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TECHNICAL INFORMATION REPORT

for Storm Water Management

Mukilteo Elementary School

2600 Mukilteo Speedway, Mukilteo, WA 98275

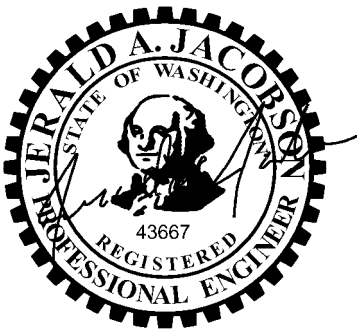
September 15, 2023

Prepared for

Mukilteo School District
9401 Sharon Dr
Everett, WA 98204

Prepared through

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Storm Drainage Report for

Mukilteo School District – Mukilteo Elementary School

JACOBSON CONSULTING ENGINEERS

Project No. C200011-0075

September 15, 2023

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I. PROJECT OVERVIEW

GENERAL DESCRIPTION

The following Drainage Report provides the design analysis for the Mukilteo Elementary School stormwater plan. The storm water design for the project was based on the requirements set forth in the Department of Ecology 2019 Stormwater Management Manual for Western Washington (2019 SWMMWW).

The project for Mukilteo School district is located at 2600 Mukilteo Speedway in Mukilteo on the property of Mukilteo Elementary School. The elementary school exists on multiple parcels owned by the Mukilteo School District (see *Figure 1 – Vicinity Map)*. The area within the district property boundary includes four parcels. Parcel 1 (28040900102200) is 6.77 acres, parcel 2 (00591100000102) is 11.42 acres, parcel 3 (00591100000701) is 9.2 acres, and parcel 4 (28040900104200) is 1.79 acres. The total area of the school property is 29.18 acres, of which approximately 1.9 acres will be redeveloped in the school renovation. Mukilteo Elementary School is bound by single family residences to the north and east, Olympic View Middle School to the south (located on parcels 2 and 3), and Washington Avenue to the west. The site is in the NE quarter of Section 9, Township 28 North, Range 4 East, Willamette Meridian.

The proposed project consists of adding a new building located in the northeast corner of parcel 1. Along with site improvements, new utilities, added play areas, and sidewalks. The school property is currently occupied by (3) buildings connected by covered walkway, portables, and play areas. There are trees and vegetation in between buildings and around driving surfaces. In the northwest corner of the school property there is a heavily forested area (parcel 4).

EXISTING CONDITIONS

Mukilteo Elementary School is a developed campus consisting of existing classroom buildings, portables, parking, drive aisles, soft surface play areas, and a sand play field. A large parking lot is located on the southwest side of the school. There is a large sand play field and playground equipment on the east side of the school. There is also playground equipment and a hard play surface on the north side of the school (See *Figure 2 – Existing Conditions).*

PROPOSED CONDITIONS

The proposed 1.9 acre re-development project consists of removing and reconstructing the northeast corner of parcel 1. The area that will be redeveloped currently consists of play field, wood mulch play area, and concrete walkways. Associated site improvements include a new building, new play areas, fire lane improvements, and new utility services to include a storm detention system. See *Figure 3 – Proposed Conditions*.

PROPOSED DRAINAGE SYSTEM

The project will create 36,600 square feet of new impervious surface. As this project exceeds 5,000 square feet of new impervious surface, the project will be required to provide stormwater flow control for all new and replaced hard surfaces and converted vegetated areas. Stormwater flow control systems (also called detention systems) are a place to store potentially damaging peak stormwater from the impervious surfaces temporarily until the downstream pipes, creeks, and streams can safely carry the water away. The flow control system will be designed to mimic forested conditions as determined with runoff models approved by the permitting jurisdiction (City of Mukilteo). Stormwater from the redevelopment will continue to discharge to the existing storm system installed on site.

Although the redeveloped portion of the Mukilteo Elementary School site may seem like a small area when considering the entire Goat Trail Creek Drainage Basin, controlling flows from small projects is important to the municipal and state agencies because the cumulative effect of uncontrolled flows from many small projects can be as damaging as those from larger projects. Peak stormwater flow rates from developed conditions can have damaging impacts to downstream storm systems and streams that historically received runoff from a less developed tributary area.

DETENTION AREA SWAP

Due to existing utility conflicts and elevation limitations, it is not feasible to route all stormwater from disturbed surfaces by gravity to the proposed flow control system. In order to meet the flow control requirements for the site as a whole, it is necessary utilize a flow control area swap. Existing storm pipes will be intercepted as part of the proposed development and routed to the new detention system so that flow control requirements will be met. The proposed area swap is discussed in more detail in Section IV of this report.

WATER QUALITY TREATMENT

The project does not propose any pollution generating impervious surface, which does not exceed the threshold of 5,000 square feet of pollution generating impervious surfaces or ¾ of an acre or more of pollution-generating pervious surfaces. Therefore, a water quality treatment system is not proposed or required for this project. See *Figure 3 – Proposed Conditions*.

II. MINIMUM REQUIREMENTS

As determined using Figure 1-3.2: Flow Chart for Determining Requirements for Redevelopment, this project is subject to addressing all minimum requirements for new and replaced hard surfaces and converted vegetation areas, see *Figure 4 – Minimum Requirements Flow Chart*. This section will address the nine required minimum requirements set forth by the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) as adopted by the City of Mukilteo.

MR1 (PREPARATION OF STORM WATER SITE PLANS)

Stormwater plans are included in the submittal drawings and show the sizes and locations of the conveyance system and detention system.

MR2 (CONSTRUCTION STORM WATER POLLUTION PREVENTION PLAN)

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

MR3 (SOURCE CONTROL OF POLLUTION)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR4 (PRESERVATION OF NATURAL DRAINAGE SYSTEM AND OUTFALLS)

Storm water will continue to flow towards the current discharge point located at the southern side of the site.

MR5 (ON-SITE STORM WATER MANAGEMENT)

In accordance with the drainage manual, Low Impact Development (LID) Best Management Practices (BMP) must be implemented to the maximum extent feasible. Operation and maintenance guidelines for any proposed BMPs and stormwater infrastructure are attached in Appendix A of this report. There are two compliance methods for MR5: the "LID Performance Standard" and the "List Approach." This project will use the List Approach for compliance with the MR5 (as the LID Performance Standard requires the site soils to have a good infiltration capacity in order to comply with the stormwater discharge requirements). This project has been noted by the geotechnical investigation as having poor infiltration soils, additional information about the infeasibility is noted below. The feasibility of List #2 BMPs were evaluated for this project. The following is a list of BMPs reviewed for feasibility:

BMP T5.13 Post-Construction Soil Quality and Depth: Post-Construction Soil Quality and Depth will be implemented on the new landscaped areas, except where existing vegetation will be retained on steep slopes, and all areas disturbed and not covered in impervious surfacing.

BMP T5.30 Full Dispersion or BMP T5.10A Downspout Full Infiltration Systems: Minimum flow path requirements for Full Dispersion cannot be met on this site, therefore Full Dispersion is not feasible for this project. A professional Geotechnical Engineer has determined that infiltration is not feasible on this site, therefore Downspout Full Infiltration is not feasible for this project.

BMP T7.30 Bioretention: Due to the lack of available useable landscaped space for bioretention in this re-development project, the implementation of bioretention is not feasible for this project.

BMP T5.10B Downspout Dispersion Systems: Minimum flow path requirements for Downspout Dispersion Systems cannot be met on this site, therefore Downspout Dispersion is not feasible for this project.

BMP T5.10C Perforated Stub-out Connections: Perforated stub out connections were reviewed for all new downspout drain lines. Perforated Stub-out Connections will be implemented for seven of the nine proposed downspouts on this project. The two downspouts that are not mitigated by this BMP are surrounded by pavement, per BMP T5.10C requirements in the 2019 SWMMWW, downspout conveyance lines located under impervious or heavily compacted surfaces shall not be perforated. Perforated Stub-out Connections are implemented to the maximum extent feasible for this project.

BMP T5.15 Permeable Pavement: Permeable pavement was evaluated for all paved surfaces on site, to include proposed play areas, roadways, and sidewalks. Per BMP T5.15 applications and limitations in the 2019 SWMMWW, permeable pavement should have no run-on from adjacent pervious or impervious surfaces, should not be above 6% slope, or replace existing impervious surfaces. All roadway surfaces are replacing existing impervious surfaces. All sidewalk surfaces are either covered by a roof, sloped greater than 6%, or replacing existing impervious surface. All play surfaces are either covered by a roof, replace existing impervious surfaces, or would receive run-on from adjacent pervious and impervious surfaces. Therefore, permeable pavement is not feasible for this project.

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

MR6 (RUNOFF TREATMENT)

The project does not propose any pollution generating impervious surface, which does not exceed the threshold of 5,000 square feet of pollution generating impervious surfaces or ¾ of an acre or more of pollution-generating pervious surfaces. Therefore, a water quality treatment system is not proposed or required for this project. See *Figure 3 – Proposed Conditions*.

MR7 (FLOW CONTROL)

The proposed project is a redevelopment of an existing site. Therefore, flow control is required for all new and replaced impervious surfaces. Runoff from the site will be mitigated by a R-Tank detention system located north east of the new school building. As mentioned previously, the detention system will be sized using an area swap where a portion of the proposed development and some existing surface runoff will be routed to the detention pipes. This system is described in greater detail in Section IV of this report.

MR8 (WETLAND PROTECTION)

There are no wetlands on the parcel therefore MR8 is not applicable to this project.

MR9 (OPERATION AND MAINTENANCE)

An operation and maintenance manual is included in Appendix A and will be provided to the school district for all flow control and treatment facilities that are maintained by the school district.

III. OFF-SITE ANALYSIS

FIELD INSPECTION

Site visits have been made to gather information about the existing drainage system, including a Level 1 Downstream Analysis. These field visit took place August 2, 2022, June 9, 2023, and July 27, 2023. Please refer to Downstream Analysis below for more information.

DRAINAGE SYSTEM PROBLEM DESCRIPTIONS

The school district has not raised concerns about any existing drainage problems. As such, no drainage problems are anticipated to be present in the redevelopment as a result of previously existing problems.

UPSTREAM ANALYSIS

The existing school is surrounded by single-family residences and established public right-of-way. Generally, the residences to the north flow away from the school property, with some to the east flowing toward the school property which will provide some offsite flow. The existing drainage systems being maintained with this project currently intercept this offsite flow.

DOWNSTREAM ANALYSIS

The project is located within the Goat Trail Ravine basin of the Puget sound watershed. Stormwater from the project site flows northwest through the Mukilteo school area into a detention pond in the northwest corner of the school property before entering the city owned/operated storm drainage system. From the detention pond water there are two drainage paths. The first stormwater flow path is water being taken offsite through Clover Lane within storm pipes under the street. After the water flows through Clover Lane, it connects underground to a pipe system in Mukilteo Speedway continuing to flow under the street before discharging through a culver into Goat trail Creek. The other path from the detention pond is through a stream named Clover Pl that is located on a parcel owned by the city of Mukilteo that is adjacent to the school property. This stream flows into a stormwater pipe system and flows under private property and connects underground into a pipe system in 19th Drive. Once in 19th Drive the stormwater flows towards Mukilteo speedway where it reconnects with the other stormwater flow path from the school. The stormwater discharges into Goat Trail Creek that eventually drains to a culvert in the Puget sound. Based on the city of Mukilteo stormwater network viewer stormwater pipe size information was not available and therefore not included in this description.

MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

N/A

IV. FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

EXISTING SITE HYDROLOGY (PART A)

After completing the proposed lot line adjustments, the existing parcel totals 11.33-acres and consists of the existing school building, parking lots, landscaping, sidewalks, hard and soft play areas, and athletic fields. Stormwater runoff is collected and conveyed via sheet flow and underground pipes to the site outfall on the east side of the site without any flow control or water quality treatment. Table 1 below provides a tabulation of the total existing parcel pervious and impervious area.

TABLE 1 – EXISTING PARCEL CONDITIONS AREA BREAKDOWN

Land Cover	Area
Impervious Area	5.41 acres
Pervious Area	5.92 acres
Total Site	11.33 acres
Percent Impervious	47.7%

Table 2 below summarizes the existing land cover characteristics of the project scope area for the redevelopment.

TABLE 2 – EXISTING PROJECT CONDITIONS AREA BREAKDOWN

Land Cover	Area
Impervious Area	0.75 acres
Pervious Area	1.15 acres
Total Site	1.90 acres
Percent Impervious	39.5%

DEVELOPED SITE HYDROLOGY (PART B)

Storm water mitigation will be required for construction of the school building addition, drive aisles, and play areas, as well as the new landscaping and site amenities being disturbed. The following tables tabulate the amount of impervious surface being added on a parcel basis as well as within the limited work area of the project. Table 3 below provides a tabulation of the total proposed parcel pervious and impervious area:

TABLE 3 –DEVELOPED PARCEL CONDITIONS AREA BREAKDOWN

Land Cover	Area
Impervious Area	5.48 acres
Pervious Area	5.85 acres
Total Site	11.33 acres
Percent Impervious	48.4%

Table 4 below summarizes the land cover characteristics of the proposed re-development.

TABLE 4 –DEVELOPED PROJECT CONDITIONS AREA BREAKDOWN

Land Cover	Area
Impervious Area	0.83 acres
Pervious Area	1.07 acres
Total Site	1.90 acres
Percent Impervious	43.7%

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

Flow control conforming to MR#7 is required for this project area. Specifically, flow durations for the developed site must match flow durations for the pre-existing forested site between ½ the two-year and the 50-year storm events. In accordance with the 2019 SWMMWW, MGS Flood, a continuous-modeling software, will be used to model the existing and proposed site drainage basins. Existing site development conditions disturbed by the project were modeled as having forested surface cover and broken out by flat (0-5%), moderate (5-15%) and steep (15%+) slope areas, and excess existing areas captured for the area swap are modeled as their current surface coverage which will be described in further detail below. New and replaced impervious areas are modeled as impervious sidewalk or roof surfaces, and landscaped areas are modeled as lawn, both also broken out by flat, moderate or steep slope.

AREA SWAP:

As described previously in this report, an area swap was necessary to provide flow control for this project due to grading limitations. Because of this, only a portion of the proposed development will be routed to the detention system, and the bypassing areas will be accounted for by the area swap where an equivalent surface is available. The detention system will intercept existing sand field drainage and sheet flow from existing sidewalks and landscape. See Table 5 below and *Figure 5 – Flow Control Drainage Basin Summary* for an overview of the three basins.

TABLE 5 – FLOW CONTROL AREA SWAP

Surface	(1) Proposed to Flow Control (ac)	(2) Proposed to Bypass (ac)	(3) Existing Basin (ac)	(4) Area Swap (ac)	(5) Bypass Remaining (ac)	(6) Inflow (ac)
Flat Lawn	*1.041*	0.04	0.059	*0.04*	0	*0.019*
Flat Sidewalk	*0.392*	0.073	0.121	*0.073*	0	*0.048*
Flat Roof	*0.375*	0	0	0	0	*0*
Steep Lawn	0	0	0.051	0	0	*0.051*
Total	1.808	0.113	0.231	0.113	0	0.118

* Italicized values are as modeled in MGS Flood. Columns 2 and 3 are shown for reference and include the entire Bypass and Existing Basin areas from Figure 5. Column 4 represents the amount of area swap utilized from column 3 to mitigate the bypass in column 2. Any remaining bypass after the area swap is listed in column 5, and excess existing areas in column 3 not used for the area swap in column 4 are considered inflow and listed in column 6.

As noted in Tables 5 above, more existing surfaces are routed to the detention system than is needed for the area swap to mitigate the disturbed areas bypassing detention. These excess areas in column 6 of the above table are considered inflow and are modeled as a separate basin in the existing and proposed conditions. This inflow basin

consists of 0.118 acres in the model. The pre-developed model includes the inflow basin and disturbed area basin where all proposed project area is modeled as pre-existing forested condition, see *Figure 6 – Flow Control Existing Conditions*. The proposed conditions are modeled in four basins; the disturbed project areas routed to detention (column 1 in the tables above), the area swap (column 4 in the tables above), the inflow basin (column 6 in the tables above), and bypass (column 5 in the tables above). See *Section VII – Engineering Calculations* for MGS Flood model results.

DETENTION SYSTEM:

The detention system will be comprised of R-Tank HD Double modules with 6" of gravel below and 12" of gravel above the system with a minimum of 6" of dead storage and 6" of freeboard. The R-Tank system is located to the northeast of the proposed building and is designed to sustain AASHTO HS-20 loading capacity. The detention system will provide 35,300 CF of live storage volume. Flows discharging from the detention system will be managed by a control structure before connecting to the existing storm system on site.

WATER QUALITY SYSTEM (PART E)

The project does not propose any pollution generating impervious surface, which does not exceed the threshold of 5,000 square feet of pollution generating impervious surfaces or ¾ of an acre or more of pollution-generating pervious surfaces. Therefore, a water quality treatment system is not proposed or required for this project. See *Figure 3 – Proposed Conditions*.

V. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

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

DEVELOPED STORM SYSTEM DESCRIPTION

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

CONVEYANCE ANALYSIS

Conveyance analysis results will be provided in a forthcoming submittal.

OUTFALLS

The proposed redevelopment does not include any new systems which utilize an outfall requiring outfall protection. As flows will be conserved or even reduced by the implementation of the detention system on this project, no upgrades to existing outfalls are included as part of this project.

VI. SUPPLEMENTAL REPORTS AND REQUIREMENT SUMMARY

Geotechnical Engineering Report – by GeoTest, dated June 23, 2023.

Geotechnical Engineering Report

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, WA 98275

Prepared For:

Mukilteo School District
Capital Projects Department
9401 Sharon Drive
Everett, WA 98204

Attn: Mr. Phillip LaFranchi
Construction Project Manager

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June 23, 2023
Project No. 23-0066

Mukilteo School District
Capital Projects Department
9401 Sharon Drive
Everett, WA 98204

Attention: **Mr. Phillip LaFranchi**
Construction Project Manager

Regarding: **Geotechnical Engineering Report**
Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, WA 98275
(Parcel Nos. 28040900104200, 28040900102200, 00591100000102)

Dear Mr. LaFranchi,

GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our geotechnical engineering evaluation for the proposed improvements to Mukilteo Elementary School in Mukilteo, WA (see *Vicinity Map*, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated May 8, 2023 and authorized by yourself.

GeoTest appreciates the opportunity to provide geotechnical services on this project and looks forward to assisting you during the construction phase. Should you have any further questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.

EDWARDO A. GARCIA
STATE OF WASHINGTON
40819
REGISTERED
PROFESSIONAL ENGINEER
06-23-23

Coire McCabe, L.G.
Staff Geologist

Edwardo Garcia, P.E.
Geotechnical Department Manager

Enclosure: Geotechnical Engineering Report

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PURPOSE AND SCOPE OF SERVICES

The purpose of this evaluation is to establish general subsurface conditions beneath the site from which recommendations pertaining to project design can be formulated. Our scope of services includes the following tasks:

- Explore soil and groundwater conditions underlying the site by advancing seven test pit explorations and 13 soil borings at predetermined locations using a track-mounted excavator and track-mounted drill rig equipped with a hollow stem auger subcontracted by GeoTest.

- Perform laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered.

- Provide an assessment of the on-site infiltration capability based on USDA textural classification based on the *Stormwater Management Manual of Western Washington [Manual].* The Manual is the adopted stormwater management manual per Mukilteo Municipal Code 13.12.040.

- Provide a written report containing a description of subsurface conditions and exploration logs. The findings and recommendations in this report pertain to site preparation and earthwork, fill and compaction, seismic design, foundation recommendations, concrete slab-on-grade construction, foundation and site drainage, temporary and permanent slopes, geotechnical consultation, and construction monitoring.

- Assessment of Geologically Hazardous Areas (if present) per the City of Mukilteo Municipal Code (MMC).

PROJECT DESCRIPTION

GeoTest understands that improvements are planned at the existing Mukilteo Elementary School facility in Mukilteo, WA. The facility currently consists of three main buildings, six portable buildings, parking and bus drop off areas, and associated play fields, sport courts, and hard scape surfaces. A preliminary development plan shows the construction of one new building that will be oriented in an east-west direction. GeoTest understands that the design team is still evaluating various site development options, some of which will depend on the subsurface soil explorations performed for this report.

GeoTest generally anticipates that the existing school buildings will be demolished and replaced with a new and improved elementary school facility. GeoTest expects one- or two-story buildings that will utilize shallow conventional foundations with slab-on-grade floors. GeoTest is anticipating a brick or masonry exterior and metal frame construction consistent with similar

educational facilities in the area, although GeoTest acknowledges that other materials may be specified by the Architect during the design process.

GeoTest is not aware of any specific stormwater plan for the property, but it is expected that elements of Low Impact Development (LID) paired with detention and/or a stormwater vault are likely to be utilized to address stormwater concerns.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on a review of available information, site reconnaissance, subsurface explorations, laboratory testing, and previous experience in the project vicinity.

Surface Conditions

The project area currently contains an active elementary school and is relatively flat within the previously developed area. The school is adjacent to a residential neighborhood with single-family housing to the north, east, and west of the property. Olympic View Middle School facilities border the south end of the property. The eastern portion of the project area contains dirt soccer and baseball/softball fields. North of the existing buildings are some impervious basketball courts and a playground. A parking lot and bus loop are located along the southwest end of the existing structures. An outdoor natural learning area is in the northwest corner of the parcel. Many of the areas throughout the school consist of impervious pavement, asphalt, or concrete.



Images 1 and 2: Playground and basketball hardscape in the northern portion of property, facing west (Image 1). Dirt soccer field east of the main school buildings, facing southeast (Image 2). Images 1 through 6 taken on February 22, 2023.

The soccer and baseball/softball fields to the east are higher in elevation than the majority of the rest of the project area. A retaining wall approximately 6 feet tall separates the elevated play

fields and the eastern classrooms. The parking lot and bus loop area slopes gently to the southwest. The northwest corner of the property consists of a drainage gulch which is also referred to as the "natural learning area" by school staff. This area is mostly vegetated with deciduous trees, foliage, and a few old growth trees. Slopes adjacent to the school property in proximity to the gulch are west and northwest facing, and are approximately 20 feet tall. Within the lowest portion of the gulch, GeoTest observed a 12-inch-thick cast in place dam that is upwards of 5 feet tall. This dam is currenting retaining water on its south side and is approximately 50 feet across the basin in the southwest direction before elbowing to the south for another 12 or so feet.





Image 3 and 4: Administration/gymnasium building and some portable buildings north of the parking lot in the southern portion of the project area, facing north (Image 3). A concrete dam in the natural learning area (Image 4).

Subsurface Soil Conditions

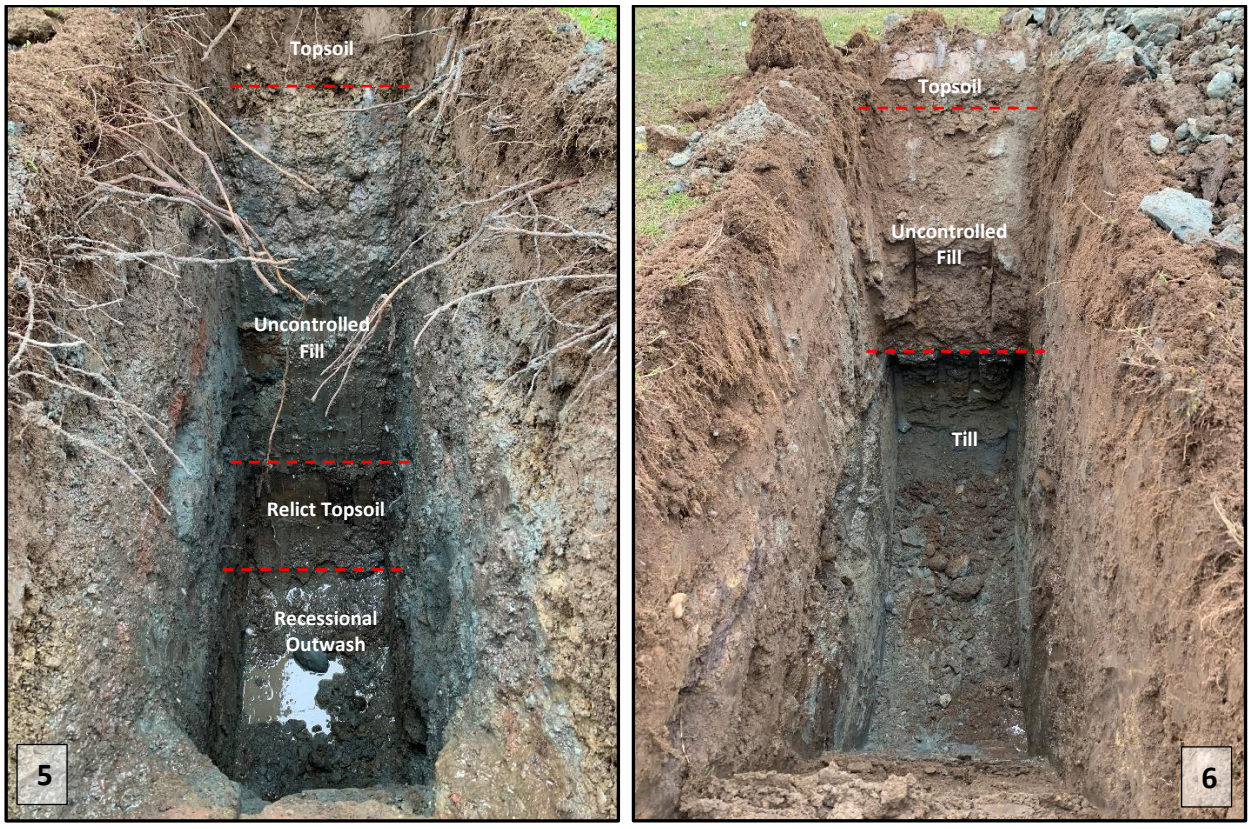
Test Pit Explorations

Subsurface conditions were explored and documented by advancing seven test pits (TP-1 through TP-7) on February 22, 2023, under the direction of a Licensed GeoTest Geologist. Soils were classified in general accordance with the guidelines of the American Society for Testing and Materials (ASTM) D2487 and D2488. Approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figures 2A and 2B). A *Soil Classification System and Key* can be found as Figure 7, detailed test pit logs are presented as Figures 8 through 11, with laboratory results as Figures 25 through 28.

Test pit explorations consisted of the excavation of shallow open pits with the use of a rubber tracked mini excavator and operator subcontracted to GeoTest. Grab samples were obtained at approximately 2-foot intervals or upon changes in soil stratigraphy. Depths of the test pit explorations ranged to depths of approximately 8 to 9 feet below the ground surface (BGS).

It should also be noted that a total of eight exploration locations were requested by the project team, but only seven were advanced due to the concentration of underground utilities present within the remaining test pit location. This test pit was located near the northwest corner of the existing school, near the base of a retaining wall.

The on-site subsurface soils in all seven test pits consisted of approximately 3 to 12 inches of topsoil, which was loose, brown, moist, gravelly, silty sand with numerous organics (grass, roots, wood, etc.). Underlying the topsoil was varying thicknesses of uncontrolled fill. The uncontrolled fill ranged from 1.5 to 8 feet thick, with thicker sections of uncontrolled fill generally being in the western portion of the project area. Uncontrolled fill consisted of variable amounts of loose to medium stiff, orange-brown to black, moist, gravelly, silty sands to sandy silts. The uncontrolled fills also contained various amounts of construction debris and large amounts of organics (logs, wood, roots, etc.) in localized areas. At the TP-1 exploration, GeoTest observed what appeared to be relict topsoil consisting of medium dense, brown, moist, slightly gravelly, silty sand with roots, grass, and wood. This relict topsoil was observed from approximately 5.5 to 7 feet BGS.



Images 5 and 6: General soil sequence observed in the test pits explorations where uncontrolled fill sections were generally thicker and contained abundant organics (TP-1 – Image 5). Soil sequence where uncontrolled fill was thinner and native Till was observed in the northern portion of the site (TP-4 – Image 6).

Beneath the uncontrolled fill (when observed) and at depths ranging from 7 to 8 feet BGS with test pits TP-1 to TP-3 was medium dense, gray to brown, moist, gravelly, silty sand with occasional

organics, which GeoTest is interpreting to be native Recessional Outwash Sands. Native Till was encountered beneath the uncontrolled fill and/or Recessional Outwash at depths ranging from 5 to 8 feet BGS at test pit locations TP-4 to TP-7. Recessional Outwash was observed overlying the native Till from 3 to 8 feet BGS within test pit TP-6.

The Till was comprised of hard or very dense, gray to brown, moist, gravelly, sandy silt to silty sand with trace cobbles and boulders. As previously mentioned, uncontrolled fill sections were generally thicker to the west. Uncontrolled fill was directly underlain by Recessional Outwash deposits or Till deposits. The very dense, Till soils were encountered to the maximum explored depths of test pit explorations TP-4 to TP-7.

Soil Boring Explorations

Subsurface conditions were also explored by advancing 13 hollow stem auger (HSA) soil borings (B-1 to B-13) on June 3, 2023. Our soil borings were advanced to depths ranging between 7.5 and 25.5 feet below ground surface (BGS), using 4-inch diameter hollow-stem augers, and two soil drills on track-mounted assemblies operated by Geologic Drill. Samples were generally taken at 2.5-foot intervals in the upper 10 feet and transitioned to 5-foot intervals until the terminal depth. Two Geologists directed and observed drilling operations and logged the soils encountered. Soils were classified in general accordance with the guidelines of the American Society for Testing and Materials (ASTM) D2487 and D2488. Upon completion, all the boring locations (B-1 to B-13) were backfilled with bentonite and soil tailings to match pre-existing surface conditions.

Geologic Drill installed two monitoring wells (B-1 and B-10) for wet season monitoring (if needed) in the winter of 2023-2024. These shallow monitoring wells were installed at two locations in the southwestern and northeastern portion of the project area on June 3, 2023. Monitoring wells were installed within the HSA following the completion of the borings at locations B-1 and B-10. The wells were installed to the approximate depth of 25 and 10 feet BGS, respectively. Each well consisted of a 1-inch diameter plastic threaded PVC pipe with the bottom section consisting of a slotted screen. Slotted screen was installed from approximately 25 to 15, and 10 to 5 feet BGS, respectively. The lower portion of the well was then backfilled with silica sand to a depth of approximately 12 and 4 feet BGS, respectively. The upper portion of the wells were backfilled with bentonite chips and some on-site soils.

The approximate locations of the explorations have been plotted on the *Site and Exploration Plan* (Figures 2A and 2B). A *Soil Classification System and Key* can be found as Figure 7, Boring Logs as Figures 12 through 24 *Boring Logs,* and laboratory results as Figures 25 through 28.

Disturbed but representative samples were obtained during drilling by using the Standard Penetration Test (SPT) procedure in accordance with American Society for Testing and Materials (ASTM) D1586 during the explorations. This test and sampling method consists of driving a standard 2-inch outside-diameter, split-barrel sampler a distance of 18 inches into the soil with

a 140-pound drop hammer free-falling a height of 30 inches. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 blows is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are reported on the attached boring logs.

The on-site subsurface soils consisted of approximately 0.5-foot of loose topsoil in locations not covered by asphalt or gravel (B-1), asphalt thickness was approximately 0.5-foot thick as well. Generally, there was approximately 1 to 10 feet of loose to medium dense, black to brown, moist, slightly gravelly, silty sands to sandy silts with varying percentages of organics (wood, roots, etc.) that was interpreted to be uncontrolled fill. It should be noted that there was approximately 14 feet of fill at the B-5 location, but is thought to be an outlier due to its close proximity to the "natural learning area" slope. Stated differently, it's likely that thicker sections of fill were pushed out in this area, near the top-of-slope condition, to make a flat area during original construction.



Image 7: Soil sample at a depth of 5 feet BGS at boring location B-11 showing perched water in a more permeable sand lens overlying the less permeable weathered Till.

Underlying the uncontrolled fill (when observed) were 2 to 5 feet of weathered Glacial Till consisting of medium dense to dense, orange-gray, gravelly, very silty sand with orange oxidations staining and occasional mottling. Underlying the Weathered Glacial Till and uncontrolled fill, GeoTest observed dense to very dense and/or hard, gray, slightly gravelly to

gravelly, very silts sands to very sandy silts with occasional seams and/or layers of sand, that was interpreted to be Glacial Till.

Refer to Table 1 below for a summary of depths to native soils underlying existing fill observed on site for all explorations.

Table 1. Subsurface Soil Depths and Elevations

Test Pit Exploration ID	Surface Elevation* (ft)	Depth to Recessional Outwash		Depth to Till	
		Depth BGS (ft)	Approximate Elevation (ft)	Depth BGS (ft)	Approximate Elevation (ft)
TP-1	404	7	397	Unknown	
TP-2	396	7	389	Unknown	
TP-3	404	8	396	Unknown	
TP-4	407	N/A	N/A	5	402
TP-5	411	N/A	N/A	7.5	403.5
TP-6	405	3	402	8	397
TP-7	398	N/A	N/A	2	396
B-1	394	N/A	N/A	7	387
B-2	400	N/A	N/A	7	393
B-3	405	N/A	N/A	6.5	398.5
B-4	403	N/A	N/A	7.5	395.5
B-5	402	N/A	N/A	14	388
B-6	402	N/A	N/A	10	392
B-7	399	N/A	N/A	5.5	393.5
B-8	404	N/A	N/A	5	399
B-9	411	N/A	N/A	1	410
B-10	411	N/A	N/A	7.5	403.5
B-11	405	N/A	N/A	5	400
B-12	412	N/A	N/A	11	401
B-13	412	N/A	N/A	8.5	403.5

Notes:
All locations, depths, and elevations are approximate. Surface elevation data is derived from a land survey data available on the Snohomish County *PDS Map Portal*.

General Geologic Conditions

Geologic information for the project site was obtained from the *Distribution and description of geologic units in the Mukilteo quadrangle, Washington* (Minard, J.P., 1982) and from the *Geologic Information Portal*. According to these publications, geology within the vicinity of the project site consists of Recessional Outwash (map unit Qvr) and Till (map unit Qvt) originating from Pleistocene glacial periods.

Recessional Outwash generally consists of well-drained, stratified outwash sand and gravel that was deposited by glaciofluvial processes originating from the stagnating and receding Vashon glacier. Prior to recessional deposition, glaciers advanced south to the vicinity of the project area and the depositional environment transitioned to a subglacial one. Here, the height, weight, and horizontal velocity of the advancing and receding glaciers created a grinding-like, geologic, depositional environment, in which Till is created. These soils generally consist of glacially consolidated clays, silts, sands, and gravels, in which are non-sorted, matrix supported, and rest unconformably on older geologic units. Till can also typically be described as a concrete-like mixture of sediment that is very dense or hard due to very large glaciers overriding and densifying these soils during glacial advance and retreat. The contact between the Recessional Outwash and Till in the project area is difficult to map due to the varying amounts of fill that was brought in during the construction of the elementary school.

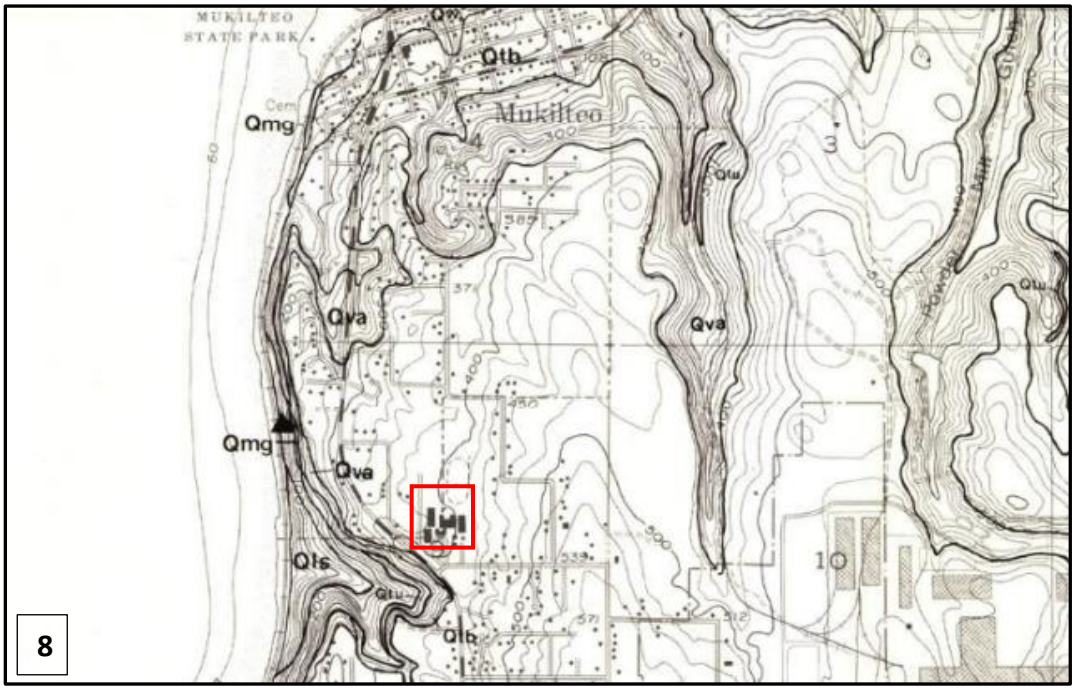


Image 8. Clip from the *Distribution and description of geologic units in the Mukilteo quadrangle, Washington* (Minard, J.P., 1982) illustrating that the subject property is underlain by mapped Till, and the close proximity of the mapped "Recessional Outwash". Approximate site vicinity encapsulated by the red polygon.

Groundwater

At the time of our site visit on February 22, 2023, perched groundwater seepage was encountered in exploration test pit TP-1, TP-4 and TP-7 between 1 and 3 feet BGS. During our site visit on June 3, 2023, perched groundwater seepage was encountered in borings B-1, B-5, B-6, B-7, B-11, B-12, and B-13 between 2.5 and 20 feet BGS.

Perched groundwater seepage should be anticipated during the wet season or after long periods of precipation, atop soils with lower permeability, such as Till and uncontrolled fill consisting of a high percentage of fines.

Perched groundwater conditions can occur and should be anticipated in these soil types. Perched groundwater occurs above the regional groundwater table in the unsaturated zone and typically occurs when loose, more permeable soil is underlain by harder, less permeable soil. The vertical movement of water through looser soils is restricted once a hard or less permeable soil is encountered. Perched groundwater conditions typically develop in the wet season or after extended periods of rainfall.

The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater and seepage levels are variable and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use. Seasonal groundwater monitoring is not currently part of our scope of services.

Web Soil Survey

According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) *Web Soil Survey* website, two primary soils are present within the vicinity of the subject property.

Table 2
USDA NRCS Soil Classifications

Map Unit Symbol	18	6
Map Unit Name	Everett very gravelly sand loam, 8 to 15 percent slopes	Alderwood-urban land complex, 8 to 15 percent slopes
Soil Description	Very gravelly sand loam to extremely cobbly coarse sand	Gravelly ashy sandy loam to gravelly sandy loam
Landform	Moraines, eskers, kames	Till plains
Parent Material	Sandy and gravelly glacial outwash	Basal till
Land Capability Classification	4s	4s
Erosion K Factor, Whole Soil	.10	0.20

These soils are classified as Alderwood-urban land complex, 8 to 15 percent slopes and Everett very gravelly sandy loam, 8 to 15 percent slopes. See Table 2 for a summary of the USDA *Web Soil Survey* classification information. Values of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water. It is interpreted that the site has a **low to moderate** erosion factor based on the findings in Table 2.

Bare Earth Imagery Review

GeoTest reviewed bare earth imagery of the site vicinity, subject property, and slopes in the northwest corner of the school property, which is also referred to as the "natural learning area." Based on a review of this imagery (refer to the *Bare Earth Site Plans*, Figures 3 – 4), there does not appear to be visible indications of tension cracks or large-scale head scarps associated with slope stability. Outside of the general topographic profile of the slope, no apparent signs of large-scale "global" instability on the subject property were observed in our bare earth imagery review.

The digital elevation data used for analysis was acquired from the *Washington Lidar Portal.* Please note that not all signs of slope instability can be observed in the bare earth imagery review due to imagery resolution and scale. In addition, any signs of instability on the site slopes that have occurred since 2017, if present, have occurred after original bare earth imagery acquisition.

GEOLOGIC HAZARD ASSESSMENT

Based on City of Mukilteo Municipal Code (MMC) 17B.52A.020, *Geologic Hazard Areas* are referred to as *Geologic Sensitive Areas* and are defined as "areas susceptible to erosion, landslide, seismically induced soil failure, or other geological events and conditions."

The following sections provide a discussion of the "Geologic Sensitive Areas." After careful review of publicly available geologic literature pertaining to the area, it should be noted that geologic hazards associated with "other geologic events" such as volcanic, tsunami events, etc., were not found to be applicable to this project due to the location of the proposed development.

Erosion Hazard Areas

Erosion Hazard Areas are defined by MMC 17.08 as follows: *"Erosion hazard areas" means at least those areas identified by the U.S. Department of Agriculture National Resources Conservation Service as having a "severe" rill and inter-rill erosion hazard.*

Based on the above MMC criteria, it is GeoTest's interpretation that **no Erosion Hazard Areas exist on site**. Due to the generally low gradient of topography, vegetated areas are relatively flat, and preexisting buildings and facilities, the erosion potential for the site is estimated to be relatively low. Similarly, the *Web Soil Survey* indicates the on-site soils have a "low to moderate" erosion susceptibility. While it is true that Till soils are glacially consolidated, considered to be low permeability soils, and can result in erosion when paired with slopes, the risk of erosion on this project site is greatly diminished due to the lack of slopes that exist. GeoTest recommends that typical mitigations and housekeeping items are implemented to prevent excessive erosion from occurring during construction.

Erosion Mitigation

GeoTest recommends that the following be implemented to prevent and mitigate excessive erosion from occurring during clearing and grading for the proposed development:

- All clearing and grading activities for future vegetation management will need to incorporate Best Management Practices (BMPs) for erosion control in compliance with current MMC codes and standards.
- GeoTest recommends that appropriate silt fencing be incorporated into the vegetation management plan for erosion control.
- GeoTest recommends that on-site BMPs be implemented during vegetation management operations and practices. Areas of native vegetation left in place could also be enhanced by adding additional native plant species and/or other vegetation enhancements.
- Removal of vegetation and trees without proper mitigation may increase the risk of failure for the surficial soils during periods of wet weather. Planting additional brush and vegetation within the subject site and in areas disturbed by excavation activities will help maintain near-surface slope stability by providing a stable root base within the near-surface soils.
- Yard waste should not be dumped onto the top or face of existing or developed site slopes. Yard waste can retain water and cause slope instability.
- Proper drainage controls have a significant effect on erosion. All surface water and any collected drainage water should not be allowed to be concentrated and discharged down the face of an existing steep slope. All collected stormwater should be directed to an appropriate collection system during vegetation management.
- All areas disturbed by vegetation management operations should be protected to limit the potential for erosion as soon as practical during and after manipulation. Areas requiring immediate protection from the effects of erosion should be covered with either plastic, mulch, or erosion control netting/blankets. Areas requiring permanent stabilization should be seeded with an approved grass seed mixture, hydroseeded with an approved seed-mulch-fertilizer mixture or landscaped with a suitable planting design.

In addition to the preceding recommendations, typical erosion control measures during vegetation management will be required. These measures can include high visibility fencing, downslope silt fencing, and a proper site entrance, depending on city regulations. No other mitigations are required to address erosion hazards on the property.

Landslide Hazard Areas

Landslide Hazard Areas are defined by MMC 17.08 as follows: *areas that are potentially subject to risk of mass movement due to a combination of geologic, topographic, and hydrologic factors.*

These areas are typically susceptible to landslides because of a combination of factors including: bedrock, soil, slope gradient, slope aspect, geologic structure, ground water, or other factors.

Similarly, per MMC 17.08, "Steep slopes" are naturally occurring slopes that rise ten feet or more for every twenty-five feet horizontal (i.e., forty percent or greater, also represented as a twenty-two-degree angle). A slope is delineated by establishing the toe (bottom) of the slope and the top of the slope, the horizontal and vertical difference between the toe and top can allow the calculation of the slope percent. Existing slopes modified with engineering oversight or in accordance with standard construction industry techniques are not considered steep slopes.

Per the *City of Mukilteo Geological Sensitive Areas Map,* the proposed development falls outside of the *Landslide Hazard* designation area. Similarly, the *City of Mukilteo Geologically Sensitive Areas Map* does not show any steep slopes on the property outside of the retaining wall along the western edge of the neighboring schools play fields. After reviewing the Client-provided proposed development plan, and performing our onsite investigations, it appears that there is a steep slope in the northwest corner of the property in the "natural learning area." The slope appears to be approximately 20 feet tall with a slope between 20 and 30 percent. Based on our research, it appears that **there are no Landslide Hazard Areas within or 200 feet from the proposed development area.** As such, MMC does not require any specific mitigations to address landslide hazard areas for this project. However, GeoTest recommends providing at least a 20-foot setback from the top of the slope in the northwest quadrant of the property for any building footprints, and at least a 7-foot setback from the top of the slope for any fire lanes, parking areas, or auxiliary driving paths.

Seismic Hazard Areas

Seismic Hazard Areas are typically defined as areas that, due to a combination of soil and groundwater conditions, are subject to severe risk of ground shaking, subsidence, or liquefaction of soils during earthquakes. These areas are typically underlain by soft or loose saturated soils (such as alluvium), have a shallow groundwater table, and are typically located on the floors of river valleys.

Seismic Hazard Areas are defined by MMC 17.08 as follows: *areas subject to risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting.*

According to both the *Geologic Information Portal* and the *PDS Map Portal*, the subject property is mapped as having a "very low" potential for seismic liquefaction. According to the *Geologic Information Portal* and USGS, the nearest active fault trenches and mapped folds are located approximately 2 miles southwest of the project location as part of the Southern Whidbey Island Fault Zone. This fault zone runs northwest-southeast from Whidbey Island down through the City of Mukilteo. Based on the existing site conditions, proposed construction, and our understanding of the local geology, it is GeoTest's opinion that **the subject property is not a Seismic Hazard.**

Outside of compliance with current building codes, GeoTest does not recommend specific mitigations for the planned construction to address potential seismic hazards.

Please keep in mind that the Pacific Northwest is seismically active. Large Cascadia subduction zone earthquakes with possible magnitudes of 8 or 9 could produce ground shaking events with the potential to significantly impact the subject property regardless of the topography or subsurface conditions. Cascadia subduction zone earthquakes have occurred 6 times in the last 3,500 years with the most recent taking place in 1700, approximately 322 years ago. They have been determined to have an average recurrence interval of approximately 300 to 700 years (Atwater and Haley, 1997).

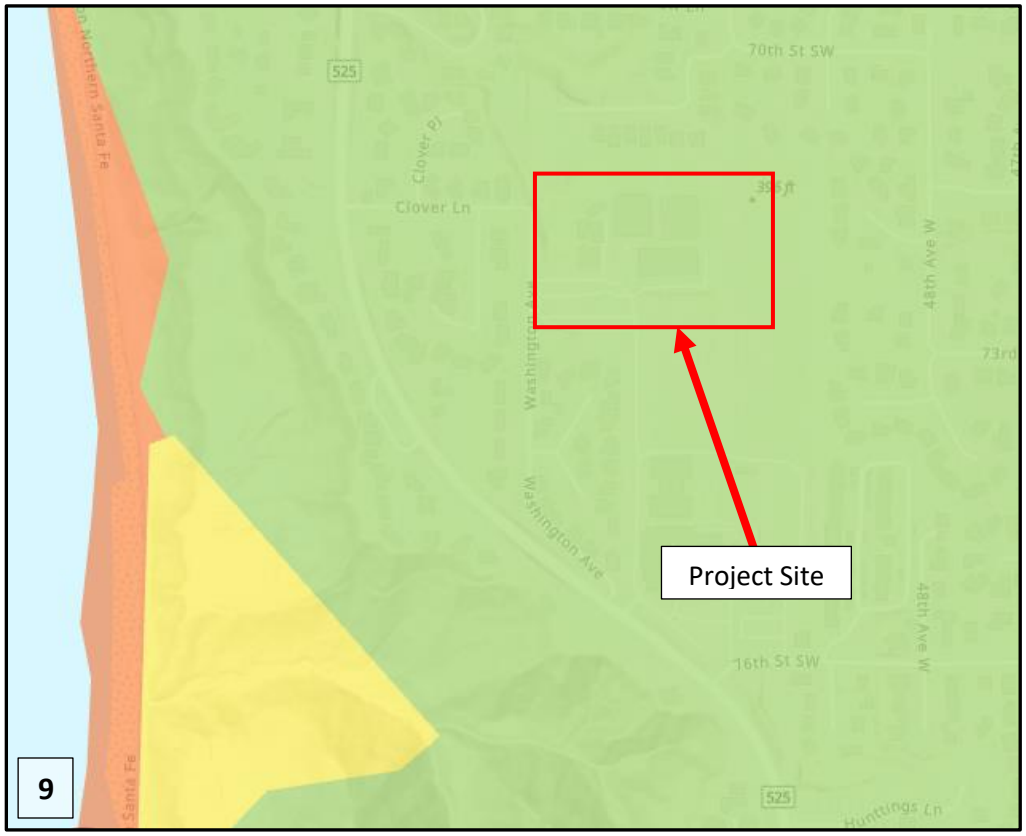


Image 9. Screenshot from the *DNR Geologic Information Portal*, in which the entire project site is considered to possess a "very low" liquefaction susceptibly (shown in green).

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the data collected during this investigation, it is our opinion that the subsurface conditions at the site are suitable for the proposed development, provided the recommendations contained herein are incorporated into the project design.

Existing fill, organics, and loose/unsuitable portions of native soil (if remedial compaction is infeasible) should be removed and replaced with suitable Structural Fill. Overlying the

Recessional Outwash and Till soils across much of the site is 1 to 14 feet of uncontrolled fill, with the thicker sections observed in the western portions of the project area. These fill soils are not suitable for shallow conventional foundation support as a result of the high percentages of debris and organics. Though as previously mentioned, the approximately 14 feet of fill observed at the B-5 location is thought to be an outlier due to the close proximity to the slope near the "natural learning area." In general, the fill thickness appeared to be approximately 3 to 8 feet thick (as noted in Table 1) in most locations.

As previously mentioned, the site is relatively flat and underlain by medium dense, slightly gravelly, silty sand typical of Recessional Outwash, as well as, medium dense to very dense, gravelly, silty sands to sandy silts typical of Till deposits. The Recessional Outwash were generally observed within 3 to 8 feet of existing site grades in the western and southeastern portions on the site (TP-1 to TP-3, and TP-6). The native Till deposits were generally observed within 1 to 14 feet of existing site grades (TP-4 to TP-7 and B-1 to B-13). Both soil types are suitable for shallow conventional foundation support when recompacted to a firm and unyielding condition. It should be noted Recessional Outwash was observed overlying the Till deposits within test pit exploration TP-6.

The native Recessional Outwash and Till may be suitable for reuse as Structural Fill when placed and compacted as recommended in this report. We recommend the Client plan for a typical stripping depth of 1 to 8 feet for building footprints. Some efficiencies may be achieved if building foundations are "stepped down" along the eastern, middle, and western thirds of the planned building alignment to more naturally connect with native soils. Stated differently, native soils appear to have a natural east-to-west descending gradient in the region. Stripping depths are expected to vary and could be more extensive than anticipated due to inconsistent thicknesses of uncontrolled fill. Uncontrolled fill is not recommended for reuse as Structural Fill due to the high percentage of debris and organics. For ancillary driveways and pavement structures, GeoTest recommends stripping no more than 2 feet of Uncontrolled Fill and preparing the subgrade in accordance with the *Site Preparation and Earthwork* section of this report.

Shallow restriction layers exist on the property that will make the design of infiltration systems challenging. It should also be noted that very dense glacially consolidated Till was encountered as shallow as 1-foot and as deep as 14 feet BGS in some test pits and borings at the time of our investigation. The *Stormwater Management Manual of Western Washington [Manual]* has requirements and limitations for the design of stormwater facilities when shallow restriction layers exist below a facility. Stormwater management strategies that include detention vaults may be feasible but should have a fundamental expectation that there will be shallow restriction layers present that might influence the overall design of stormwater systems. At the time of writing this report, it is our understanding that there are no conceptual stormwater facility designs put together. It should also be noted that two monitoring wells were installed for seasonal groundwater monitoring as "wet season" monitoring may be required by the City of Mukilteo in the future. A Pilot Infiltration Test (PIT) was planned to be performed during our

initial site visit on February 22, 2023, however, due to shallow restriction layers and thick deposits of uncontrolled fill, GeoTest was unable to perform the PIT at the originally planned location.

A preliminary site development plan showing the building type and footprint, not including stormwater facilities was available to us at the time of writing this report, but it is not known if the development will incorporate the use of shoring or retaining walls. As a result, GeoTest attempted to get as wide of a range of subsurface data as possible to help with the planning process but was limited in some respects due to encountering utilities during our excavations. It should be expected that additional design services, possibly paired with additional field work and collaboration with the project Civil Engineer, may be needed to complete the grading, shoring, and stormwater design until finalized plans are put in place.

Site Preparation and Earthwork

The portions of the site proposed for foundation(s) and floor slab(s) should be prepared by removing existing pavements, topsoil, deleterious material, and significant accumulations of organics. Based on our explorations, GeoTest anticipates approximately 1 to 14 feet of topsoil and uncontrolled fill removal to expose native soils, depending on where development occurs. For ancillary driveways and pavement structures, GeoTest recommends stripping no more than 2 feet of uncontrolled fill.

Prior to placement of any foundation elements or Structural Fill, the exposed subgrade under all areas to be occupied by soil-supported floor slabs, foundations, ancillary driveways, or pavement structures should be recompacted to a firm and unyielding condition. Verification of compaction can be accomplished through proof rolling with a loaded dump truck, large self-propelled vibrating roller, or similar piece of equipment applicable to the size of the excavation. The purpose of this effort is to identify loose or soft soil deposits so that, if feasible, the soil disturbed during site work can be recompacted.

Proof rolling should be carefully observed by qualified geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be overexcavated to firm soil. Alternatively, Dynamic Cone Penetrometers or soil probing by a qualified GeoTest representative can confirm firm and unyielding conditions in localized areas if a proof roll cannot be performed. Overexcavated areas should be backfilled with compacted granular material placed in accordance with subsequent recommendations for Structural Fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, qualified geotechnical personnel should observe subgrade conditions to determine if proof rolling is feasible.

Fill and Compaction

Structural Fill used to obtain final elevations for footings and soil-supported floor slabs must be properly placed and compacted. In most cases, suitable, non-organic, predominantly granular

soil may be used for fill material provided the material is properly moisture conditioned prior to placement and compaction, and the specified degree of compaction is obtained. Material containing topsoil, wood, trash, organic material, or construction debris is not suitable for reuse as Structural Fill and should be properly disposed off-site or placed in nonstructural areas.

Soils containing more than approximately 5 percent fines are considered moisture sensitive and are difficult to compact to a firm and unyielding condition when over the optimum moisture content by more than approximately 2 percent. The optimum moisture content is that which allows the greatest dry density to be achieved at a given level of compactive effort.

Reuse of On-Site Soil – Existing Fill

Due to the high percentage of organics and debris observed in the uncontrolled fill sections GeoTest does not recommend reusing the uncontrolled fill for Structural Fill. If it is desired to use fill soils for Structural Fill, GeoTest would be able to observe the soils in question to determine if it is suitable for Structural Fill. Existing fill soils may be utilized in non-structural applications.

Reuse of On-Site Soil – Native Soil

The non-organic, native Recessional Outwash and Till may be suitable for reuse as Structural Fill when placed at or near optimum moisture contents, as determined by ASTM D1557 and if allowed for in the project plans and specifications. The Till soils found on site contain high percentage of fines and should be considered moisture sensitive. Reuse of Till may be considerably more difficult, if not impossible, to use at or near perched groundwater elevations and during the wet weather season (October 1 – April 30). Furthermore, the silty nature of the Till may limit its use if being considered close to areas where infiltration or a stormwater vault may be planned. If using on-site materials, the Contractor or Owner should be prepared to manage over-optimum moisture content soils. The moisture content of the soils may be difficult to control during periods of wet weather.

During our investigation on-site, in more than one instance, GeoTest observed oversized materials consisting of cobbles and scattered boulders within a few of the test pit excavations. It is GeoTest's opinion that there is a likelihood that cobbles and boulders will be encountered during grading and/or excavation activities. The Client and/or Owner should anticipate their presence and issues associated with them during the construction phase. Screening of oversized materials should be anticipated.

Imported Structural Fill

GeoTest recommends that imported Structural Fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved naturally occurring granular material (pit run) or a well-graded crushed rock. We recommend Structural Fill for dry weather construction meet Washington State

Department of Transportation (WSDOT) Standard Specification 9-03.14(2) for "Select Borrow" with the added requirement than 100 percent pass a 4-inch-square sieve.

Soil containing more than about 5 percent fines (that portion passing the U.S. No. 200 sieve) cannot consistently be compacted to a dense, non-yielding condition when the water content is greater than optimum. Accordingly, GeoTest recommends that imported Structural Fill for wet weather construction meet WSDOT Standard Specification 9-03.14(1) for "Gravel Borrow" with the added requirement that no more that 5 percent pass the U.S. No. 200 sieve. Due to wet weather or wet site conditions, soil moisture contents could be high enough that it may be very difficult to compact even 'clean' imported select granular fill to a firm and unyielding condition. Soils with over-optimum moisture contents should be scarified and dried back to more suitable moisture contents during periods of dry weather or removed and replaced with fill soils at a more suitable range of moisture contents.

Based on local availability, the designer may elect to utilize Crushed Surfacing Base Course (CSBC) or Crushed Surfacing Top Course (CSTC) as Structural Fill. As such, we recommend WSDOT Standard Specification 9-03.9(3) be incorporated into the project plans.

Backfill and Compaction

Structural Fill should be placed in horizontal lifts. The Structural Fill must measure 8 to 10 inches in loose thickness and be thoroughly compacted. All Structural Fill placed under load bearing areas should be compacted to at least 95 percent of the maximum dry density, as determined using test method ASTM D1557. The top of the compacted Structural Fill should extend outside all foundations and other structural improvements a minimum distance equal to the thickness of the fill. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

The native soils on site have a significant percentage of fines content. As such, these soils may be susceptible to degradation during wet weather. If construction takes place during wet weather, GeoTest recommends that Structural Fill consist of imported, clean, well-graded sand or sand and gravel as described above. If fill is to be placed or earthwork is to be performed in wet conditions, the contractor may reduce soil disturbance by:

- Limiting the size of areas that are stripped of topsoil and left exposed
- Accomplishing earthwork in small sections
- Limiting construction traffic over unprotected soil
- Sloping excavated surfaces to promote runoff
- Limiting the size and type of construction equipment used
- Providing gravel 'working mats' over areas of prepared subgrade
- Removing wet surficial soil prior to commencing fill placement each day

- Sealing the exposed ground surface by rolling with a smooth drum compactor or rubber-tired roller at the end of each working day
- Providing up-gradient perimeter ditches or low earthen berms and using temporary sumps to collect runoff and prevent water from ponding and damaging exposed subgrades

Seismic Design Considerations

The Pacific Northwest is seismically active, and the site could be subject to movement from a moderate or major earthquake. Consequently, moderate levels of seismic shaking should be accounted for during the design life of the project, and the proposed structure should be designed to resist earthquake loading using appropriate design methodology.

For structures designed using the seismic design provisions of the 2018 International Building Code, the medium dense Recessional Outwash are classified as Site Class D, and the dense to very dense Till soils are classified as Site Class C according to ASCE 7-16. The structural engineer should select the appropriate design response spectrum based on Site Class C and D soils and the geographical location of the proposed construction.

Foundation Support

Continuous or isolated spread footings founded on proof-rolled, undisturbed, medium dense to very dense native soils or on properly compacted Structural Fill placed directly over undisturbed native soil can provide foundation support for the proposed improvements. We recommend that qualified geotechnical personnel confirm that suitable bearing conditions have been reached prior to placement of Structural Fill or foundation formwork.

To provide proper support, GeoTest recommends that existing topsoil, existing fill, and/or loose upper portions of the native soil be removed from beneath the building foundation area(s) or be replaced with properly compacted Structural Fill as described in the *Fill and Compaction* section of this report. Localized overexcavation, if necessary, can be backfilled to the design footing elevation with lean concrete, or foundations may be extended to bear on undisturbed native soil. In areas requiring overexcavation to competent native soil, the limits of the overexcavation should extend laterally beyond the edge of each side of the footing a distance equal to the depth of the excavation below the base of the footing. If lean concrete is used to backfill the overexcavation, the limits of the overexcavation need only extend a nominal distance beyond the width of the footing. In addition, GeoTest recommends that foundation elements for the proposed structure(s) bear entirely on similar soil conditions to help prevent differential settlement from occurring.

Continuous and isolated spread footings should be founded 18 inches, minimum, below the lowest adjacent final grade for freeze/thaw protection. The footings should be sized in accordance with the structural engineer's prescribed design criteria and seismic considerations.

Allowable Bearing Capacity

Assuming the above foundation support criteria are satisfied, continuous or isolated spread footings founded directly on medium dense, firm and unyielding native soil or on compacted Structural Fill placed directly over firm and unyielding undisturbed native soils may be proportioned using a net allowable soil bearing pressure of 2,500 pounds per square foot (psf).

The "net allowable bearing pressure" refers to the pressure that can be imposed on the soil at foundation level. This pressure includes all dead loads, live loads, the weight of the footing, and any backfill placed above the footing. The net allowable bearing pressure may be increased by one-third for transient wind or seismic loads.

Foundation Settlement

Settlement of shallow foundations depends on foundation size and bearing pressure, as well as the strength and compressibility characteristics of the underlying soil. If construction is accomplished as recommended and at the maximum allowable soil bearing pressure, GeoTest estimates the total settlement of building foundations to be less than one inch under static conditions. Differential settlement between two adjacent load-bearing components supported on competent soil is estimated to be less than one half the total settlement.

Floor Support

Conventional slab-on-grade floor construction is feasible for the planned site improvements. Floor slabs may be supported on properly prepared native subgrade or on properly placed and compacted Structural Fill placed over properly prepared native soil. Prior to placement of the Structural Fill, the native soil should be proof rolled as recommended in the *Site Preparation and Earthwork* section of this report.

GeoTest recommends that interior concrete slab-on-grade floors be underlain with at least 6 inches of clean, compacted, free-draining crushed gravel to serve as a capillary break. This material should be clear, crushed, ¾-inch rock with no fines or similar. The purpose of this gravel layer is to provide uniform support for the slab, provide a capillary break, and act as a drainage layer. To help reduce the potential for water vapor migration through floor slabs, a continuous 10- to 15-mil minimum thick polyethylene sheet with tape-sealed joints should be installed below the slab to serve as an impermeable vapor barrier. The vapor barrier should be installed and sealed in accordance with the manufacturer's instructions. American Concrete Institute (ACI) guidelines suggest that the slab may be poured directly on the vapor barrier.

A Subgrade Modulus (k) of 150 pounds per cubic inch (pci) is recommended for use in the design of concrete slab elements placed on near-surface soils remedially compacted to Structural Fill requirements.

Exterior concrete, such as for parking and sidewalks, may be supported directly on properly prepared existing site soils. However, long-term performance will be enhanced if exterior slabs are placed on a layer of clean, durable, well-draining granular material above existing site soils.

Foundation and Site Drainage

Positive surface gradients should be provided adjacent to the proposed building to direct surface water away from the building and toward suitable drainage facilities. Roof drainage should not be introduced into the perimeter footing drains but should be separately discharged directly to the stormwater collection system or similar municipality-approved outlet. Pavement and sidewalk areas, if present, should be sloped and drainage gradients should be maintained to carry surface water away from the building towards an approved stormwater collection system. Surface water should not be allowed to pond and soak into the ground surface near buildings or paved areas during or after construction. Construction excavations should be sloped to drain to sumps where water from seepage, rainfall, and runoff can be collected and pumped to a suitable discharge facility.

The filtering media may consist of open-graded drain rock wrapped in a nonwoven geotextile fabric such as Mirafi 140N (or equivalent) or wrapped with a graded sand and gravel filter. For foundations supporting retaining walls, drainage backfill should be carried up the back of the wall and be at least 12 inches wide. The drainage backfill should extend from the foundation drain to within approximately 1 foot of the finished grade and consist of open-graded drain rock containing less than 3 percent fines by weight passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The invert of the footing drainpipe should be placed at approximately the same elevation as the bottom of the footing or 12 inches below the adjacent floor slab grade (whichever is deeper) so that water will be contained. This process prevents water from seeping through walls or floor slabs. The drain system should include cleanouts to allow for periodic maintenance and inspection.

The drainage backfill should extend from the foundation drain to within approximately 1 foot of the finished grade and consist of open-graded drain rock containing less than 3 percent fines by weight passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The invert of the footing drainpipe should be placed at approximately the same elevation as the bottom of the footing or 12 inches below the adjacent floor slab grade, whichever is deeper, so that water will be contained. This process prevents water from seeping through walls or floor slabs. The drain system should include cleanouts to allow for periodic maintenance and inspection.

Please understand that the above recommendations are intended to assist the design engineer and/or architect in the development of foundation and site drainage parameters and are based on our experience with similar projects in the area. The final foundation and site drainage plan that will be incorporated into the project plans is to be determined by the design team.

Resistance to Lateral Loads

The lateral earth pressures that develop against foundation walls will depend on the method of backfill placement, degree of compaction, slope of backfill, type of backfill material, provisions for drainage, magnitude and location of any adjacent surcharge loads, and the degree to which the wall can yield laterally during or after placement of backfill. If the wall can rotate or yield so the top of the wall moves an amount equal to or greater than about 0.001 to 0.002 times its height (a yielding wall), the soil pressure exerted comprises the active soil pressure. When a wall is restrained against lateral movement or tilting (a nonyielding wall), the soil pressure exerted comprises the at rest soil pressure. Wall restraint may develop if a rigid structural network is constructed prior to backfilling or if the wall is inherently stiff.

GeoTest recommends that yielding walls under drained conditions be designed for an equivalent fluid density of 35 pounds per cubic foot (pcf) for Structural Fill, Recessional Outwash, and native Till in active soil conditions. Nonyielding walls under drained conditions should be designed for an equivalent fluid density of 55 pcf for Structural Fill, Recessional Outwash, and native Till soils in at-rest conditions.

Design of walls should include appropriate lateral pressures caused by surcharge loads located within a horizontal distance equal to or less than the height of the wall. For uniform surcharge pressures, a uniformly distributed lateral pressure equal to 35 percent and 50 percent of the vertical surcharge pressure should be added to the lateral soil pressures for yielding and nonyielding walls, respectively. GeoTest also recommends that a seismic surcharge of 8H be included where H is the wall height. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the wall.

Passive earth pressures developed against the sides of building foundations, in conjunction with friction developed between the base of the footings and the supporting subgrade, will resist lateral loads transmitted from the structure to its foundation. For design purposes, the passive resistance of well-compacted fill placed against the sides of foundations is equivalent to a fluid with a density of 350 pcf. The recommended value includes a safety factor of about 1.5 and assumes that the ground surface adjacent to the structure is level in the direction of movement for a distance equal to or greater than twice the embedment depth. The recommended value also assumes drained conditions that will prevent the buildup of hydrostatic pressure in the compacted fill. Retaining walls should include a drain system constructed in general accordance with the recommendations presented in the *Foundation and Site Drainage* section of this report. In design computations, the upper 12 inches of passive resistance should be neglected if the soil is not covered by floor slabs or pavement. If future plans call for the removal of the soil providing resistance, the passive resistance should not be considered.

An allowable coefficient of base friction of 0.35, applied to vertical dead loads only, may be used between the underlying soil and the base of the footing. If passive and frictional resistance are considered together, one half the recommended passive soil resistance value should be used

since larger strains are required to mobilize the passive soil resistance as compared to frictional resistance. A safety factor of about 1.5 is included in the base friction design value. GeoTest does not recommend increasing the coefficient of friction to resist seismic or wind loads.

Temporary and Permanent Slopes

The contractor is responsible for construction slope configurations and maintaining safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored during and after excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring.

Temporary excavations in excess of 4 feet should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403. Till soils are classified as Type B soil, while Recessional Outwash soils are classified as Type C soil. According to WAC 296-155-66401, Type B soils may be sloped as steep as 1:1 (Horizontal: Vertical) and Type C soils may be sloped and as steep as 1.5:1. All soils encountered are classified as Type C soil in the presence of groundwater seepage. Flatter slopes or temporary shoring may be required in areas where groundwater flow is present and unstable conditions develop.

Temporary slopes and excavations should be protected as soon as possible using appropriate methods to prevent erosion from occurring during periods of wet weather.

GeoTest recommends that permanent cut or fill slopes be designed for inclinations of 2H:1V or flatter. Permanent cuts or fills used in detention ponds, retention ponds, or earth slopes intended to hold water should be 3H:1V or flatter. All permanent slopes should be vegetated or otherwise protected to limit the potential for erosion as soon as practical after construction.

Utilities

Utility trenches must be properly backfilled and compacted to reduce cracking or localized loss of foundation, slab, or pavement support. Excavations for new shallow underground utilities are expected to be placed within Recessional Outwash, Till, or Structural Fill on the subject parcel.

Trench backfill in improved areas (beneath structures, pavements, sidewalks, etc.) should consist of Structural Fill as defined in the *Fill and Compaction* section of this report. Outside of improved areas, trench backfill may consist of reused native material provided the backfill can be compacted to the project specifications. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the *Fill and Compaction* section of this report.

Surcharge loads on trench support systems due to construction equipment, stockpiled material, and vehicle traffic should be included in the design of any anticipated shoring system. The

contractor should implement measures to prevent surface water runoff from entering trenches and excavations. In addition, vibration as a result of construction activity and traffic may cause caving of the trench walls.

The contractor is responsible for trench configurations. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored by the contractor during excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring. If groundwater or groundwater seepage is present, and the trench is not properly dewatered, the soil within the trench zone may be prone to caving, channeling, and running. Trench widths may be substantially wider than under dewatered conditions.

Pavement Subgrade Preparation

GeoTest recommends that pavement sections be founded on firm and unyielding native or existing fill soils, or on compacted Structural Fill placed directly over firm and unyielding subgrade. GeoTest recommends stripping no more than 2 feet of Uncontrolled Fill for ancillary driveways and pavement structures**.** Where existing fill soils are present and consist of mineral soil, it should be expected that these fill soils will be scarified to a depth of 18 inches below the bottom of pavement elevations and recompacted to the requirements for Structural Fill. Existing fill with elevated levels of organics should be overexcavated and replaced with Structural Fill.

Site grading plans should include provisions for the sloping of subgrade soils in the proposed pavement areas so that passive drainage of the pavement section(s) can proceed uninterrupted during the life of the project. The discussion below represents typical pavement sections used at similar projects in the site vicinity. The final pavement design is to be determined by the project Civil Engineer.

Flexible Pavement Sections – Light Duty

If utilized within light vehicle parking and lower traffic areas, GeoTest recommends a standard, or “light duty”, pavement section that consists of 3 inches of Class ½-inch HMA asphalt above 2 inches of crushed surfacing top course (CSTC) meeting criteria set forth in the Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9[3]. The base material for the pavement section should consist of 6 inches of crushed surface base course (CSBC). This would result in a total of 8 inches of rock (CSTC and CSBC) underlying the asphalt.

Flexible Pavement Sections – Heavy Duty

Fire truck and general heavy access or high-volume lanes will require a thicker asphalt section and should be designed using a paving section consisting of 4 inches of Class ½-inch HMA asphalt above 2 inches of CSTC meeting criteria set forth in the WSDOT Standard Specification 9-03.9[3].

The base material for the road section should consist of 6 inches of CSBC. This would result in a total of 8 inches of rock (CSTC and CSBC) underlying the asphalt.

Concrete Hardscape Sections

Concrete pavements could be used for sidewalks and other features such as parking or access areas. The design of concrete pavements is a function of concrete strength, reinforcement steel, and the anticipated loading conditions for the roads. For design purposes, a vertical modulus of subgrade reaction of 150 pounds per cubic inch (pci) should be expected for concrete elements constructed over properly prepared, firm and unyielding native or existing fill soil, or on properly placed and compacted Structural Fill over properly prepared subgrade. GeoTest expects that concrete pavement sections, if utilized, will be at least 8 inches thick and be founded on a minimum of 8 inches of compacted CSBC. The design of concrete access and parking areas will need to be performed by a Structural Engineer. GeoTest recommends that subgrade soils supporting concrete pavement sections include minor grade changes to allow for passive drainage away from the pavement.

GeoTest is available to further consult, review, and/or modify our pavement section recommendations based on further discussion with the project team/owner. The above pavement sections are initial recommendations and may be accepted and/or modified by the site Civil Engineer based on the actual finished site grading elevations and/or the owner's preferences.

Stormwater Infiltration Potential

The native soils observed underlying the site are medium dense to very dense, contain elevated silt contents (14 to 71 percent), and are expected to exhibit low permeability characteristics. GeoTest also observed perched groundwater seepage atop low permeability Till during our investigation, but also anticipates its presence during the wet season and after extended periods of heavy precipitation. Both groundwater seepage and glacial deposits such as Till are widely regarded as "hydraulic restriction layers" as defined by the Manual. Till, in particular, is used as construction materials in stormwater pond liners and in berm construction where low-permeability soils are required as part of the design. Per the Manual, Till is expected to have a saturated hydraulic conductivity of less than 0.3 inches per hour, which the Manual defines as a "restriction layer."

Shallow restriction layers, as defined by the Manual, exist on the property that will make the design of infiltration systems challenging. The Manual has requirements and limitations for the design of stormwater facilities when shallow restriction layers exist below a facility. At the time of this report, a Stormwater Plan has not been developed for this property. Thus, it should be expected that the Civil Engineer will need to review the contents of this report with a specific focus on soil type, soil density, and/or the amount of vertical separation between the bottom of the facility and the restriction layer.

It is GeoTest's opinion that stormwater infiltration is not feasible for this site. Due to the shallow, low permeability soil, low impact development (LID) features such as pervious pavement or rain gardens may be challenging to incorporate into the stormwater plan that will be prepared for this project. The underlying low permeability soil must be accounted for in the design of stormwater facilities.

Stormwater Treatment

The on-site stormwater facilities may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or off-site discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were also tested to determine possible pollutant treatment suitability.

Cation exchange capacity, organic content, and pH tests were performed by Northwest Agricultural Consultants on four soil samples collected from the explorations shown in Table 3. A summary of the laboratory test results is presented in Table 3 below.

Table 3
Cation Exchange Capacity, Organic Content, and pH Laboratory Test Results

Test Pit ID	Sample Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content (%)	pH
TP-2	0.25	Topsoil	10.9	4.49	5.7
TP-2	8.5	Recessional Outwash	7.0	1.84	6.1
TP-6	4.0	Recessional Outwash	8.6	1.21	6.4
TP-7	6.0	Till	8.5	1.05	6.2

Suitability for on-site pollutant treatment is determined in accordance with SSC-6 of the Manual. Soils with an organic content greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable soils for stormwater treatment. Based on the results shown in Table 3, the native soils and topsoil observed on-site are suitable for stormwater treatment purposes.

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

We also recommend that geotechnical construction monitoring services be provided. These services should include observation by GeoTest personnel during Structural Fill placement,

compaction activities and subgrade preparation operations to confirm that design subgrade conditions are obtained beneath the areas of improvement.

Periodic field density testing should be performed to verify that the appropriate degree of compaction is obtained. The purpose of these services is to observe compliance with the design concepts, specifications, and recommendations of this report. In the event that subsurface conditions differ from those anticipated before the start of construction, GeoTest would be pleased to provide revised recommendations appropriate to the conditions revealed during construction.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing, and structural steel. These services are supported by our fully accredited materials testing laboratories.

USE OF THIS REPORT

GeoTest Services, Inc. has prepared this preliminary report for the exclusive use of the Mukilteo School District Capital Projects Department and their design consultants for specific application to the design of the proposed Mukilteo Elementary School development located at 2600 Mukilteo Speedway in Mukilteo, WA. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

This report is intended to be a preliminary evaluation of the subject property. Thus, additional studies outside of the current scope of work will likely be needed once preliminary design concepts are known.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published geological information for the site. If variations in subsurface conditions are encountered during construction that differs from those contained within this report, GeoTest should be allowed to review the recommendations and, if necessary, make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible for performing all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

Attachments:

Figure 1	Vicinity Map
Figure 2A	Site and Exploration Plan
Figure 2B	Site and Exploration Plan – Soil Groups
Figure 3	2005 Bare Earth Imagery
Figure 4	2017 Bare Earth Imagery
Figure 5	A – A' Fence Diagram
Figure 6	Conceptual Footing and Wall Drain Section
Figure 7	Soil Classification System and Key
Figures 8 – 11	Test Pit Exploration Logs
Figures 12 – 24	Soil Boring Exploration Logs
Figures 25 – 28	Grain Size Test Data
Attachment	NW Agricultural Consultants Test Results
Attachment	Report Limitations and Guidelines for Its Use (4 pages)

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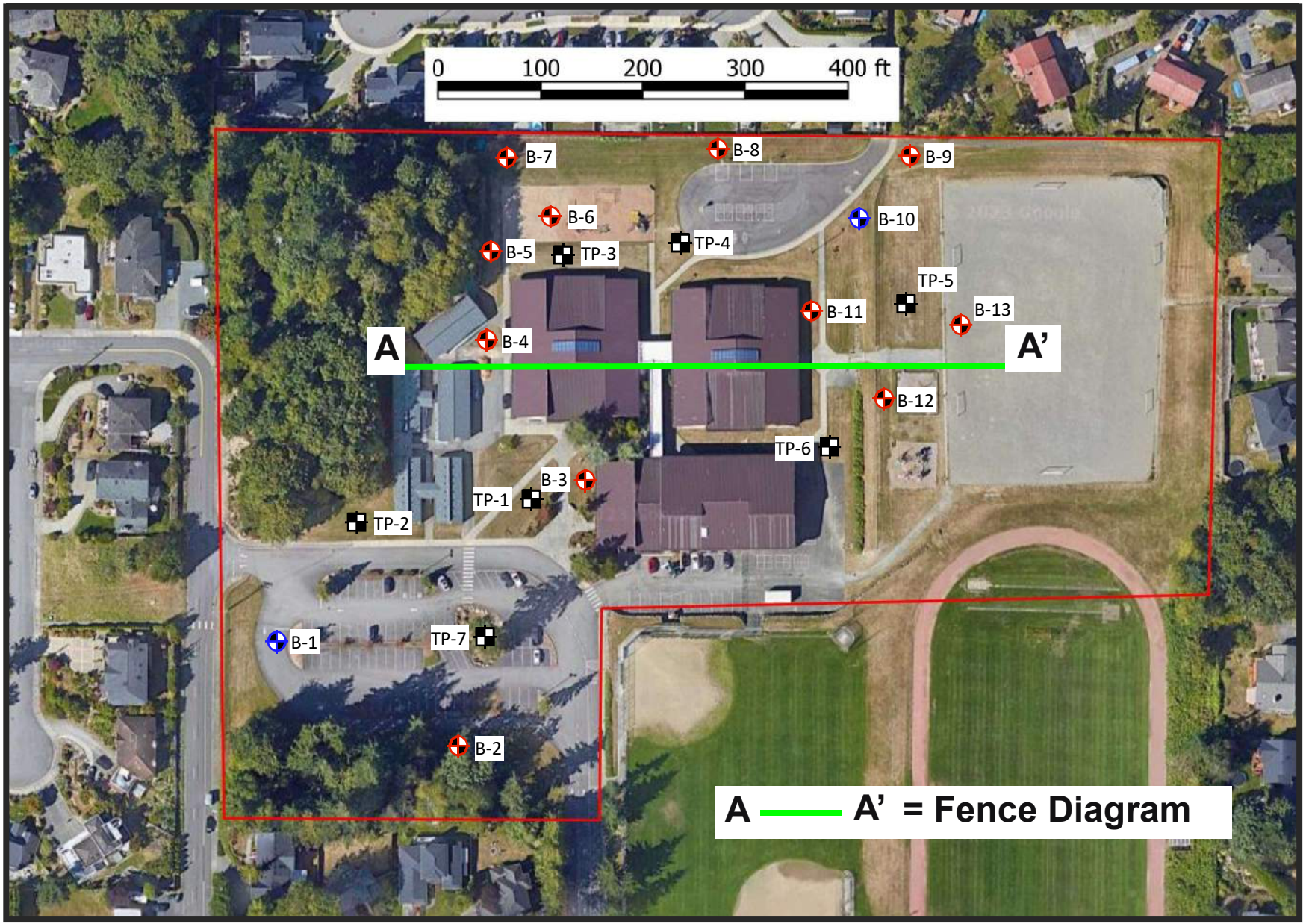


GEOTEST An RMA Company	Date: 6-7-2023	By: CM	Scale: As Shown

VICINITY MAP
MUKILTEO ELEMENTARY SCHOOL
2600 MUKILTEO SPEEDWAY
MUKILTEO, WASHINGTON

Project
23-0066

Figure
1



TP-# = Approximate Test Pit Location

B-# = Approximate Boring Location

= Approximate Monitoring Well Location

N

Notes:

1) Parcel shapefile sourced from *Snohomish County PDS Map Portal*
2) Approximate project area outlined in RED
3) Map image created using *QGIS 3.22.6.*

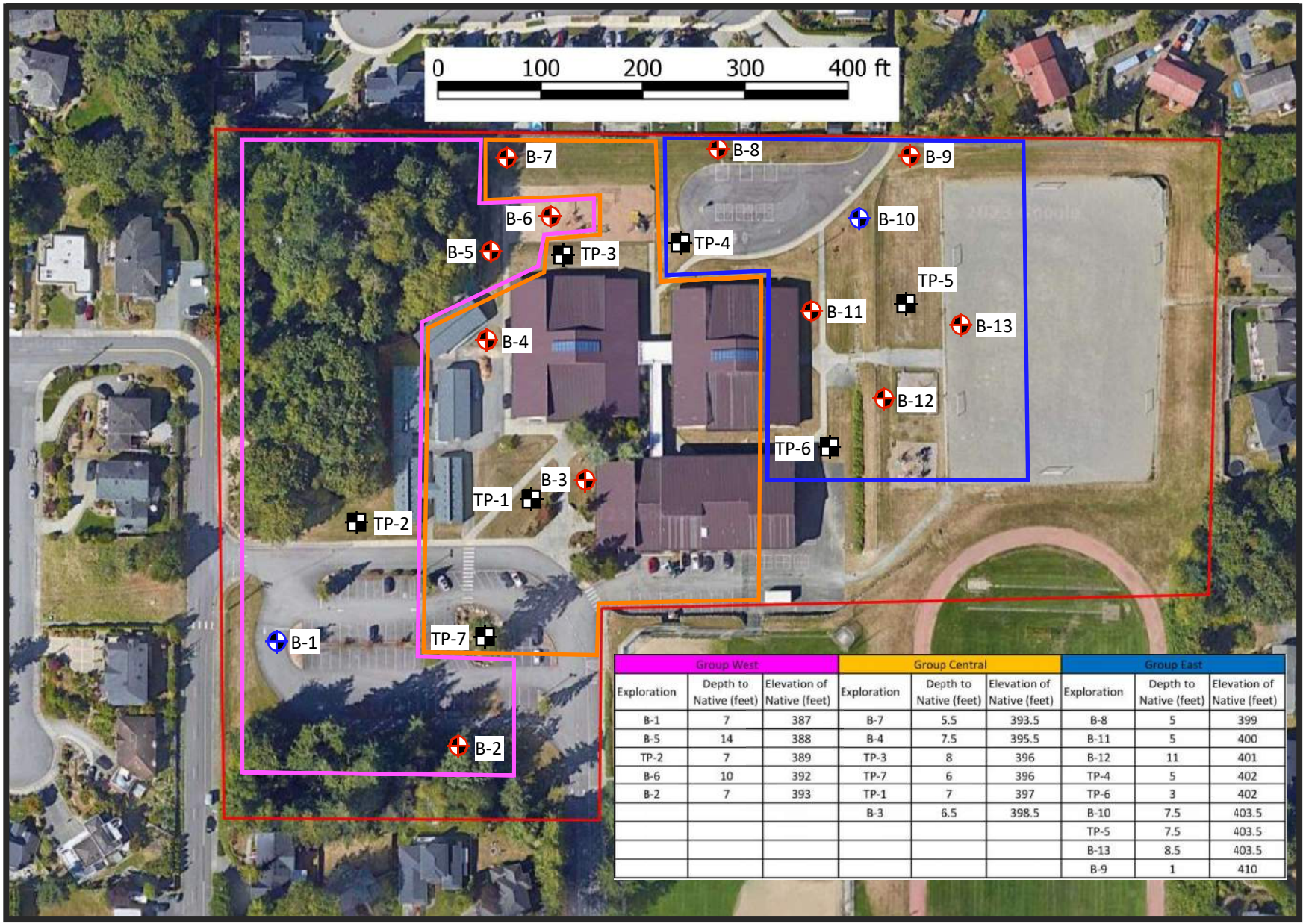
GEOTEST
An RMA Company

Date: 2-24-2023	By: CM	Scale: As Shown	Project 23-0066

SITE AND EXPLORATION PLAN

MUKILTEO ELEMENTARY SCHOOL
2600 MUKILTEO SPEEDWAY
MUKILTEO, WASHINGTON

Figure 2A



Group West			Group Central			Group East		
Exploration	Depth to Native (feet)	Elevation of Native (feet)	Exploration	Depth to Native (feet)	Elevation of Native (feet)	Exploration	Depth to Native (feet)	Elevation of Native (feet)
B-1	7	387	B-7	5.5	393.5	B-8	5	399
B-5	14	388	B-4	7.5	395.5	B-11	5	400
TP-2	7	389	TP-3	8	396	B-12	11	401
B-6	10	392	TP-7	6	396	TP-4	5	402
B-2	7	393	TP-1	7	397	TP-6	3	402
			B-3	6.5	398.5	B-10	7.5	403.5
						TP-5	7.5	403.5
						B-13	8.5	403.5
						B-9	1	410

= Eastern Group of Explorations
= Central Group of Explorations
= Western Group of Explorations

N

Notes:

1) Parcel shapefile sourced from *Snohomish County PDS Map Portal*
2) Approximate project area outlined in RED
3) Map image created using *QGIS 3.22.6.*

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An RMA Company

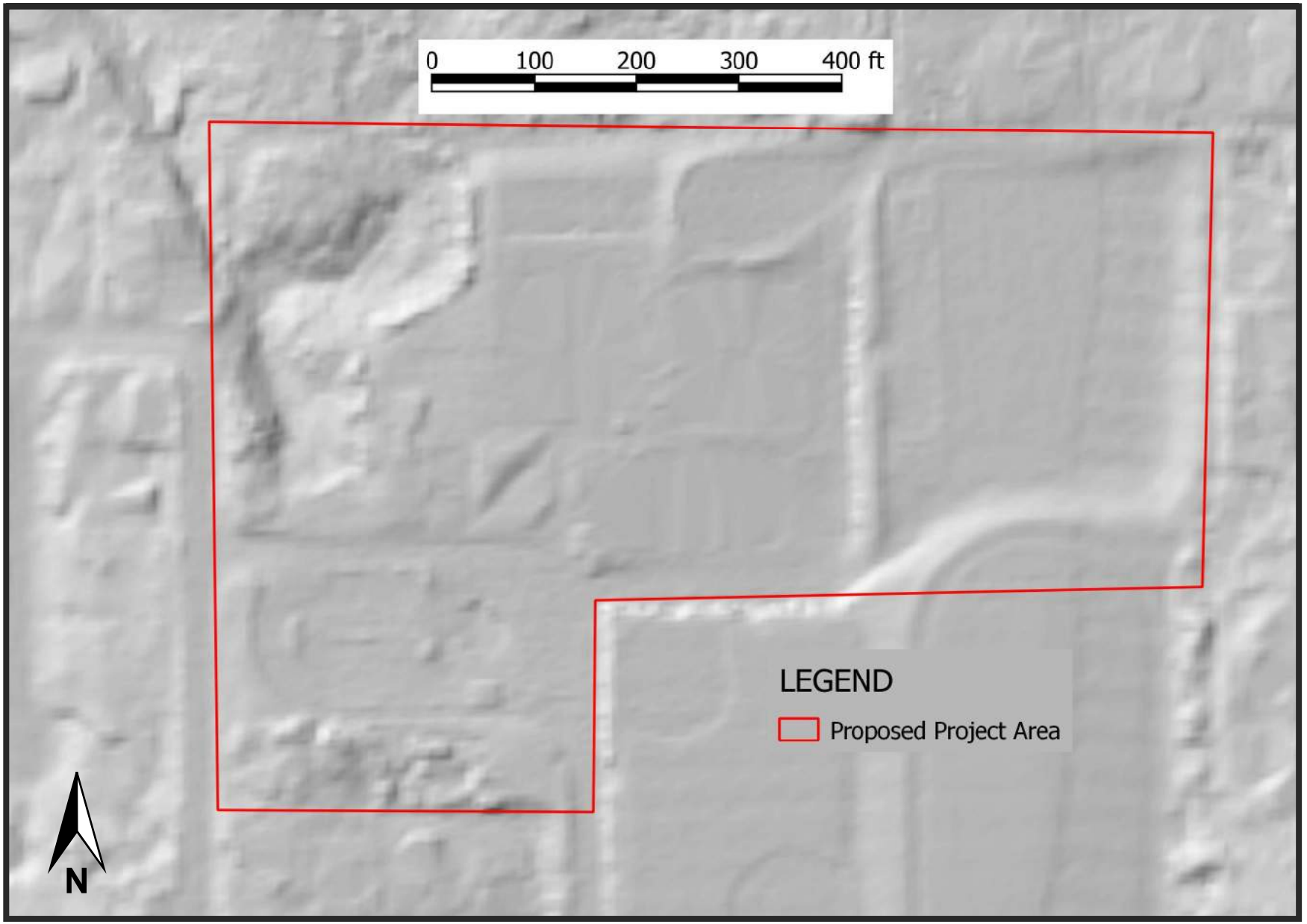
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SITE AND EXPLORATION PLAN - SOIL GROUPS

MUKILTEO ELEMENTARY SCHOOL
2600 MUKILTEO SPEEDWAY
MUKILTEO, WASHINGTON

Project
23-0066

Figure
2B



Notes:

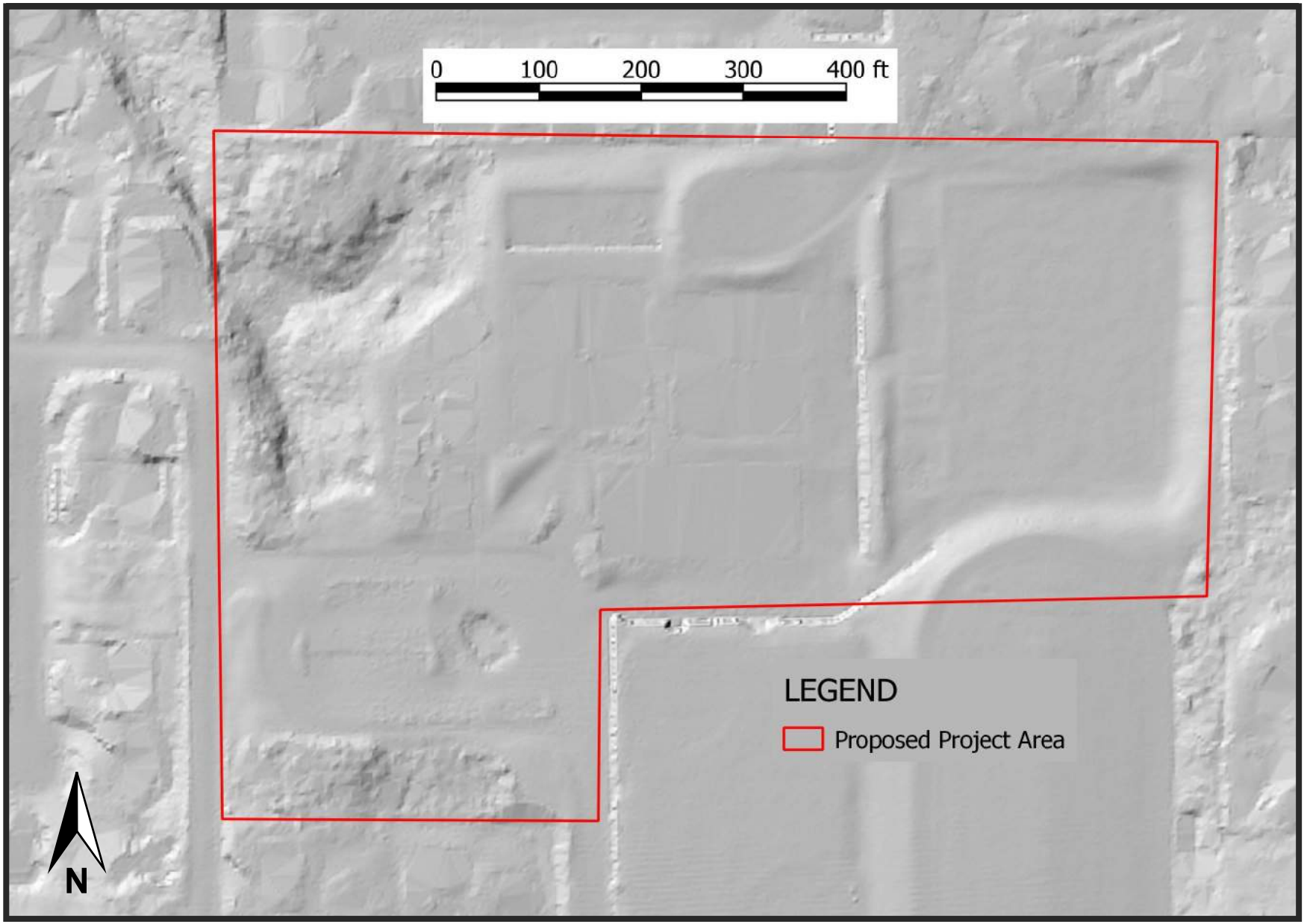
1) Map image created using *QGIS 3.22.6.*
2) Hillshade and scale compiled using the *Snohomish County 2005* digital elevation model (Source: *Washington LiDAR Portal*)
3) Parcel shapefile exported from *Snohomish County PDS Map Portal*.
4) All locations and elevations are approximate.

GEOTEST

Date: 2-24-2023	By: CM	Scale: As Shown	Project 23-0066

2005 BARE EARTH SITE PLAN
MUKILTEO ELEMENTARY SCHOOL
2600 MUKILTEO SPEEDWAY
MUKILTEO, WASHINGTON

Figure 3



Notes:

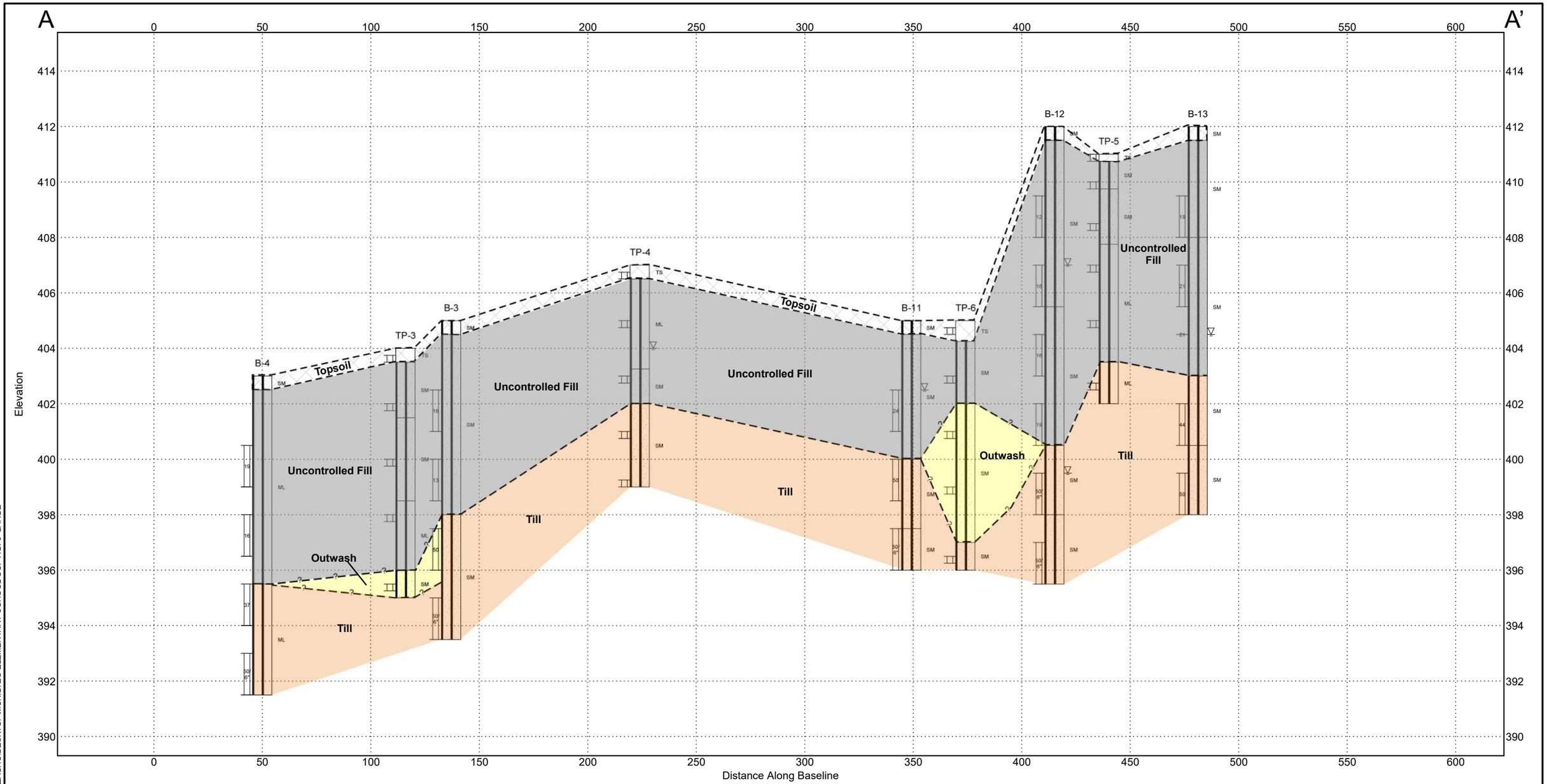
1) Map image created using *QGIS 3.22.6.*
2) Hillshade and scale compiled using the *North Puget Sound 2017* digital elevation model (Source: *Washington LiDAR Portal*)
3) Parcel shapefile exported from *Snohomish County PDS Map Portal*.
4) All locations and elevations are approximate.

GEOTEST

Date: 2-24-2023	By: CM	Scale: As Shown	Project 23-0066

2017 BARE EARTH SITE PLAN
MUKILTEO ELEMENTARY SCHOOL
2600 MUKILTEO SPEEDWAY
MUKILTEO, WASHINGTON

Figure 4



23-0066 6/22/23 C:\USERS\ZACH\DESKTOP\MUKILTEO ELEMENTARY SCHOOL COPY.GPJ LARGE

Point	North	East	Elev.	Depth
B-3	-108	137	405.0	11.5
B-4	25	50	403.0	11.5
B-11	58	349	405.0	9.0
B-12	-33	415	412.0	16.5
B-13	50	481	412.0	14.0
TP-3	108	116	404.0	9.0
TP-4	116	224	407.0	8.0
TP-5	66	440	411.0	9.0
TP-6	-133	374	405.0	9.0

= Sample Interval and Associated Blow Counts Per Foot

Fence Position	North	East
Left, Front	0	0
Right, Front	0	600
Left, Back	0	0
Right, Back	0	600

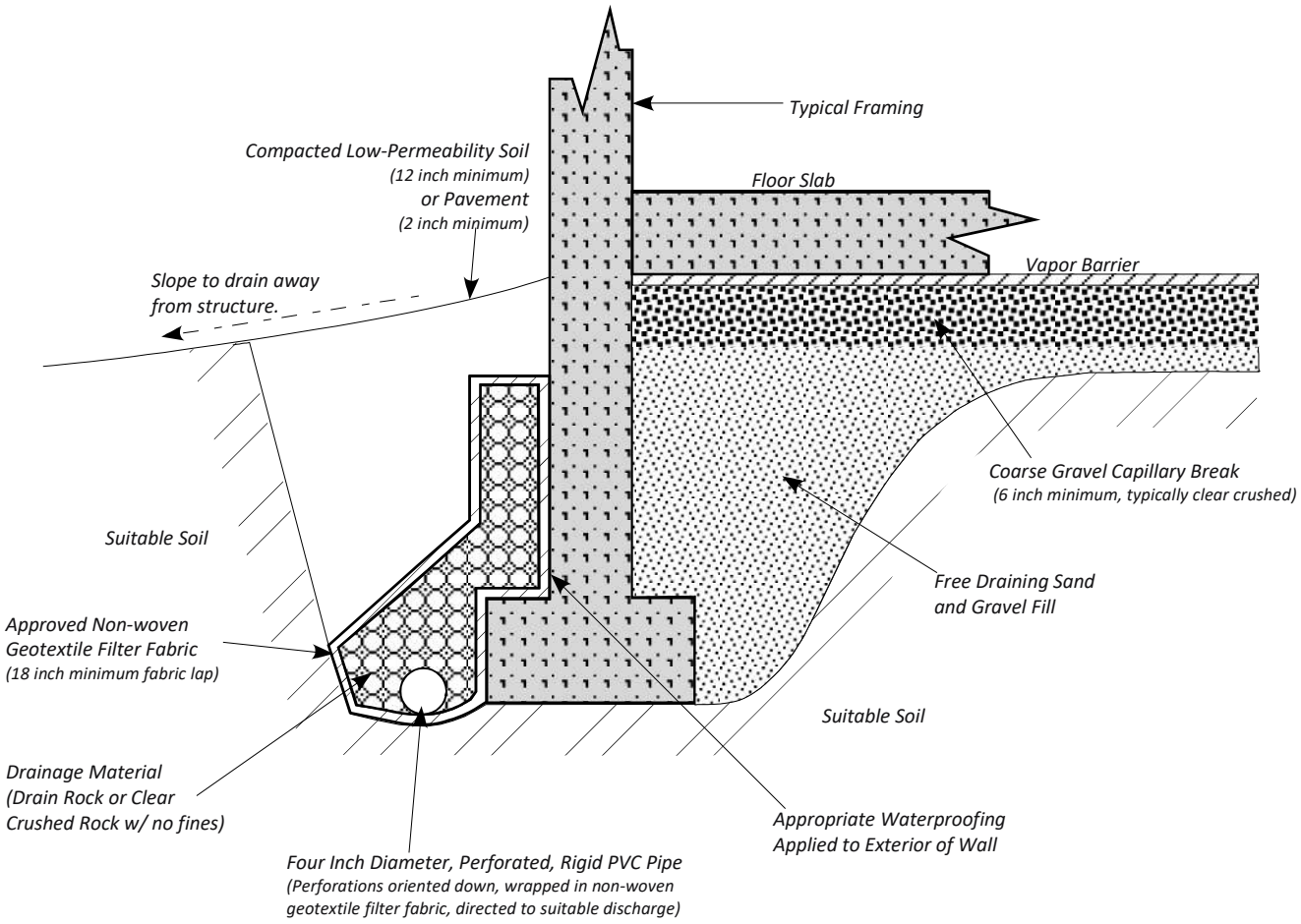
Baseline Distances (ft)
Beginning: 0
Ending: 600
Viewing Angles (deg)
Horizontal: 0.0
Vertical: 0.0

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Subsurface Fence Diagram A-A'

Figure 5

CONCEPTUAL FOOTINGS WITH INTERIOR SLAB-ON-GRADE



Notes:

This figure is not intended to be representative of a design. This figure is intended to present concepts that can be incorporated into a functional foundation drain designed by a Civil Engineer. In all cases, refer to the Civil plan sheet for drain details and elevations.

Footings should be properly buried for frost protection in accordance with International Building Code or local building codes (Typically 18 inches below exterior finished grades).

The footing drain will need to be modified from this typical drawing to fit the dimensions of the planned footing and slab configuration.

GEOTEST	Date: 3-3-2023	By: CM	Scale: None
	CONCEPTUAL FOOTING & WALL DRAIN SECTION **MUKILTEO ELEMENTARY SCHOOL** **2600 MUKILTEO SPEEDWAY** **MUKILTEO, WASHINGTON**		Project **23-0066** Figure 6

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS[1][2]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

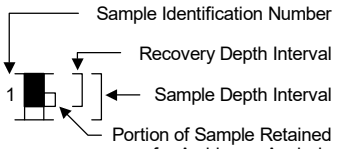
OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.
2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 12% and ≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 12% - "slightly gravelly," "slightly sandy," "slightly silty," etc.
	≤ 5% - "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key

SAMPLE NUMBER & INTERVAL



SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Other - See text if applicable

Groundwater

▽ ATD — Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Soil Classification System and Key

Figure 7

TP-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 404 Excavated By: PacNW Excavation/C. McCabe	
0	1	d			TS	Loose, brown, moist, gravelly, silty SAND, numerous roots and grass (Topsoil)	▽ Slight
	2	d			GM SM	Dense, brown, wet, sandy, silty angular GRAVEL (Uncontrolled Fill)	
2	3	d			SM	Medium dense, purple-gray, moist, gravelly, silty SAND (Uncontrolled Fill)	
4	4	d			SM	Medium dense, blue-gray, moist, gravelly, silty SAND, trace cobbles and boulders (Uncontrolled Fill)	
6	5	d			SM	Medium dense, brown, moist, slightly gravelly, silty SAND, scattered roots and wood (Relict Topsoil)	
8	6	d	W = 13 GS		SM	Medium dense, tan, moist, gravelly, silty SAND (Recessional Outwash)	
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 8.5 ft.

TP-2

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 396 Excavated By: PacNW Excavation/C. McCabe	
0	7	d			TS SM	Loose, dark brown, moist, slightly gravelly, silty SAND, numerous roots and grass (Topsoil)	Groundwater not encountered.
2	8	d				Medium dense, brown, moist, gravelly, silty SAND, trace cobbles, occasional roots (Uncontrolled Fill)	
4	9	d				Large log observed at approximately 4.5 feet	
6	10	d	W = 20 GS		SM	Medium stiff, dark brown-gray, moist, gravelly, very silty SAND, occasional roots and wood (Uncontrolled Fill)	
8	11	d			SM	Medium dense, gray-brown, moist to wet, gravelly, silty SAND (Recessional Outwash)	
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of Test Pits

Figure 8

TP-3

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 404 Excavated By: PacNW Excavation/C. McCabe	
0	12	d	W = 23 GS		TS SM	Loose, brown, moist, gravelly, silty SAND, occasional roots and grass (Topsoil)	Groundwater not encountered.
2	13	d			SM	Loose, orange-brown, moist, slightly gravelly, silty SAND, trace cobbles and boulders, occasional roots and wood (Uncontrolled Fill)	
4	14	d				Medium dense, dark gray, moist, slightly gravelly, very silty SAND, trace cobbles and boulders, occasional logs and wood (Uncontrolled Fill)	
6	15	d			ML	Medium stiff, dark gray, moist, gravelly, sandy SILT, scattered roots and wood (Uncontrolled Fill)	
8	16	d			SM	Medium dense, brown, moist to wet, gravelly, silty SAND, occasional roots (Recessional Outwash)	
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 9.0 ft.

TP-4

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 407 Excavated By: PacNW Excavation/C. McCabe	
0	17	d			TS ML	Loose, brown, moist, slightly gravelly, silty SAND, numerous roots and grass (Topsoil)	
2	18	d				Medium stiff, brown, moist, gravelly, sandy SILT, trace cobbles and boulders, occasional roots and wood (Uncontrolled Fill)	▽ Slight
4	19	d	W = 12 GS		SM	Dense, blue-gray to dark gray, slightly gravelly, very silty SAND, trace cobbles and boulders (Uncontrolled Fill)	
6	20	d	W = 12 GS		SM	Very stiff to hard, gray, moist, slightly gravelly, silty SAND (Till)	
8	21	d					
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 8.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of Test Pits

Figure 9

TP-5

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 411 Excavated By: PacNW Excavation/C. McCabe	
0	22	d			TS	Loose, dark brown, moist, slightly gravelly, silty SAND, numerous roots and grass (Topsoil)	Groundwater not encountered.
	23	d			SM		
2					SM	Loose, gray, moist, silty SAND, occasional roots (Uncontrolled Fill)	
	24	d					
					ML	Medium dense, brown, moist, gravelly, silty SAND, trace cobbles and boulders (Uncontrolled Fill)	
4	25	d					
						Stiff to very stiff, gray, moist, gravelly, sandy SILT, trace cobbles and boulders, occasional roots (Uncontrolled Fill)	
6	26	d					
					ML	Very stiff, orange-gray, moist, sandy SILT, trace cobbles, mottling present (Till)	
8	27	d	W = 20 GS				
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 9.0 ft.

TP-6

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 405 Excavated By: PacNW Excavation/C. McCabe	
0	28	d			TS	Loose, dark brown, moist, slightly gravelly, silty SAND, numerous roots and grass (Topsoil)	Groundwater not encountered.
					SM		
2	29	d	W = 9 GS			Medium stiff, brown, moist, slightly gravelly, silty SAND, trace cobbles, occasional roots (Uncontrolled Fill)	
					SM	Medium dense, tan, moist, silty SAND (Recessional Outwash)	
4	30	d					
6	31	d	W = 12 GS				
8	32	d			SM	Dense, tan, moist, gravelly, silty SAND, trace cobbles and boulders (Till)	
10							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

GEOTEST

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of Test Pits

Figure 10

TP-7

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): 398 Excavated By: PacNW Excavation/C. McCabe	
0	33	d			TS	Loose, black, moist, slightly gravelly, silty SAND, numerous roots and grass (Topsoil)	
	34	d			SM	Loose, brown, moist, gravelly, silty SAND, occasional roots (Uncontrolled Fill)	▽ Moderate
2					SM	Dense, brown-gray, moist to wet, silty, gravelly SAND with cobbles and boulders (Till)	
4	35	d	W = 16 GS				
6	36	d			SM/ML	Dense, orange-tan, moist, gravelly, sandy SILT to silty SAND (Till)	
	37	d					
8							

Test Pit Completed 02/22/23
Total Depth of Test Pit = 8.0 ft.

10

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

GEOTEST
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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of Test Pits

Figure
11

B-01

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 394 Drilled By: Geologic Drill/CM/AD	Water Level
0						AC	Approximately 5 inches of asphalt	
						SM	Medium dense, tan to brown, moist, slightly gravelly, very silty SAND, mottling present (Fill)	
	1	b2	20					
5							Increase in density to dense soils	
	2	b2	37					
	3	b2				SM	Dense, tan-gray, moist, very gravelly, very silty SAND (Till)	
10	4	b2	48					
						SM	Very dense, gray-brown, moist, silty SAND with trace gravel (Till)	
15	5	b2	50					
								ATD ▽
20	6	b2	50/ 6"					
	7	b2	50/ 6"	W = 17 GS		ML	Hard, gray, moist, slightly gravelly, sandy SILT (Till)	
25	8	b2	50/ 6"					
30								

Detail: Flush-mounted monument with locking cap; Bentonite chips; 2-inch diameter, Schedule 40, PVC well casing; 10/20 Colorado sand pack; 2-inch diameter, Schedule 40, PVC screen (0.010-inch slot size)

Boring Completed 06/03/23
Total Depth of Boring = 26.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-01	Figure 12

B-02

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 400 Drilled By: Geologic Drill/CM/AD	
0	400						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.
							SM	Medium dense, brown to gray, moist, very silty SAND with trace gravel (Fill)	
2	398	1	b2	15					
4	396							Mottling present	
6	394	2	b2	17					
							ML	Hard, gray, moist, slightly gravelly, sandy SILT (Till)	
8	392	3	b2	50/ 6"	W = 13 GS				
10	390	4	b2	50/ 6"	W = 9 GS				
12									
14									

Boring Completed 06/03/23
Total Depth of Boring = 11.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-02	Figure 13

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

B-03

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 405 Drilled By: Geologic Drill/CM/AD	
0	405						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.
							SM	Medium dense, brown to gray, moist, slightly gravelly to gravelly, very silty SAND (Fill)	
2	404								
	402	1	b2	16					
4									
	400	2	b2	13					
6									
	398						SM	Very dense, brown, moist, slightly gravelly, very silty SAND (Till)	
8		3	b2	50	W = 13 GS				
	396								
10		4	b2	50/ 6"					
	394								
12									
14									

Boring Completed 06/03/23
Total Depth of Boring = 11.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-03	Figure 14

B-04

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 403 Drilled By: Geologic Drill/CM/AD	
0							SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.
							ML	Very stiff, gray, moist, gravelly, sandy SILT (Fill)	
2	402								
	400	1	b2	19					
4									
	398							Wood present in sample	
6		2	b2	16					
	396								
8							ML	Hard, gray, moist, slightly gravelly, sandy SILT (Till)	
		3	b2	37				No recovery	
	394								
10									
	392	4	b2	50/ 6"					
12									
14									

Boring Completed 06/03/23
Total Depth of Boring = 11.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-04	Figure 15

B-05

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 402 Drilled By: Geologic Drill/CM/AD	Water Level
0	402						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	
							SM	Loose, dark brown, moist, slightly gravelly, very silty SAND with scattered wood (Fill)	
2	400	1	b2	6					
4	398								
6	396	2	b2	9					ATD
8	394	3	b2	9			ML	Stiff, black, wet, slightly gravelly, sandy SILT with scattered wood and roots (Fill)	
10	392	4	b2	6					
12	390								
14	388						SM	Very dense, gray, moist, gravelly, silty SAND (Till)	
16	386	5	b2	50/6"					
18									
20									

Boring Completed 06/03/23
Total Depth of Boring = 16.5 ft.

Refusal at 16.5 feet

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-05	Figure 16

B-06

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 402 Drilled By: Geologic Drill/CM/AD	Water Level
0	402						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	
							ML	Stiff, dark brown to black, moist, sandy SILT with trace gravel and wood debris (Fill)	
2	400	1	b2	6					
4	398						ML	Stiff, dark brown, moist, sandy SILT with occasional wood No recovery	
6	396	2	b2	9					
8	394	3	b2	9					
10	392	4	b2	6			SM	Medium dense, gray to brown, moist to wet, slightly gravelly, silty SAND (Weathered Till)	▽ ATD
12	390						ML	Hard, gray-blue, moist, gravelly, sandy SILT (Till)	
14	388	5	b2	50/ 6"					
16	386	6	b2	50/ 2"					
18									
20									

Boring Completed 06/03/23
Total Depth of Boring = 16.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-06	Figure 17

B-07

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 399 Drilled By: Geologic Drill/CM/AD	Water Level
0							SM	Loose wood chips (Landscape Wood Chips)	
							ML	Medium stiff, light to dark brown, moist, gravelly, sandy SILT with occasional wood (Fill)	
	398								
2									
	396	1	b2	6					
4									ATD
	394	2	b2	50			ML	Very soft, brown-gray, wet, gravelly, sandy SILT (Fill)	
							SM	Very dense, gray, moist, slightly gravelly, very silty SAND (Till)	
6		3	b2	50/ 6"	W = 8 GS				
	392								
8		4	b2	50/ 6"					
	390								
10									

Boring Completed 06/03/23
Total Depth of Boring = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

GEOTEST An RMA Company	Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-07

Figure 18

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

B-08

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 404 Drilled By: Geologic Drill/CM/AD	
0	404						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.
							SM	Loose, brown, moist, slightly gravelly, silty SAND with occasional rootlets (Fill)	
2	402	1	b2	10					
4	400								
		2	b2	50	W = 11 GS		SM	Very dense, gray, moist, gravelly, very silty SAND (Till)	
6	398								
								Refusal at 8.5 feet	
8	396	3	b2	50/ 6"					
10									

Boring Completed 06/03/23
Total Depth of Boring = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of B-08

Figure
19

B-09

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 411 Drilled By: Geologic Drill/CM/AD	
0							SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.
	410						SM	Dense, gray-brown, moist, gravelly, very silty SAND, localized oxidation (Weathered Till)	
2	408	1	b2	38	W = 11 GS				
4	406						SM	Very dense, brown, moist, silty, very gravelly SAND (Till)	
6		2	b2	50					
	404							No recovery	
8		3	b2	50/ 4"				Refusal at 8 feet	
	402								
10									

Boring Completed 06/03/23
Total Depth of Boring = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-09	Figure 20

B-10

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 411 Drilled By: Geologic Drill/CM/AD	Water Level	Detail
0						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	Groundwater not encountered.	Flush-mounted monument with locking cap
						SM	Medium dense, dark brown, moist, gravelly, silty SAND with occasional wood and roots (Fill)		
2	1	b2	17						Bentonite chips 2-inch diameter, Schedule 40, PVC well casing
4						ML	Medium stiff, black, moist, sandy SILT with occasional wood (Fill)		
6	2	b2	7						
									10/20 Colorado sand pack
8	3	b2	27			SM	Medium dense, gray, moist, silty SAND (Weathered Till)		2-inch diameter, Schedule 40, PVC screen (0.010-inch slot size)
10	4	b2	50/ 6"			SM	Very dense, gray, moist, silty SAND (Till)		
							Refusal at 11 feet		
12									
14									

Boring Completed 06/03/23
Total Depth of Boring = 11.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

GEOTEST
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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of B-10

Figure
21

B-11

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 405 Drilled By: Geologic Drill/CM/AD	Water Level
0							SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	
							SM	Medium dense, gray, moist to wet, gravelly, silty SAND (Fill)	
	404								
2								perched water in sandy layer	▽ ATD
	402	1	b2	24					
4									
	400	2	b2	50	W = 8 GS		SM	Very dense, orange-brown, moist, gravelly, very silty SAND, highly oxidized (Weathered Till)	
6									
	398								
		3	b2	50/ 6"			SM	Very dense, brown, moist, slightly gravelly, silty SAND (Till)	
8									
	396								
10									

Boring Completed 06/03/23
Total Depth of Boring = 9.0 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-11	Figure 22

B-12

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 412 Drilled By: Geologic Drill/CM/AD	Water Level
0	412						SM	Loose, brown, moist, slightly gravelly, silty SAND with grass and roots (Topsoil)	
							SM	Medium dense, brown to gray, moist, slightly gravelly, silty SAND with occasional roots (Fill)	
2	410	1	b2	12					
4	408							Perched water in sand lenses	▽ ATD
		2	b2	16					
6	406						SM	Medium dense, gray-brown, moist, gravelly, silty SAND, oxidation common (Fill)	
8	404	3	b2	16					
10	402	4	b2	19					
								Increased drilling resistance at approximately 11 feet	
12	400						SM	Very dense, brown-gray, moist to wet, slightly gravelly, silty SAND (Weathered Till)	▽ ATD
		5	b2	50/ 6"	W = 9 GS			Perched water in sand lenses	
14	398						SM	Very dense, brown, moist, slightly gravelly, silty SAND (Till)	
		6	b2	50/ 6"					
16	396								
18									
20									

Boring Completed 06/03/23
Total Depth of Boring = 16.5 ft.

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST An RMA Company

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Log of B-12

Figure 23

B-13

SAMPLE DATA						SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 412 Drilled By: Geologic Drill/CM/AD	Water Level
0	412						SM	Loose, gray, moist, slightly gravelly, silty SAND (Field Sand)	
							SM	Medium dense, gray-dark brown, moist, slightly gravelly, silty SAND with pockets of organics (Fill)	
2	410	1	b2	19					
4	408						SM	Medium dense, gray-brown, moist to wet, silty SAND with pockets and layers of wet sand (Fill)	
6	406	2	b2	21					
		3	b2	21					▽ ATD
8	404								
							SM	Dense, brown, moist, gravelly, silty SAND (Weathered Till)	
10	402	4	b2	44					
							SM	Very dense, orange-brown, moist, slightly gravelly, silty SAND, oxidation throughout (Weathered Till)	
12	400								
		5	b2	50					
14	398								
16									
18									
20									

Boring Completed 06/03/23
Total Depth of Boring = 14.0 ft.

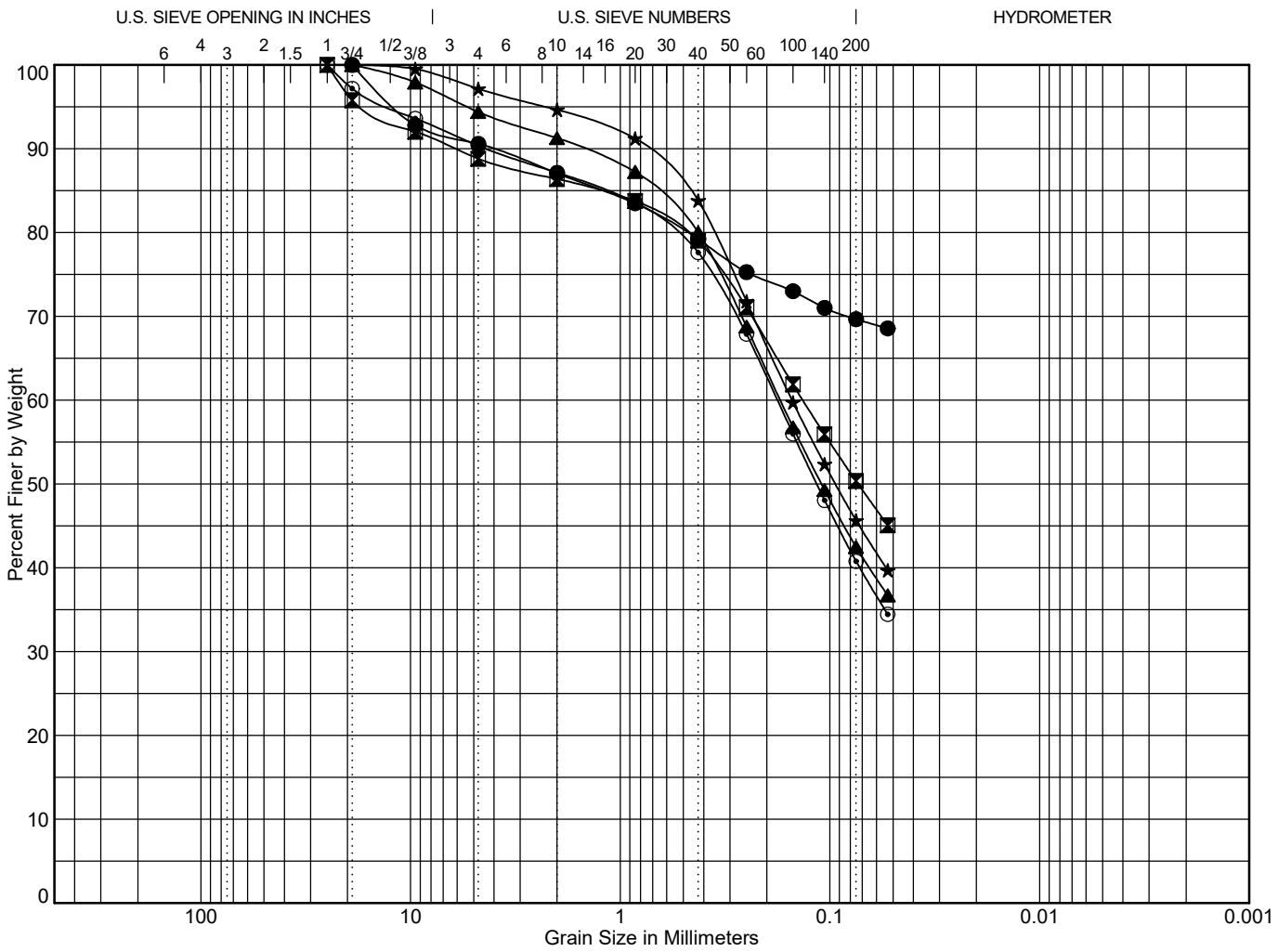
Refusal at 14 feet

Notes: Approximate Elevations Obtained from Snohomish County PDS Map Portal

23-0066 6/23/23 X:\PROJECTS GEO\0-PROJECTS 2023-GEO\GEOTECH EVALUATION\MUKILTEO SD-23-0066-MUKILTEO ELEMENTARY SCHOOL\GINT\MUKILTEO ELEMENTARY SCHOOL.GPJ SOIL BORING LOG W/ ELEV

GEOTEST
An RMA Company

Mukilteo Elementary School 2600 Mukilteo Speedway Mukilteo, Washington	Log of B-13	Figure 24



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	B-1	20.5	Slightly gravelly, sandy SILT (ML)					
⊠	B-2	7.5	Slightly gravelly, sandy SILT (ML)					
▲	B-2	10.0	Slightly gravelly, very silty SAND (SM)					
★	B-3	7.5	Very silty SAND with trace gravel (SM)					
⊙	B-7	5.5	Slightly gravelly, very silty SAND (SM)					

Point		Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	B-1	20.5	4.122					0.0	9.4	3.5	7.8	9.6	69.7
⊠	B-2	7.5	6.14	0.135	0.073			4.2	7.0	2.4	7.3	28.7	50.3
▲	B-2	10.0	1.53	0.172	0.11			0.0	5.6	3.1	11.2	37.5	42.5
★	B-3	7.5	0.758	0.152	0.094			0.0	2.8	2.5	10.8	38.2	45.6
⊙	B-7	5.5	4.33	0.178	0.115			2.8	6.8	3.2	9.5	36.8	40.8

$C_c = D_{30}^2/(D_{60} * D_{10})$
$C_u = D_{60}/D_{10}$

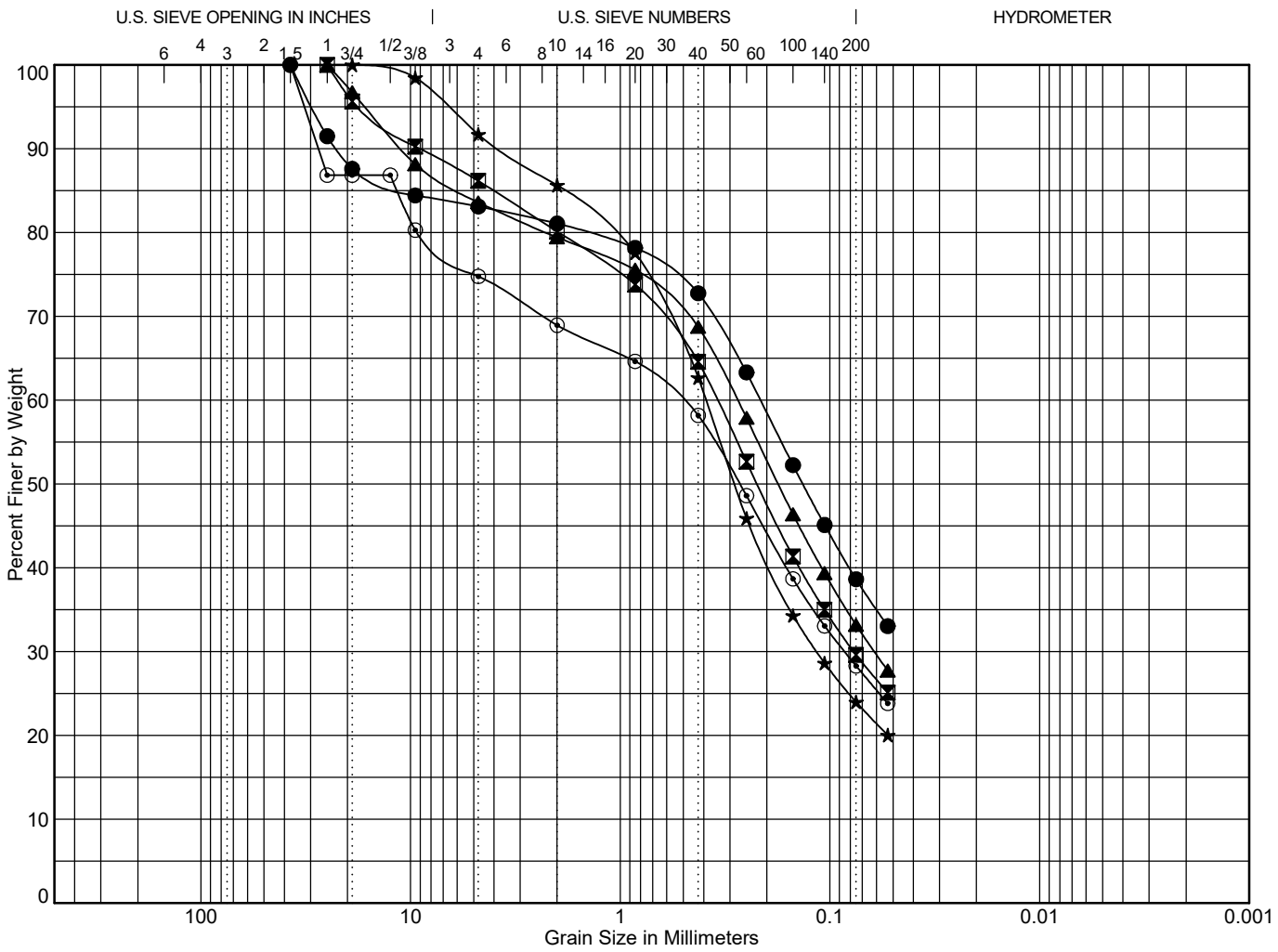
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST
An RMA Company

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Grain Size Test Data

Figure
25



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	B-8	5.0	Gravelly, very silty SAND (SM)					
⊠	B-9	2.5	Gravelly, very silty SAND (SM)					
▲	B-11	5.0	Gravelly, very silty SAND (SM)					
★	B-12	12.5	Slightly gravelly, silty SAND (SM)					
⊙	TP-1	8.0	Gravelly, silty SAND (SM)					

Point		Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	B-8	5.0	22.513	0.215	0.134			12.4	4.5	2.0	8.3	34.1	38.6
⊠	B-9	2.5	9.087	0.347	0.222	0.077		4.4	9.5	6.0	15.5	35.0	29.6
▲	B-11	5.0	11.032	0.277	0.176	0.061		3.3	13.1	4.2	10.7	35.6	33.2
★	B-12	12.5	3.725	0.39	0.285	0.115		0.0	8.3	6.1	23.0	38.7	24.0
⊙	TP-1	8.0	27.556	0.517	0.27	0.085		13.2	12.1	5.8	10.8	29.9	28.3

$C_c = D_{30}^2/(D_{60} * D_{10})$

$C_u = D_{60}/D_{10}$

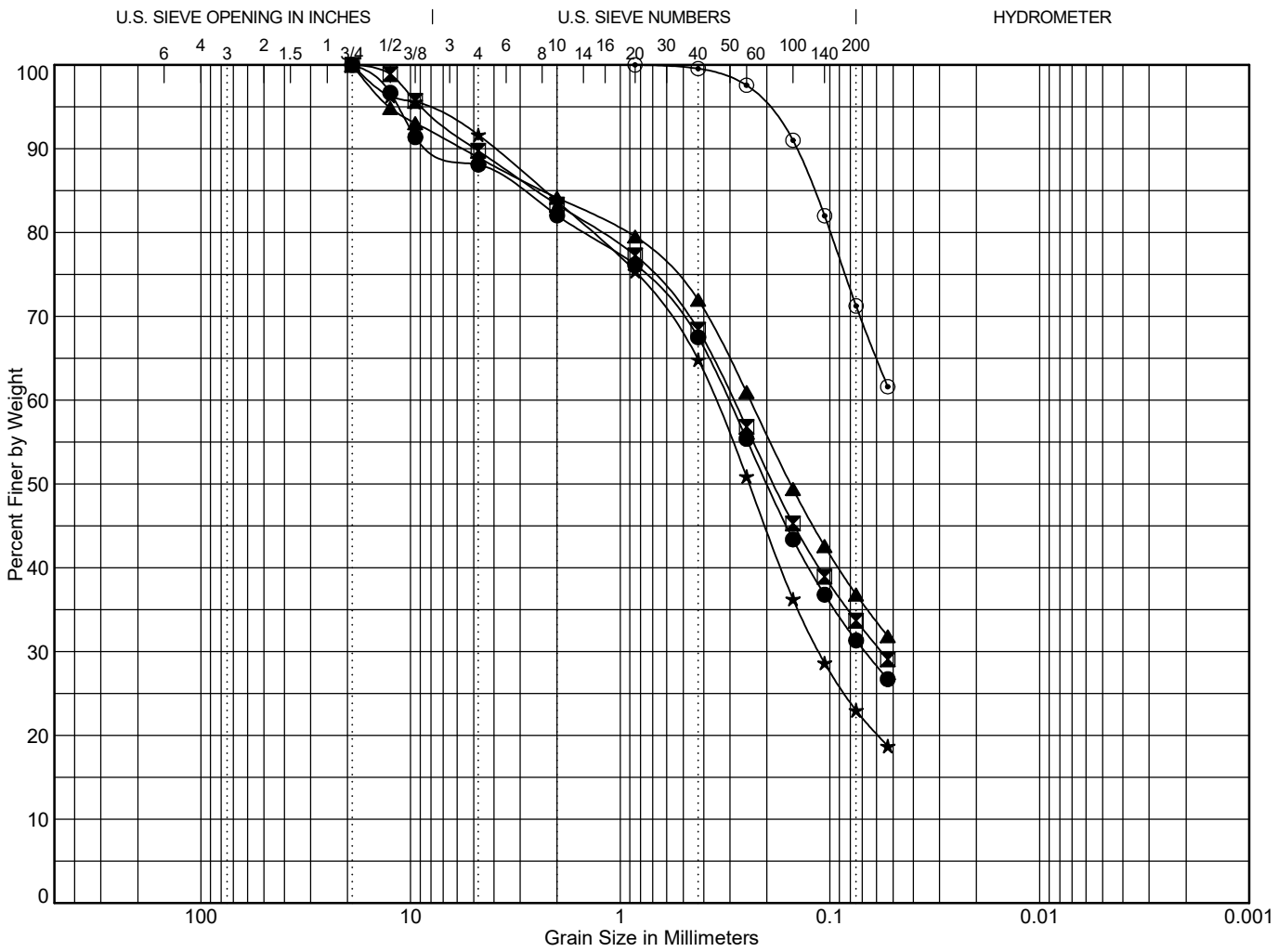
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Grain Size Test Data

Figure
26



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	TP-2	6.0	Gravelly, very silty SAND (SM)					
⊠	TP-3	4.0	Slightly gravelly, very silty SAND (SM)					
▲	TP-4	4.0	Slightly gravelly, very silty SAND (SM)					
★	TP-4	6.0	Slightly gravelly, silty SAND (SM)					
⊙	TP-5	8.3	Sandy SILT (ML)					

Point		Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-2	6.0	7.102	0.306	0.199	0.068		0.0	11.9	6.1	14.5	36.2	31.3
⊠	TP-3	4.0	4.895	0.289	0.185	0.057		0.0	10.3	6.4	14.9	34.7	33.7
▲	TP-4	4.0	5.676	0.24	0.154			0.0	11.1	4.8	12.2	35.1	36.8
★	TP-4	6.0	3.97	0.354	0.242	0.113		0.0	8.4	7.9	18.9	41.8	23.0
⊙	TP-5	8.3	0.144					0.0	0.0	0.0	0.4	28.3	71.2

$C_c = D_{30}^2/(D_{60} * D_{10})$

$C_u = D_{60}/D_{10}$

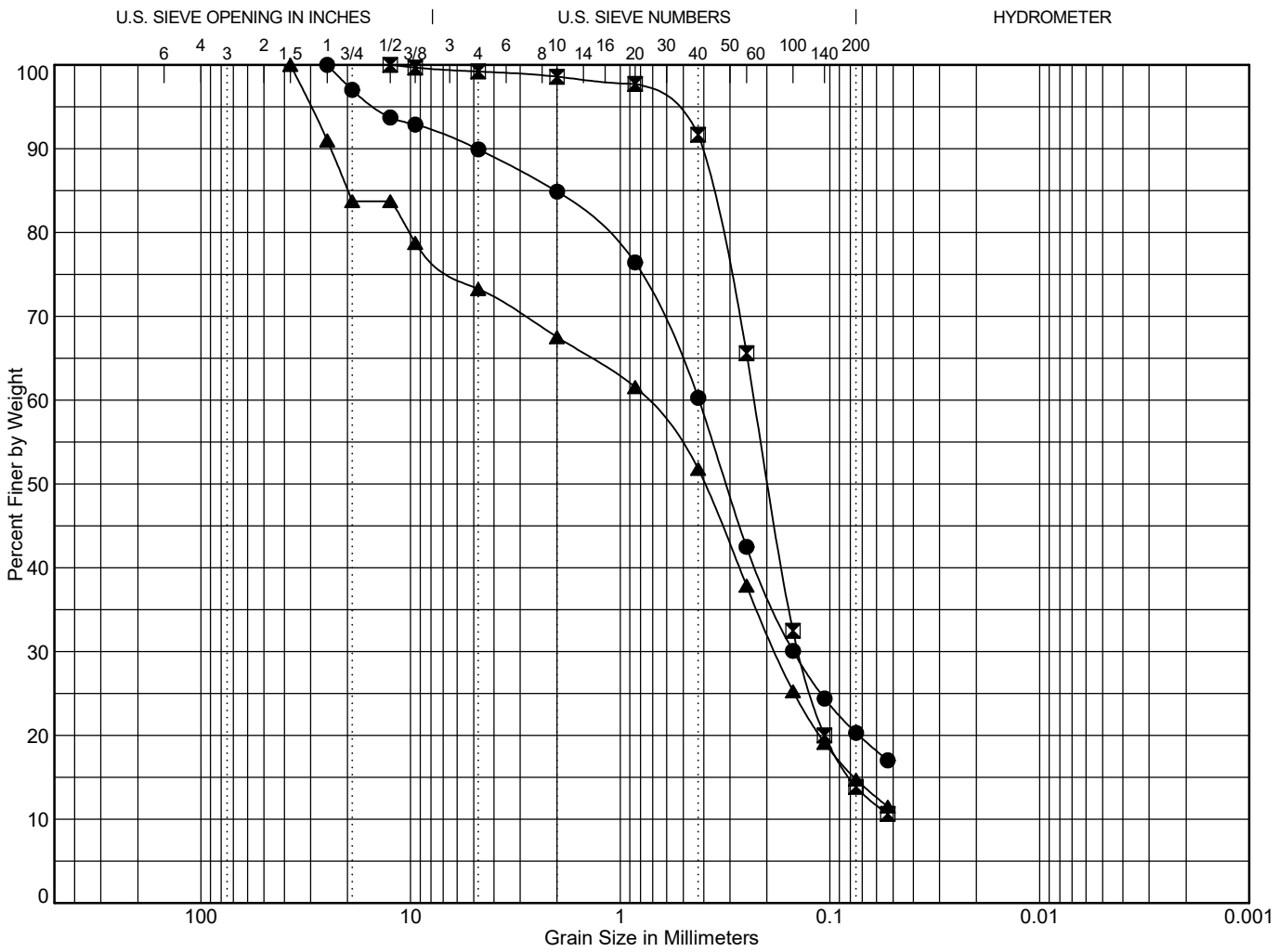
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST
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Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Grain Size Test Data

Figure
27



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C_c	C_u
●	TP-6 2.0	Slightly gravelly, silty SAND (SM)					
⊠	TP-6 6.0	Silty SAND (SM)					
▲	TP-7 3.5	Silty, gravelly SAND (SM)					

Point	Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-6 2.0	4.84	0.422	0.313	0.149		3.0	7.1	5.0	24.6	40.0	20.3
⊠	TP-6 6.0	0.411	0.229	0.197	0.14		0.0	0.8	0.6	6.9	77.8	13.9
▲	TP-7 3.5	24.079	0.761	0.397	0.182		16.3	10.5	5.8	15.7	37.0	14.7

$C_c = D_{30}^2/(D_{60} * D_{10})$
$C_u = D_{60}/D_{10}$

To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST
An RMA Company

Mukilteo Elementary School
2600 Mukilteo Speedway
Mukilteo, Washington

Grain Size Test Data

Figure
28

Northwest Agricultural Consultants

2545 W Falls Avenue
Kennewick, WA 99336
509.783.7450
www.nwag.com
lab@nwag.com

PAP-Accredited
NAPT

GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 62478-1-1
Date: March 1, 2023
Project No: 23-0066
Project Name: Mukilteo Elementary School

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP2 @ 0.25’	5.7	4.49 %	10.9 meq/100g
TP2 @ 8.5’	6.1	1.84 %	7.0 meq/100g
TP6 @ 4.0’	6.4	1.21 %	8.6 meq/100g
TP7 @ 6.0’	6.2	1.05 %	8.5 meq/100g
Method	**SM 4500-H^+ B**	**ASTM D2974**	**EPA 9081**

REPORT LIMITATIONS AND GUIDELINES FOR ITS USE[1]

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report is Based on a Unique Set of Project-Specific Factors

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

Our geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors of omissions, the logs included in this report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable; but recognizes that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, consider advising the contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoTest and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services preformed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

VII. ENGINEERING CALCULATIONS

FLOW CONTROL CALCULATIONS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.57
Program License Number: 201910001
Project Simulation Performed on: 09/15/2023 2:51 PM
Report Generation Date: 09/15/2023 2:51 PM

Input File Name: MES Phase 1 Detention Sizing.fld
Project Name: Mukilteo ES
Analysis Title: CUP Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 14

Full Period of Record Available used for Routing
Precipitation Station : 96003605 Puget East 36 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961036 Puget East 36 in MAP
Evaporation Scale Factor : 0.750

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

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

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

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	2.039	2.039
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	2.039	2.039

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 2

---------- Subbasin : Disturbed Areas ----------

	-------Area (Acres) --------
C, Forest, Flat	1.493
C, Forest, Mod	0.254
C, Forest, Steep	0.174

Subbasin Total 1.921

---------- Subbasin : Inflow ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.019
C, Lawn, Steep	0.051
SIDEWALKS/FLAT	0.048
Subbasin Total	0.118

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 3

---------- Subbasin : Disturbed Areas ----------

	-------Area (Acres) --------
C, Lawn, Flat	1.041
ROOF TOPS/FLAT	0.375
SIDEWALKS/FLAT	0.392
Subbasin Total	1.808

---------- Subbasin : Inflow ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.019
C, Lawn, Steep	0.051
SIDEWALKS/FLAT	0.048
Subbasin Total	0.118

---------- Subbasin : Area Swap ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.040
SIDEWALKS/FLAT	0.073
Subbasin Total	0.113

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

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

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

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

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

Link Name: R Tank
Link Type: Structure
Downstream Link: None

User Specified Elevation Volume Table Used

Elevation (ft)	Pond Volume (cu-ft)
393.68	0.
393.76	327.
393.85	653.
393.93	980.
394.01	1306.
394.10	1633.
394.18	1959.
394.26	2698.
394.35	3437.
394.43	4176.
394.51	4915.
394.60	5654.
394.68	6393.
394.76	7132.
394.85	7872.
394.93	8611.
395.01	9350.
395.10	10089.
395.18	10828.
395.26	11567.
395.35	12306.
395.43	13045.
395.51	13784.
395.60	14523.
395.68	15262.
395.76	16001.
395.85	16740.
395.93	17479.
396.01	18218.
396.10	18957.
396.18	19696.
396.26	20435.
396.35	21174.
396.43	21913.
396.51	22652.
396.60	23391.
396.68	24130.
396.76	24869.
396.85	25608.
396.93	26347.
397.01	27086.
397.10	27413.
397.18	27739.
397.26	28066.
397.35	28393.

397.43	28719.
397.51	29046.
397.60	29372.
397.68	29699.
397.76	30025.
397.85	30352.
397.93	30678.
398.01	31005.
398.10	31331.

Hydraulic Conductivity (in/hr) : 0.00
Massmann Regression Used to Estimate Hydralic Gradient
Depth to Water Table (ft) : 100.00
Bio-Fouling Potential : Low
Maintenance : Average or Better

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 12.00
Common Length (ft) : 0.000
Riser Crest Elevation : 397.50 ft

Hydraulic Structure Geometry

Number of Devices: 2

---Device Number 1 ---
Device Type : Circular Orifice
Control Elevation (ft) : 394.18
Diameter (in) : 0.87
Orientation : Horizontal
Elbow : No

---Device Number 2 ---
Device Type : Circular Orifice
Control Elevation (ft) : 395.85
Diameter (in) : 1.75
Orientation : Horizontal
Elbow : Yes

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

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 2
Number of Links: 1

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 3
Number of Links: 1

********** Link: R Tank ********** Link WSEL Stats
WSEL Frequency Data(ft)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	394.756
1.11-Year	394.847
1.25-Year	394.957
2.00-Year	395.268
3.33-Year	395.499
5-Year	395.741
10-Year	396.028
25-Year	396.211
50-Year	396.288
100-Year	396.449

************Groundwater Recharge Summary **************

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

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Disturbed Areas	293.333
Subbasin: Inflow	7.879
Link: New Copy Lnk1	0.000
Total:	301.212

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Disturbed Areas	119.932
Subbasin: Inflow	7.879
Subbasin: Area Swap	4.608
Link: R Tank	0.000
Total:	132.420

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 1.906 ac-ft/year, Post Developed: 0.838 ac-ft/year

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

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

Number of Links: 1

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

2-Year Discharge Rate : 0.045 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.03 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.02 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 153.27
Inflow Volume Including PPT-Evap (ac-ft): 153.27
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 153.27
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

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

Number of Links: 1

********** Link: R Tank **********

Basic Wet Pond Volume (91% Exceedance): 4827. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 7241. cu-ft

2-Year Discharge Rate : 0.021 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.12 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.07 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 531.41
Inflow Volume Including PPT-Evap (ac-ft): 531.41
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 531.31
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

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

Scenario Predeveloped Compliance Link: New Copy Lnk1
Scenario Postdeveloped Compliance Link: R Tank

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

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.517E-02	2-Year	2.130E-02
5-Year	8.092E-02	5-Year	2.553E-02
10-Year	0.107	10-Year	6.041E-02
25-Year	0.131	25-Year	7.570E-02
50-Year	0.165	50-Year	8.098E-02

100-Year	0.196	100-Year	9.080E-02
200-Year	0.264	200-Year	9.116E-02
500-Year	0.355	500-Year	9.132E-02

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

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	-1.5%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	-1.5%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-17.2%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	335.0%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	470.0%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

VIII. FIGURES

FIGURE 1 – VICINITY MAP

FIGURE 2 – EXISTING CONDITIONS

FIGURE 3 – PROPOSED CONDITIONS

FIGURE 4 – MINIMUM REQUIREMENTS FLOW CHART

FIGURE 5 – FLOW CONTROL DRAINAGE BASIN SUMMARY

FIGURE 6 – FLOW CONTROL EXISTING CONDITIONS

JACOBSON
CONSULTING ENGINEERS

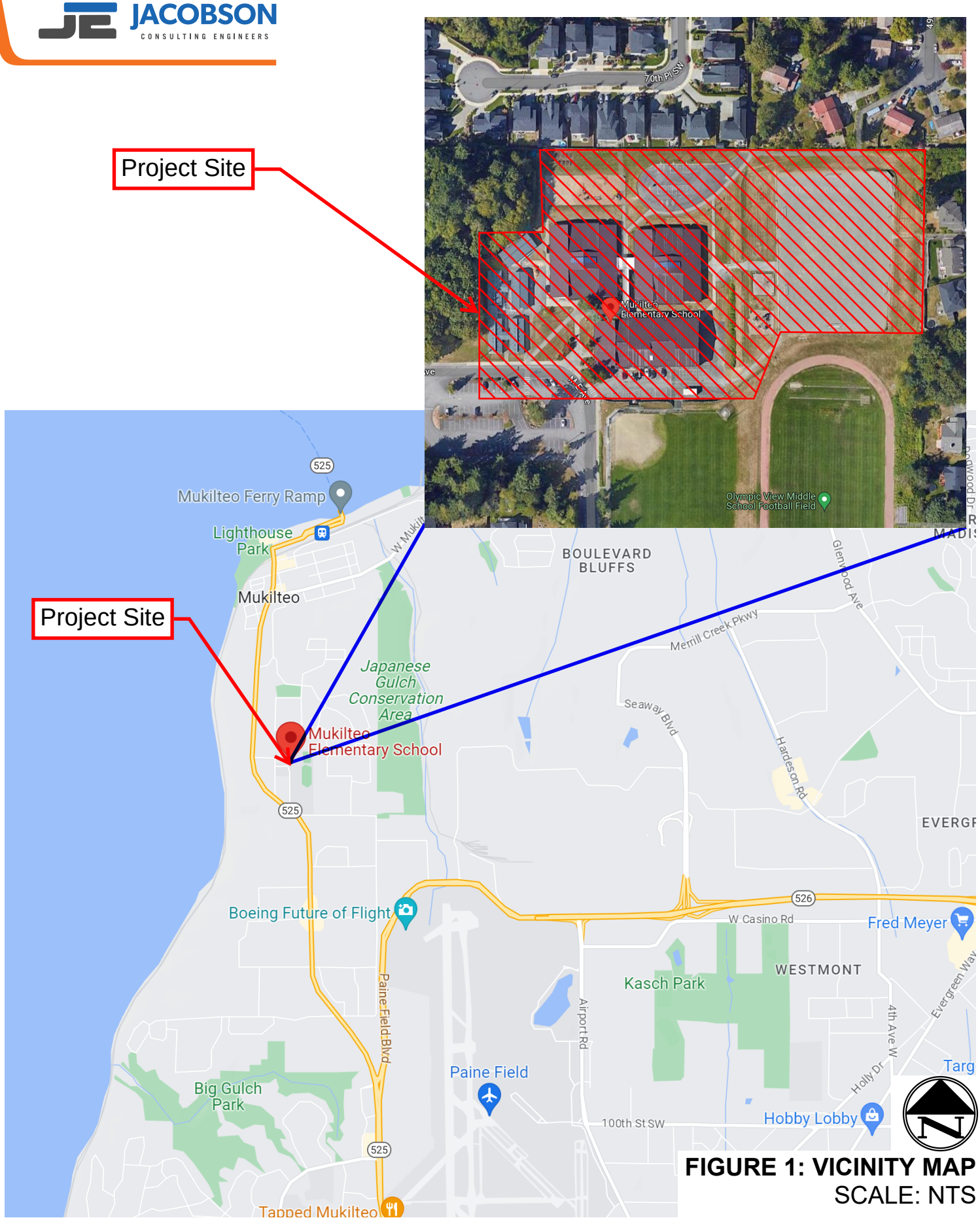


FIGURE 1: VICINITY MAP
SCALE: NTS

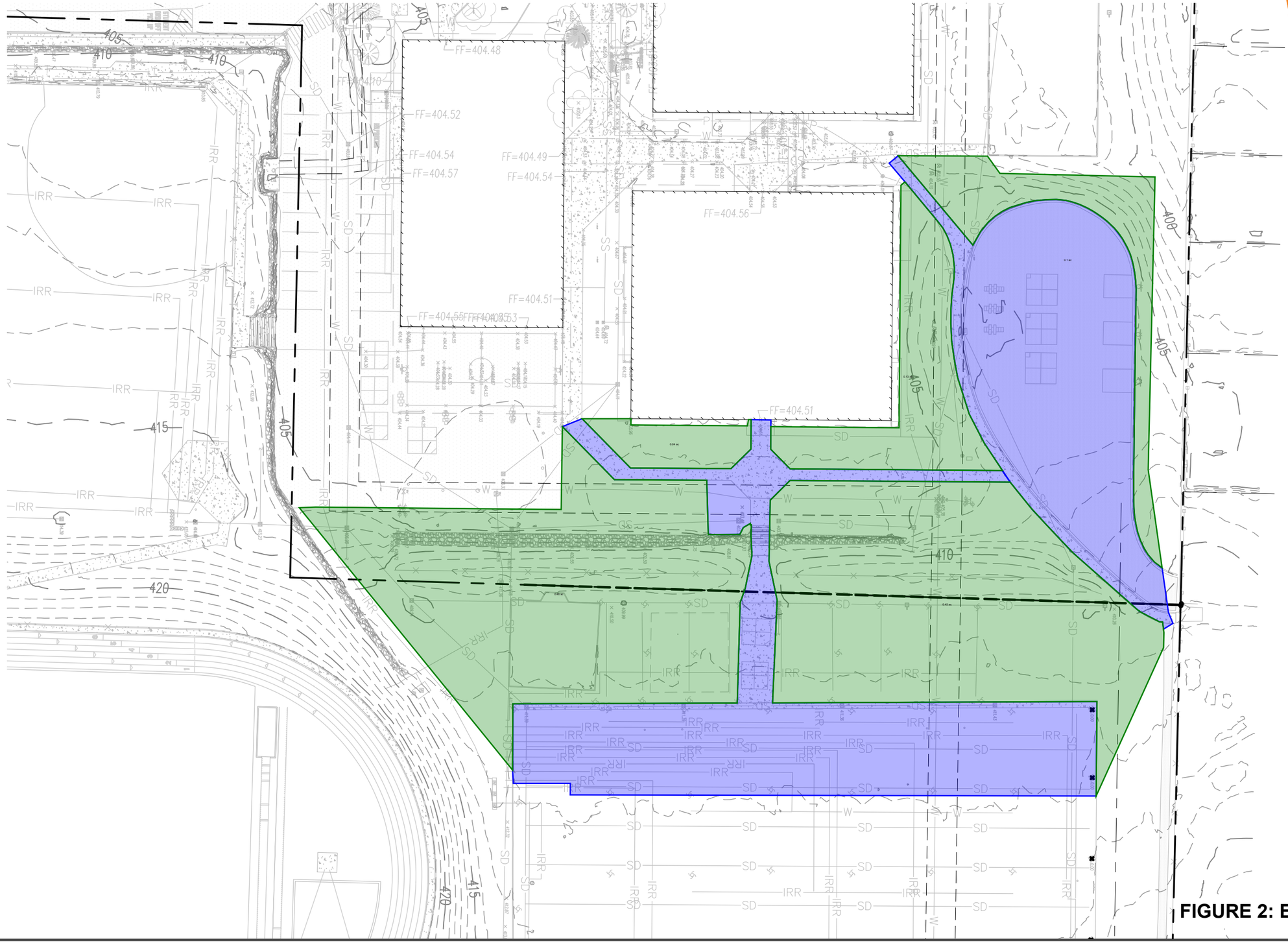
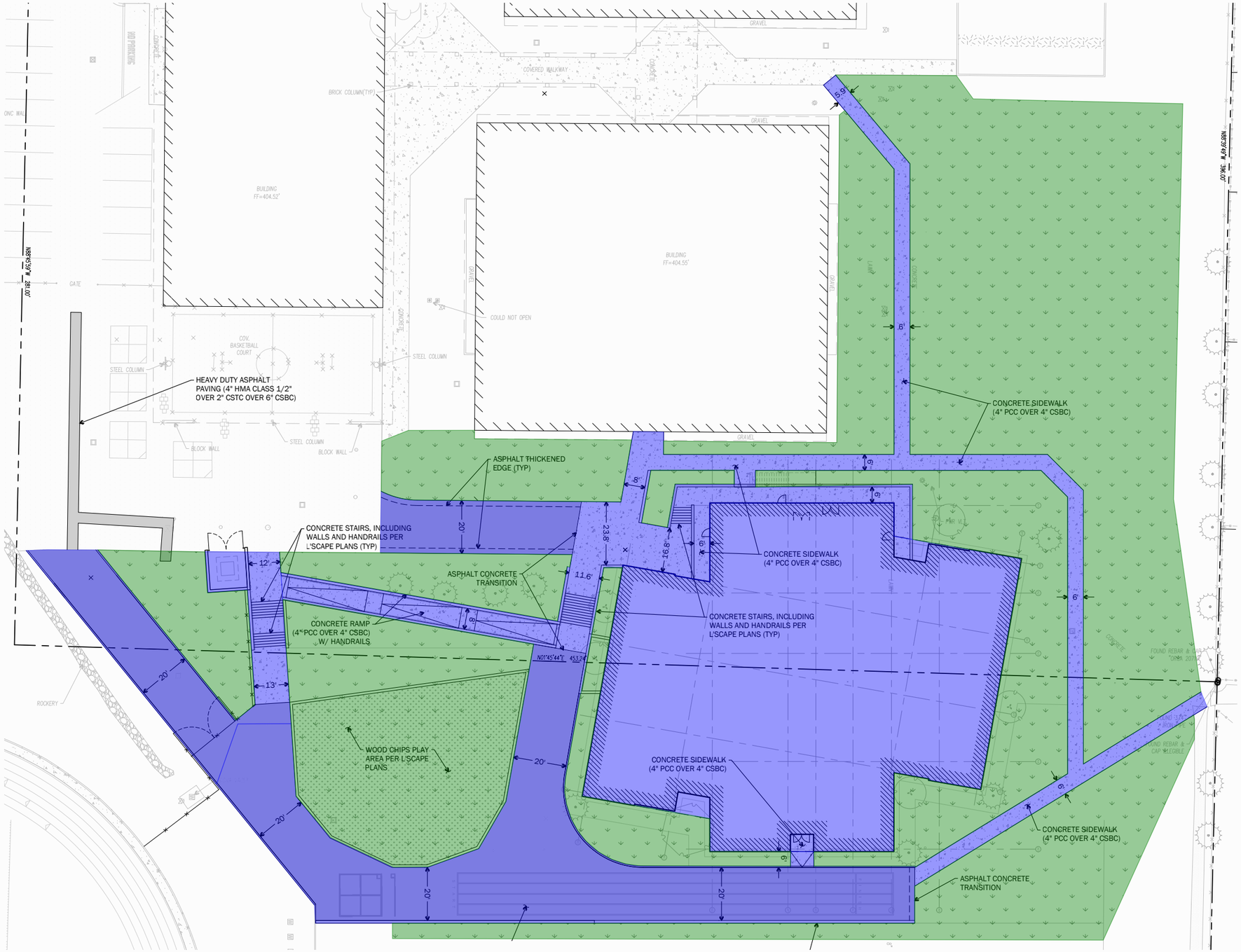


FIGURE 2: EXISTING CONDITIONS



Legend

Description	Quantity	Unit
Impervious	0.840	ac
Pervious	1.081	ac

TOTAL = 1.92 AC

FIGURE 3: PROPOSED CONDITIONS
SCALE: 1"=40'

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

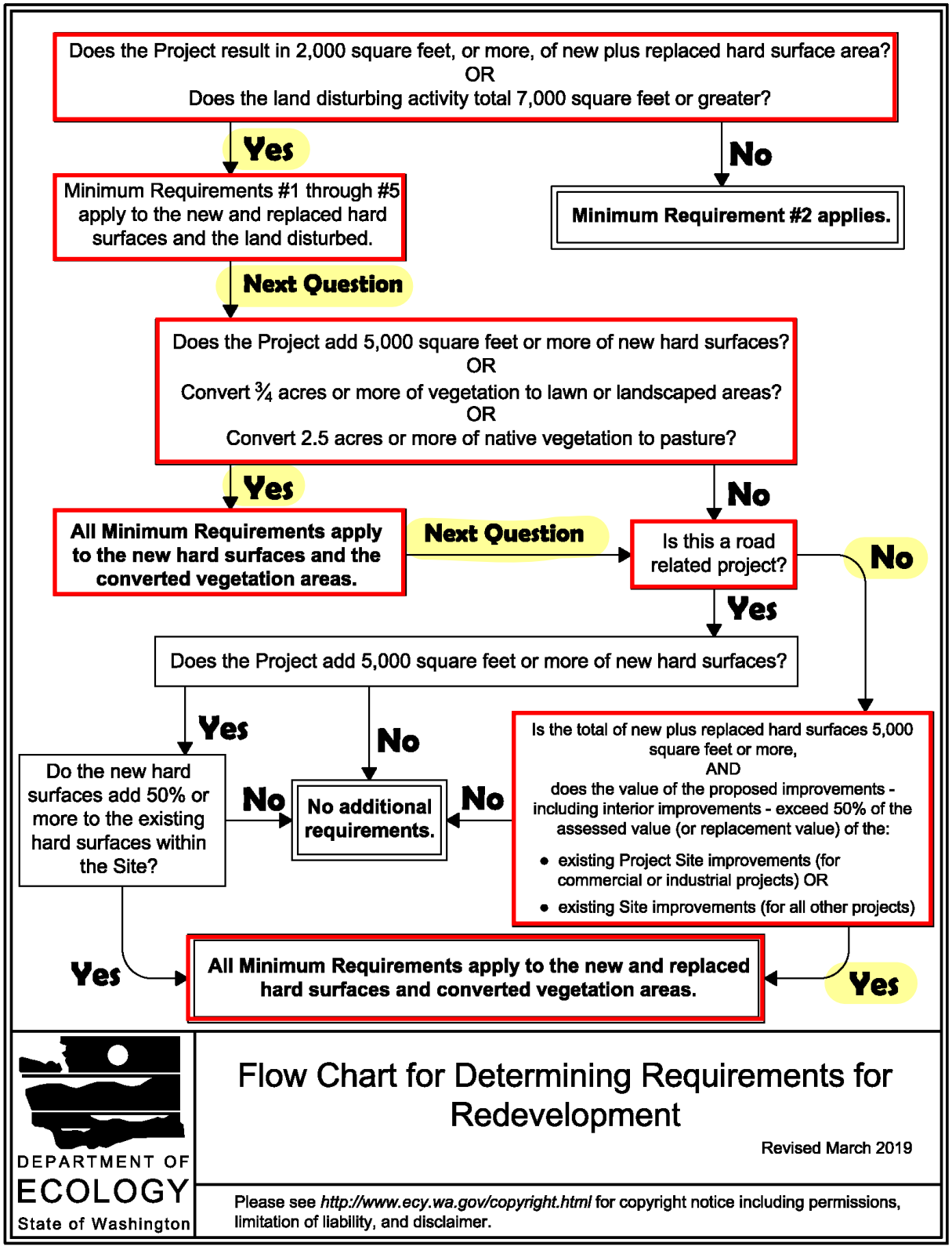
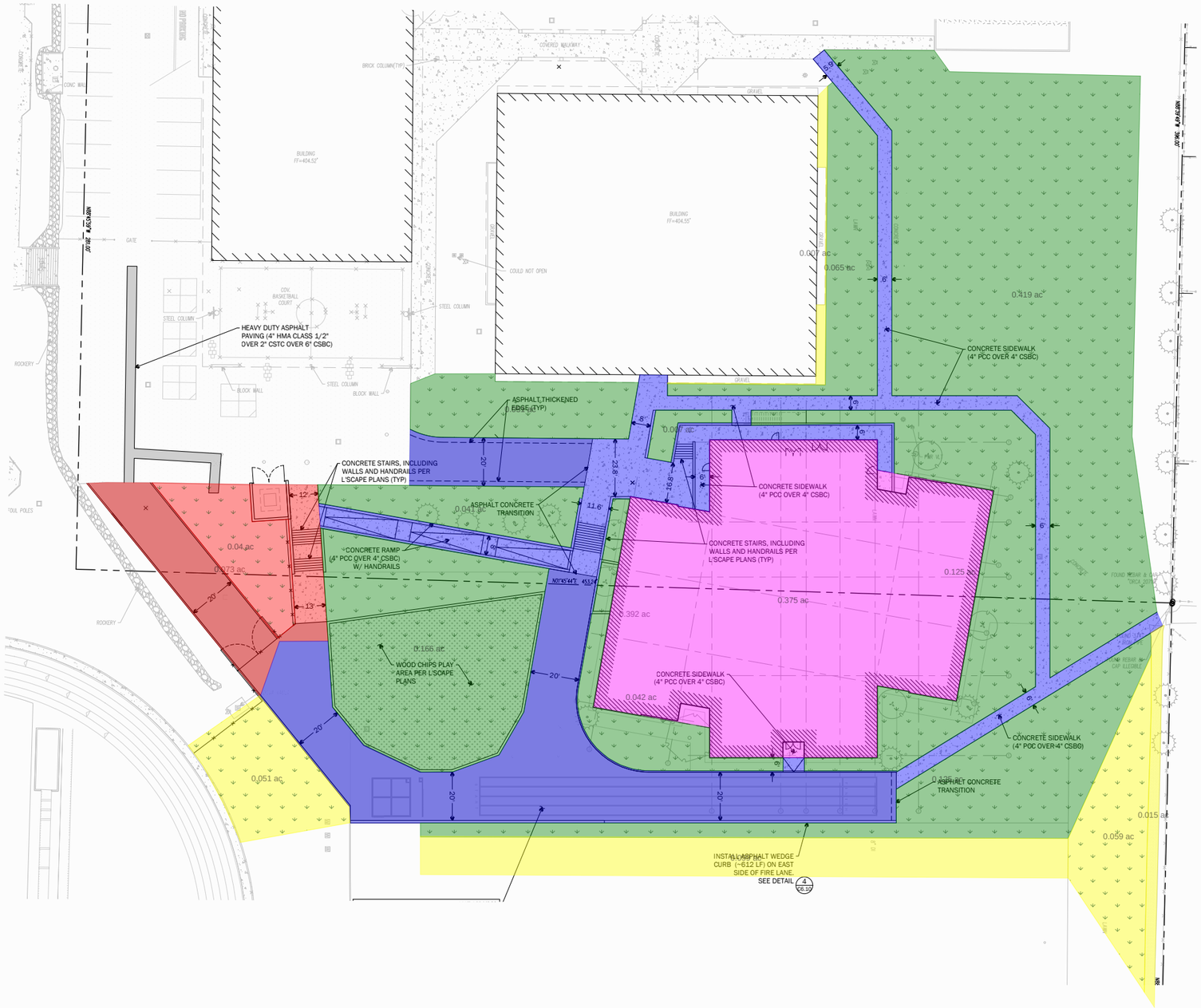


FIGURE 4: MINIMUM REQUIREMENTS FLOW CHART



Legend

Description	Quantity	Unit
Bypass Flat Landscape	0.040	ac
Bypass Flat Sidewalk	0.073	ac
Flat Landscape	1.041	ac
Flat Roof	0.375	ac
Flat Sidewalk	0.392	ac
Inflow Flat Landscape	0.059	ac
Inflow Flat Sidewalk	0.121	ac
Inflow Steep Landscape	0.051	ac

0 25 50 100

SCALE 1"=50'

FIGURE 5: FLOW CONTROL BASIN SUMMARY

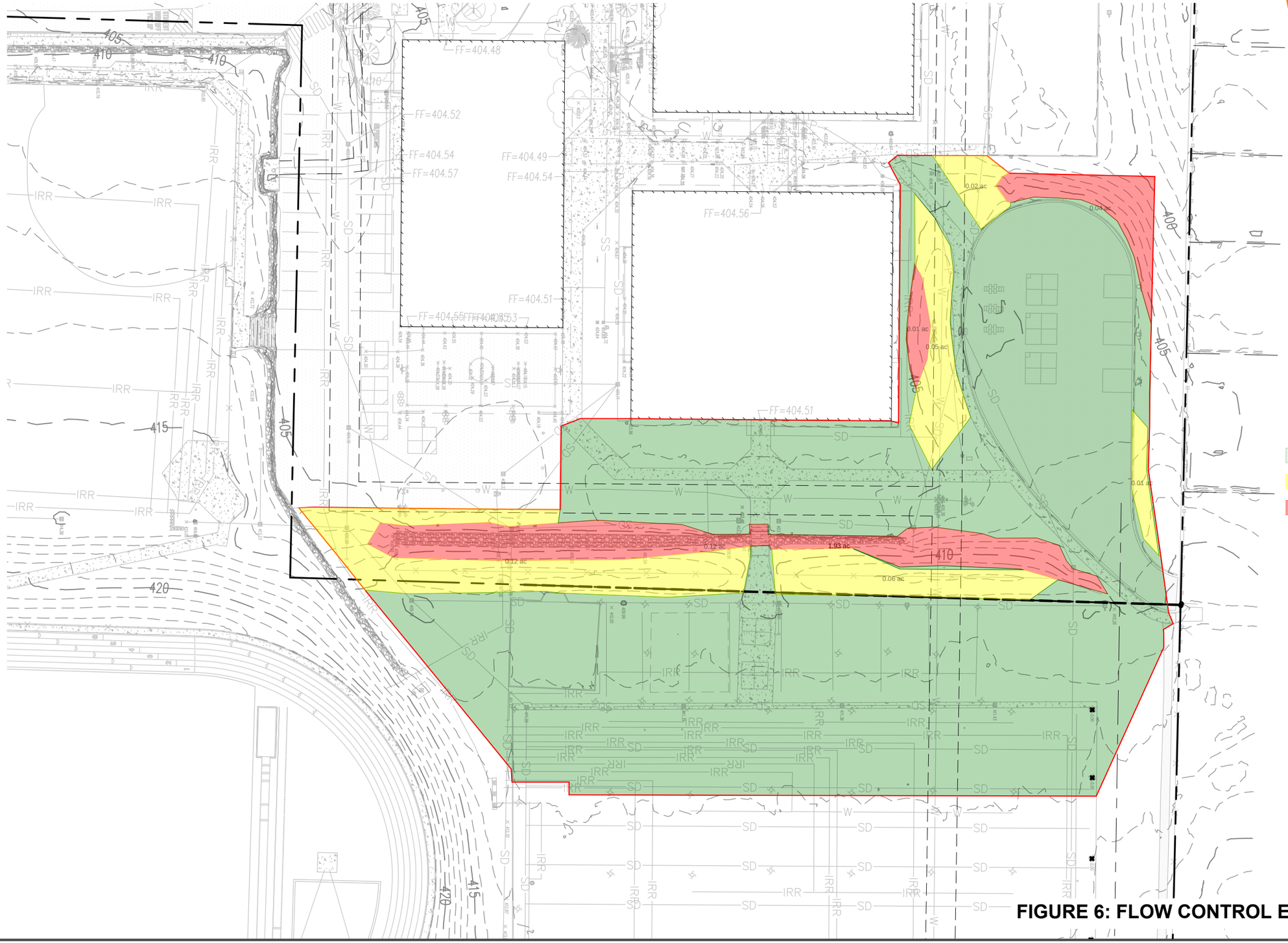


FIGURE 6: FLOW CONTROL EXISTING CONDITIONS

APPENDIX A

OPERATIONS AND MAINTENANCE MANUAL – TO BE PROVIDED IN A FORTHCOMING SUBMITTAL

APPENDIX B

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

Construction Stormwater General Permit (CSWGP)

Stormwater Pollution Prevention Plan (SWPPP)

for

Mukilteo Elementary School

Prepared for:

Mukilteo School District and Project Contractor

Permittee / Owner	Developer	Operator / Contractor
Mukilteo School District	Mukilteo School District	TBD

2600 Mukilteo Speedway, Mukilteo, WA

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

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

SWPPP Preparation Date

09 / 15 / 2023

Project Construction Dates

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

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C. Correspondence

D. Site Inspection Form

E. Construction Stormwater General Permit (CSWGP)

F. 303(d) List Waterbodies / TMDL Waterbodies Information

G. Contaminated Site Information

H. Engineering Calculations

List of Acronyms and Abbreviations

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

1 Project Information

Project/Site Name: Mukilteo Elementary School
Street/Location: 2600 Mukilteo Speedway
City: Mukilteo State: WA Zip code: 98275
Subdivision: N/A
Receiving waterbody: Puget Sound

1.1 Existing Conditions

The project for the Mukilteo Elementary School is located at 2600 Mukilteo Speedway, Mukilteo, WA 98275 on the property of the Mukilteo School district. The area within the district's property boundary includes four parcels. Parcel 1 (28040900102200) is 6.77 acres, parcel 2 (00591100000102) is 11.42 acres, parcel 3 (00591100000701) is 9.2 acres, and parcel 4 (28040900104200) is 1.79 acres. The parcels are mostly developed, combined are roughly rectangular in shape, and comprise an area of about 29.18 acres. The property consists of Olympic View Middle School, Mukilteo Elementary School, a football field, baseball field, tennis courts, sand playfield, wood chip playgrounds, parking lots, sidewalks, and a forested area. The property slopes to the west with approximately 55 feet of elevation change across the whole site.

Total acreage:	29.18-acre
Disturbed acreage:	1.9-acre
Landscape topography:	In general, the site topography of the Mukilteo Elementary School property slopes to the west with an elevation change of approximately 55 vertical feet.
Drainage patterns:	Stormwater from the project site flows northwest into an existing detention pond. From the detention pond water is taken offsite through Clover Pl creek and enters the municipal system in Clover Lane or there is a drain through 19th Drive. The two different drainage paths connect again near Mukilteo Speedway and outfall into Goat Trail Creek that eventually drains to a culvert in the Puget Sound.
Existing Vegetation:	Generally, the entire site is developed with approximately 1.79 acres of native forest on the parcel. On the school campuses the pervious areas are made up of lawn areas and landscaped areas.
Critical Areas:	There is a Geologic Sensitive Area Report Zone on parcel 3 where Olympic View Middle school. However, there are no critical areas in the vicinity of the proposed project work.

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

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

Table 1 – Summary of Site Pollutant Constituents

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

1.2 Proposed Construction Activities

Description of site development:
The proposed project consists of removing and reconstructing existing asphalt paving, concrete sidewalks, play areas, and landscaping to construct the new school building. The proposed improvements will include storm, water, fire services, electrical, and sewer services.

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

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
Stormwater will be discharged to the current/existing discharge location in the northwest corner of the project site into a detention pond after going through an onsite flow control system. From the detention pond water is taken offsite two different discharge paths. One route is water draining from the detention pond into Clover Pl Creek and entering the municipal system in Clover Lane. The other route drains to the municipal stormwater system in 19th Drive. The two different paths connect near Mukilteo speedway and outfall into Goat Trail Creek where it continues to flow until it discharges to a culvert in the Puget Sound.

The existing school is surrounded by single-family residences and established public right-of-way. Generally, the residences to the north flow away from the school property, with some to

the east flowing toward the school property which will provide some offsite flow. The existing drainage systems being maintained with this project currently intercept this offsite flow.

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

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
There is no contaminated soil or groundwater conditions known at the project site and therefore no proposed activities for the cleanup of existing contamination.

2 Construction Stormwater Best Management Practices (BMPs)

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

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

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

List and describe BMPs:

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

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

2.1.2 Element 2: Establish Construction Access

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

List and describe BMPs:

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

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

2.1.3 Element 3: Control Flow Rates

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

Will you construct stormwater retention and/or detention facilities?
Yes

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

List and describe BMPs:

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

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

2.1.4 Element 4: Install Sediment Controls

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

List and describe BMPs:

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

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

2.1.5 Element 5: Stabilize Soils

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

List and describe BMPs:

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

West of the Cascade Mountains Crest

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

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

Will you construct during the wet season? YES

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

2.1.6 Element 6: Protect Slopes

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

Will steep slopes be present at the site during construction? YES

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Plastic Covering (BMP C123)
- Surface Roughening (BMP C130)
- Gradient Terraces (BMP C131)

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

2.1.7 Element 7: Protect Drain Inlets

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

List and describe BMPs:

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

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

2.1.8 Element 8: Stabilize Channels and Outlets

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

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

List and describe BMPs:

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

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

2.1.9 Element 9: Control Pollutants

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

Table 2 – Pollutants

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

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

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

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

Demolition:

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

Concrete and grout:

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

Sanitary wastewater:

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

List and describe BMPs:

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

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

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

NO

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

YES

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

List and describe BMPs:

- Wheel Wash (BMP C106)

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

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

Table 3 – pH-Modifying Sources

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

List and describe BMPs:

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

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

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

2.1.10 Element 10: Control Dewatering

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

Table 4 – Dewatering BMPs

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

List and describe BMPs: N/A

2.1.11 Element 11: Maintain BMPs

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

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

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

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

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

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

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

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

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

Table 5 – Management

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

Table 6 – BMP Implementation Schedule

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

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

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

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

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	
Resident Engineer	TBD	
Emergency Ecology Contact	TBD	
Emergency Permittee/ Owner Contact	TBD	
Non-Emergency Owner Contact	TBD	
Monitoring Personnel	TBD	
Ecology Regional Office	Northwest Regional Office	425-649-7098

4 Monitoring and Sampling Requirements

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

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

File a blank form under Appendix D.

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

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

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

4.1 Site Inspection

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

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

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

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

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

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

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

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

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

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

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

4.2.2 pH Sampling

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

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

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

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

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

Method for sampling pH:

Table 9 – pH Sampling Method

X	pH meter
	pH test kit
	Wide range pH indicator paper

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

5.1 303(d) Listed Waterbodies

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

NO

List the impairment(s): N/A

List and describe BMPs: N/A

5.2 TMDL Waterbodies

Waste Load Allocation for CWSGP discharges:

This project site discharges to the Goat Trail Ravine Basin. The proposed development is not proposing any pollution generating surfaces and is therefore not required provide water quality treatment and does not discharge to a TMDL Waterbody.

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

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

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

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

6.1.2 Records Retention

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

Permit documentation to be retained on-site:

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

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

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

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

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

6.2 Reporting

6.2.1 Discharge Monitoring Reports

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

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

6.2.2 Notification of Noncompliance

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

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

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

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

Include the following information:

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

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

Appendix/Glossary

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

Appendix A – Site Map

JACOBSON
CONSULTING ENGINEERS

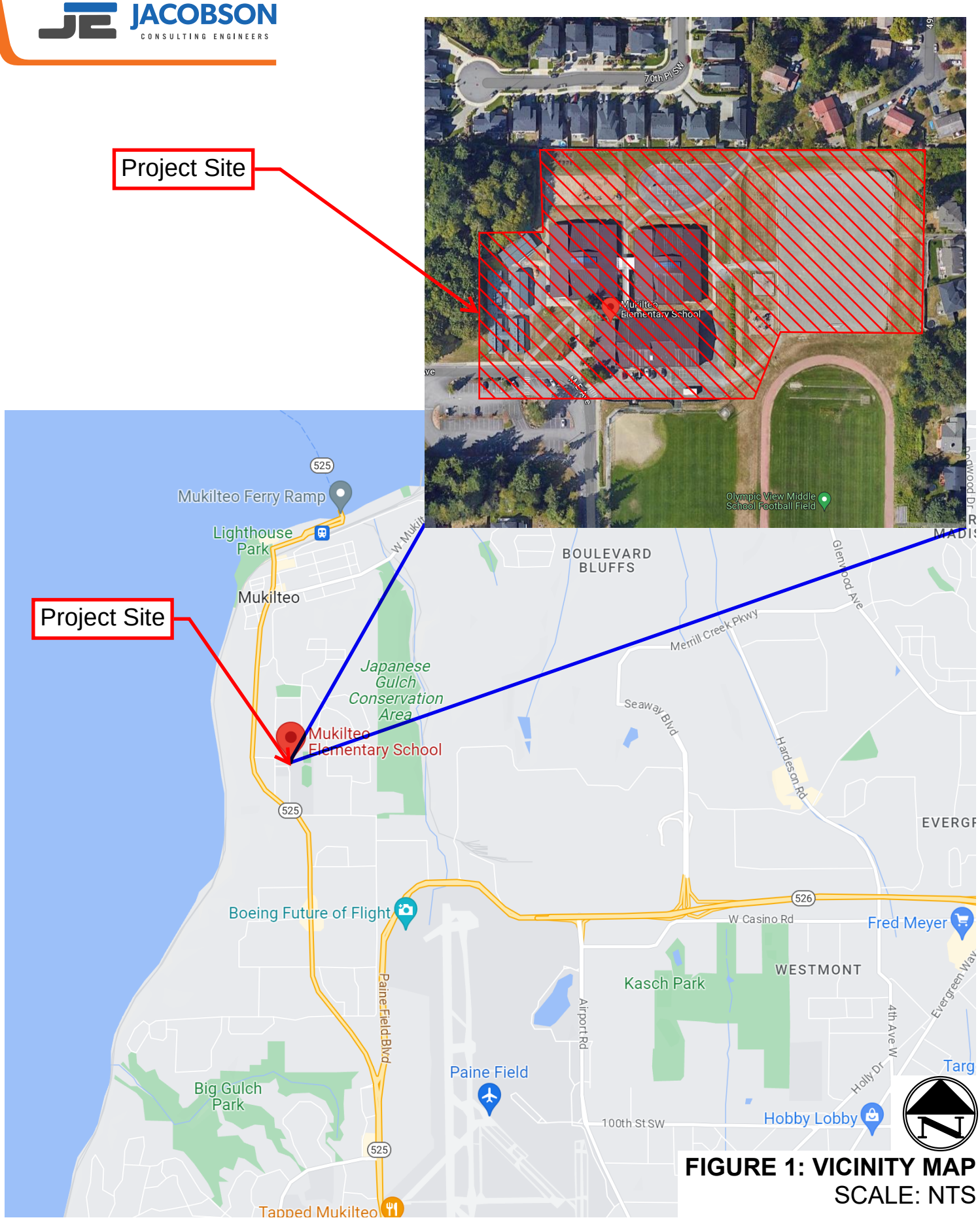


FIGURE 1: VICINITY MAP
SCALE: NTS

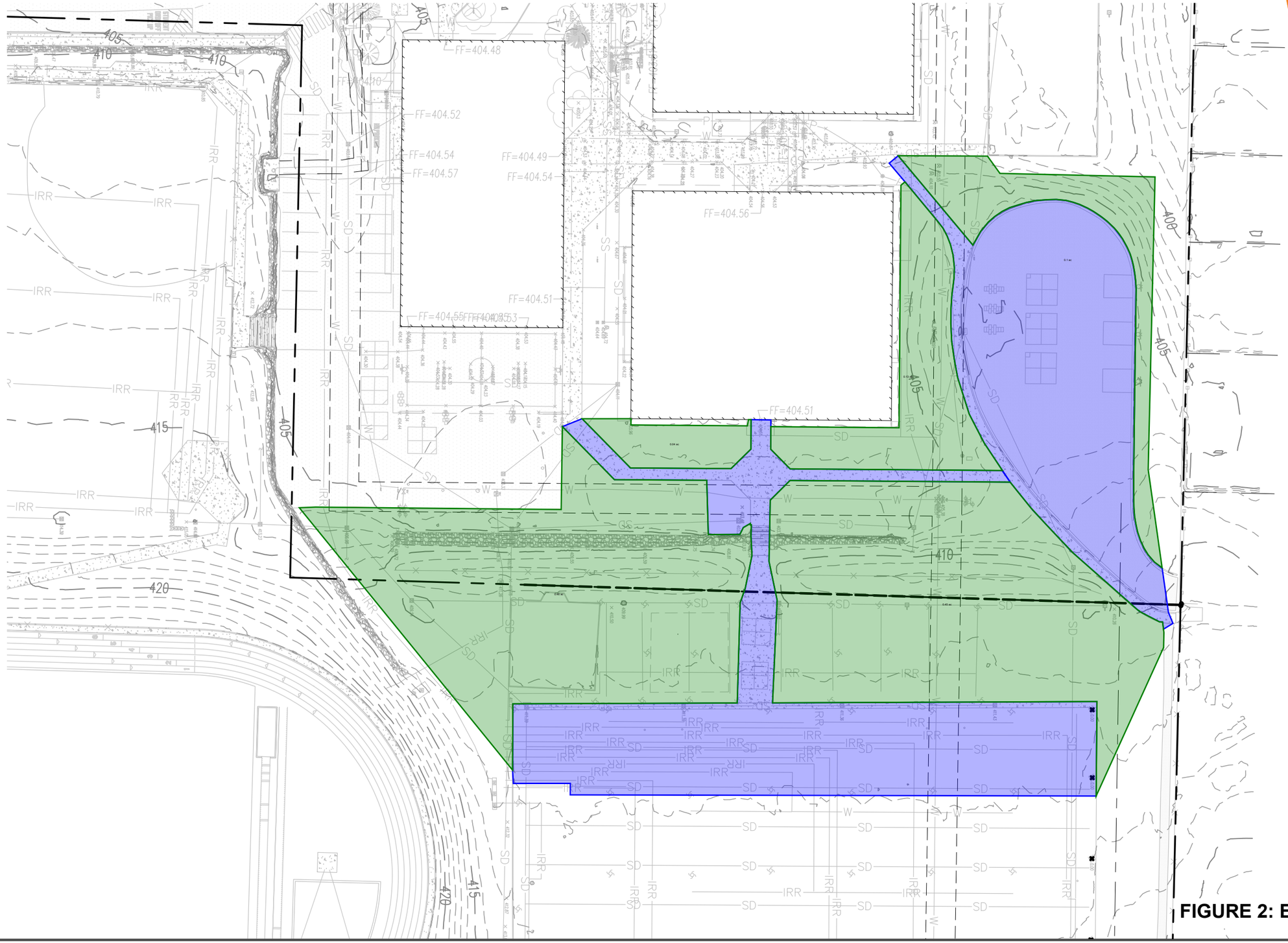
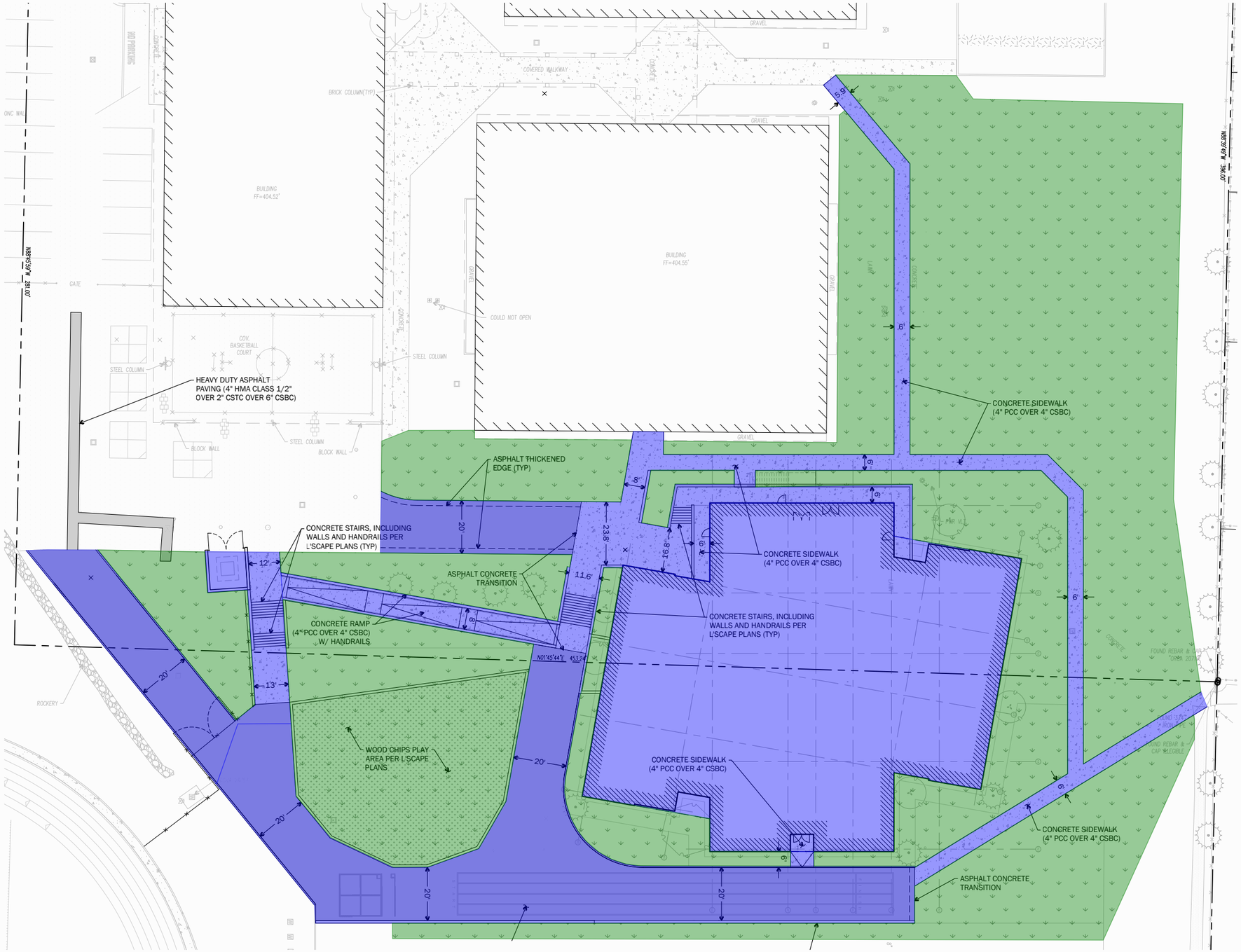


FIGURE 2: EXISTING CONDITIONS



Legend

Description	Quantity	Unit
Impervious	0.840	ac
Pervious	1.081	ac

TOTAL = 1.92 AC

FIGURE 3: PROPOSED CONDITIONS
SCALE: 1"=40'

PROTECT PORTION EX CONC SIDEWALK TO REMAIN

SAWCUT LINE (TYP)

PROTECT EX LIGHT POLE TO REMAIN

TEMP CUT AND CAP EX 12" STORM PIPE IE 397.00 (EX)

EX UNDERGROUND POWER CONDUIT TO EX LIGHT POLES TO BE LOWERED AS REQUIRED TO LOWER GRADE IN THIS AREA SEE SHEET C3.00

REMOVE EX CONCRETE SIDEWALK

REMOVE EX CATCH BASIN AND 12" STORM PIPING AS REQUIRED TO LOWER GRADE SEE SHEET C3.00

REMOVE EX BASKETBALL HOOPS, BACKBOARDS, AND POSTS (3 TOTAL)

PROTECT EX BUILDING TO REMAIN

PROTECT PORTION EX CONC SIDEWALK TO REMAIN

TEMP CUT AND CAP EX 6" STORM PIPE (ASSUMED SIZE) IE 401.65 (EX)

SAWCUT LINE (TYP)

PROTECT EX 6" (ASSUMED) DOWNSPOUT TIGHTLINE FOR EX BUILDING DOWNSPOUTS TO REMAIN

REMOVE EX CONCRETE VERTICAL CURB AND GUTTER

REMOVE EX TETHERBALL POLES

REMOVE EX ASPHALT PAVEMENT

REMOVE EX CONCRETE SIDEWALK

PROTECT EX LIGHT POLE TO REMAIN

PROTECT EX POWER VAULT TO REMAIN

REPLACE EX CATCH BASIN AND 8" STORM PIPING TO THE EAST AND SW TO REMAIN. CUT AND CAP EX 6" STORM INLET PIPE FROM THE NORTH.

REPLACE EX FIRE HYDRANT

RELOCATE EX IRRIGATION METER TO NEW SERVICE LOCATION

REMOVE EX ROCKERY

REMOVE EX ROCKERY

PROTECT EX CATCH BASIN AND ASSOCIATED STORM PIPING TO THE EASTTO REMAIN. CUT AND CAP EX 8" STORM OUTLET PIPE TO THE WEST.

PROTECT EX CHAINLINK PERIMETER FENCE TO REMAIN

REMOVE EX CONCRETE STAIRS, CHEEK WALLS, AND HANDRAILS

REMOVE EX 4-FT HIGH CHAINLINK FENCE

REPLACE EX IRRIGATION

REMOVE EX IRRIGATION HEAD (TYP)

REMOVE EX WOOD MULCH PLAY AREA. PLAY EQUIPMENT TO BE RETURNED TO OWNER.

REMOVE EX ASPHALT PAVEMENT

REMOVE EX CATCH BASIN AND ASSOCIATED PIPING (TYP FROM HERE SOUTH)

REMOVE EX CATCH BASINS IN CONCRETE CHANNEL (TYP)

PROTECT EX CATCH BASIN AND 8" STORM PIPING TO THE SW AND NE TO REMAIN. CUT AND CAP EX 8" STORM INLET PIPE FROM THE NORTH.

REMOVE EX WOOD MULCH PLAY AREA AND TIMBER BORDER

PROTECT EX CATCH BASIN AND 8" STORM PIPING TO THE SW AND WEST TO REMAIN. CUT AND CAP EX 8" STORM INLET PIPE FROM THE NORTH.

REMOVE EX IRRIGATION PIPING, AND IRRIGATION HEADS WITHIN LIMITS OF PHASE 1 CONSTRUCTION AS REQUIRED TO CONSTRUCT IMPROVEMENTS (TYP)

CUT AND CAP EX IRRIGATION LINES AS REQUIRED (TYP)

REMOVE EX 4" PERF (ASSUMED) FIELD UNDERDRAIN PIPE

REMOVE EX CONCRETE CHANNEL

REMOVE EX 8" CPP STORM PIPING (TYP)

0 10 20 40

SCALE 1"=20'

Call before you DIg. 8-1-1 or 1-800-424-5555 UNDERGROUND SERVICE (USA)

811

LEGEND

- PROPERTY LINE — N 79°33'06" E – 46.81'
- SAWCUT LINE
- REMOVE CURBING
- REMOVE ASPHALT PAVEMENT
- REMOVE CONCRETE PAVEMENT
- DEMOLISH BUILDING
- REMOVE TREE(S)
- FENCING
- REMOVE ROCKERY
- ELECTRICAL SERVICE — E —
- GAS MAIN/SERVICE — GAS —
- GAS METER/VALVE
- IRRIGATION LINE — IRR —
- OVERHEAD POWER — OP —
- SANITARY SEWER — SS —
- SANITARY MH/CO
- STORM DRAINAGE PIPE — SD —
- YD/CO/CB/CB 2/MH
- WATER MAIN — W —
- FH/FDC/PIV/VALVE

NOTE: FOR REMOVAL OF EX WATERMAIN AND WATER SERVICES THAT ARE IMPACTED BY PHASE 1 CONSTRUCTION, SEE SHEET C5.00.

HUTTEBALL +OREMUS architecture

4010 LAKE WASHINGTON BLVD NE
SUITE 320
KIRKLAND, WA 98033

425.828.8948

HOARCH.COM

ARCHITECT STAMP

CONSULTANT STAMP

MICHAEL RAY DALE JACOBSON — STATE OF WASHINGTON — 23667 — REGISTERED PROFESSIONAL ENGINEER

NOT FOR CONSTRUCTION

PROJECT INFORMATION

Mukilteo Elementary School Replacement - Phase 1

2600 Mukilteo Speedway
Mukilteo,WA 98275

Mukilteo School District No. 6

SCHOOL DISTRICT LOGO

Mukilteo School District

06.30.2023 SCHEMATIC DESIGN

07.31.2023 MASTERPLAN SD

08.31.2023 DESIGN DEVELOPMENT

CUP SUBMITTAL

09.22.2023

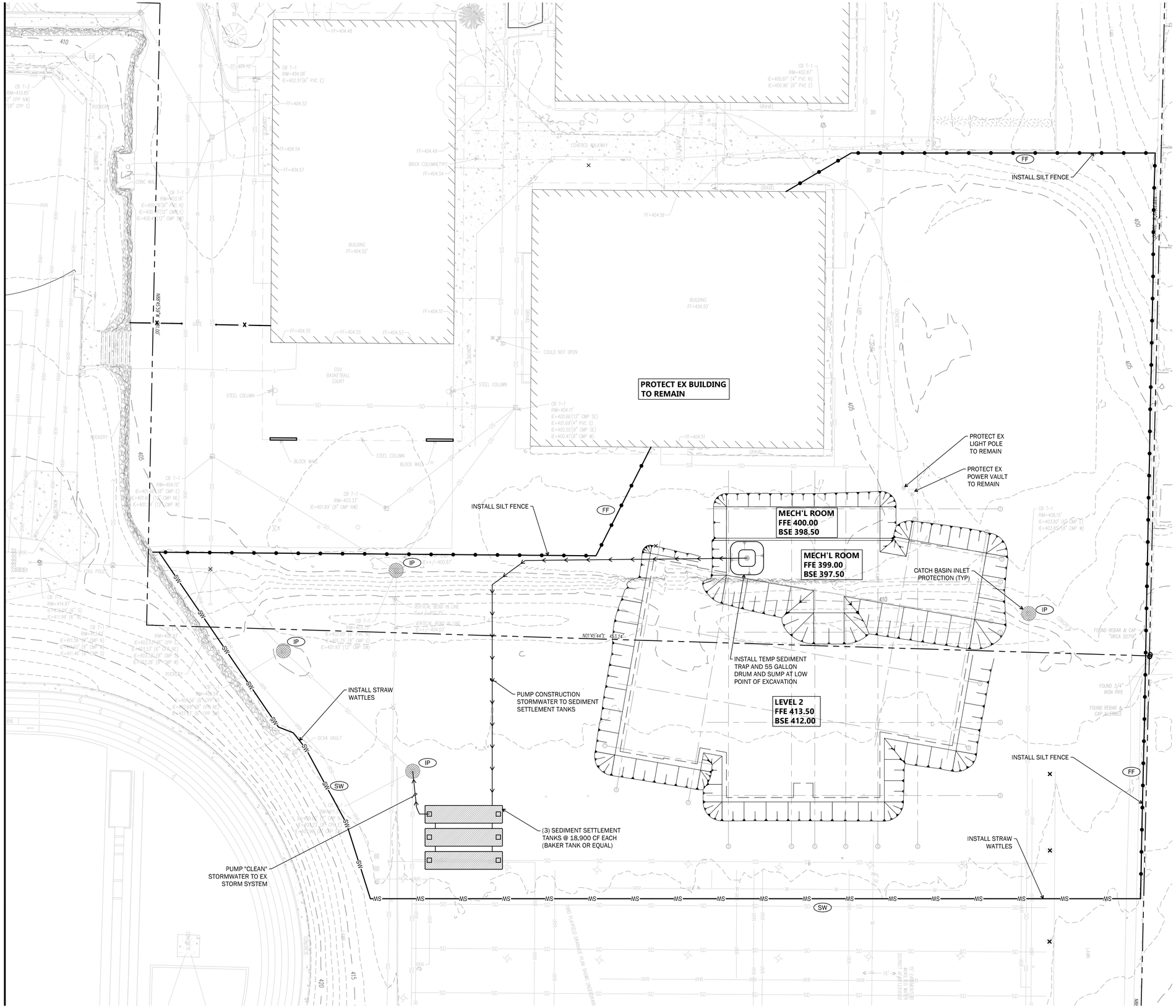
PROJECT NUMBER: 2213

SHEET NAME

DEMOLITION PLAN

SHEET NUMBER

C1.00



0 10 20 40

SCALE 1"=20'

Call before you Dig. 8-1-1 or 1-800-424-5555 UNDERGROUND SERVICE (USA) 811

JACOBSON

LEGEND

- PROPERTY LINE — N 79°33'06" E 46.81'
- EXCAVATION SIDE SLOPE
- (SW) STRAW WATTLES — SW
- (FF) SILT FENCE
- INLET PROTECTION (IP)

FFE = FINISH FLOOR ELEVATION
BSE = BOTTOM SLAB SECTION ELEVATION
BOE = BOTTOM OF EXCAVATION

NOTE: FOR EARTHWORK QUANTITIES BELOW PH1 BUILDING, SEE SHEET C3.00

NOTE: INSTALL TEMP CONSTRUCTION FENCING AROUND PERIMETER OF PHASE 1 WORK AND PROVIDE GATES FOR ACCESS TO AND FROM CONSTRUCTION WORK ZONE.

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ARCHITECT STAMP

CONSULTANT STAMP

JEREMY D. A. JACOBSON — STATE OF WASHINGTON — 23667 — REGISTERED PROFESSIONAL ENGINEER — NOT FOR CONSTRUCTION

PROJECT INFORMATION

Mukilteo Elementary School Replacement - Phase 1

2600 Mukilteo Speedway
Mukilteo,WA 98275

Mukilteo School District No. 6

SCHOOL DISTRICT LOGO

Mukilteo School District

06.30.2023 SCHEMATIC DESIGN
07.31.2023 MASTERPLAN SD
08.31.2023 DESIGN DEVELOPMENT

CUP SUBMITTAL

09.22.2023

PROJECT NUMBER: 2213

SHEET NAME

T.E.S.C. PLAN

SHEET NUMBER

C2.00

Appendix B – BMP Details

BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20-30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

Natural vegetation should be preserved on steep slopes, near perennial and intermittent water-courses or swales, and on building sites in wooded areas.

- As required by local governments.
- Phase construction to preserve natural vegetation on the project site for as long as possible during the construction period.

Design and Installation Specifications

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. Local governments may also have ordinances to save natural vegetation and trees.
- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

Plants need protection from three kinds of injuries:

- *Construction Equipment* - This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.
- *Grade Changes* - Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can typically tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

  When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. The tile system should be laid out on the original grade leading from a dry well

around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2-3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- *Excavations* - Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:
    - Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint if roots will be exposed for more than 24-hours.
    - Backfill the trench as soon as possible.
    - Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.
- The windthrow hazard of Pacific silver fir and madrona is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.
- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.
- Thinning operations in pure or mixed stands of Grand fir, Pacific silver fir, Noble fir, Sitka spruce, Western red cedar, Western hemlock, Pacific dogwood, and Red alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots, and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

Maintenance Standards

Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

If tree roots have been exposed or injured, “prune” cleanly with an appropriate pruning saw or loppers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

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 C103: High-Visibility Fence

Purpose

High-visibility fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances, exits, or internal roads.
- Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High-visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high-visibility orange. The fence tensile strength shall be 360 lbs/ft using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233: Silt Fence to act as high-visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

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.

Table II-3.2: Stabilized Construction Access Geotextile Standards (continued)

Geotextile Property	Required Value
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

Table II-3.3: Stabilized Construction Access Alternative Material Requirements (continued)

Sieve Size	Percent Passing
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.

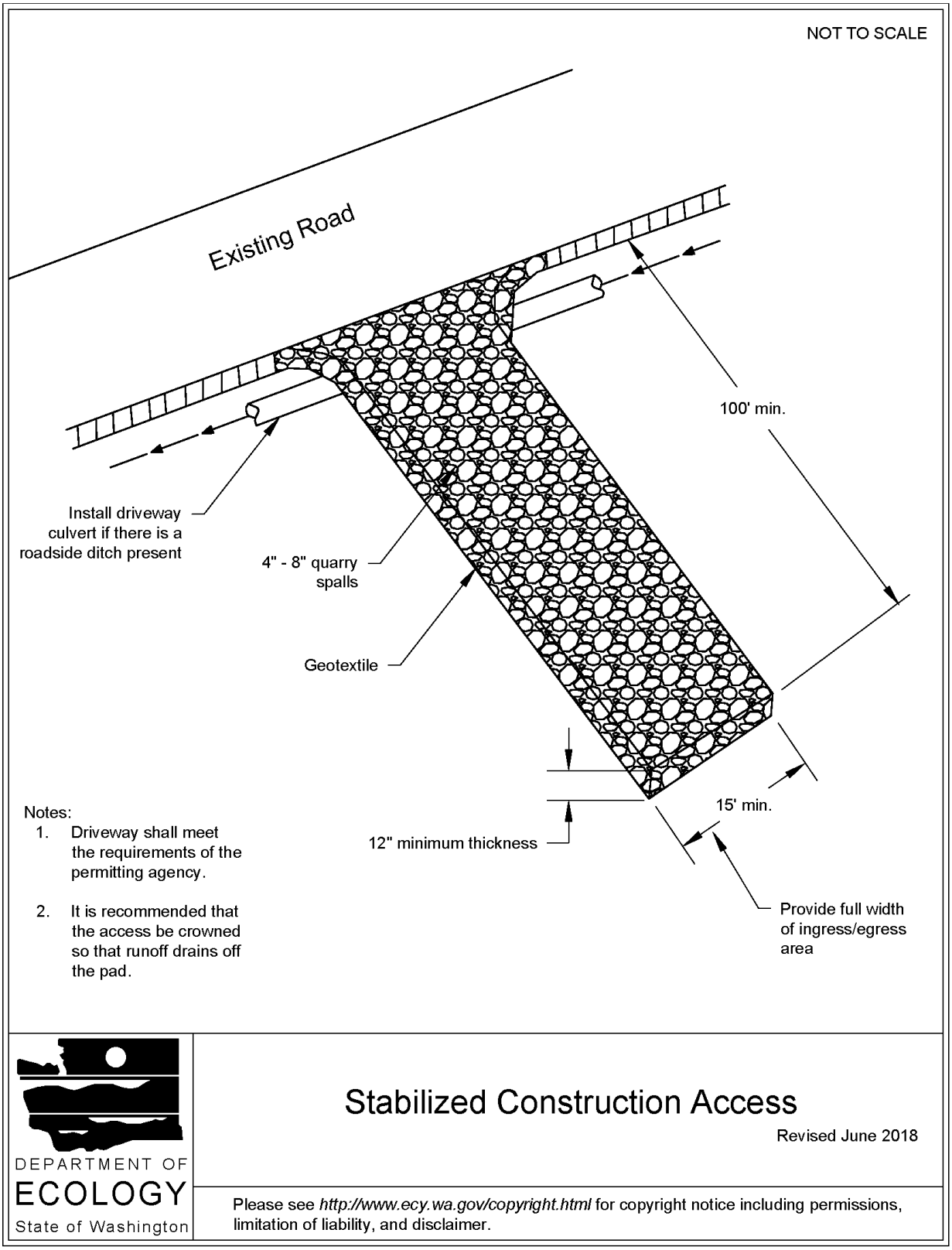
Maintenance Standards

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 C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by washing dirt from the wheels of motor vehicles prior to the motor vehicles leaving the construction site.

Conditions of Use

- Use a wheel wash when BMP C105: Stabilized Construction Access is not preventing sediment from being tracked off site.
- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.
- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.
- Wheel wash wastewater is not stormwater. It is commonly called process water, and must be discharged to a separate on-site treatment system that prevents discharge to waters of the State, or to the sanitary sewer with local sewer district approval.
- Wheel washes may use closed-loop recirculation systems to conserve water use.
- Wheel wash wastewater shall not include wastewater from concrete washout areas.
- When practical, the wheel wash should be placed in sequence with BMP C105: Stabilized Construction Access. Locate the wheel wash such that vehicles exiting the wheel wash will enter directly onto BMP C105: Stabilized Construction Access. In order to achieve this, BMP C105: Stabilized Construction Access may need to be extended beyond the standard installation to meet the exit of the wheel wash.

Design and Installation Specifications

Suggested details are shown in Figure II-3.2: Wheel Wash. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

Midpoint spray nozzles are only needed in extremely muddy conditions.

Wheel wash systems should be designed with a small grade change, 6- to 12-inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

Maintenance Standards

The wheel wash should start out each day with fresh water.

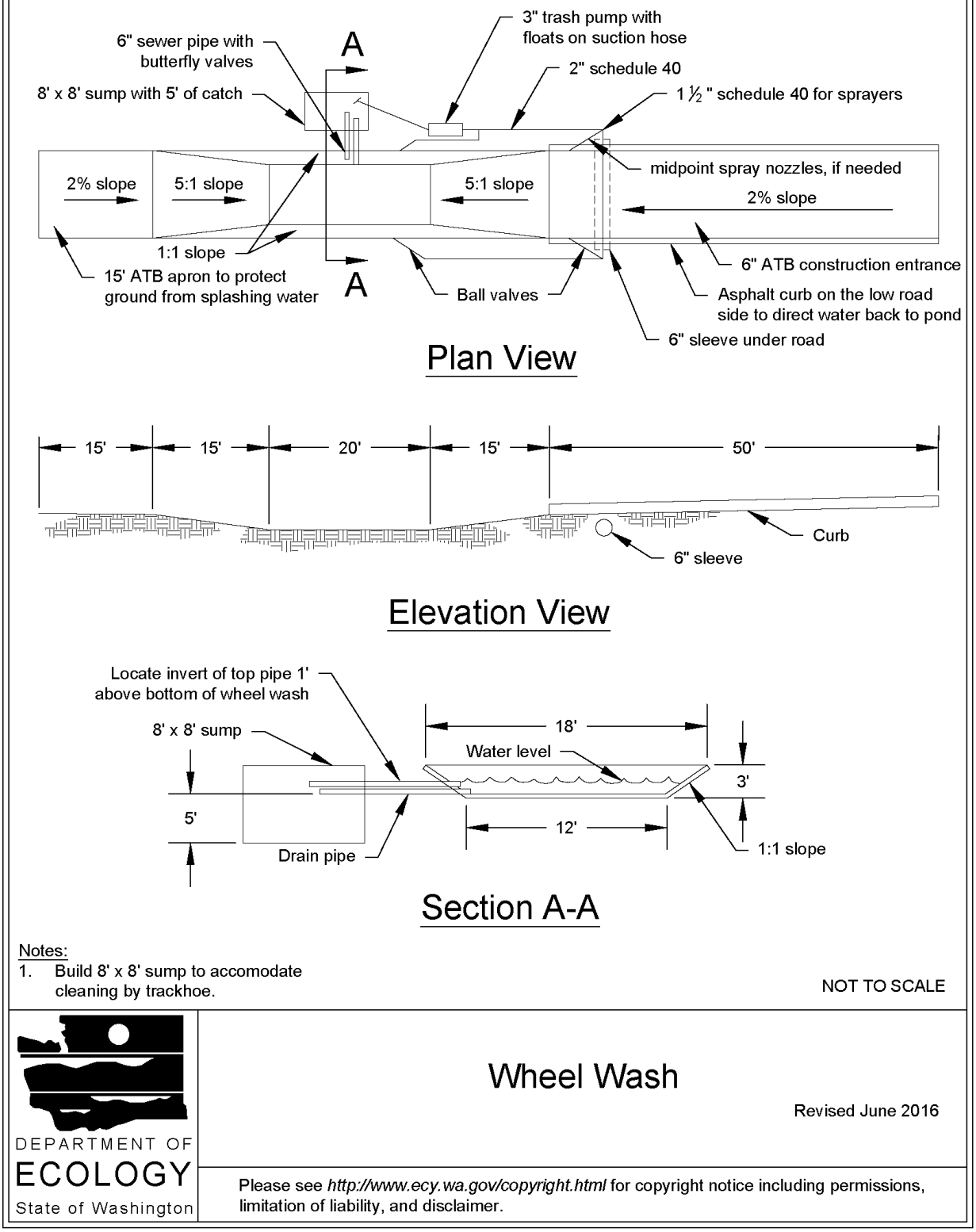
The wheel wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wheel wash water will need to be changed more often.

Approved as Functionally Equivalent

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

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

Figure II-3.2: Wheel Wash



Notes:

1. Build 8' x 8' sump to accomodate cleaning by trackhoe.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Wheel Wash

Revised June 2016

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BMP C107: Construction Road / Parking Area Stabilization

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

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

Maintenance Standards

Inspect stabilized areas regularly, especially after large storm events.

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

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

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

BMP C120: Temporary and Permanent Seeding

Purpose

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

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

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 control 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 Bonded 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 fes-	*Festuca arundin-*	75-80	98	90

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

Common Name	Latin Name	% Weight	% Purity	% Germination
cue	*acea* or *Festuca elatior*			
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.				
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 performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the 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:

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

BMP C121: Mulching

Purpose

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

Conditions of Use

As a temporary cover measure, mulch should be used:

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

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

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

- cottonseed meal;
- fibers made of wood, recycled cellulose, hemp, or kenaf;

- compost;
- or blends of these.

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

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

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

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

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

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table II-3.6: Mulch Standards and Guidelines. Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of "Compost" is selected, it should be a coarse compost that meets the size gradations listed in Table II-3.5: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Table II-3.5: Size Gradations of Compost as Mulch Material

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

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

Maintenance Standards

The thickness of the mulch cover must be maintained.

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

Table II-3.6: Mulch Standards and Guidelines

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

Table II-3.6: Mulch Standards and Guidelines (continued)

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

BMP C122: Nets and Blankets

Purpose

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

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

Conditions of Use

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

Erosion control nets and blankets should be used:

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

Disadvantages of nets and blankets include:

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

Advantages of nets and blankets include:

- Installation without mobilizing special equipment.
- Installation by anyone with minimal training
- Installation in stages or phases as the project progresses.
- Installers can hand place seed and fertilizer as they progress down the slope.
- Installation in any weather.
- There are numerous types of nets and blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

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

Design and Installation Specifications

- See Figure II-3.3: Channel Installation (Clackamas County et al., 2008) and Figure II-3.4: Slope Installation for typical orientation and installation of nets and blankets used in channels and as slope protection. Note: these are typical only; all nets and blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of nets and blankets on slopes:
    1. Complete final grade and track walk up and down the slope.
    2. Install hydromulch with seed and fertilizer.
    3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
    4. Install the leading edge of the net/blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal, "U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
    5. Roll the net/blanket slowly down the slope as the installer walks backward. NOTE: The net/blanket rests against the installer's legs. Staples are installed as the net/blanket is unrolled. It is critical that the proper staple pattern is used for the net/blanket being installed. The net/blanket is not to be allowed to roll down the slope on its own as this stretches the net/blanket, making it impossible to maintain soil contact. In addition, no one is allowed to walk on the net/blanket after it is in place.
    6. If the net/blanket is not long enough to cover the entire slope length, the trailing edge of the upper net/blanket should overlap the leading edge of the lower net/blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the designer consult the manufacturer's information and that a site visit takes place in order to ensure that the product specified is appropriate. Information is also available in WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Division 8-01 and Division 9-14 (WSDOT, 2016).
- Use jute matting in conjunction with mulch (BMP C121: Mulching). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If

synthetic blankets are used, the soil should be hydromulched first.

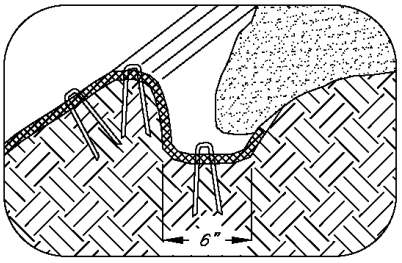
- 100-percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning it breaks down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

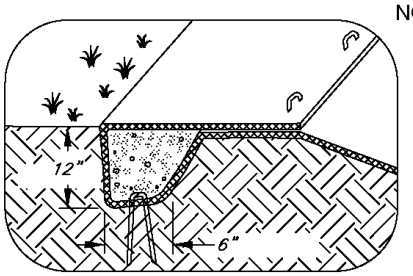
- Maintain good contact with the ground. Erosion must not occur beneath the net or blanket.
- Repair and staple any areas of the net or blanket that are damaged or not in close contact with the ground.
- Fix and protect eroded areas if erosion occurs due to poorly controlled drainage.

Figure II-3.3: Channel Installation

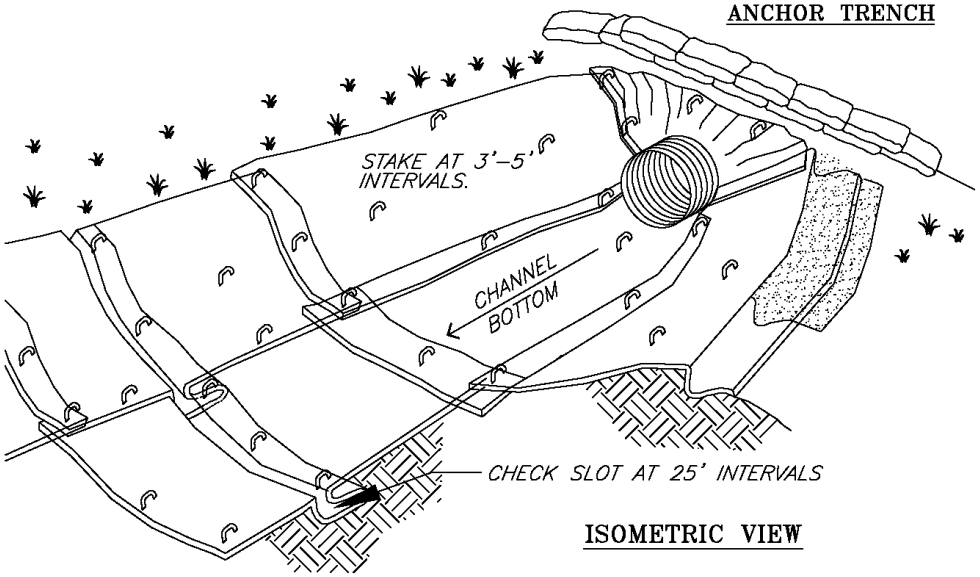
NOT TO SCALE



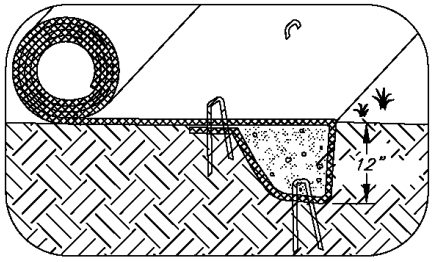
LONGITUDINAL ANCHOR TRENCH



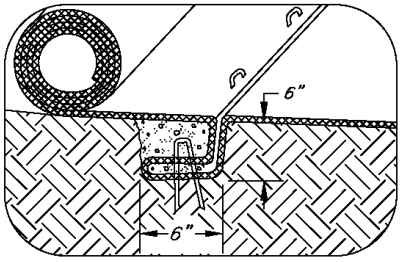
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

Notes:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.

(Clackamas County et al., 2008)

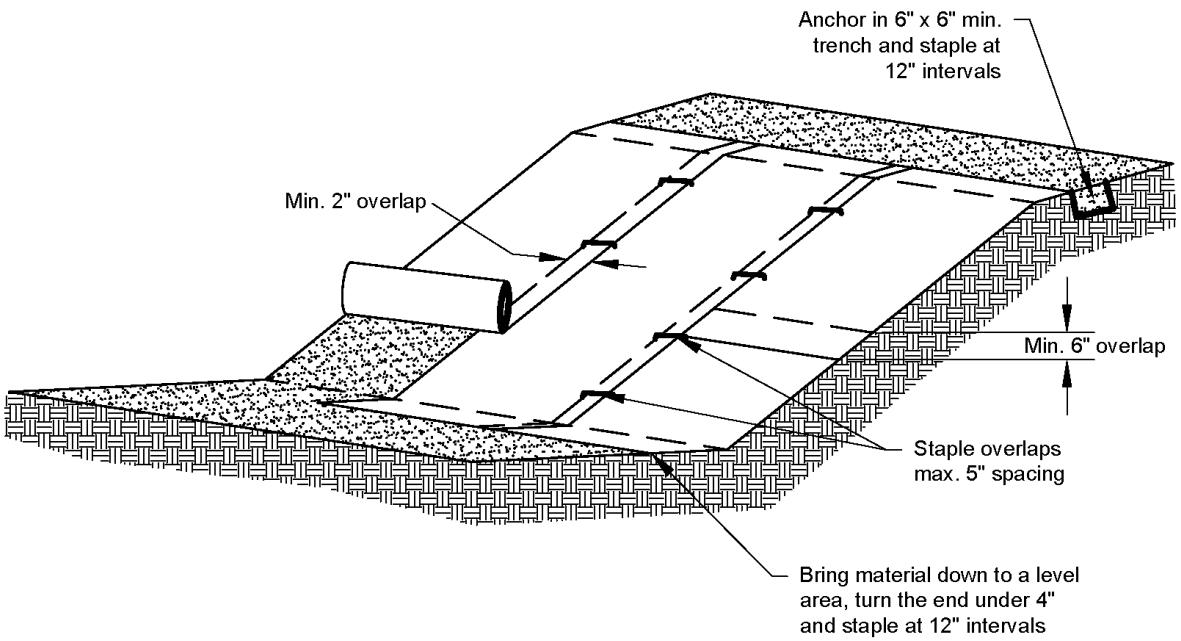
DEPARTMENT OF ECOLOGY
State of Washington

Channel Installation

Revised July 2016

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Figure II-3.4: Slope Installation



Notes:

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

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Slope Installation

Revised June 2016

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BMP C123: Plastic Covering

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.

3. Provide a minimum of 8-inch overlap at the seams.
4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

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

Approved as Functionally Equivalent

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

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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

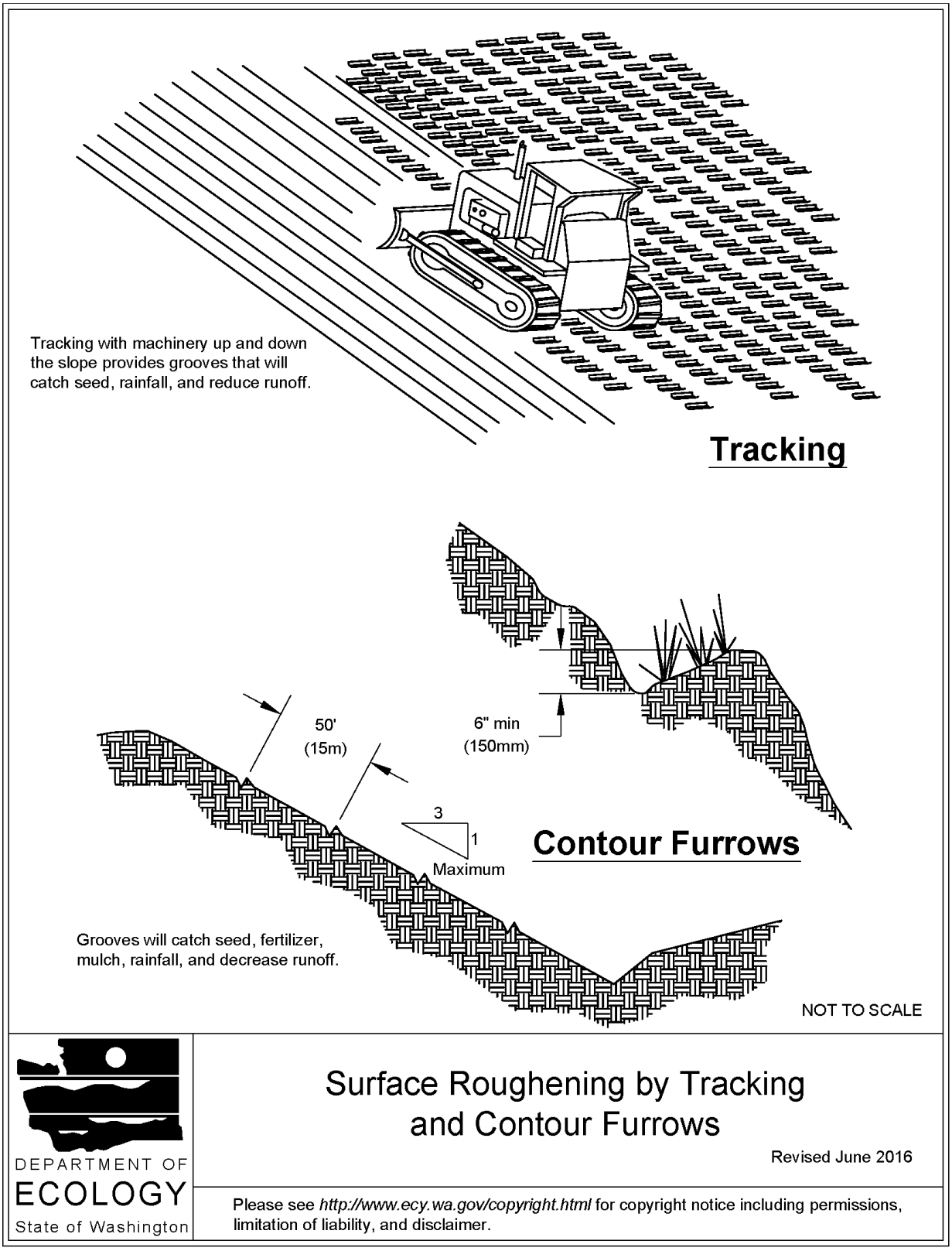
There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, contour furrows, and tracking. See Figure II-3.5: Surface Roughening by Tracking and Contour 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 C131: Gradient Terraces

Purpose

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

Conditions of Use

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

Design and Installation Specifications

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

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

  Where:

  VI = vertical interval in feet

  s = land rise per 100 feet, expressed in feet

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

  Values of "y" are influenced by soil erodibility and cover practices. The lower values are applicable to erosive soils where little to no residue is left on the surface. The higher value is applicable only to erosion-resistant soils where a large amount of residue (1½ tons of straw/acre equivalent) is on the surface.

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

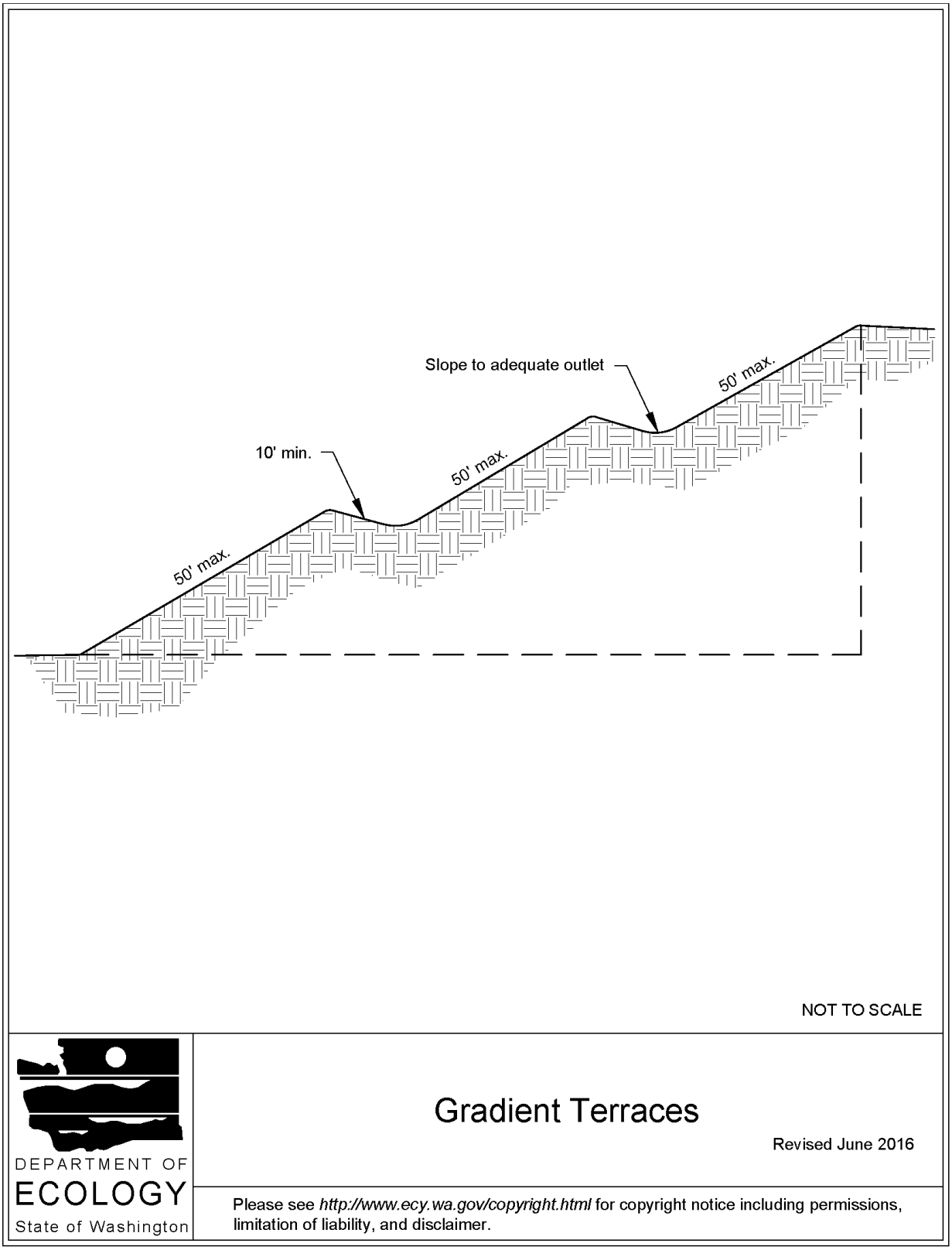
flow.

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

Maintenance Standards

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

Figure II-3.6: Gradient Terraces



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 control 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 C150: Materials on Hand

Purpose

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

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible

pipe, sandbags, geotextile fabric and steel “T” posts.

- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

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

- Clear Plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw Bales for mulching
- Quarry Spalls
- Washed Gravel
- Geotextile Fabric
- Catch Basin Inserts
- Steel "T" Posts
- Silt fence material
- Straw Wattles

Maintenance Standards

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

BMP C151: Concrete Handling

Purpose

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

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction project components include, but are not limited to:

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

Disposal options for concrete, in order of preference are:

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

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.

- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

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

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that 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 vacuum trucks.

BMP C153: Material Delivery, Storage, and Containment

Purpose

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

Conditions of Use

Use at construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds

- Hazardous chemicals such as acids, lime, adhesives, paints, solvents, and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:

- 1-Water Resistant Nylon Bag
- 3-Oil Absorbent Socks 3”x 4’
- 2-Oil Absorbent Socks 3”x 10’
- 12-Oil Absorbent Pads 17”x19”
- 1-Pair Splash Resistant Goggles
- 3-Pair Nitrile Gloves
- 10-Disposable Bags with Ties
- Instructions

Maintenance Standards

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

BMP C154: Concrete Washout Area

Purpose

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

Conditions of Use

Concrete washout areas are implemented on construction projects where:

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

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

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

Design and Installation Specifications

Implementation

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

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for the contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each concrete washout area to inform concrete equipment operators to utilize the proper facilities.

Contracts

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

Location and Placement

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

Concrete Truck Washout Procedures

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

Concrete Washout Area Installation

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

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden,

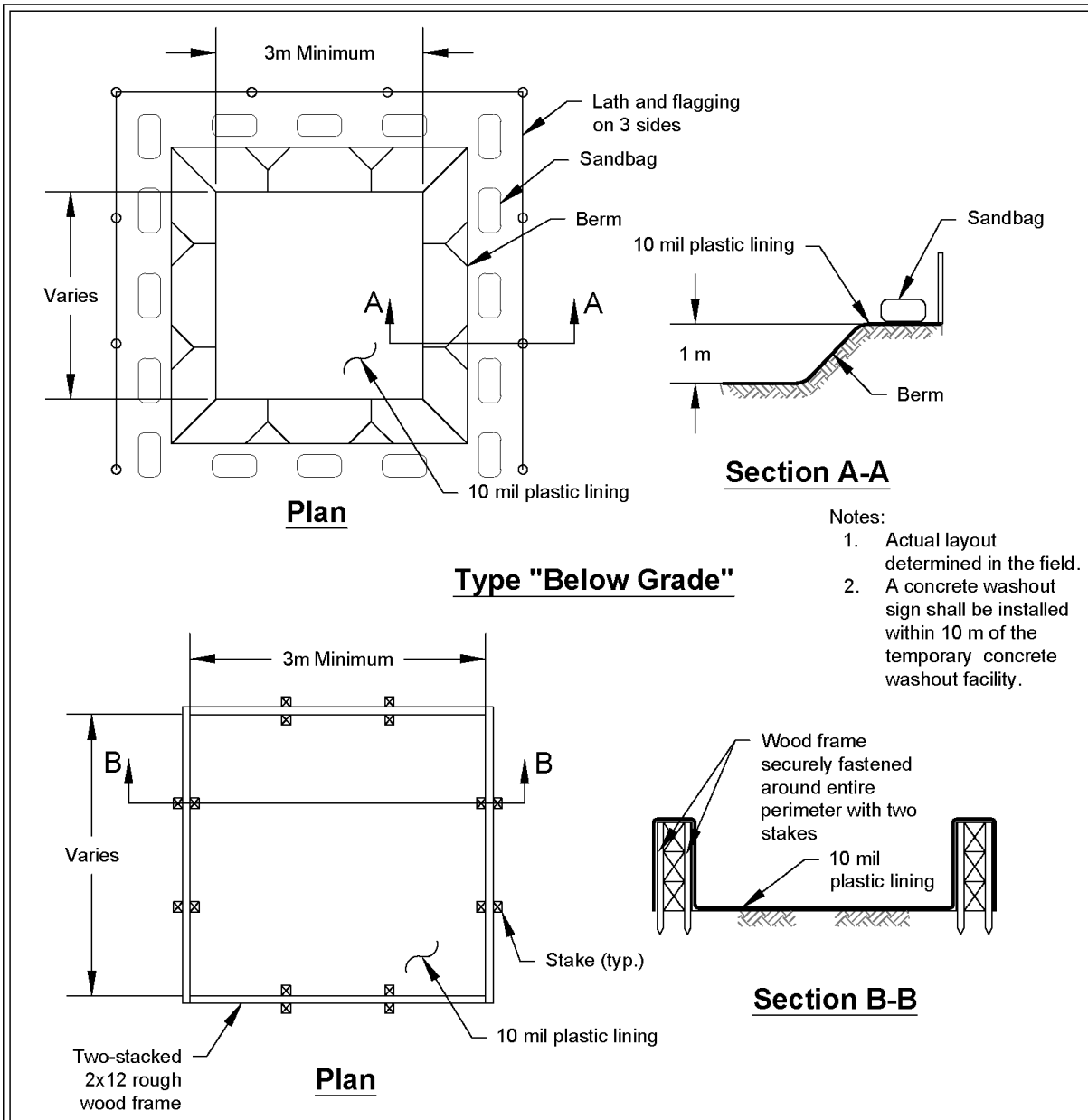
the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.

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

Removal of Concrete Washout Areas

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

Figure II-3.7: Concrete Washout Area with Wood Planks



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Figure II-3.8: Concrete Washout Area with Straw Bales

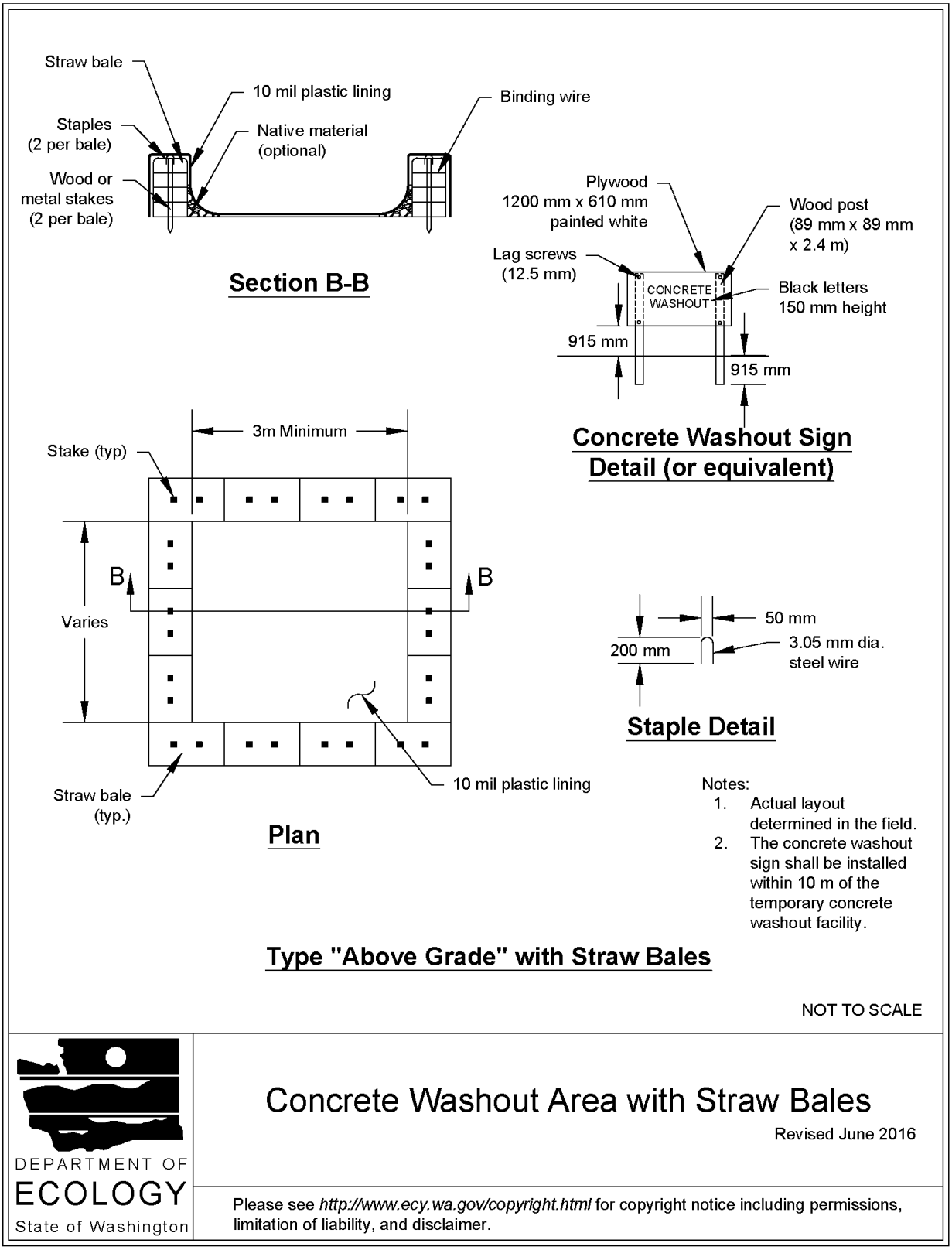
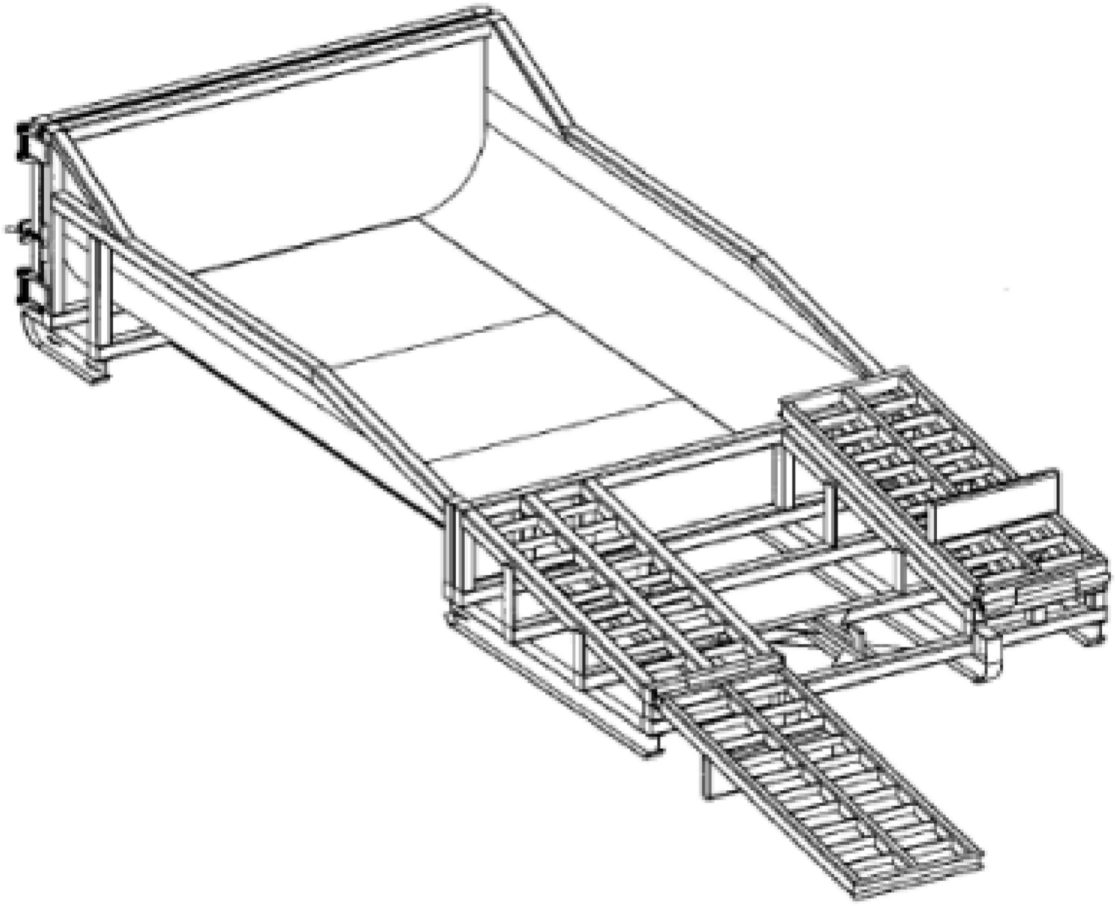


Figure II-3.9: Prefabricated Concrete Washout Container w/Ramp



NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Prefabricated Concrete Washout Container w/Ramp

Revised June 2016

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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-sediment-control

  OR

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

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

Specifications

- CESCL certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL. See II-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.

BMP C162: Scheduling

Purpose

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

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

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

Design Considerations

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

II-3.3 Construction Runoff BMPs

BMP C200: Interceptor Dike and Swale

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

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

      OR

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

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

Interceptor Dikes

Interceptor dikes shall meet the following criteria:

- Top Width: 2 feet minimum.
- Height: 1.5 feet minimum on berm.
- Side Slope: 2H:1V or flatter.
- Grade: Depends on topography, however, dike system minimum is 0.5%, and maximum is 1%.
- Compaction: Minimum of 90 percent ASTM D698 standard proctor.
- Stabilization: Depends on velocity and reach. Inspect regularly to ensure stability.
- Ground Slopes <5%: Seed and mulch applied within 5 days of dike construction (see BMP C121: Mulching).
- Ground Slopes 5 - 40%: Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap, or other measures to avoid erosion.
- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall

occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.

- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.
- See Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope for recommended horizontal spacing between dikes.

Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope

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

Interceptor Swales

Interceptor swales shall meet the following criteria:

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

Maintenance Standards

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

BMP C207: Check Dams

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

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

upstream dam is at the same elevation as the top of the downstream dam.

- Keep the maximum height at 2 feet at the center of the check dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2H:1V or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.
- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, filter fabric is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.
- See Figure II-3.16: Rock Check Dam.

Maintenance Standards

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

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

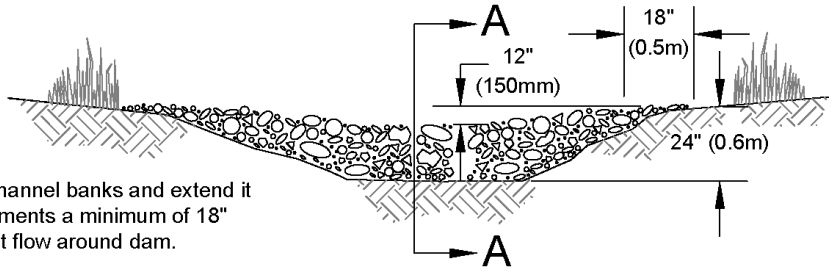
Approved as Functionally Equivalent

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

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

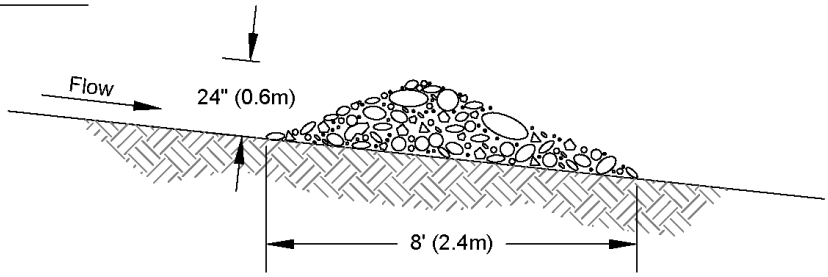
Figure II-3.16: Rock Check Dam

View Looking Upstream

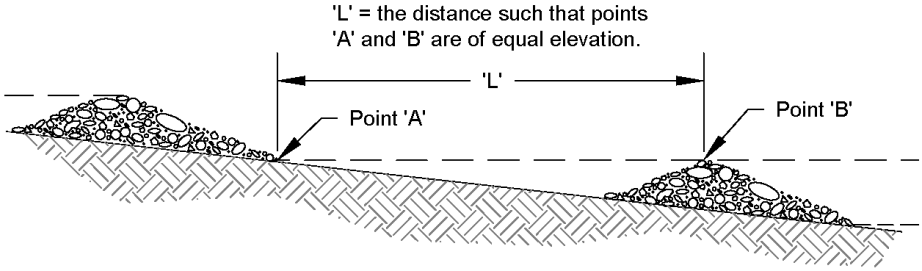


Note:
Key stone into channel banks and extend it beyond the abutments a minimum of 18" (0.5m) to prevent flow around dam.

Section A-A



Spacing Between Check Dams



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Rock Check Dam

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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.

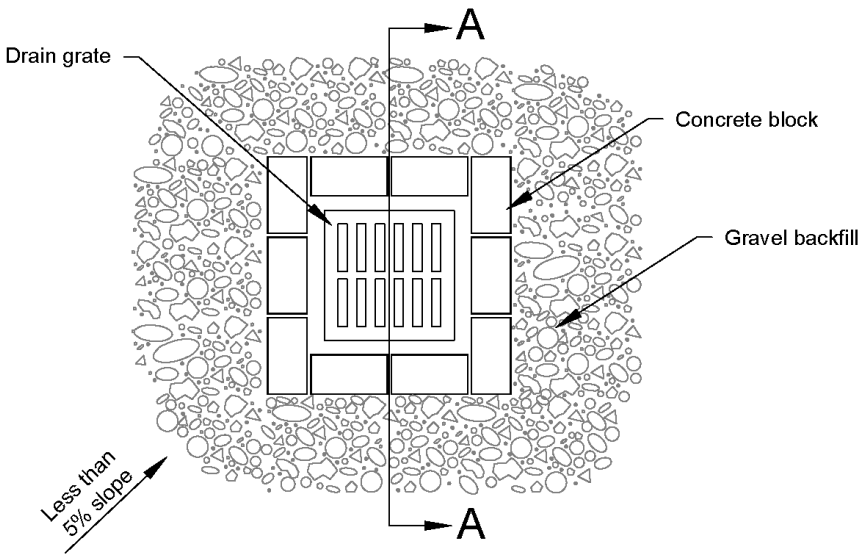
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent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

Block and Gravel Filter

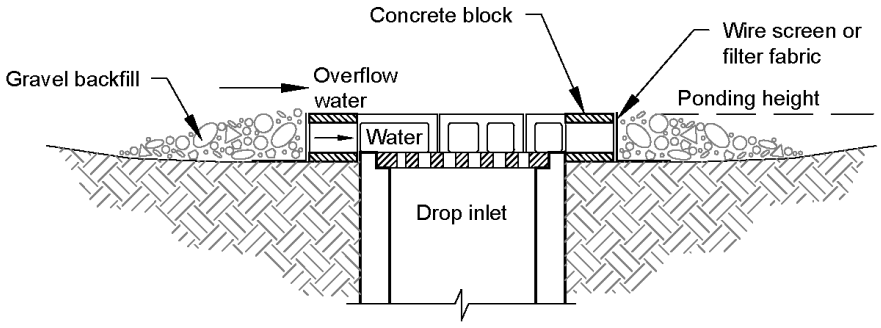
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with 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

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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:

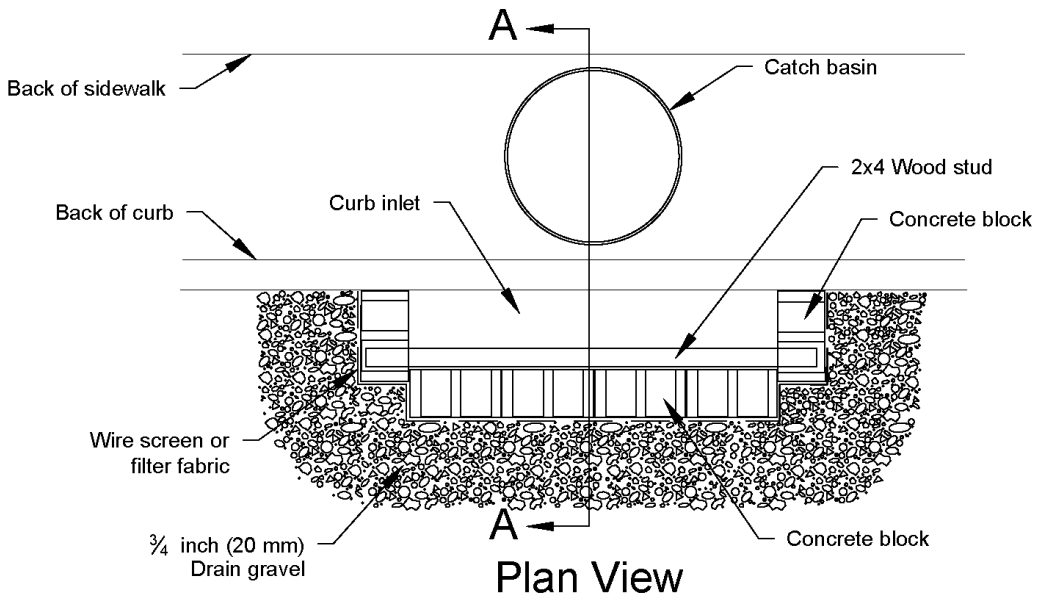
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

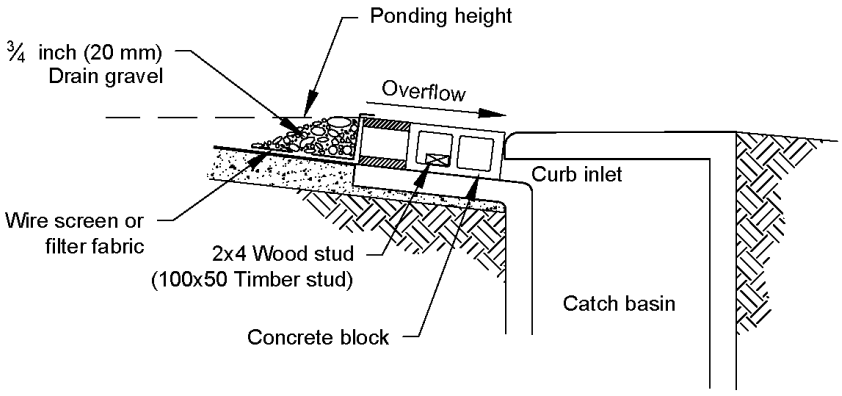
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- 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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Block and Gravel Curb Inlet Protection

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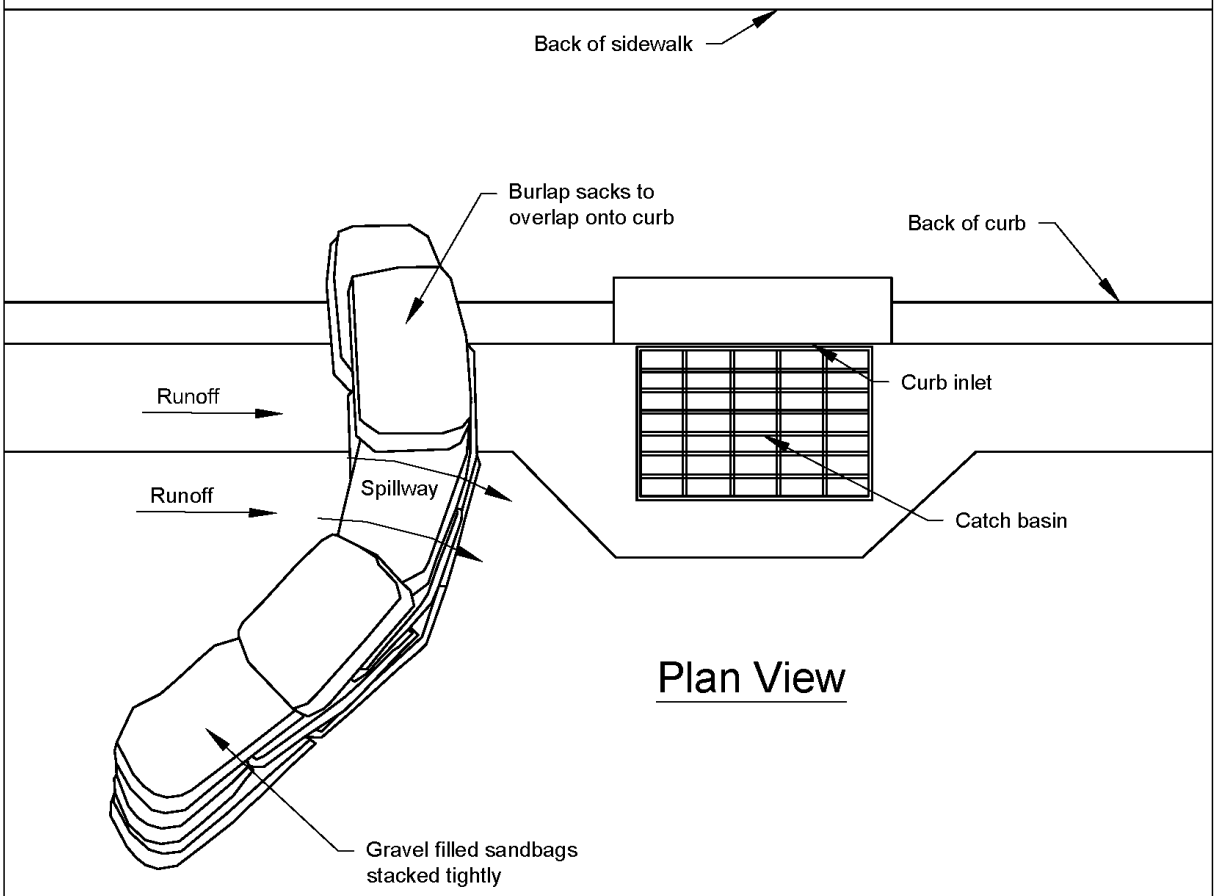
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Curb and Gutter Sediment Barrier

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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Curb and Gutter Barrier

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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:

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BMP C233: Silt Fence

Purpose

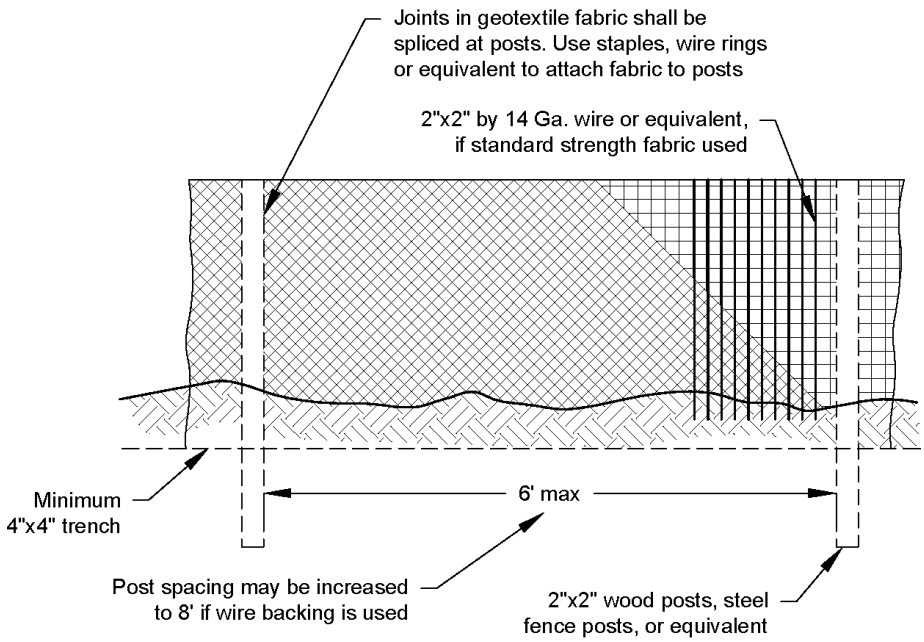
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

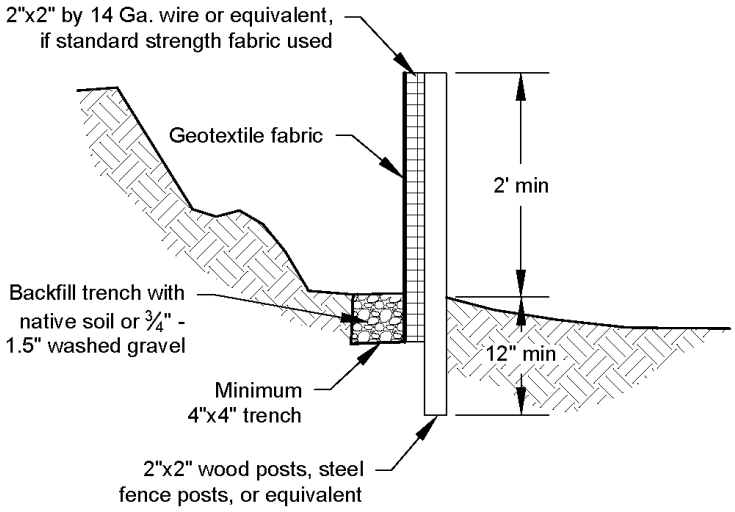
Conditions of Use

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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Silt Fence

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Design and Installation Specifications

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

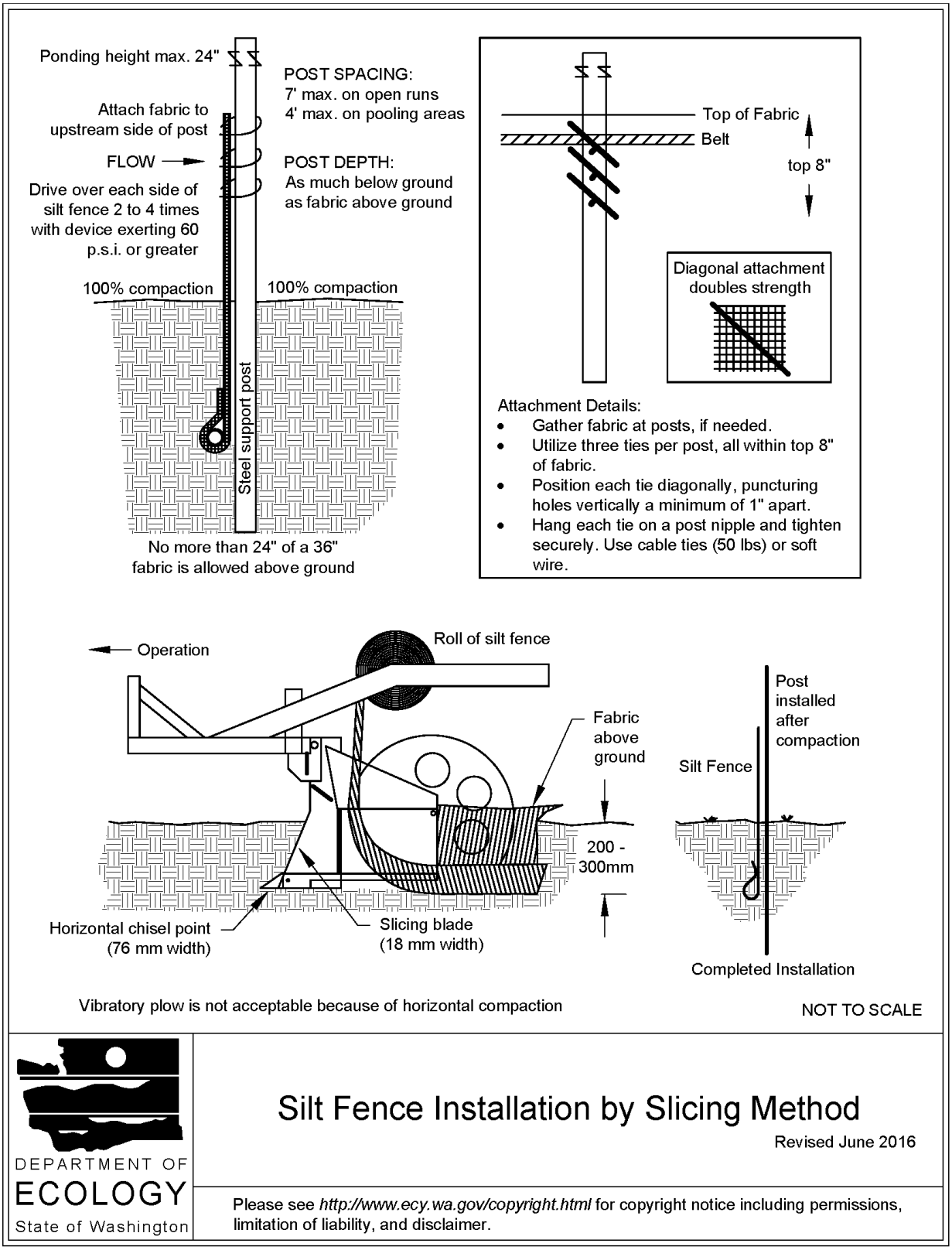
3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can 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



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Maintenance Standards

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

BMP C235: Wattles

Purpose

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

Conditions of Use

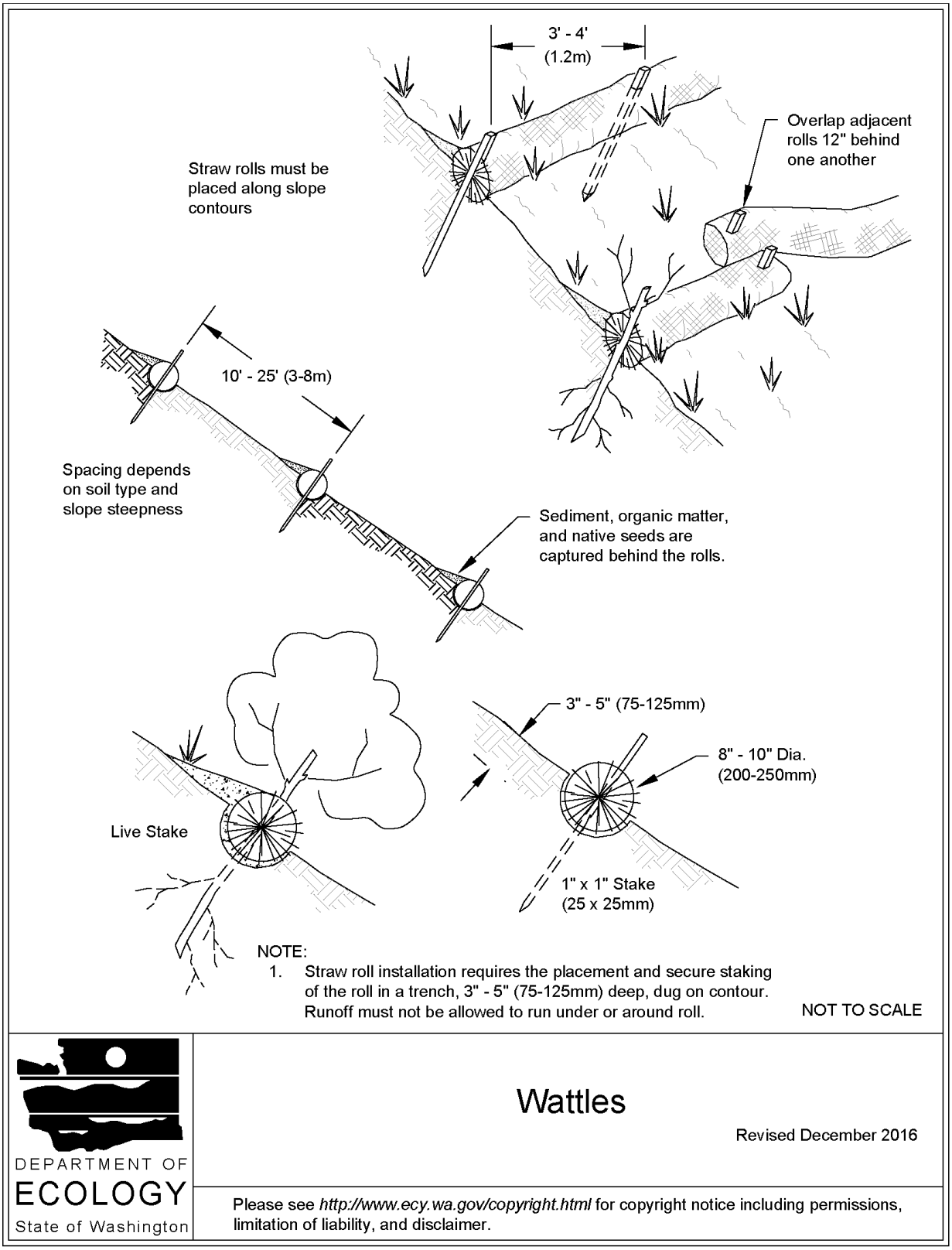
- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles:
    - In disturbed areas that require immediate erosion protection.
    - On exposed soils during the period of short construction delays, or over winter months.
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.

- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- See Figure II-3.24: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3- to 5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-3.24: Wattles



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Maintenance Standards

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

Approved as Functionally Equivalent

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

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BMP C240: Sediment Trap

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

- See Figure II-3.26: Cross Section of Sediment Trap and Figure II-3.27: Sediment Trap Outlet for details.
- To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS(Q_2/V_s)$$

where

Q_2 =

  - Option 1 - Single Event Hydrograph Method:

    Q_2 = Peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 2-year, 24-hour frequency storm for the developed condition. The 10-year peak volumetric flow rate shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection.

  - Option 2 - For construction sites that are less than 1 acre, the Rational Method may be used to determine Q_2.

V_s = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm3 has been selected as the particle of interest and has a settling velocity (Vs) of 0.00096 ft/sec.

FS = A safety factor of 2 to account for non-ideal settling.

Therefore, the equation for computing sediment trap surface area becomes:

$$SA = 2 \times Q_2/0.00096$$

or

2080 square feet per cfs of inflow

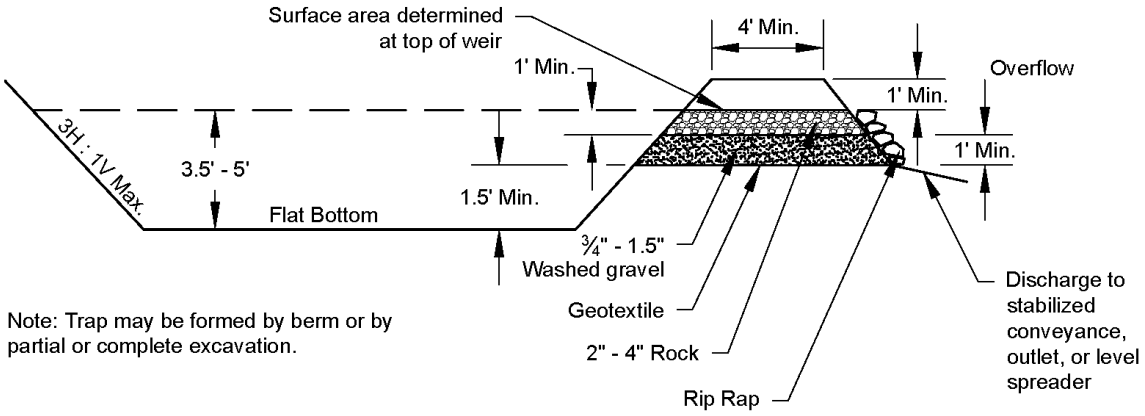
- Sediment trap depth shall be 3.5 feet minimum from the bottom of the trap to the top of the overflow weir.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.

- Design the discharge from the sediment trap by using the guidance for discharge from temporary sediment ponds in BMP C241: Sediment Pond (Temporary).

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1-foot in depth.
- Any damage to the trap embankments or slopes shall be repaired.

Figure II-3.26: Cross Section of Sediment Trap



NOT TO SCALE

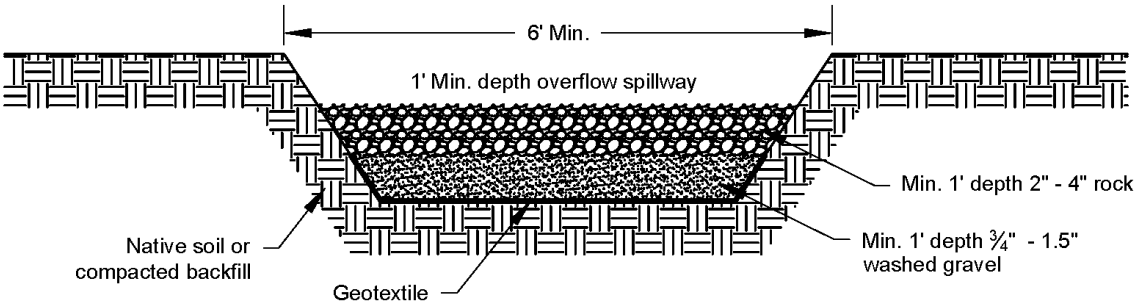
DEPARTMENT OF ECOLOGY
State of Washington

Cross Section of Sediment Trap

Revised June 2016

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Figure II-3.27: Sediment Trap Outlet



NOT TO SCALE

DEPARTMENT OF
ECOLOGY
State of Washington

Sediment Trap Outlet

Revised June 2016

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Maintenance Standards

- Remove sediment from the pond when it reaches 1 foot in depth.
- Repair any damage to the pond embankments or slopes.

BMP C252: Treating and Disposing of High pH Water

Purpose

When pH levels in stormwater rise above 8.5, it is necessary to lower the pH levels to the acceptable range of 6.5 to 8.5 prior to discharge to surface or ground water. A pH level range of 6.5 to 8.5 is typical for most natural watercourses, and this neutral pH range is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms may become stressed and may die.

Conditions of Use

- The water quality standard for pH in Washington State is in the range of 6.5 to 8.5. Stormwater with pH levels exceeding water quality standards may be either neutralized on site or disposed of to a sanitary sewer or concrete batch plant with pH neutralization capabilities.
- Neutralized stormwater may be discharged to surface waters under the Construction Stormwater General permit.
- Neutralized process water such as concrete truck wash-out, hydro-demolition, or saw-cutting slurry must be managed to prevent discharge to surface waters. Any stormwater

contaminated during concrete work is considered process wastewater and must not be discharged to waters of the State or stormwater collection systems.

- The process used for neutralizing and/or disposing of high pH stormwater from the site must be documented in the Construction Stormwater Pollution Prevention Plan.

Causes of High pH

High pH at construction sites is most commonly caused by the contact of stormwater with poured or recycled concrete, cement, mortars, and other Portland cement or lime containing construction materials. (See BMP C151: Concrete Handling for more information on concrete handling procedures). The principal caustic agent in cement is calcium hydroxide (free lime).

Calcium hardness can contribute to high pH values and cause toxicity that is associated with high pH conditions. A high level of calcium hardness in waters of the state is not allowed. Ground water standard for calcium and other dissolved solids in Washington State is less than 500 mg/l.

Treating High pH Stormwater by Carbon Dioxide Sparging

Advantages of Carbon Dioxide Sparging

- Rapidly neutralizes high pH water.
- Cost effective and safer to handle than acid compounds.
- CO_2 is self-buffering. It is difficult to overdose and create harmfully low pH levels.
- Material is readily available.

The Chemical Process of Carbon Dioxide Sparging

When carbon dioxide (CO_2) is added to water (H_2O), carbonic acid (H_2CO_3) is formed which can further dissociate into a proton (H+) and a bicarbonate anion (HCO_3-) as shown below:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H+ + HCO_3-$$

The free proton is a weak acid that can lower the pH. Water temperature has an effect on the reaction as well. The colder the water temperature is, the slower the reaction occurs. The warmer the water temperature is, the quicker the reaction occurs. Most construction applications in Washington State have water temperatures in the 50°F or higher range so the reaction is almost simultaneous.

The Treatment Process of Carbon Dioxide Sparging

High pH water may be treated using continuous treatment, continuous discharge systems. These manufactured systems continuously monitor influent and effluent pH to ensure that pH values are within an acceptable range before being discharged. All systems must have fail safe automatic shut off switches in the event that pH is not within the acceptable discharge range. Only trained operators may operate manufactured systems. System manufacturers often provide trained operators or training on their devices.

The following procedure may be used when not using a continuous discharge system:

1. Prior to treatment, the appropriate jurisdiction should be notified in accordance with the regulations set by the jurisdiction.
2. Every effort should be made to isolate the potential high pH water in order to treat it separately from other stormwater on-site.
3. Water should be stored in an acceptable storage facility, detention pond, or containment cell prior to pH treatment.
4. Transfer water to be treated for pH to the pH treatment structure. Ensure that the pH treatment structure size is sufficient to hold the amount of water that is to be treated. Do not fill the pH treatment structure completely, allow at least 2 feet of freeboard.
5. The operator samples the water within the pH treatment structure for pH and notes the clarity of the water. As a rule of thumb, less CO_2 is necessary for clearer water. The results of the samples and water clarity observations should be recorded.
6. In the pH treatment structure, add CO_2 until the pH falls into the range of 6.9-7.1. Adjusting pH to within 0.2 pH units of receiving water (background pH) is recommended. It is unlikely that pH can be adjusted to within 0.2 pH units using dry ice. Compressed carbon dioxide gas should be introduced to the water using a carbon dioxide diffuser located near the bottom of the pH treatment structure, this will allow carbon dioxide to bubble up through the water and diffuse more evenly.
7. Slowly discharge the water, making sure water does not get stirred up in the process. Release about 80% of the water from the pH treatment structure leaving any sludge behind. If turbidity remains above the maximum allowable, consider adding filtration to the treatment train. See BMP C251: Construction Stormwater Filtration.
8. Discharge treated water through a pond or drainage system.
9. Excess sludge needs to be disposed of properly as concrete waste. If several batches of water are undergoing pH treatment, sludge can be left in the treatment structure for the next batch treatment. Dispose of sludge when it fills 50% of the treatment structure volume.
10. Disposal must comply with applicable local, state, and federal regulations.

Treating High pH Stormwater by Food Grade Vinegar

Food grade vinegar that meets FDA standards may be used to neutralize high pH water. Food grade vinegar is only 4% to 18% acetic acid with the remainder being water. Food grade vinegar may be used if dosed just enough to lower pH sufficiently. Use a treatment process as described above for CO_2 sparging, but add food grade vinegar instead of CO_2.

This treatment option for high pH stormwater does not apply to anything but food grade vinegar. Acetic acid does not equal vinegar. Any other product or waste containing acetic acid must go through the evaluation process in Appendix G of *Whole Effluent Toxicity Testing Guidance and Test Review Criteria* (Marshall, 2016).

Disposal of High pH Stormwater

Sanitary Sewer Disposal

Local sewer authority approval is required prior to disposal via the sanitary sewer.

Concrete Batch Plant Disposal

- Only permitted facilities may accept high pH water.
- Contact the facility to ensure they can accept the high pH water.

Maintenance Standards

Safety and materials handling:

- All equipment should be handled in accordance with OSHA rules and regulations.
- Follow manufacturer guidelines for materials handling.

Each operator should provide:

- A diagram of the monitoring and treatment equipment.
- A description of the pumping rates and capacity the treatment equipment is capable of treating.

Each operator should keep a written record of the following:

- Client name and phone number.
- Date of treatment.
- Weather conditions.
- Project name and location.
- Volume of water treated.
- pH of untreated water.
- Amount of CO_2 or food grade vinegar needed to adjust water to a pH range of 6.9-7.1.
- pH of treated water.
- Discharge point location and description.

A copy of this record should be given to the client/contractor who should retain the record for three years.

Appendix D – Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

Appendix E – Construction Stormwater General Permit (CSWGP)

Issuance Date: November 18, 2020
Effective Date: January 1, 2021
Expiration Date: December 31, 2025

CONSTRUCTION STORMWATER GENERAL PERMIT

National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity

State of Washington
Department of Ecology
Olympia, Washington 98504

In compliance with the provisions of
Chapter 90.48 Revised Code of Washington
(State of Washington Water Pollution Control Act)
and
Title 33 United States Code, Section 1251 et seq.
The Federal Water Pollution Control Act (The Clean Water Act)

Until this permit expires, is modified, or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions that follow.



Vincent McGowan, P.E.
Water Quality Program Manager
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions within this permit for additional submittal requirements. Appendix A provides a list of definitions. Appendix B provides a list of acronyms.

Table 1 Summary of Required Submittals

Permit Section	Submittal	Frequency	First Submittal Date
S5.A and S8	High Turbidity/Transparency Phone Reporting	As Necessary	Within 24 hours
S5.B	Discharge Monitoring Report	Monthly*	Within 15 days following the end of each month
S5.F and S8	Noncompliance Notification – Telephone Notification	As necessary	Within 24 hours
S5.F	Noncompliance Notification – Written Report	As necessary	Within 5 Days of non-compliance
S9.D	Request for Chemical Treatment Form	As necessary	Written approval from Ecology is required prior to using chemical treatment (with the exception of dry ice, CO_2 or food grade vinegar to adjust pH)
G2	Notice of Change in Authorization	As necessary	
G6	Permit Application for Substantive Changes to the Discharge	As necessary	
G8	Application for Permit Renewal	1/permit cycle	No later than 180 days before expiration
S2.A	Notice of Permit Transfer	As necessary	
G19	Notice of Planned Changes	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	

NOTE: *Permittees must submit electronic Discharge Monitoring Reports (DMRs) to the Washington State Department of Ecology monthly, regardless of site discharge, for the full duration of permit coverage. Refer to Section S5.B of this General Permit for more specific information regarding DMRs.

Table 2 Summary of Required On-site Documentation

Document Title	Permit Conditions
Permit Coverage Letter	See Conditions S2, S5
Construction Stormwater General Permit (CSWGP)	See Conditions S2, S5
Site Log Book	See Conditions S4, S5
Stormwater Pollution Prevention Plan (SWPPP)	See Conditions S5, S9
Site Map	See Conditions S5, S9

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Permit Area

This Construction Stormwater General Permit (CSWGP) covers all areas of Washington State, except for federal operators and Indian Country as specified in Special Condition S1.E.3 and 4.

B. Operators Required to Seek Coverage Under this General Permit

1. Operators of the following construction activities are required to seek coverage under this CSWGP:

    a. Clearing, grading and/or excavation that results in the disturbance of one or more acres (including off-site disturbance acreage related to construction-support activity as authorized in S1.C.2) and discharges stormwater to surface waters of the State; and clearing, grading and/or excavation on sites smaller than one acre that are part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one acre or more and discharge stormwater to surface waters of the State.

        i. This category includes forest practices (including, but not limited to, class IV conversions) that are part of a construction activity that will result in the disturbance of one or more acres, and discharge to surface waters of the State (that is, forest practices that prepare a site for construction activities); and

    b. Any size construction activity discharging stormwater to waters of the State that the Washington State Department of Ecology (Ecology):

        i. Determines to be a significant contributor of pollutants to waters of the State of Washington.

        ii. Reasonably expects to cause a violation of any water quality standard.

2. Operators of the following activities are not required to seek coverage under this CSWGP (unless specifically required under Special Condition S1.B.1.b, above):

    a. Construction activities that discharge all stormwater and non-stormwater to groundwater, sanitary sewer, or combined sewer, and have no point source discharge to either surface water or a storm sewer system that drains to surface waters of the State.

    b. Construction activities covered under an Erosivity Waiver (Special Condition S1.F).

    c. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

C. Authorized Discharges

1. ***Stormwater Associated with Construction Activity.*** Subject to compliance with the terms and conditions of this permit, Permittees are authorized to discharge stormwater associated with construction activity to surface waters of the State or to a storm sewer system that drains to surface waters of the State. (Note that "surface waters of the

State" may exist on a construction site as well as off site; for example, a creek running through a site.)

2. ***Stormwater Associated with Construction Support Activity.*** This permit also authorizes stormwater discharge from support activities related to the permitted construction site (for example, an on-site portable rock crusher, off-site equipment staging yards, material storage areas, borrow areas, etc.) provided:

    a. The support activity relates directly to the permitted construction site that is required to have an NPDES permit; and

    b. The support activity is not a commercial operation serving multiple unrelated construction projects, and does not operate beyond the completion of the construction activity; and

    c. Appropriate controls and measures are identified in the Stormwater Pollution Prevention Plan (SWPPP) for the discharges from the support activity areas.

3. ***Non-Stormwater Discharges.*** The categories and sources of non-stormwater discharges identified below are authorized conditionally, provided the discharge is consistent with the terms and conditions of this permit:

    a. Discharges from fire-fighting activities.

    b. Fire hydrant system flushing.

    c. Potable water, including uncontaminated water line flushing.

    d. Hydrostatic test water.

    e. Uncontaminated air conditioning or compressor condensate.

    f. Uncontaminated groundwater or spring water.

    g. Uncontaminated excavation dewatering water (in accordance with S9.D.10).

    h. Uncontaminated discharges from foundation or footing drains.

    i. Uncontaminated or potable water used to control dust. Permittees must minimize the amount of dust control water used.

    j. Routine external building wash down that does not use detergents.

    k. Landscape irrigation water.

The SWPPP must adequately address all authorized non-stormwater discharges, except for discharges from fire-fighting activities, and must comply with Special Condition S3. At a minimum, discharges from potable water (including water line flushing), fire hydrant system flushing, and pipeline hydrostatic test water must undergo the following: dechlorination to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units (su), if necessary.

D. Prohibited Discharges

The following discharges to waters of the State, including groundwater, are prohibited:

1. Concrete wastewater

2. Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.

3. Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.2 (See Appendix A of this permit).

4. Slurry materials and waste from shaft drilling, including process wastewater from shaft drilling for construction of building, road, and bridge foundations unless managed according to Special Condition S9.D.9.j.

5. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.

6. Soaps or solvents used in vehicle and equipment washing.

7. Wheel wash wastewater, unless managed according to Special Condition S9.D.9.

8. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to Special Condition S9.D.10.

E. Limits on Coverage

Ecology may require any discharger to apply for and obtain coverage under an individual permit or another more specific general permit. Such alternative coverage will be required when Ecology determines that this CSWGP does not provide adequate assurance that water quality will be protected, or there is a reasonable potential for the project to cause or contribute to a violation of water quality standards.

The following stormwater discharges are not covered by this permit:

1. Post-construction stormwater discharges that originate from the site after completion of construction activities and the site has undergone final stabilization.

2. Non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance, from which there is natural runoff as excluded in 40 CFR Subpart 122.

3. Stormwater from any federal operator.

4. Stormwater from facilities located on ***Indian Country*** as defined in 18 U.S.C.§1151, except portions of the Puyallup Reservation as noted below.

   Indian Country includes:

   a. All land within any Indian Reservation notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation. This includes all federal, tribal, and Indian and non-Indian privately owned land within the reservation.

   b. All off-reservation Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

   c. All off-reservation federal trust lands held for Native American Tribes.

Puyallup Exception: Following the *Puyallup Tribes of Indians Land Settlement Act of 1989*, 25 U.S.C. §1773; the permit does apply to land within the Puyallup Reservation except for discharges to surface water on land held in trust by the federal government.

5. Stormwater from any site covered under an existing NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

6. Stormwater from a site where an applicable Total Maximum Daily Load (TMDL) requirement specifically precludes or prohibits discharges from construction activity.

F. Erosivity Waiver

Construction site operators may qualify for an Erosivity Waiver from the CSWGP if the following conditions are met:

1. The site will result in the disturbance of fewer than five (5) acres and the site is not a portion of a common plan of development or sale that will disturb five (5) acres or greater.

2. Calculation of Erosivity "R" Factor and Regional Timeframe:

    a. The project's calculated rainfall erosivity factor ("R" Factor) must be less than five (5) during the period of construction activity, (See the CSWGP homepage http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html for a link to the EPA's calculator and step by step instructions on computing the "R" Factor in the *EPA Erosivity Waiver Fact Sheet*). The period of construction activity starts when the land is first disturbed and ends with final stabilization. In addition:

    b. The entire period of construction activity must fall within the following timeframes:

        i. For sites west of the Cascades Crest: June 15 – September 15.

        ii. For sites east of the Cascades Crest, excluding the Central Basin: June 15 – October 15.

        iii. For sites east of the Cascades Crest, within the Central Basin: no timeframe restrictions apply. The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches. For a map of the Central Basin (Average Annual Precipitation Region 2), refer to: http://www.ecy.wa.gov/programs/wq/stormwater/construction/resourcesguidance.html.

3. Construction site operators must submit a complete Erosivity Waiver certification form at least one week before disturbing the land. Certification must include statements that the operator will:

    a. Comply with applicable local stormwater requirements; and

    b. Implement appropriate erosion and sediment control BMPs to prevent violations of water quality standards.

4. This waiver is not available for facilities declared significant contributors of pollutants as defined in Special Condition S1.B.1.b or for any size construction activity that could

reasonably expect to cause a violation of any water quality standard as defined in Special Condition S1.B.1.b.ii.

5. This waiver does not apply to construction activities which include non-stormwater discharges listed in Special Condition S1.C.3.

6. If construction activity extends beyond the certified waiver period for any reason, the operator must either:

    a. Recalculate the rainfall erosivity "R" factor using the original start date and a new projected ending date and, if the "R" factor is still under 5 *and* the entire project falls within the applicable regional timeframe in Special Condition S1.F.2.b, complete and submit an amended waiver certification form before the original waiver expires; *or*

    b. Submit a complete permit application to Ecology in accordance with Special Condition S2.A and B before the end of the certified waiver period.

S2. APPLICATION REQUIREMENTS

A. Permit Application Forms

1. *Notice of Intent Form*

a. Operators of new or previously unpermitted construction activities must submit a complete and accurate permit application (Notice of Intent, or NOI) to Ecology.

b. Operators must apply using the electronic application form (NOI) available on Ecology's website (http://ecy.wa.gov/programs/wq/stormwater/construction/index.html). Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

> Department of Ecology
> Water Quality Program - Construction Stormwater
> PO Box 47696
> Olympia, Washington 98504-7696

c. The operator must submit the NOI at least 60 days before discharging stormwater from construction activities and must submit it prior to the date of the first public notice (See Special Condition S2.B, below, for details). The 30-day public comment period begins on the publication date of the second public notice. Unless Ecology responds to the complete application in writing, coverage under the general permit will automatically commence on the 31st day following receipt by Ecology of a *completed* NOI, or the issuance date of this permit, whichever is later; unless Ecology specifies a later date in writing as required by WAC173-226-200(2). See S8.B for Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters.

d. If an applicant intends to use a Best Management Practice (BMP) selected on the basis of Special Condition S9.C.4 ("demonstrably equivalent" BMPs), the applicant must notify Ecology of its selection as part of the NOI. In the event the applicant selects BMPs after submission of the NOI, the applicant must provide notice of the

selection of an equivalent BMP to Ecology at least 60 days before intended use of the equivalent BMP.

e. Applicants must notify Ecology if they are aware of contaminated soils and/or groundwater associated with the construction activity. Provide detailed information with the NOI (as known and readily available) on the nature and extent of the contamination (concentrations, locations, and depth), as well as pollution prevention and/or treatment BMPs proposed to control the discharge of soil and/or groundwater contaminants in stormwater. Examples of such detail may include, but are not limited to:

   i. List or table of all known contaminants with laboratory test results showing concentration and depth,

   ii. Map with sample locations,

   iii. Related portions of the Stormwater Pollution Prevention Plan (SWPPP) that address the management of contaminated and potentially contaminated construction stormwater and dewatering water,

   iv. Dewatering plan and/or dewatering contingency plan.

2. ***Transfer of Coverage Form***

The Permittee can transfer current coverage under this permit to one or more new operators, including operators of sites within a Common Plan of Development, provided:

   i. The Permittee submits a complete Transfer of Coverage Form to Ecology, signed by the current and new discharger and containing a specific date for transfer of permit responsibility, coverage and liability (including any Administrative Orders associated with the permit); and

   ii. Ecology does not notify the current discharger and new discharger of intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the written agreement.

When a current discharger (Permittee) transfers a portion of a permitted site, the current discharger must also indicate the remaining permitted acreage after the transfer. Transfers do not require public notice.

3. ***Modification of Coverage Form***

Permittees must notify Ecology regarding any changes to the information provided on the NOI by submitting an Update/Modification of Permit Coverage form in accordance with General Conditions G6 and G19. Examples of such changes include, but are not limited to:

   i. Changes to the Permittee's mailing address,

   ii. Changes to the on-site contact person information, and

   iii. Changes to the area/acreage affected by construction activity.

B. Public Notice

For new or previously unpermitted construction activities, the applicant must publish a public notice at least one time each week for two consecutive weeks, at least 7 days apart, in a newspaper with general circulation in the county where the construction is to take place. The notice must be run after the NOI has been submitted and must contain:

1. A statement that "*The applicant is seeking coverage under the Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit*."
2. The name, address, and location of the construction site.
3. The name and address of the applicant.
4. The type of construction activity that will result in a discharge (for example, residential construction, commercial construction, etc.), and the total number of acres to be disturbed over the lifetime of the project.
5. The name of the receiving water(s) (that is, the surface water(s) to which the site will discharge), or, if the discharge is through a storm sewer system, the name of the operator of the system and the receiving water(s) the system discharges to.
6. The statement: *Any persons desiring to present their views to the Washington State Department of Ecology regarding this application, or interested in Ecology's action on this application, may notify Ecology in writing no later than 30 days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320. Comments can be submitted to: Department of Ecology, PO Box 47696, Olympia, Washington 98504-7696 Attn: Water Quality Program, Construction Stormwater*.

S3. COMPLIANCE WITH STANDARDS

A. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), groundwater quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the Federal water quality criteria applicable to Washington. (40 CFR Part 131.45) Discharges that are not in compliance with these standards are prohibited.

B. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply All Known, Available, and Reasonable methods of prevention, control, and Treatment (AKART). This includes the preparation and implementation of an adequate SWPPP, with all appropriate BMPs installed and maintained in accordance with the SWPPP and the terms and conditions of this permit.

C. Ecology presumes that a Permittee complies with water quality standards unless discharge monitoring data or other site-specific information demonstrates that a discharge causes or contributes to a violation of water quality standards, when the Permittee complies with the following conditions. The Permittee must fully:

1. Comply with all permit conditions, including; planning, sampling, monitoring, reporting, and recordkeeping conditions.

2. Implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent to BMPs contained in stormwater management manuals published or approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate BMPs for on-site pollution control. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the *Phase I Municipal Stormwater Permit* are approved by Ecology.)

D. Where construction sites also discharge to groundwater, the groundwater discharges must also meet the terms and conditions of this CSWGP. Permittees who discharge to groundwater through an injection well must also comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

S4. MONITORING REQUIREMENTS, BENCHMARKS, AND REPORTING TRIGGERS

A. Site Log Book

The Permittee must maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements, including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

B. Site Inspections

Construction sites one (1) acre or larger that discharge stormwater to surface waters of the State must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Sites less than one (1) acre may have a person without CESCL certification conduct inspections. (See Special Conditions S4.B.3 and B.4, below, for detailed requirements of the Permittee's CESCL.)

Site inspections must include all areas disturbed by construction activities, all BMPs, and all stormwater discharge points under the Permittee's operational control.

1. The Permittee must have staff knowledgeable in the principles and practices of erosion and sediment control. The CESCL (sites one acre or more) or inspector (sites less than one acre) must have the skills to assess the:

    a. Site conditions and construction activities that could impact the quality of stormwater; and

    b. Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. The SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times. The CESCL (sites one (1) acre or more) must obtain this certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology. (See BMP C160 in the manual, referred to in Special Condition S9.C.1 and 2.)

2. The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. BMP effectiveness must be evaluated to

determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

Based on the results of the inspection, the Permittee must correct the problems identified, by:

a. Reviewing the SWPPP for compliance with Special Condition S9 and making appropriate revisions within 7 days of the inspection.

b. Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs, within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

c. Documenting BMP implementation and maintenance in the site log book.

3. The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one (1) day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one (1) inspection is required that week.) Inspection frequency may be reduced to once every calendar month for inactive sites that are temporarily stabilized.

4. The Permittee must summarize the results of each inspection in an inspection report or checklist and enter the report/checklist into, or attach it to, the site log book. At a minimum, each inspection report or checklist must include:

   a. Inspection date and time.

   b. Weather information.

   c. The general conditions during inspection.

   d. The approximate amount of precipitation since the last inspection.

   e. The approximate amount of precipitation within the last 24 hours.

   f. A summary or list of all implemented BMPs, including observations of all erosion/sediment control structures or practices.

   g. A description of:

      i. BMPs inspected (including location).

      ii. BMPs that need maintenance and why.

      iii. BMPs that failed to operate as designed or intended, and

      iv. Where additional or different BMPs are needed, and why.

   h. A description of stormwater discharged from the site. The Permittee must note the presence of suspended sediment, turbidity, discoloration, and oil sheen, as applicable.

i. Any water quality monitoring performed during inspection.

j. General comments and notes, including a brief description of any BMP repairs, maintenance, or installations made following the inspection.

k. An implementation schedule for the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

l. A summary report of the inspection.

m. The name, title, and signature of the person conducting the site inspection, a phone number or other reliable method to reach this person, and the following statement: *I certify that this report is true, accurate, and complete to the best of my knowledge and belief.*

Table 3 Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	CESCL Required for Inspections?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

[1] Soil disturbance is calculated by adding together all areas that will be affected by construction activity. Construction activity means clearing, grading, excavation, and any other activity that disturbs the surface of the land, including ingress/egress from the site.

[2] If construction activity results in the disturbance of 1 acre or more, and involves significant concrete work (1,000 cubic yards of concrete or recycled concrete placed or poured over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer stormwater collection system that drains to other surface waters of the State, the Permittee must conduct pH sampling in accordance with Special Condition S4.D.

[3] Sites with one or more acres, but fewer than 5 acres of soil disturbance, must conduct turbidity or transparency sampling in accordance with Special Condition S4.C.4.a or b.

[4] Sites equal to or greater than 5 acres of soil disturbance must conduct turbidity sampling using a turbidity meter in accordance with Special Condition S4.C.4.a.

C. Turbidity/Transparency Sampling Requirements

1. Sampling Methods

    a. If construction activity involves the disturbance of five (5) acres or more, the Permittee must conduct turbidity sampling per Special Condition S4.C.4.a, below.

    b. If construction activity involves one (1) acre or more but fewer than five (5) acres of soil disturbance, the Permittee must conduct either transparency sampling *or* turbidity sampling per Special Condition S4.C.4.a or b, below.

2. Sampling Frequency

    a. The Permittee must sample all discharge points at least once every calendar week when stormwater (or authorized non-stormwater) discharges from the site or enters any on-site surface waters of the state (for example, a creek running through a site); sampling is not required on sites that disturb less than an acre.

    b. Samples must be representative of the flow and characteristics of the discharge.

    c. Sampling is not required when there is no discharge during a calendar week.

    d. Sampling is not required outside of normal working hours or during unsafe conditions.

    e. If the Permittee is unable to sample during a monitoring period, the Permittee must include a brief explanation in the monthly Discharge Monitoring Report (DMR).

    f. Sampling is not required before construction activity begins.

    g. The Permittee may reduce the sampling frequency for temporarily stabilized, inactive sites to once every calendar month.

3. Sampling Locations

    a. Sampling is required at all points where stormwater associated with construction activity (or authorized non-stormwater) is discharged off site, including where it enters any on-site surface waters of the state (for example, a creek running through a site).

    b. The Permittee may discontinue sampling at discharge points that drain areas of the project that are fully stabilized to prevent erosion.

    c. The Permittee must identify all sampling point(s) in the SWPPP and on the site map and clearly mark these points in the field with a flag, tape, stake or other visible marker.

    d. Sampling is not required for discharge that is sent directly to sanitary or combined sewer systems.

    e. The Permittee may discontinue sampling at discharge points in areas of the project where the Permittee no longer has operational control of the construction activity.

4. Sampling and Analysis Methods

   a. The Permittee performs turbidity analysis with a calibrated turbidity meter (turbidimeter) either on site or at an accredited lab. The Permittee must record the results in the site log book in nephelometric turbidity units (NTUs).

   b. The Permittee performs transparency analysis on site with a 1¾ inch diameter, 60 centimeter (cm)-long transparency tube. The Permittee will record the results in the site log book in centimeters (cm).

Table 4 Monitoring and Reporting Requirements

Parameter	Unit	Analytical Method	Sampling Frequency	Benchmark Value
Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs
Transparency	Cm	Manufacturer instructions, or Ecology guidance	Weekly, if discharging	33 cm

5. Turbidity/Transparency Benchmark Values and Reporting Triggers

   The benchmark value for turbidity is 25 NTUs. The benchmark value for transparency is 33 centimeters (cm). Note: Benchmark values do not apply to discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus; these discharges are subject to a numeric effluent limit for turbidity. Refer to Special Condition S8 for more information and follow S5.F – Noncompliance Notification for reporting requirements applicable to discharges which exceed the numeric effluent limit for turbidity.

   a. Turbidity 26 – 249 NTUs, or Transparency 32 – 7 cm:

      If the discharge turbidity is 26 to 249 NTUs; or if discharge transparency is 32 to 7 cm, the Permittee must:

      i. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs, and no later than 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

      ii. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

      iii. Document BMP implementation and maintenance in the site log book.

   b. Turbidity 250 NTUs or greater, or Transparency 6 cm or less:

      If a discharge point's turbidity is 250 NTUs or greater, or if discharge transparency is less than or equal to 6 cm, the Permittee must complete the reporting and adaptive

management process described below. For discharges which are subject to a numeric effluent limit for turbidity, see S5.F – Noncompliance Notification.

i. Within 24 hours, telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) number (or through Ecology's Water Quality Permitting Portal [WQWebPortal] – Permit Submittals when the form is available), in accordance with Special Condition S5.A.

- **Central Region** (Okanogan, Chelan, Douglas, Kittitas, Yakima, Klickitat, Benton): (509) 575-2490
- **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
- **Northwest Region** (Kitsap, Snohomish, Island, King, San Juan, Skagit, Whatcom): (425) 649-7000
- **Southwest Region** (Grays Harbor, Lewis, Mason, Thurston, Pierce, Clark, Cowlitz, Skamania, Wahkiakum, Clallam, Jefferson, Pacific): (360) 407-6300

These numbers and a link to the ERTS reporting page are also listed at the following website: http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html.

ii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iii. Sample discharges daily until:

a) Turbidity is 25 NTUs (or lower); or

b) Transparency is 33 cm (or greater); or

c) The Permittee has demonstrated compliance with the water quality standard for turbidity:

1) No more than 5 NTUs over background turbidity, if background is less than 50 NTUs, or

2) No more than 10% over background turbidity, if background is 50 NTUs or greater; or

*Note: background turbidity in the receiving water must be measured immediately upstream (upgradient) or outside of the area of influence of the discharge.

d) The discharge stops or is eliminated.

iv. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within seven (7) days of the date the discharge exceeded the benchmark.

v. Document BMP implementation and maintenance in the site log book.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with permit benchmarks.

D. pH Sampling Requirements – Significant Concrete Work or Engineered Soils

If construction activity results in the disturbance of 1 acre or more, *and* involves significant concrete work (significant concrete work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer system that drains to surface waters of the State, the Permittee must conduct pH sampling as set forth below. Note: In addition, discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for high pH are subject to a numeric effluent limit for pH; refer to Special Condition S8.

1. The Permittee must perform pH analysis on site with a calibrated pH meter, pH test kit, or wide range pH indicator paper. The Permittee must record pH sampling results in the site log book.

2. During the applicable pH monitoring period defined below, the Permittee must obtain a representative sample of stormwater and conduct pH analysis at least once per week.

    a. For sites with significant concrete work, the Permittee must begin the pH sampling period when the concrete is first placed or poured and exposed to precipitation, and continue weekly throughout and after the concrete placement, pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 (su).

    b. For sites with recycled concrete where monitoring is required, the Permittee must begin the weekly pH sampling period when the recycled concrete is first exposed to precipitation and must continue until the recycled concrete is fully stabilized with the stormwater pH in the range of 6.5 to 8.5 (su).

    c. For sites with engineered soils, the Permittee must begin the pH sampling period when the soil amendments are first exposed to precipitation and must continue until the area of engineered soils is fully stabilized.

3. The Permittee must sample pH in the sediment trap/pond(s) or other locations that receive stormwater runoff from the area of significant concrete work or engineered soils before the stormwater discharges to surface waters.

4. The benchmark value for pH is 8.5 standard units. Anytime sampling indicates that pH is 8.5 or greater, the Permittee must either:

    a. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters of the state; *or*

    b. If necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO_2) sparging, dry ice or food grade vinegar. The Permittee must obtain written approval from Ecology before using any form of chemical treatment other than CO_2 sparging, dry ice or food grade vinegar.

S5. REPORTING AND RECORDKEEPING REQUIREMENTS

A. High Turbidity Reporting

Anytime sampling performed in accordance with Special Condition S4.C indicates turbidity has reached the 250 NTUs or more (or transparency less than or equal to 6 cm), high turbidity reporting level, the Permittee must notify Ecology within 24 hours of analysis either by calling the applicable Ecology Region's Environmental Report Tracking System (ERTS) number by phone or by submitting an electronic ERTS report (through Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals when the form is available). See the CSWGP website for links to ERTS and the WQWebPortal. (http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html) Also, see phone numbers in Special Condition S4.C.5.b.i.

B. Discharge Monitoring Reports (DMRs)

Permittees required to conduct water quality sampling in accordance with Special Conditions S4.C (Turbidity/Transparency), S4.D (pH), S8 (303[d]/TMDL sampling), and/or G12 (Additional Sampling) must submit the results to Ecology.

Permittees must submit monitoring data using Ecology's WQWebDMR web application accessed through Ecology's Water Quality Permitting Portal.

Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper copy DMR at:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

Permittees who obtain a waiver not to use WQWebDMR must use the forms provided to them by Ecology; submittals must be mailed to the address above. Permittees must submit DMR forms to be received by Ecology within 15 days following the end of each month.

If there was no discharge during a given monitoring period, all Permittees must submit a DMR as required with "no discharge" entered in place of the monitoring results. DMRs are required for the full duration of permit coverage (from the first full month following the effective date of permit coverage up until Ecology has approved termination of the coverage). For more information, contact Ecology staff using information provided at the following website: www.ecy.wa.gov/programs/wq/permits/paris/contacts.html.

C. Records Retention

The Permittee must retain records of all monitoring information (site log book, sampling results, inspection reports/checklists, etc.), Stormwater Pollution Prevention Plan, copy of the permit coverage letter (including Transfer of Coverage documentation) and any other documentation of compliance with permit requirements for the entire life of the construction project and for a minimum of five (5) years following the termination of permit coverage. Such information must include all calibration and maintenance records, and records of all data used to complete the application for this permit. This period of retention must be extended during

the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

D. Recording Results

For each measurement or sample taken, the Permittee must record the following information:

1. Date, place, method, and time of sampling or measurement.
2. The first and last name of the individual who performed the sampling or measurement.
3. The date(s) the analyses were performed.
4. The first and last name of the individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee samples or monitors any pollutant more frequently than required by this permit using test procedures specified by Special Condition S4 of this permit, the sampling results for this monitoring must be included in the calculation and reporting of the data submitted in the Permittee's DMR.

F. Noncompliance Notification

In the event the Permittee is unable to comply with any part of the terms and conditions of this permit, and the resulting noncompliance may cause a threat to human health or the environment (such as but not limited to spills or fuels or other materials, catastrophic pond or slope failure, and discharges that violate water quality standards), or exceed numeric effluent limitations (see S8 – Discharges to 303(d) or TMDL Waterbodies), the Permittee must, upon becoming aware of the circumstance:

1. Notify Ecology within 24 hours of the failure to comply by calling the applicable Regional office ERTS phone number (refer to Special Condition S4.C.5.b.i, or go to https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue to find contact information for the regional offices.)
2. Immediately take action to prevent the discharge/pollution, or otherwise stop or correct the noncompliance, and, if applicable, repeat sampling and analysis of any noncompliance immediately and submit the results to Ecology within five (5) days of becoming aware of the violation (See S5.F.3, below, for details on submitting results in a report).
3. Submit a detailed written report to Ecology within five (5) days of the time the Permittee becomes aware of the circumstances, unless requested earlier by Ecology. The report must be submitted using Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals, unless a waiver from electronic reporting has been granted according to S5.B. The report must contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Permittee must report any unanticipated bypass and/or upset that exceeds any effluent limit in the permit in accordance with the 24-hour reporting requirement contained in 40 C.F.R. 122.41(l)(6).

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply. Upon request of the Permittee, Ecology may waive the requirement for a written report on a case-by-case basis, if the immediate notification is received by Ecology within 24 hours.

G. Access to Plans and Records

1. The Permittee must retain the following permit documentation (plans and records) on site, or within reasonable access to the site, for use by the operator or for on-site review by Ecology or the local jurisdiction:

    a. General Permit

    b. Permit Coverage Letter

    c. Stormwater Pollution Prevention Plan (SWPPP)

    d. Site Log Book

    e. Erosivity Waiver (if applicable)

2. The Permittee must address written requests for plans and records listed above (Special Condition S5.G.1) as follows:

    a. The Permittee must provide a copy of plans and records to Ecology within 14 days of receipt of a written request from Ecology.

    b. The Permittee must provide a copy of plans and records to the public when requested in writing. Upon receiving a written request from the public for the Permittee's plans and records, the Permittee must either:

        i. Provide a copy of the plans and records to the requester within 14 days of a receipt of the written request; *or*

        ii. Notify the requester within 10 days of receipt of the written request of the location and times within normal business hours when the plans and records may be viewed; and provide access to the plans and records within 14 days of receipt of the written request; *or*

            Within 14 days of receipt of the written request, the Permittee may submit a copy of the plans and records to Ecology for viewing and/or copying by the requester at an Ecology office, or a mutually agreed location. If plans and records are viewed and/or copied at a location other than at an Ecology office, the Permittee will provide reasonable access to copying services for which a reasonable fee may be charged. The Permittee must notify the requester within 10 days of receipt of the request where the plans and records may be viewed and/or copied.

S6. PERMIT FEES

The Permittee must pay permit fees assessed by Ecology. Fees for stormwater discharges covered under this permit are established by Chapter 173-224 WAC. Ecology continues to assess permit fees until the permit is terminated in accordance with Special Condition S10 or revoked in accordance with General Condition G5.

S7. SOLID AND LIQUID WASTE DISPOSAL

The Permittee must handle and dispose of solid and liquid wastes generated by construction activity, such as demolition debris, construction materials, contaminated materials, and waste materials from maintenance activities, including liquids and solids from cleaning catch basins and other stormwater facilities, in accordance with:

A. Special Condition S3, Compliance with Standards.

B. WAC 173-216-110.

C. Other applicable regulations.

S8. DISCHARGES TO 303(d) OR TMDL WATERBODIES

A. Sampling and Numeric Effluent Limits For Certain Discharges to 303(d)-Listed Water Bodies

1. Permittees who discharge to segments of water bodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, high pH, or phosphorus, must conduct water quality sampling according to the requirements of this section, and Special Conditions S4.C.2.b-f and S4.C.3.b-d, and must comply with the applicable numeric effluent limitations in S8.C and S8.D.

2. All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current listing by Ecology of impaired waters (Category 5) that exists on January 1, 2021, or the date when the operator's complete permit application is received by Ecology, whichever is later.

B. Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters

Construction sites that discharge to a TMDL or 303(d)-listed waterbody are not eligible for coverage under this permit *unless* the operator:

1. Prevents exposing stormwater to pollutants for which the waterbody is impaired, and retains documentation in the SWPPP that details procedures taken to prevent exposure on site; *or*

2. Documents that the pollutants for which the waterbody is impaired are not present at the site, and retains documentation of this finding within the SWPPP; *or*

3. Provides Ecology with data indicating the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retains such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrate:

    a. For discharges to waters without an EPA-approved or -established TMDL, that the discharge of the pollutant for which the water is impaired will meet in-stream water quality criteria at the point of discharge to the waterbody; *or*

    b. For discharges to waters with an EPA-approved or -established TMDL, that there is sufficient remaining wasteload allocation in the TMDL to allow construction stormwater discharge and that existing dischargers to the waterbody are subject to compliance schedules designed to bring the waterbody into attainment with water quality standards.

    Operators of construction sites are eligible for coverage under this permit only after Ecology makes an affirmative determination that the *discharge will not cause or contribute to the existing impairment or exceed the TMDL.*

C. Sampling and Numeric Effluent Limits for Discharges to Water Bodies on the 303(d) List for Turbidity, Fine Sediment, or Phosphorus

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus must conduct turbidity sampling in accordance with Special Condition S4.C.2 and comply with either of the numeric effluent limits noted in Table 5 below.

2. As an alternative to the 25 NTUs effluent limit noted in Table 5 below (applied at the point where stormwater [or authorized non-stormwater] is discharged off-site), Permittees may choose to comply with the surface water quality standard for turbidity. The standard is: no more than 5 NTUs over background turbidity when the background turbidity is 50 NTUs or less, or no more than a 10% increase in turbidity when the background turbidity is more than 50 NTUs. In order to use the water quality standard requirement, the sampling must take place at the following locations:

    a. Background turbidity in the 303(d)-listed receiving water immediately upstream (upgradient) or outside the area of influence of the discharge.

    b. Turbidity at the point of discharge into the 303(d)-listed receiving water, inside the area of influence of the discharge**.**

3. Discharges that exceed the numeric effluent limit for turbidity constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

Table 5 Turbidity, Fine Sediment & Phosphorus Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Sampling Frequency	Numeric Effluent Limit[1]
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs, at the point where stormwater is discharged from the site; ***OR*** In compliance with the surface water quality standard for turbidity (S8.C.2.a)

[1] Permittees subject to a numeric effluent limit for turbidity may, at their discretion, choose either numeric effluent limitation based on site-specific considerations including, but not limited to, safety, access and convenience.

D. Discharges to Water Bodies on the 303(d) List for High pH

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for high pH must conduct pH sampling in accordance with the table below, and comply with the numeric effluent limit of pH 6.5 to 8.5 su (Table 6).

Table 6 pH Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled/Units	Analytical Method	Sampling Frequency	Numeric Effluent Limit
High pH	pH /Standard Units	pH meter	Weekly, if discharging	In the range of 6.5 – 8.5 su

2. At the Permittee's discretion, compliance with the limit shall be assessed at one of the following locations:

   a. Directly in the 303(d)-listed waterbody segment, inside the immediate area of influence of the discharge; *or*

   b. Alternatively, the Permittee may measure pH at the point where the discharge leaves the construction site, rather than in the receiving water.

3. Discharges that exceed the numeric effluent limit for pH (outside the range of 6.5 – 8.5 su) constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

E. Sampling and Limits for Sites Discharging to Waters Covered by a TMDL or another Pollution Control Plan

1. Discharges to a waterbody that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL. Refer to http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html for more information on TMDLs.

    a. Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges must be consistent with any specific waste load allocations or requirements established by the applicable TMDL.

        i. The Permittee must sample discharges weekly, unless otherwise specified by the TMDL, to evaluate compliance with the specific waste load allocations or requirements.

        ii. Analytical methods used to meet the monitoring requirements must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136.

        iii. Turbidity and pH methods need not be accredited or registered unless conducted at a laboratory which must otherwise be accredited or registered.

    b. Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but has not identified specific requirements, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    c. Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    d. Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

S9. STORMWATER POLLUTION PREVENTION PLAN

The Permittee must prepare and properly implement an adequate Stormwater Pollution Prevention Plan (SWPPP) for construction activity in accordance with the requirements of this permit beginning with initial soil disturbance and until final stabilization.

A. The Permittee's SWPPP must meet the following objectives:

1. To identify best management practices (BMPs) which prevent erosion and sedimentation, and to reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. To prevent violations of surface water quality, groundwater quality, or sediment management standards.

3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

1. The SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

    a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

    b. Potential erosion problem areas.

    c. The 13 elements of a SWPPP in Special Condition S9.D.1-13, including BMPs used to address each element.

    d. Construction phasing/sequence and general BMP implementation schedule.

    e. The actions to be taken if BMP performance goals are not achieved—for example, a contingency plan for additional treatment and/or storage of stormwater that would violate the water quality standards if discharged.

    f. Engineering calculations for ponds, treatment systems, and any other designed structures. When a treatment system requires engineering calculations, these calculations must be included in the SWPPP. Engineering calculations do not need to be included in the SWPPP for treatment systems that do not require such calculations.

2. The Permittee must modify the SWPPP if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee must then:

    a. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the inspection or investigation.

    b. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than 10 days from the inspection or investigation. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

    c. Document BMP implementation and maintenance in the site log book.

    The Permittee must modify the SWPPP whenever there is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

C. Stormwater Best Management Practices (BMPs)

BMPs must be consistent with:

1. *Stormwater Management Manual for Western Washington* (most current approved edition at the time this permit was issued), for sites west of the crest of the Cascade Mountains; *or*

2. *Stormwater Management Manual for Eastern Washington* (most current approved edition at the time this permit was issued), for sites east of the crest of the Cascade Mountains; *or*

3. Revisions to the manuals listed in Special Condition S9.C.1 & 2, or other stormwater management guidance documents or manuals which provide an equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230; *or*

4. Documentation in the SWPPP that the BMPs selected provide an equivalent level of pollution prevention, compared to the applicable stormwater management manuals, including:

    a. The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.

    b. An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

D. SWPPP – Narrative Contents and Requirements

The Permittee must include each of the 13 elements below in Special Condition S9.D.1-13 in the narrative of the SWPPP and implement them unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits

    a. Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.

    b. Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access

    a. Limit construction vehicle access and exit to one route, if possible.

    b. Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking sediment onto roads.

    c. Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

    d. If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pickup and transport of the sediment to a controlled sediment disposal area.

    e. Conduct street washing only after sediment removal in accordance with Special Condition S9.D.2.d.

    f. Control street wash wastewater by pumping back on site or otherwise preventing it from discharging into systems tributary to waters of the State.

3. Control Flow Rates

    a. Protect properties and waterways downstream of construction sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site, as required by local plan approval authority.

    b. Where necessary to comply with Special Condition S9.D.3.a, construct stormwater infiltration or detention BMPs as one of the first steps in grading. Assure that detention BMPs function properly before constructing site improvements (for example, impervious surfaces).

    c. If permanent infiltration ponds are used for flow control during construction, protect these facilities from sedimentation during the construction phase.

4. Install Sediment Controls

    The Permittee must design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, the Permittee must:

    a. Construct sediment control BMPs (sediment ponds, traps, filters, infiltration facilities, etc.) as one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.

    b. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

    c. Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Special Condition S9.D.3.a.

    d. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

    e. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.

    f. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

5. Stabilize Soils

    a. The Permittee must stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion

control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.

b. The Permittee must control stormwater volume and velocity within the site to minimize soil erosion.

c. The Permittee must control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

d. Depending on the geographic location of the project, the Permittee must not allow soils to remain exposed and unworked for more than the time periods set forth below to prevent erosion.

West of the Cascade Mountains Crest
During the dry season (May 1 - September 30): 7 days
During the wet season (October 1 - April 30): 2 days

East of the Cascade Mountains Crest, except for Central Basin*
During the dry season (July 1 - September 30): 10 days
During the wet season (October 1 - June 30): 5 days

The Central Basin*, East of the Cascade Mountains Crest
During the dry Season (July 1 - September 30): 30 days
During the wet season (October 1 - June 30): 15 days

***Note: The Central Basin** is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

e. The Permittee must stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

f. The Permittee must stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

g. The Permittee must minimize the amount of soil exposed during construction activity.

h. The Permittee must minimize the disturbance of steep slopes.

i. The Permittee must minimize soil compaction and, unless infeasible, preserve topsoil.

6. Protect Slopes

a. The Permittee must design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).

b. The Permittee must divert off-site stormwater (run-on) or groundwater away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.

c. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.

i. West of the Cascade Mountains Crest: Temporary pipe slope drains must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Temporary pipe slope drains must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

d. Place excavated material on the uphill side of trenches, consistent with safety and space considerations.

e. Place check dams at regular intervals within constructed channels that are cut down a slope.

7. Protect Drain Inlets

a. Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

b. Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

8. Stabilize Channels and Outlets

a. Design, construct and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:

i. West of the Cascade Mountains Crest: Channels must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

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

9. Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The Permittee must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. Minimize storage of hazardous materials on-site. Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume of the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, recycled concrete stockpiles, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. (Also refer to the definition for "concrete wastewater" in Appendix A – Definitions.)

g. Adjust the pH of stormwater or authorized non-stormwater if necessary to prevent an exceedance of groundwater and/or surface water quality standards.

h. Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete truck drums onto the ground, or into storm drains, open ditches, streets, or streams. Washout of small concrete handling equipment may be disposed of in a formed area awaiting concrete where it will not contaminate surface or groundwater. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge directly to groundwater or surface waters of the State is

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

i. Obtain written approval from Ecology before using any chemical treatment, with the exception of CO_2, dry ice or food grade vinegar, to adjust pH.

j. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, in conjunction with BMPs to reduce sedimentation before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point groundwater, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other dewatering treatment or disposal options may include:

i. Infiltration

ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.

iii. Ecology-approved on-site chemical treatment or other suitable treatment technologies (See S9.D.9.i, regarding chemical treatment written approval).

iv. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

v. Use of a sedimentation bag with discharge to a ditch or swale for small volumes of localized dewatering.

d. Permittees must handle highly turbid or contaminated dewatering water separately from stormwater.

11. Maintain BMPs

a. Permittees must maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.

b. Permittees must remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

12. Manage the Project

    a. Phase development projects to the maximum degree practicable and take into account seasonal work limitations.

    b. Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with Special Condition S4.

    c. Maintain, update, and implement the SWPPP in accordance with Special Conditions S3, S4, and S9.

13. Protect Low Impact Development (LID) BMPs

    The primary purpose of on-site LID Stormwater Management is to reduce the disruption of the natural site hydrology through infiltration. LID BMPs are permanent facilities.

    a. Permittees must protect all LID BMPs (including, but not limited to, Bioretention and Rain Garden facilities) from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden facilities. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the facility must include removal of sediment and any sediment-laden bioretention/ rain garden soils, and replacing the removed soils with soils meeting the design specification.

    b. Permittees must maintain the infiltration capabilities of LID BMPs by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

    c. Permittees must control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.

    d. Permittees must clean permeable pavements fouled with sediments or no longer passing an initial infiltration test using local stormwater manual methodology or the manufacturer's procedures.

    e. Permittees must keep all heavy equipment off existing soils under LID BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

E. SWPPP – Map Contents and Requirements

The Permittee's SWPPP must also include a vicinity map or general location map (for example, a USGS quadrangle map, a portion of a county or city map, or other appropriate map) with enough detail to identify the location of the construction site and receiving waters within one mile of the site.

The SWPPP must also include a legible site map (or maps) showing the entire construction site. The following features must be identified, unless not applicable due to site conditions.

1. The direction of north, property lines, and existing structures and roads.

2. Cut and fill slopes indicating the top and bottom of slope catch lines.

3. Approximate slopes, contours, and direction of stormwater flow before and after major grading activities.

4. Areas of soil disturbance and areas that will not be disturbed.

5. Locations of structural and nonstructural controls (BMPs) identified in the SWPPP.

6. Locations of off-site material, stockpiles, waste storage, borrow areas, and vehicle/equipment storage areas.

7. Locations of all surface water bodies, including wetlands.

8. Locations where stormwater or non-stormwater discharges off-site and/or to a surface waterbody, including wetlands.

9. Location of water quality sampling station(s), if sampling is required by state or local permitting authority.

10. Areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

11. Location or proposed location of LID facilities.

S10. NOTICE OF TERMINATION

Partial terminations of permit coverage are not authorized.

A. The site is eligible for termination of coverage when it has met any of the following conditions:

1. The site has undergone final stabilization, the Permittee has removed all temporary BMPs (except biodegradable BMPs clearly manufactured with the intention for the material to be left in place and not interfere with maintenance or land use), and all stormwater discharges associated with construction activity have been eliminated; *or*

2. All portions of the site that have not undergone final stabilization per Special Condition S10.A.1 have been sold and/or transferred (per Special Condition S2.A), and the Permittee no longer has operational control of the construction activity; *or*

3. For residential construction only, the Permittee has completed temporary stabilization and the homeowners have taken possession of the residences.

B. When the site is eligible for termination, the Permittee must submit a complete and accurate Notice of Termination (NOT) form, signed in accordance with General Condition G2, to:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

When an electronic termination form is available, the Permittee may choose to submit a complete and accurate Notice of Termination (NOT) form through the Water Quality Permitting Portal rather than mailing a hardcopy as noted above.

The termination is effective on the 31st calendar day following the date Ecology receives a complete NOT form, unless Ecology notifies the Permittee that termination request is denied because the Permittee has not met the eligibility requirements in Special Condition S10.A.

Permittees are required to comply with all conditions and effluent limitations in the permit until the permit has been terminated.

Permittees transferring the property to a new property owner or operator/Permittee are required to complete and submit the Notice of Transfer form to Ecology, but are not required to submit a Notice of Termination form for this type of transaction.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit must be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the general permit must constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications must bear a certification of correctness to be signed:

1. In the case of corporations, by a responsible corporate officer.
2. In the case of a partnership, by a general partner of a partnership.
3. In the case of sole proprietorship, by the proprietor.
4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology (including NOIs, NOTs, and Transfer of Coverage forms) must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records are kept under the terms and conditions of this permit.

B. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.

C. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved, or

D. When information is obtained that indicates cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

Pursuant to Chapter 43.21B RCW and Chapter 173-226 WAC, the Director may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

A. Violation of any term or condition of this permit.

B. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

D. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

E. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

F. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

G. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

The Director may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee must submit a new application, or a supplement to the previous application, whenever a material change to the construction activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application must be submitted at least sixty (60) days prior to any proposed changes. Filing a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit will be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal at least 180 days prior to the specified expiration date of this permit. The Permittee must reapply using the electronic application form (NOI) available on Ecology's website. Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

G9. REMOVED SUBSTANCE

The Permittee must not re-suspend or reintroduce collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information that Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment at the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G14. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Special Condition S5.F, and; 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G15. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G16. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G17. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G18. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four (4) years, or both.

G19. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, give notice to Ecology of planned physical alterations, modifications or additions to the permitted construction activity. The Permittee should be aware that, depending on the nature and size of the changes to the original permit, a new public notice and other permit process requirements may be required. Changes in activities that require reporting to Ecology include those that will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant change in the nature or an increase in quantity of pollutants discharged, including but not limited to: a 20% or greater increase in acreage disturbed by construction activity.

C. A change in or addition of surface water(s) receiving stormwater or non-stormwater from the construction activity.

D. A change in the construction plans and/or activity that affects the Permittee's monitoring requirements in Special Condition S4.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G20. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it must promptly submit such facts or information.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee must give advance notice to Ecology by submission of a new application or supplement thereto at least forty-five (45) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of

operation and degradation of effluent quality, must be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G22. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit. The discharger must submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons will fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director will either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to the construction stormwater general permit, the applicability of the construction stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G23. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW, and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit's applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G24. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G25. BYPASS PROHIBITED

A. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited for stormwater events below the design criteria for stormwater management. Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, 3 or 4) is applicable.

1. Bypass of stormwater is consistent with the design criteria and part of an approved management practice in the applicable stormwater management manual.

2. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health.

3. Bypass of stormwater is unavoidable, unanticipated, and results in noncompliance of this permit.

   This bypass is permitted only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

   c. Ecology is properly notified of the bypass as required in Special Condition S5.F of this permit.

4. A planned action that would cause bypass of stormwater and has the potential to result in noncompliance of this permit during a storm event.

   The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

   a. A description of the bypass and its cause

   b. An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.

   c. A cost-effectiveness analysis of alternatives including comparative resource damage assessment.

   d. The minimum and maximum duration of bypass under each alternative.

   e. A recommendation as to the preferred alternative for conducting the bypass.

   f. The projected date of bypass initiation.

   g. A statement of compliance with SEPA.

   h. A request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated.

   i. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

5. For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during

preparation of the Stormwater Pollution Prevention Plan (SWPPP) and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Ecology will consider the following before issuing an administrative order for this type bypass:

a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve, conditionally approve, or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

B. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

APPENDIX A – DEFINITIONS

AKART is an acronym for "**A**ll **K**nown, **A**vailable, and **R**easonable methods of prevention, control, and **T**reatment." AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus, which was completed and approved by EPA before January 1, 2021, or before the date the operator's complete permit application is received by Ecology, whichever is later. TMDLs completed after a complete permit application is received by Ecology become applicable to the Permittee only if they are imposed through an administrative order by Ecology, or through a modification of permit coverage.

Applicant means an *operator* seeking coverage under this permit.

Benchmark means a pollutant concentration used as a permit threshold, below which a pollutant is considered unlikely to cause a water quality violation, and above which it may. When pollutant concentrations exceed benchmarks, corrective action requirements take effect. Benchmark values are not water quality standards and are not numeric effluent limitations; they are indicator values.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control stormwater associated with construction activity, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer means an area designated by a local jurisdiction that is contiguous to and intended to protect a sensitive area.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Calendar Day A period of 24 consecutive hours starting at 12:00 midnight and ending the following 12:00 midnight.

Calendar Week (same as **Week**) means a period of seven consecutive days starting at 12:01 a.m. (0:01 hours) on Sunday.

Certified Erosion and Sediment Control Lead (CESCL) means a person who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (See BMP C160 in the SWMM).

Chemical Treatment means the addition of chemicals to stormwater and/or authorized non-stormwater prior to filtration and discharge to surface waters.

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Common Plan of Development or Sale means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Composite Sample means a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increases while maintaining a constant time interval between the aliquots.

Concrete Wastewater means any water used in the production, pouring and/or clean-up of concrete or concrete products, and any water used to cut, grind, wash, or otherwise modify concrete or concrete products. Examples include water used for or resulting from concrete truck/mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing). When stormwater comingles with concrete wastewater, the resulting water is considered concrete wastewater and must be managed to prevent discharge to waters of the State, including groundwater.

Construction Activity means land disturbing operations including clearing, grading or excavation which disturbs the surface of the land (including off-site disturbance acreage related to construction-support activity). Such activities may include road construction, construction of residential houses, office buildings, or industrial buildings, site preparation, soil compaction, movement and stockpiling of topsoils, and demolition activity.

Construction Support Activity means off-site acreage that will be disturbed as a direct result of the construction project and will discharge stormwater. For example, off-site equipment staging yards, material storage areas, borrow areas, and parking areas.

Contaminant means any hazardous substance that does not occur naturally or occurs at greater than natural background levels. See definition of “hazardous substance” and WAC 173-340-200.

Contaminated soil means soil which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Contaminated groundwater means groundwater which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater BMPs is documented within a SWPPP, including:

1. The method and reasons for choosing the stormwater BMPs selected.
2. The pollutant removal performance expected from the BMPs selected.

3. The technical basis supporting the performance claims for the BMPs selected, including any available data concerning field performance of the BMPs selected.
4. An assessment of how the selected BMPs will comply with state water quality standards.
5. An assessment of how the selected BMPs will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Department means the Washington State Department of Ecology.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Dewatering means the act of pumping groundwater or stormwater away from an active construction site.

Director means the Director of the Washington State Department of Ecology or his/her authorized representative.

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such groundwater infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

Engineered Soils means the use of soil amendments including, but not limited, to Portland cement treated base (CTB), cement kiln dust (CKD), or fly ash to achieve certain desirable soil characteristics.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to groundwater than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, sediment traps, and ponds. Erosion and sediment control BMPs are synonymous with stabilization and structural BMPs.

Federal Operator is an entity that meets the definition of "Operator" in this permit and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, performing construction activity for any such department, agency, or instrumentality.

Final Stabilization (same as **fully stabilized** or **full stabilization**) means the completion of all soil disturbing activities at the site and the establishment of permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See the applicable Stormwater Management Manual for more information on vegetative cover expectations and equivalent permanent stabilization measures.

Groundwater means water in a saturated zone or stratum beneath the land surface or a surface waterbody.

Hazardous Substance means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under chapter 70.105 RCW; any hazardous sub-stance as defined in RCW 70.105.010(14) or any hazardous substance as defined by rule under chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101(14) of the federal cleanup law, 42U.S.C., Sec. 9601(14); petroleum or petroleum products; and any substance or category of substances, including solid waste decomposition products, determined by the director by rule to present a threat to human health or the environment if released into the environment. The term hazardous substance does not include any of the following when contained in an underground storage tank from which there is not a release: crude oil or any fraction thereof or petroleum, if the tank is in compliance with all applicable federal, state, and local law.

Injection Well means a well that is used for the subsurface emplacement of fluids. (See **Well**.)

Jurisdiction means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology.

Notice of Intent (NOI) means the application for, or a request for coverage under this general permit pursuant to WAC 173-226-200.

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S10 of this permit.

Operator means any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

Permittee means individual or entity that receives notice of coverage under this general permit.

pH means a liquid's measure of acidity or alkalinity. A pH of 7 is defined as neutral. Large variations above or below this value are considered harmful to most aquatic life.

pH Monitoring Period means the time period in which the pH of stormwater runoff from a site must be tested a minimum of once every seven days to determine if stormwater pH is between 6.5 and 8.5.

Point Source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the State. This term does not include return flows from irrigated agriculture. (See the Fact Sheet for further explanation)

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the CWA, nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the CWA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Process Wastewater means any non-stormwater which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. If stormwater commingles with process wastewater, the commingled water is considered process wastewater.

Receiving Water means the waterbody at the point of discharge. If the discharge is to a storm sewer system, either surface or subsurface, the receiving water is the waterbody to which the storm system discharges. Systems designed primarily for other purposes such as for groundwater drainage, redirecting stream natural flows, or for conveyance of irrigation water/return flows that coincidentally convey stormwater are considered the receiving water.

Representative means a stormwater or wastewater sample which represents the flow and characteristics of the discharge. Representative samples may be a grab sample, a time-proportionate *composite sample*, or a flow proportionate sample. Ecology's Construction Stormwater Monitoring Manual provides guidance on representative sampling.

Responsible Corporate Officer for the purpose of signatory authority means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sanitary Sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation means the depositing or formation of sediment.

Sensitive Area means a waterbody, wetland, stream, aquifer recharge area, or channel migration zone.

SEPA (State Environmental Policy Act) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention or treatment; or an amount of a pollutant that has a reasonable potential to cause a violation of surface or groundwater quality or sediment management standards.

Significant Concrete Work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project.

Significant Contributor of Pollutants means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State of Washington.

Site means the land or water area where any "facility or activity" is physically located or conducted.

Source Control BMPs means physical, structural or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Stabilization means the application of appropriate BMPs to prevent the erosion of soils, such as, temporary and permanent seeding, vegetative covers, mulching and matting, plastic covering and sodding. See also the definition of Erosion and Sediment Control BMPs.

Storm Drain means any drain which drains directly into a *storm sewer system*, usually found along roadways or in parking lots.

Storm Sewer System means a means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains designed or used for collecting or conveying stormwater. This does not include systems which are part of *a combined sewer* or Publicly Owned Treatment Works (POTW), as defined at 40 CFR 122.2.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.

Stormwater Management Manual (SWMM) or **Manual** means the technical Manual published by Ecology for use by local governments that contain descriptions of and design criteria for BMPs to prevent, control, or treat pollutants in stormwater.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Temporary Stabilization means the exposed ground surface has been covered with appropriate materials to provide temporary stabilization of the surface from water or wind erosion. Materials include, but are not limited to, mulch, riprap, erosion control mats or blankets and temporary cover crops. Seeding alone is not considered stabilization. Temporary stabilization is not a substitute for the more permanent “final stabilization.”

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations must include a "margin of safety" to ensure that the waterbody can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation must also account for seasonable variation in water quality.

Transfer of Coverage (TOC) means a request for transfer of coverage under this general permit as specified by Special Condition S2.A of this permit.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Transparency means a measurement of water clarity in centimeters (cm), using a 60 cm transparency tube. The transparency tube is used to estimate the relative clarity or transparency of water by noting the depth at which a black and white Secchi disc becomes visible when water is released from a value in the bottom of the tube. A transparency tube is sometimes referred to as a “turbidity tube.”

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTUs) and measured with a calibrated turbidimeter.

Uncontaminated means free from any contaminant. See definition of “contaminant” and WAC 173-340-200.

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

Waste Load Allocation (WLA) means the portion of a receiving water’s loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2[h]).

Water-Only Based Shaft Drilling is a shaft drilling process that uses water only and no additives are involved in the drilling of shafts for construction of building, road, or bridge foundations.

Water Quality means the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Waters of the State includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which include lakes, rivers, ponds, streams, inland waters, underground waters, salt

waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Well means a bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension. (See **Injection Well**.)

Wheel Wash Wastewater means any water used in, or resulting from the operation of, a tire bath or wheel wash (BMP C106: Wheel Wash), or other structure or practice that uses water to physically remove mud and debris from vehicles leaving a construction site and prevent track-out onto roads. When stormwater comingles with wheel wash wastewater, the resulting water is considered wheel wash wastewater and must be managed according to Special Condition S9.D.9.

APPENDIX B – ACRONYMS

AKART	All Known, Available, and Reasonable Methods of Prevention, Control, and Treatment
BMP	Best Management Practice
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
cm	Centimeters
CPD	Common Plan of Development
CTB	Cement-Treated Base
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
FR	Federal Register
LID	Low Impact Development
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USC	United States Code
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WQ	Water Quality
WWHM	Western Washington Hydrology Model

Appendix H – Engineering Calculations

TESC - SEDIMENTATION TANK SIZING CALCULATIONS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.58
Program License Number: 201910001
Project Simulation Performed on: 06/16/2023 1:41 PM
Report Generation Date: 06/16/2023 1:41 PM

Input File Name: 2023-06-16 Mukilteo ES Ph1 TESC.fld
Project Name: Mariner HS
Analysis Title: TESC Sediment Tank Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 16
Precipitation Station : 96004405 Puget East 44 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961044 Puget East 44 in MAP

Evaporation Scale Factor : 0.750

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

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

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

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	1.680	1.680
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	1.680	1.680

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

---------- Subbasin : Disturbed Areas ----------

	-------Area (Acres) --------
C, Forest, Mod	1.680

TESC - SEDIMENTATION TANK SIZING CALCULATIONS

Subbasin Total 1.680

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

---------- Subbasin : Proposed To Flow Control ----------
-------Area (Acres) --------
ROADS/MOD 1.680

Subbasin Total 1.680

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

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

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

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

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

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

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

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

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

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

Total Predeveloped Recharge During Simulation
Model Element Recharge Amount (ac-ft)

TESC - SEDIMENTATION TANK SIZING CALCULATIONS

Subbasin: Disturbed Areas 319.673
Link: New Copy Lnk1 0.000

Total: 319.673

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Proposed To Flow Con	0.000
Link: New Copy Lnk1	0.000
Total:	0.000

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 2.023 ac-ft/year, Post Developed: 0.000 ac-ft/year

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

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

Number of Links: 1

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

2-Year Discharge Rate : 0.043 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.03 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.02 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 204.58
Inflow Volume Including PPT-Evap (ac-ft): 204.58
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 204.58
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

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

Number of Links: 1

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

2-Year Discharge Rate : 0.804 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.29 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.17 cfs

TESC - SEDIMENTATION TANK SIZING CALCULATIONS

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 848.17
Inflow Volume Including PPT-Evap (ac-ft): 848.17
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 848.17
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

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

Scenario Predeveloped Compliance Link: New Copy Lnk1
Scenario Postdeveloped Compliance Link: New Copy Lnk1

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

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.321E-02	2-Year	0.804
5-Year	6.925E-02	5-Year	1.056
10-Year	9.031E-02	10-Year	1.352
25-Year	0.124	25-Year	1.729
50-Year	0.156	50-Year	1.882
100-Year	0.166	100-Year	2.482
200-Year	0.265	200-Year	2.798
500-Year	0.398	500-Year	3.206

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

Proposed Runoff Conditions for TESC - Entire Site

Total Site:	Area (ac)
Pervious Area	0.000
Impervious Area	1.680
Total Area	1.680

MGS Flood

Data Type	Reduced
Time Step	15-min

MGS - Flood 2-Yr developed flow	**0.804**	cfs
MGS - Flood 10-Yr developed flow	1.352	cfs
MGS - Flood 25-Yr developed flow	1.729	cfs
MGS - Flood 100-Yr developed flow	2.482	cfs

Temporary Sediment Trap Sizing: Storage Volume per Section D.2.1.5, ESC Measures: Selection of the Design Storm of the 2021 King County Surface Water Design Manual - Appendix D:

Vr=S.A. x 3.5'

Vr = Minimum Required Storage Volume
S.A. = Minimum allowable top surface area of pond
* the volume is based a minimum pond depth of 3.5' - this depth does not include the minimum sediment storage volume or freeboard

S.A. = (2Q2)/Vsed
Q = design peak flow rate
Vsed = 0.00096 Settling Velocity (0.00096 ft/sec)

Q=	**0.804**	cfs	INPUT (note that this is the 10-yr design peak flow rate in cfs)
S.A. =	1675	sf	
Vr=	**5863**	cf	Volume Required
	43,855	gal	

Assume 18,900 gallons per sediment storage tank, then 3 sediment storage tanks are required.