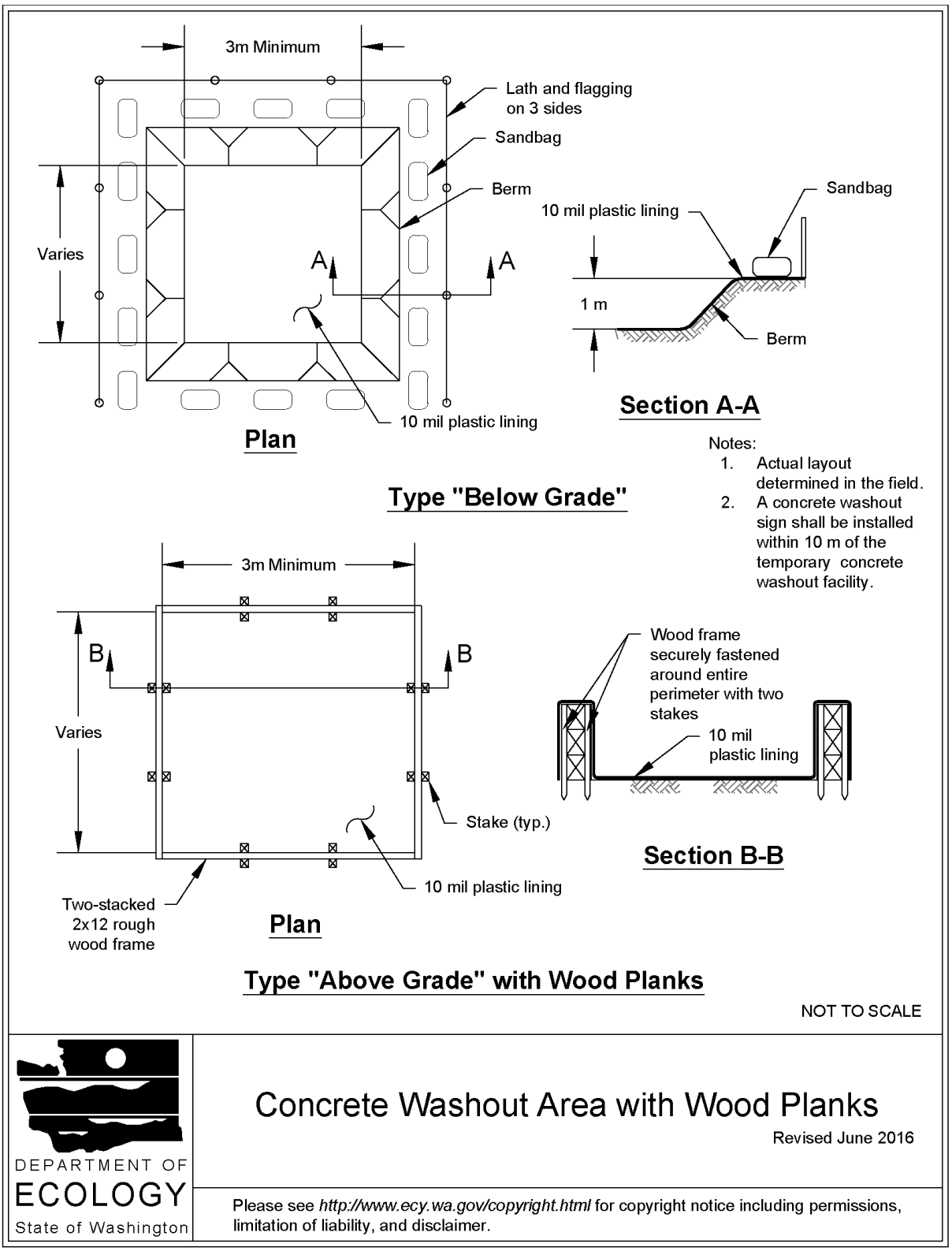


Figure II-3.8: Concrete Washout Area with Straw Bales

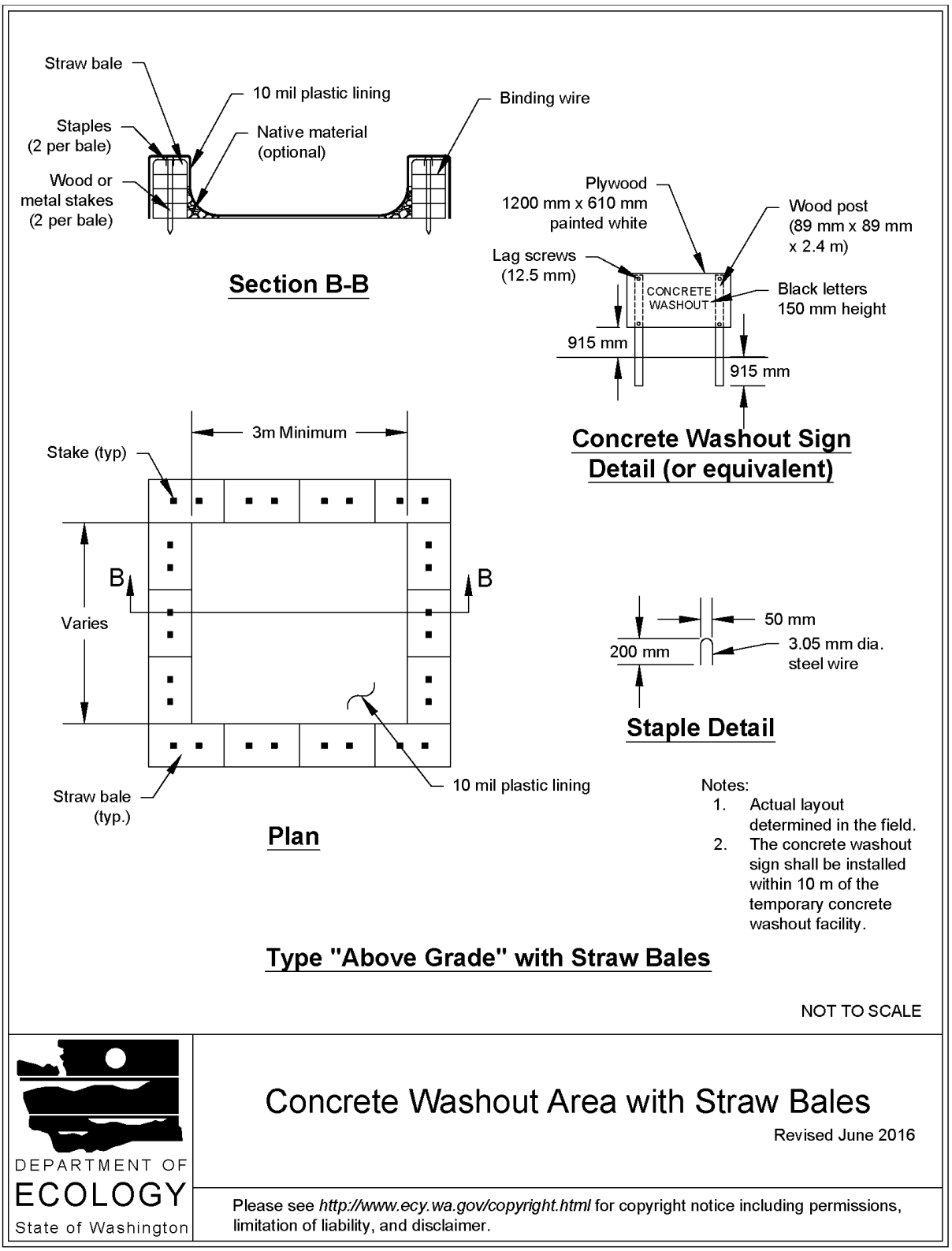
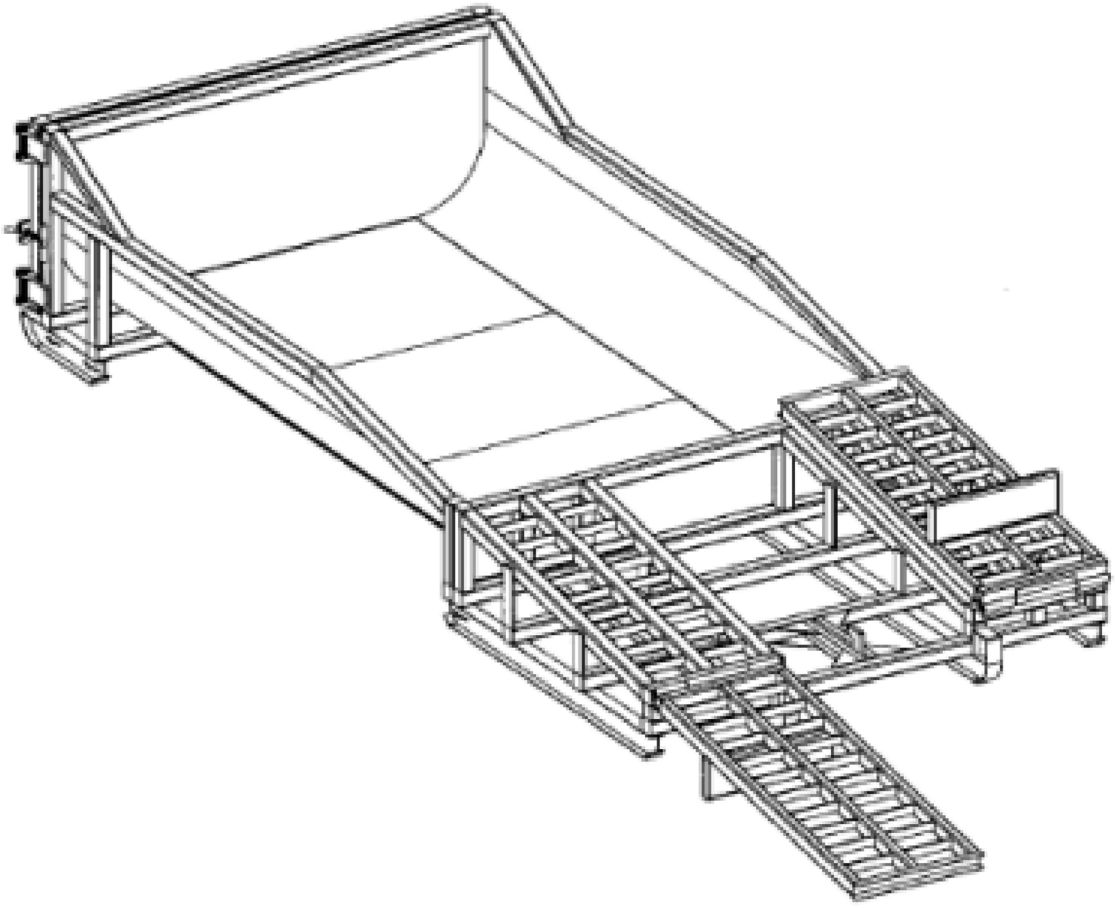


Figure II-3.9: Prefabricated Concrete Washout Container w/Ramp



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State of Washington

Prefabricated Concrete Washout Container w/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 erosion and sediment control 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-sed- iment-control

OR

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

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

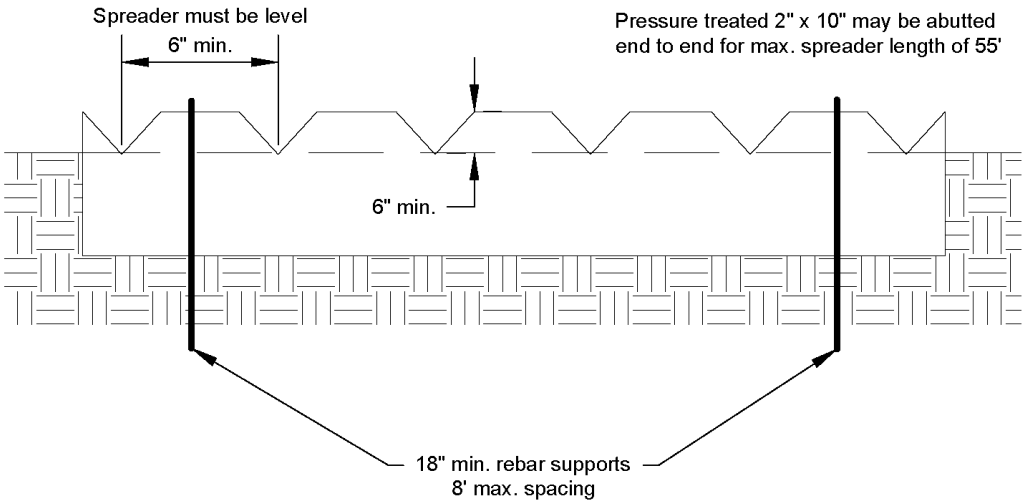
Specifications

- 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-2 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).
    - Facilitate, participate in, and take 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 erosion/sediment control 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.

Figure II-3.15: Detail of Level Spreader



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State of Washington

Detail of Level Spreader

Revised July 2017

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 manmade 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 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-2.11 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-3.10: 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-3.10: 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 1-2 ft as measured from the crest of the inlet structure.
- Slope sides 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.

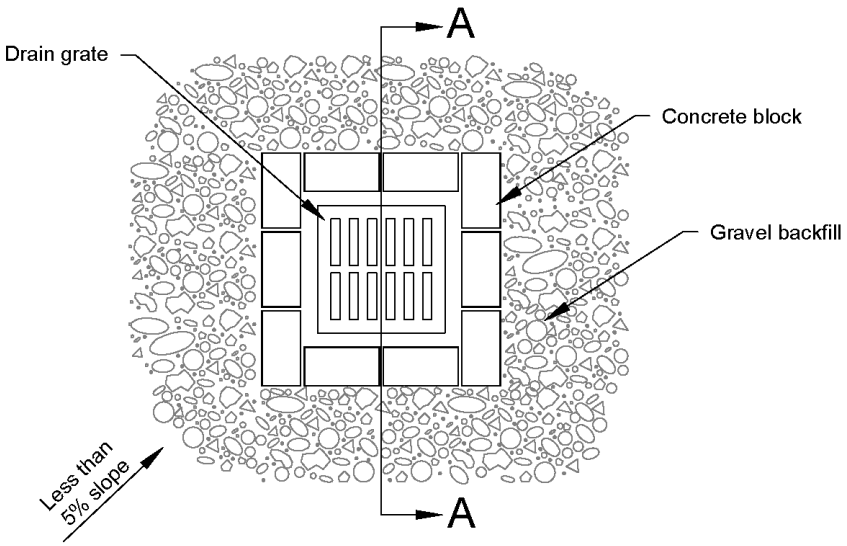
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing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

Block and Gravel Filter

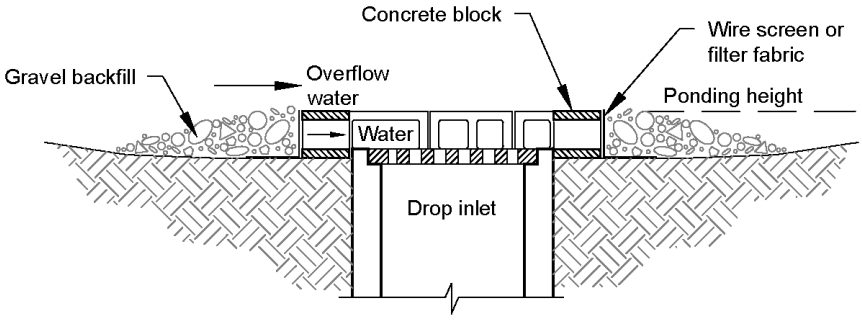
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel fil- ters include:

- 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 open- ing.
- 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 ½-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 stone area between the gravel berm and the inlet.
    - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: 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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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 ½-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:

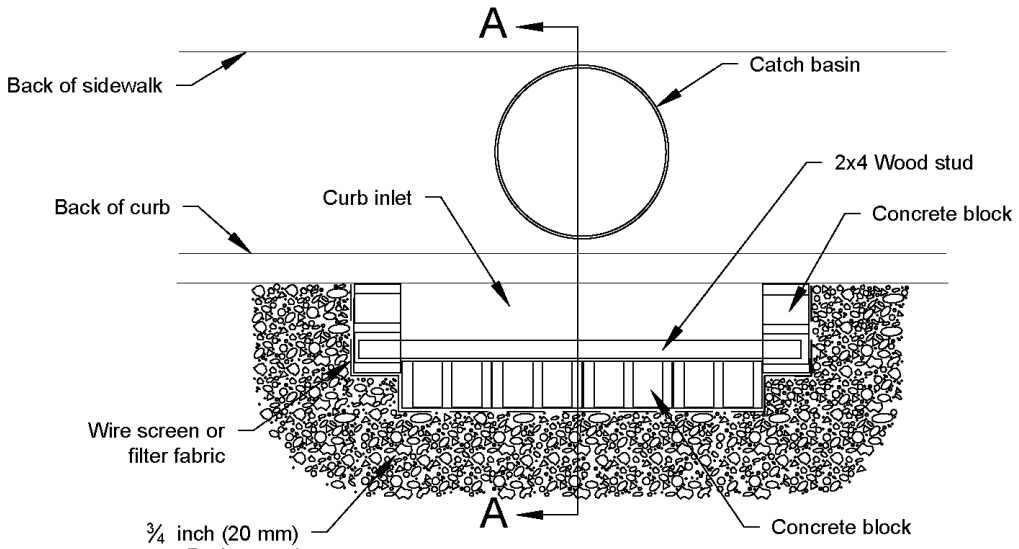
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

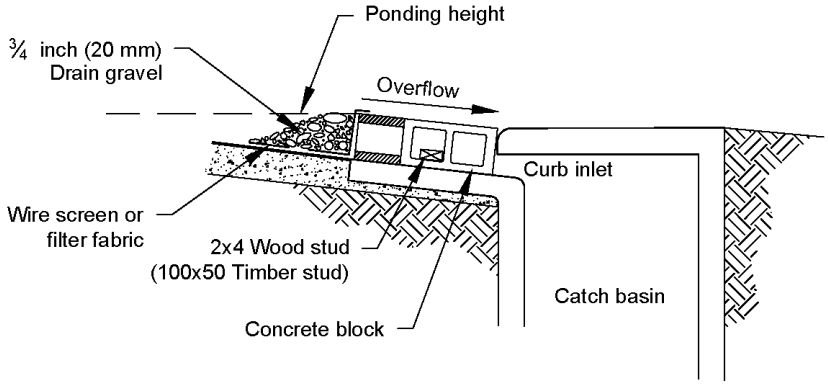
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-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-3.18: 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.

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State of Washington

Block and Gravel Curb Inlet Protection

Revised June 2016

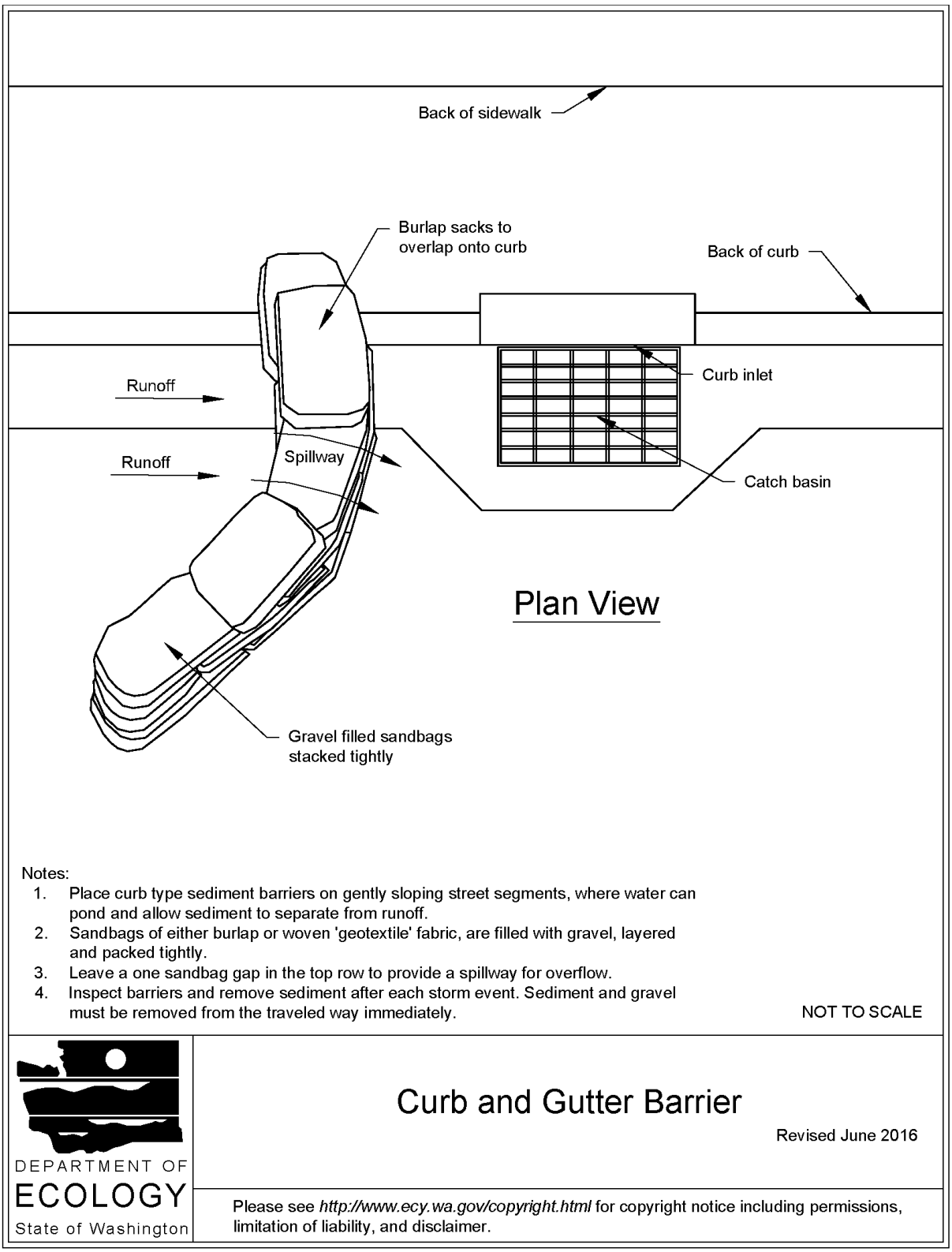
C

urb and Gutter Sediment Barrier

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-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier 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-3.19: Curb and Gutter Barrier



Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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State of Washington

Curb and Gutter Barrier

Revised June 2016

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 C233: Silt Fence

Purpose

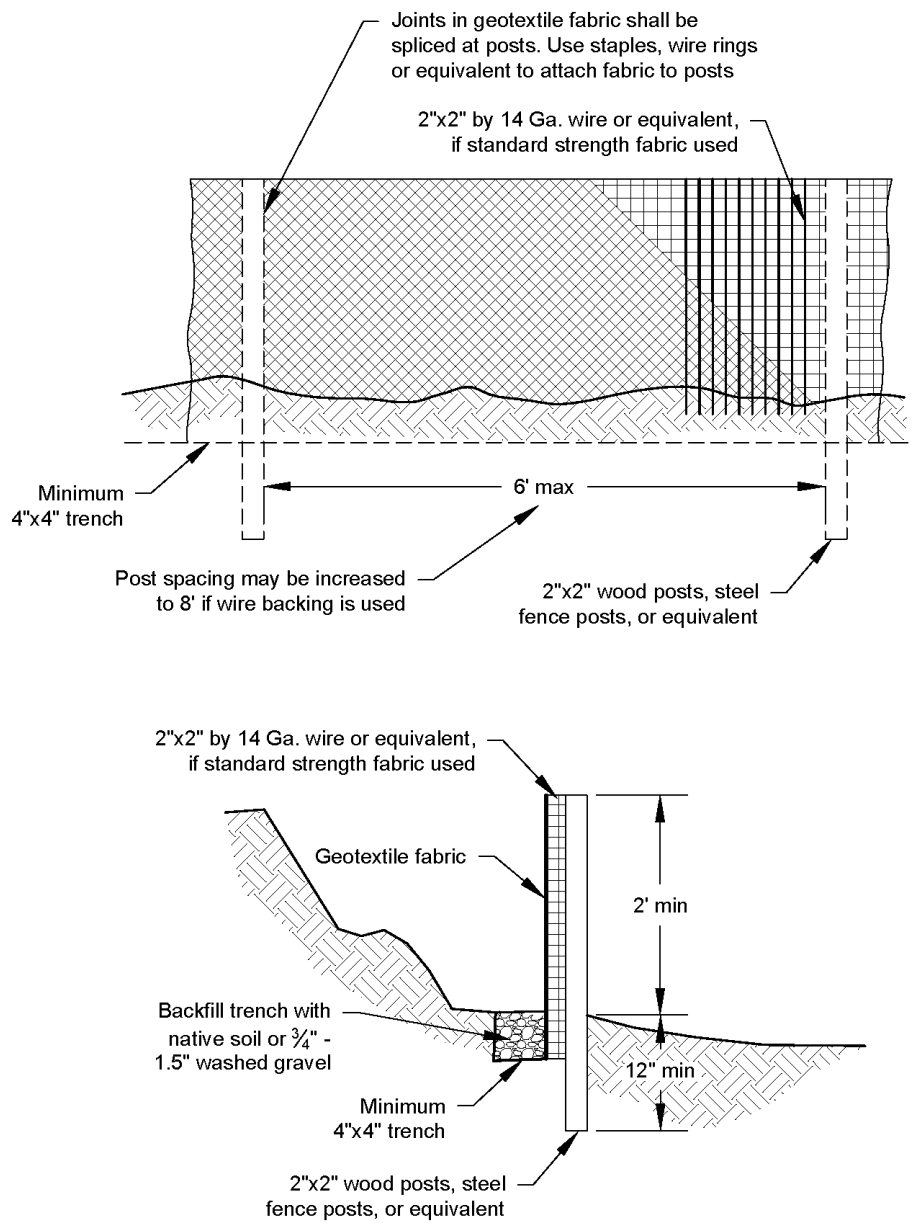
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

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-3.22: Silt Fence



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State of Washington

Silt Fence

Revised July 2017

D

esign 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-3.11: Geotextile Fabric Standards for Silt Fence):

Table II-3.11: 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 six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent 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-3.22: 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-feet min. and a 2½-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 either:

    - 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.

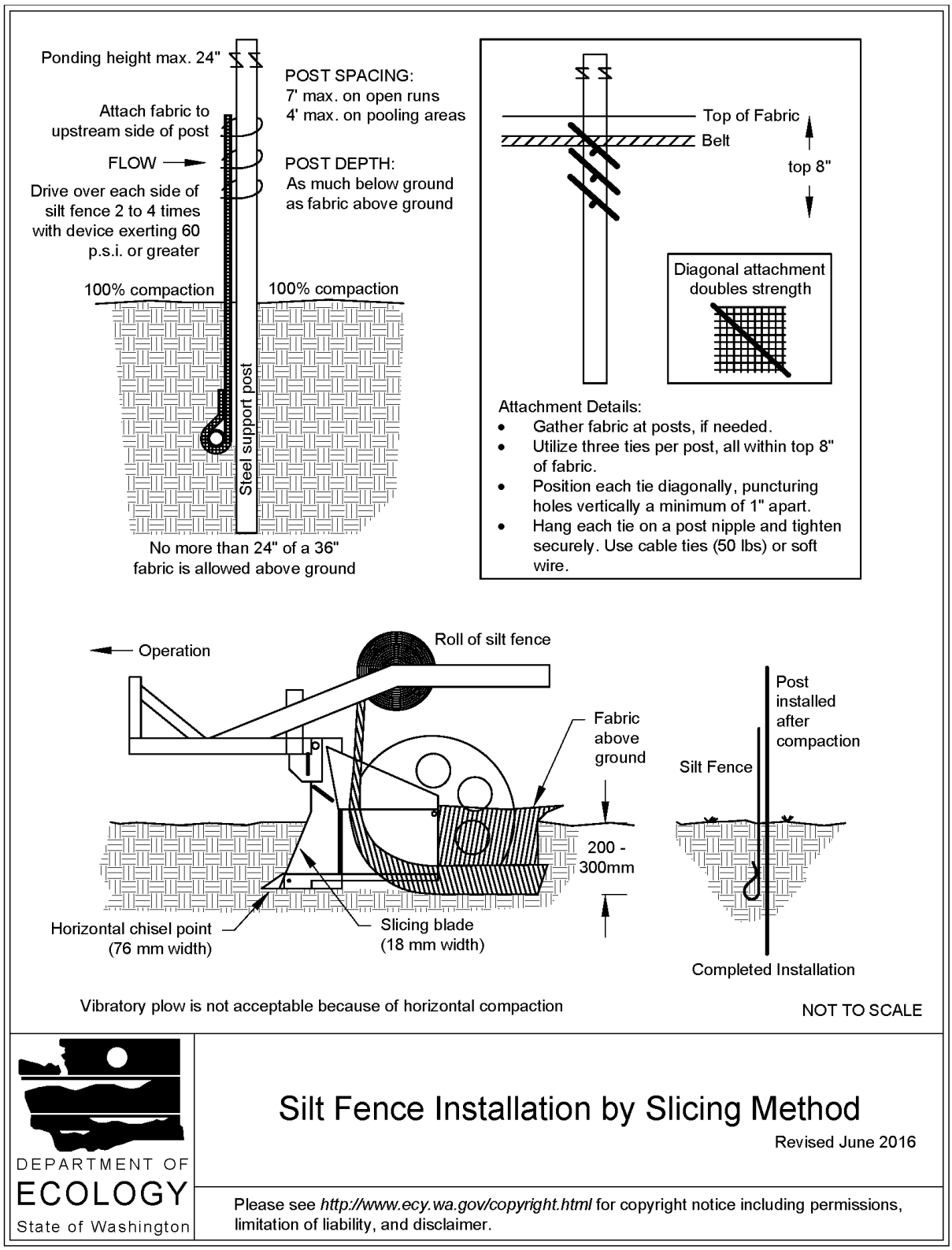
12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.

    - 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-3.23: 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-3.23: 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.

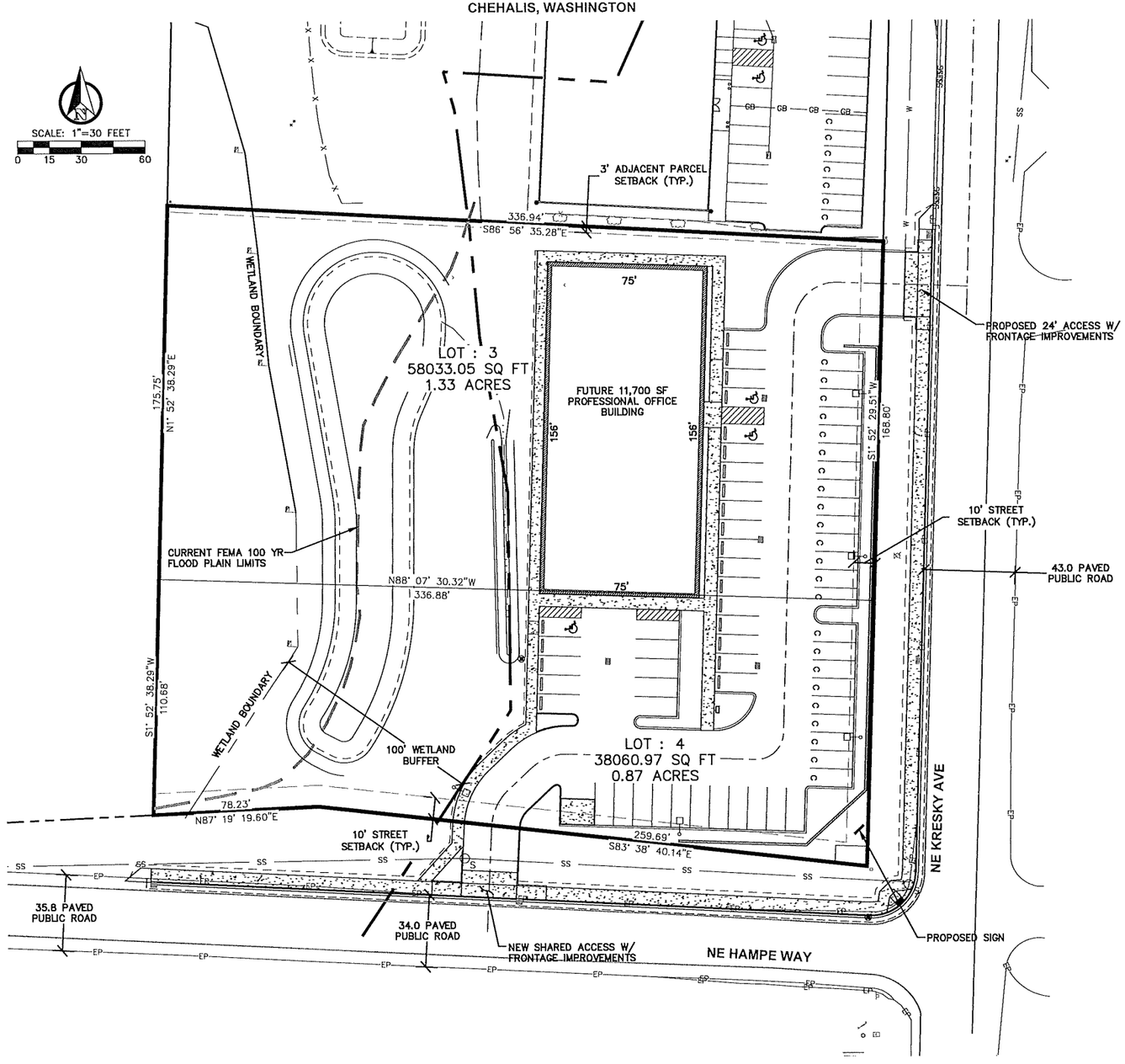
APPENDIX 6 – DRAINAGE AND TESC PLANS

WILSON COMMERCIAL BUILDING

SECTION 20, TOWNSHIP 14 NORTH, RANGE 02 WEST, W.M.
CHEHALIS, WASHINGTON

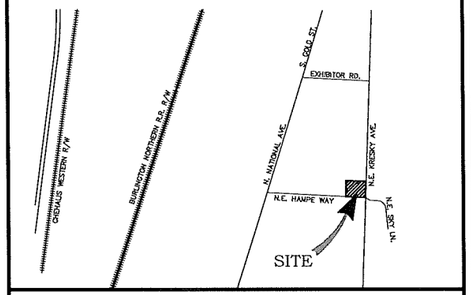
LEGEND

EXISTING	PROPOSED	
W	W	WATER MAIN
SS	SS	SANITARY SEWER MAIN
FM	FM	FORCE MAIN
SD	SD	STORM MAIN
RD	RD	ROOF DRAIN
	FD	FOOTING DRAIN
G	G	GAS LINE
UGP	UGP	POWER LINE
T	T	TELEPHONE LINE
TV	CATV	CABLE TV LINE
		ROADWAY CENTERLINE
		RIGHT-OF-WAY LINE
		EASEMENT LINE
		FRONT/BACK OF CURB
		EDGE OF GRAVEL SHOULDER
EP		EDGE OF PAVEMENT



VICINITY MAP

N.T.S.



PROJECT INFORMATION

APPLICANT:	WILSON REAL ESTATE LLC KIM & AARON WILSON (360) 269-3982
SURVEYOR:	FORESIGHT SURVEYING, INC. 1583 N. NATIONAL AVE. #2210 CHEHALIS, WA 98532 (360) 748-4000
PARCEL NOS:	005606039-001, 002
SITE ADDRESS:	2510 & 2520 KRESKY AVE NE CENTRALIA, WA 98531
ZONING:	CG - GENERAL COMMERCIAL
SITE AREA:	2.21
GRADING:	±4310 CY CUT ±3715 CY FILL
NET GRADING:	±595 CY CUT
SOIL TYPE (RATING):	MELBOURNE LOAM
SANITARY SEWER:	CITY OF CHEHALIS (HAMPE WAY)
WATER:	CITY OF CHEHALIS (KRESKY)
FIRE DISTRICT:	LEWIS COUNTY
PROPOSED BLDG:	11,700 GROSS FLOOR AREA
PARKING REQ'D:	5 STALLS / 1000 SF (CMC 17.78.020 B080/B191) 59 STALLS
PARKING PROPOSED:	62 STALLS 36 STANDARD 23 COMPACT 3 ACCESSIBLE

SHEET INDEX

SURVEY INFORMATION

LEGAL DESCRIPTION

SECTION 20 TOWNSHIP 14N RANGE 02W PT NW NE LT 2 SP

VERTICAL DATUM

NGVD 29

BASIS OF BEARING

RECORD OF SURVEY, V18/P84

TOPOGRAPHIC NOTE

TOPOGRAPHIC INFORMATION DEPICTED HEREON WAS PROVIDED BY FORESIGHT SURVEYING, INC. TOPOGRAPHIC INFORMATION WAS NOT FIELD VERIFIED BY RB ENGINEERING.

NO.	DATE	REVISION

DESIGNED BY: ARP
DRAWN BY: ARP
CHECKED BY: RWB

DATE: 10/05/2022
SCALE: 1" = 30'

WILSON COMMERCIAL BUILDING

CITY OF CHEHALIS WA.

PRELIMINARY SITE PLAN

ROBERT W. BALLINGER
STATE OF WASHINGTON
32107
REGISTERED PROFESSIONAL ENGINEER

RB Engineering
CIVIL ENGINEERING - LAND PLANNING - UTILITIES
P.O. Box 923
CHEHALIS, WA. 98532
OFF: (360) 740-8919
FAX: (360) 740-8912

JOB NUMBER
21116

DRAWING NAME
21116_C0.1_PSPL

C0.1
1 OF 5

SCALE: 1"=20 FEET
0 10 20 40

CHAINLINK FENCE
CONC
ROCKERY SLOPE
ASPH
S86° 56' 35.28"E
FOUND REBAR W/CAP
ELEV. = 195.00'
12" CPP ELEV. = 175.53' IE
GROUP 3"-12" ASH
GROUP 2"-17" ASH
SD
RIPRAP
SD
12" CPP ELEV. = 188.30' IE
WETLAND BOUNDARY
175.75'
N1° 52' 38.29"E
20" ASH
LOT : 3
58033.05 SQ FT
1.33 ACRES
S1° 52' 29.51"W
168.80'
GROUP 3"-16" ASH
CURRENT FEMA 100 YR
FLOOD PLAIN LIMITS
EXISTING GRAVEL SECTION
EXISTING INGRESS/EGRESS/ UTILITY
EASEMENT TO BE EXTINGUISHED.
EXISTING FIRE HYDRANT
N88° 07' 30.32"W
336.88'
NE KRESKY AVE
S1° 52' 38.29"W
110.68'
WETLAND BOUNDARY
100' WETLAND
BUFFER
LOT : 4
38060.97 SQ FT
0.87 ACRES
EXISTING FOGLINE STRIPING
FOUND 1" IRON PIPE W/CAP
78.23'
N87° 19' 19.60"E
12" FIR
16" FIR
10" CEDAR
RIM ELEV. = 193.01
IE 8" OUT = 171.56
IE 8" IN = 179.56
259.69'
S83° 38' 40.14"E
SSMH RIM ELEV. = 206.19'
EXISTING SEWER TO SERVE
FUTURE COMMERCIAL BUILDINGS.
RIM ELEV. = 206.19
IE 8" OUT = 198.29
IE 8" IN (N) = 202.14
IE 8" IN (E) = 198.59
NE HAMPE WAY
STREET/STOP SIGN
BROKEN ROLLED ASPH CURB

NO.	DATE	REVISION

DESIGNED BY: ARP
DRAWN BY: ARP
CHECKED BY: RWB
DATE: 10/05/2022
SCALE: 1" = 20'

WILSON COMMERCIAL BUILDING
CITY OF CHEHALIS WA.

EXISTING CONDITIONS PLAN

ROBERT W. BALLINGER
STATE OF WASHINGTON
22107
REGISTERED
PROFESSIONAL ENGINEER

RB Engineering
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JOB NUMBER 21116
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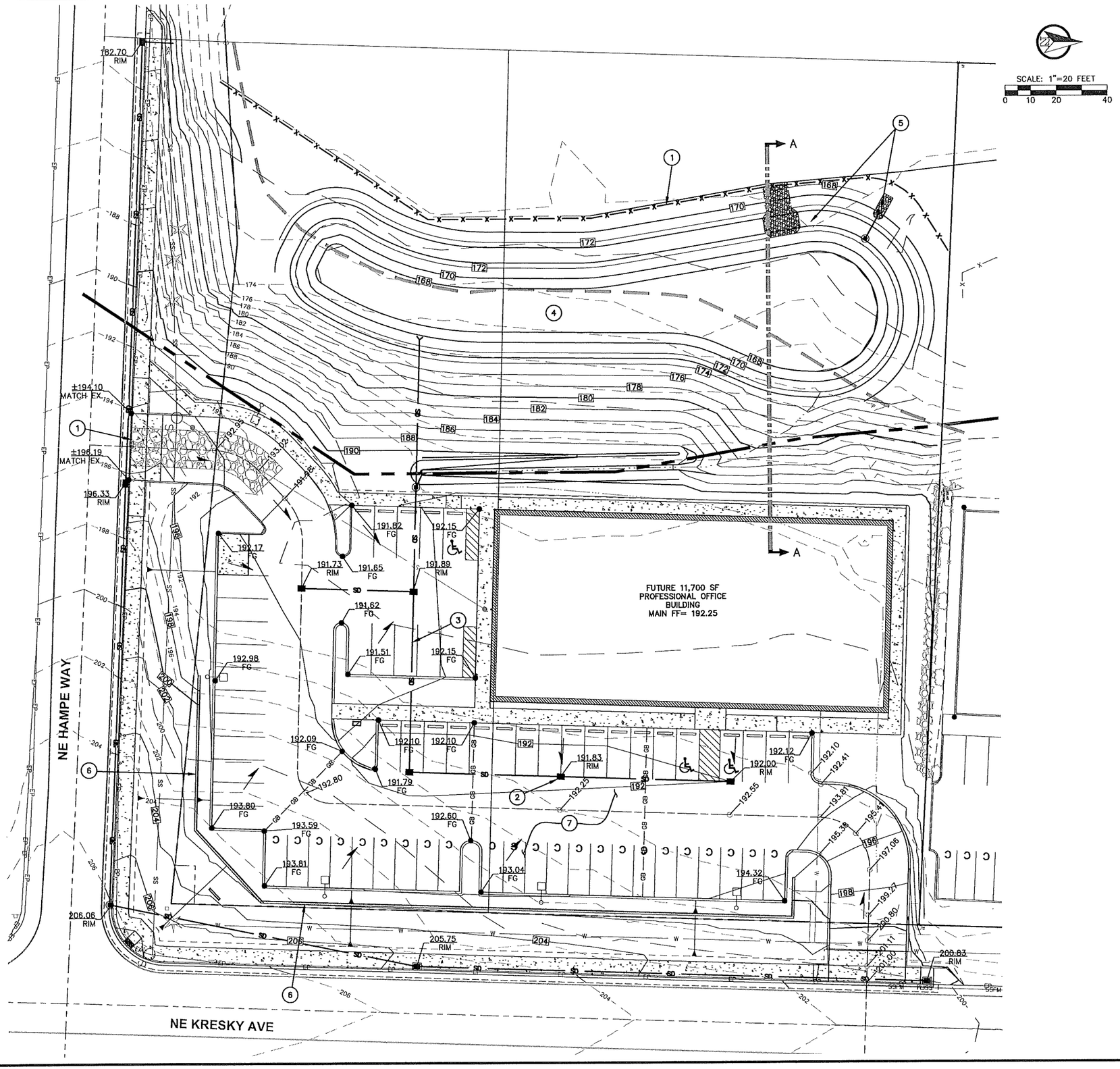
C0.2
2 OF 5



PRELIMINARY GRADING AND DRAINAGE NOTES:

1. PROPOSED TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE PROVIDED PRIOR TO CONSTRUCTION.
2. PROPOSED CATCH BASINS FOR PARKING LOT AND BUILDING RUNOFF.
3. PROPOSED STORMWATER CONVEYANCE PIPE.
4. PROPOSED STORMWATER DETENTION POND
5. PROPOSED OVERFLOW STRUCTURE AND PIPE TO DISCHARGE INTO EXISTING HYDRIC SOILS.
6. PROPOSED 4-FT TALL RETAINING WALL.
7. ALL REMOVED DEBRIS AND MATERIAL RESULTING FROM CUT AREA TO BE DISPOSED OF AT AN APPROVED LOCATION.

NO.	DATE	REVISION

DESIGNED BY: ARP
DRAWN BY: ARP
CHECKED BY: RWB

DATE: 10/06/2022
SCALE: 1" = 20'

WILSON COMMERCIAL BUILDING

CITY OF CHEHALIS WA.

PRELIMINARY GRADING AND DRAINAGE PLAN

ROBERT W. BALLINGER
STATE OF WASHINGTON
32107
REGISTERED PROFESSIONAL ENGINEER

RB Engineering
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JOB NUMBER 21116

DRAWING NAME 21116_C1.1_PGDPL

C1.1
3 OF 5

SCALE: 1"=20 FEET
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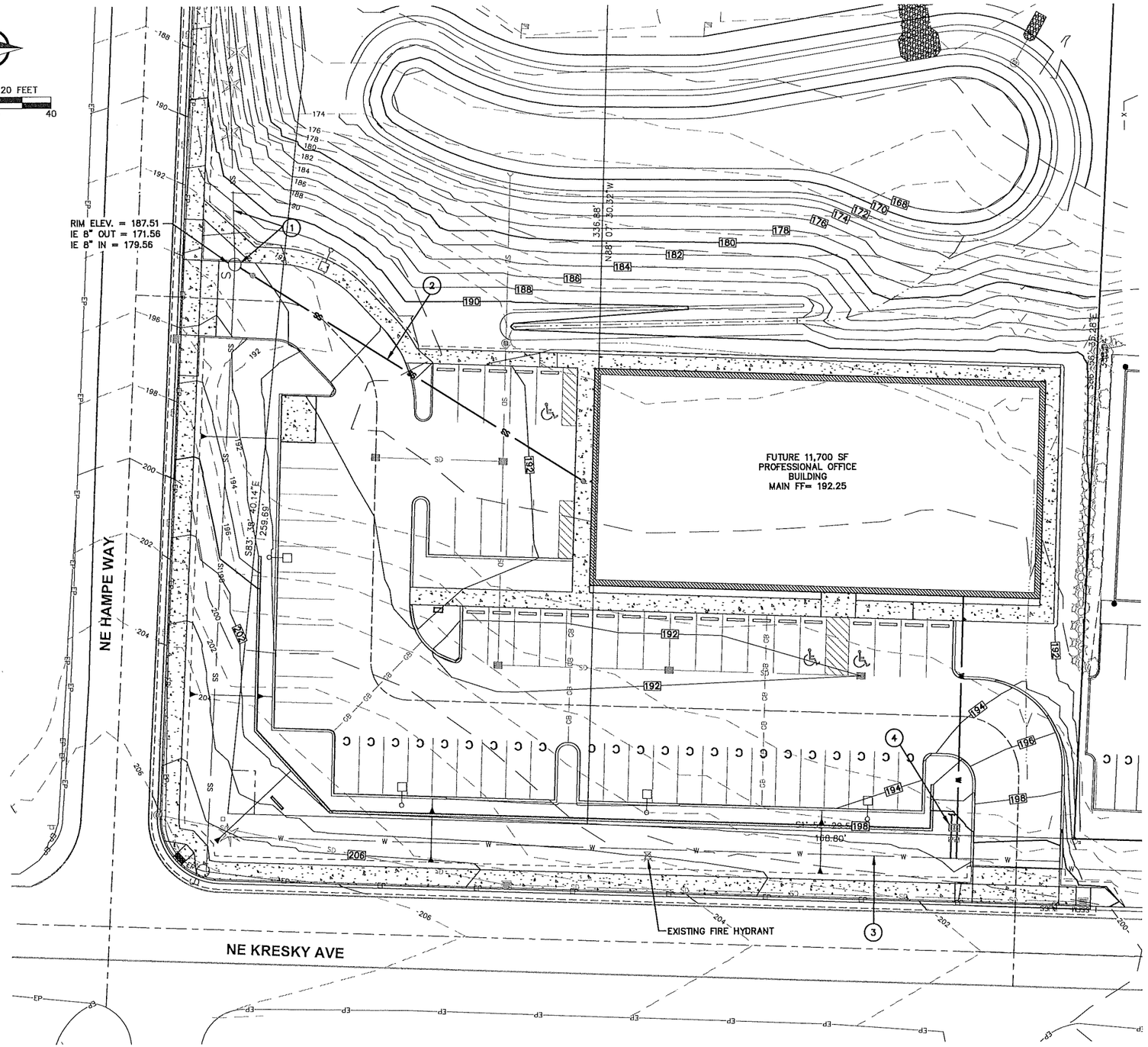

PRELIMINARY UTILITY NOTES:

1. EXISTING SEWER TO SERVE FUTURE COMMERCIAL BUILDINGS.
2. PROPOSED GRAVITY SEWER LATERAL FOR LOT 1.
3. EXISTING 8"ø WATER MAIN TO SERVE COMMERCIAL BUILDINGS.
4. PROPOSED DOMESTIC AND IRRIGATION METER LOCATIONS FOR LOT 1.

NO.	DATE	REVISION

DESIGNED BY: ARP
DRAWN BY: ARP
CHECKED BY: RWB
DATE: 10/05/2022
SCALE: 1" = 20'

WILSON COMMERCIAL BUILDING

CITY OF CHEHALIS WA.

PRELIMINARY UTILITY PLAN

ROBERT W. BALLSBROW
STATE OF WASHINGTON
32107
REGISTERED
PROFESSIONAL ENGINEER
11/04/2022

RB Engineering
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FAX: (360) 740-8912

JOB NUMBER
21116

DRAWING NAME
21116_C1.2_PUPL

C1.2
4 OF 5