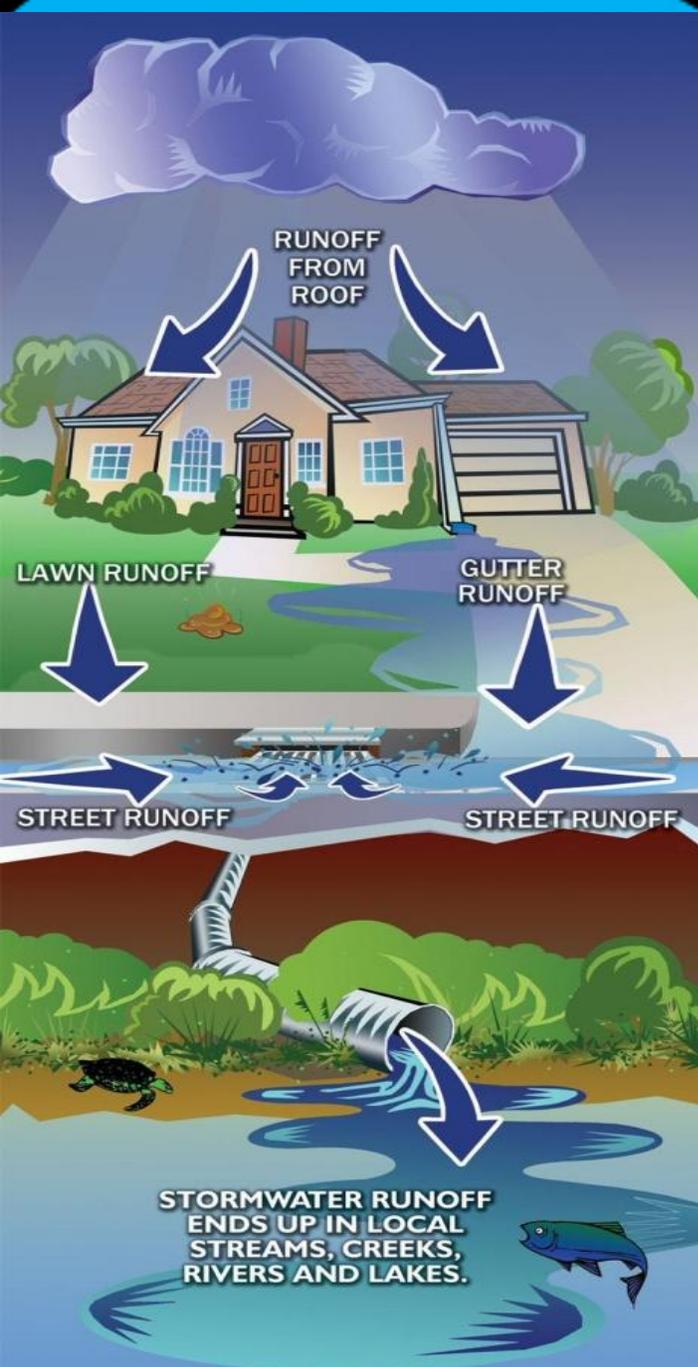


## **WMD Stormwater Management Program 2014**

# STORMWATER MANAGEMENT PROGRAM

2014



## Washington Military Department

Camp Murray WA 98430

Permit No. WAR04-4203

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## 1.0 INTRODUCTION

As a requirement of the Federal Clean Water Act (CWA), the National Pollution Discharge Elimination System (NPDES) Phase I regulations were prepared and issued by the Environmental Protection Agency. This program requires permittees to use storm water best management practices for the purpose of controlling and minimizing waterborne pollutant discharges from point sources such as wastewater and storm water. Under the CWA, a discharge permit is required for certain stormwater systems operated by public entities. In addition to stormwater systems operated by cities and counties, other public entities such as public schools, colleges and universities, parks and recreation districts, ports, drainage and flood control districts, and state military facilities also need a discharge permit.

The Environmental Protection Agency (EPA) has delegated the NPDES permit authority to state environmental agencies. In Washington State, the Department of Ecology (Ecology) has jurisdiction for implementing the NPDES permits program. Ecology issues a general NPDES permits that meets the federal minimum requirements to individual facilities or multiple entities with common activities. For cities and counties that include Pierce, the first Phase I MS4 permit was issued by Ecology in July 1995. On January 17, 2007 Ecology issued a new Phase I MS4 permit that became effective on February 16, 2007. It was modified on June 17, 2009 and September 1, 2010. In response to the direction from the Legislature, Ecology issued a new NPDES Stormwater Permit for Phase I municipalities on August 1, 2012, effective September 1, 2012 and expired on July 31, 2012. Ecology also issued the new 2013-2018 Phase 1 MS4 permit on August 1, 2012, effective August 1, 2013 and expiring on July 31, 2018.

This document describes the efforts of the Washington Military Department (WMD) to comply with the NPDES MS4 permit that is associated with Camp Murray as a secondary permittee to Pierce County.

## 2.0 SECONDARY PERMITTEE REQUIREMENT

Camp Murray facilities are owned and operated by the Washington Military Department (WMD). WMD is a Phase I Secondary permittee of Pierce County under permit number WAR04-4203. Secondary Permittees are defined by Ecology as “a public entity or special purpose district such as a sewer district, flood control district, port, public university or college, prison complex, drainage district or parks and recreation district.” The new Phase I MS4 permit is available to be viewed online at Ecology’s website:  
<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/phaseIpermit/phipermit.html>.

Section S6 of the Stormwater Management Program for Secondary Permittees requires each permittee to develop and implement a Stormwater Management Program (SWMP). Also, the permittee must prepare written documentation for annual submittal to Ecology. The purpose of the SWMP is to reduce polluted water discharge from the municipal stormwater system to the maximum extent practicable thereby protecting surface and ground water quality. The program includes actions and activities described in Sections 3 through 11 of this SWMP document.

WMD’s first SWMP was submitted to Ecology in March 2011. Since then, the SWMP has not been modified due to staffing issues. This version of the SWMP has been updated to incorporate modifications to or additional sets of actions, that would be implemented to comply with the required components listed in S6 of the permit.

The permit also requires each permittee to submit annual compliance reports to Ecology by March 31st for activities covering the previous calendar year. These reports summarize SWMP implementation status and present information from assessment and evaluation activities conducted during the reporting period.

The content of this document is based upon the requirements in the permit as well as resources that are available on Ecology's website:

[http://www.ecy.wa.gov/programs/wq/stormwater/tech.html#Stormwater Permit Implementation.](http://www.ecy.wa.gov/programs/wq/stormwater/tech.html#Stormwater%20Permit%20Implementation)

The remainder of this SWMP document is organized similar to the Permit:

Section 3.0 – Permit Requirements for Public Education and Outreach.

Section 4.0 – Permit Requirements for Public Involvement and Participation.

Section 5.0 – Permit Requirements for Illicit Discharge Detection and Elimination.

Section 6.0 – Permit Requirements for Construction Site Stormwater Runoff Control.

Section 7.0 – Permit Requirements for Post-construction Stormwater Management for New Development and Redevelopment.

Section 8.0 – Permit Requirements for Pollution Prevention and Good Housekeeping.

Section 9.0 – Permit requirements for Compliance with Total Maximum Daily Load.

Section 10.0 – Permit requirements for Water Monitoring.

Section 11.0 – Permit requirements for Annual Reporting and Records.

Each section includes a summary of the relevant permit requirements completed to date and a description of current and planned compliance activities undertaken by WMD.

### ***2.1 Coordination of Permit Coverage Activities***

The Military Department facility requiring Phase I municipal NPDES permit is Camp Murray located in Pierce County, Washington.

### ***2.2 Facility Description***

Camp Murray is located near South Puget Sound and adjacent to American Lake and Murray Creek. Camp Murray was established around 1903. The State military installation provides facilities for the Washington State Military Department, which consists of Washington Army National Guard (WAARNG), Washington Air National Guard (WAANG), and other state services such as Emergency Management Division (EMD). It is situated on approximately 240 acres of developed and undeveloped woodlands with a mix of structures dating back to 1916 (Fig. 1).

The installation lies on the eastern edge of American Lake, which is a regional recreational area used for boating, fishing, and camping. Camp Murray Beach RV Park and Campground is also located along the east shores of American Lake.

Murray Creek, a perennial stream, flows through the installation. The creek begins on the adjacent Joint Base Lewis McChord (JBLM) Military installation and ends at American Lake. The topography of the site is relatively flat with some slopes in southern areas and along the lake.



**Figure 1. Map of Camp Murray**

### **3.0 PUBLIC EDUCATION AND OUTREACH**

This Section describes the permit requirements related to Public Education and Outreach, including current and planned compliance activities.

The permit does not require WMD to implement a public stormwater education program. However, Camp Murray interacts directly with the public in so far as stormwater management is concerned due to the public's use of American Lake shorelines and activities of individual contractors retained by WMD. WMD state and federal employees could also benefit from stormwater education and contribute to the implementation of the program.

In cooperation with Pierce County Water Program, WMD provides literature aimed at educating the public, state, and federal employees on the impact of stormwater discharges to receiving waters, and the importance of maintaining our stormwater infrastructure. Compliance with environmental regulations and policies is WMD's priority and educating the public, state, and federal employees is part of this effort. It is WMD's intent to carry the same level of environmental concern and education into the stormwater and wastewater management programs as with other programs within the agency.

### ***3.1 Public Education***

Beginning in 2014, WMD’s stormwater manager will, on an annual basis, distribute educational information materials to agency staff regarding the importance of storm water pollution prevention and strategies to reduce pollutants that go with the stormwater runoff. Educational materials may be in the form of a newsletter article, one-page flyer (see sample in Appendix A), or e-mail message(s). Below are the topics that would be addressed every year, where relevant:

1. What is stormwater and how does it affect water bodies
2. What are the impacts of stormwater pollution
3. What practices contribute to stormwater pollution
4. What are the benefits of protecting storm drains and waterbodies
5. What steps can be taken to minimize water pollution

### ***3.2 Storm Drain Labeling***

In 2009, WMD commissioned TEC Inc. to conduct an inspection and labeling of storm drains and water features at Camp Murray. The study also identified catchbasins that need to be cleaned out or that have deficiencies or damage. All storm drain inlets operated and maintained under this permit were labeled with the message “Dump No Waste” along with the point of discharge. By September 15, 2009, ninety five percent of the storms drains owned and operated by WMD are labeled. Those that needed cleaning were cleaned out. In accordance with the requirement to have identified drains labeled no later than August 2011 deadline, the WMD has complied and drains have been labeled. Due to weather, wear, and natural conditions the drains are to be re-inspected and re-marked as necessary to sustain and maintain compliance. An example of the drain label is presented below (Fig. 2).



**Figure 2. Storm drain label used at Camp Murray.**

As part of the maintenance for these storm drains and as required by this permit, any storm drains where the label has faded, is removed, or is unreadable will be re-labeled within 90 days of discovery.

## **4.0 PUBLIC INVOLVEMENT AND PARTICIPATION**

This section describes the permit requirements related to Public Involvement and Participation, including current and planned compliance activities and public notices.

As required by this permit, the Secondary Permittee shall no later than 180 days before the expiration date of this permit, publish a public notice soliciting a public review of the SWMP. The latest updated version of the SWMP will be made available to the public by posting the SWMP on their website.

#### ***4.1 Public Notice***

A Public Notice to invite the public to review this SWMP was issued that contains the following language:

Washington State Department of Ecology issued a Phase I Permit – “National Pollutant Discharge Elimination System and State Waste Discharge General Permit for Discharges from Small Municipal Separate Storm Sewer Systems” to Washington State Military Department (WMD).

The permit regulates stormwater discharges from the municipal separate storm sewer system located at Camp Murray, in Pierce County, Washington. The permit requires WMD to develop and implement a Stormwater Management Program that:

- Reduces the discharge of pollutants to the maximum extent practicable;
- Protects water quality;
- Satisfies appropriate requirements of the Clean Water Act.

The WMD’s Stormwater Management Program for Camp Murray can be viewed at <http://mil.wa.gov/Environmental/Army.shtml>. Contact WMD at (253) 512-8704 to request a time to review a hard copy of the document. Views or comments concerning this Stormwater Management Program document may be submitted to WMD in writing within 30 days from the last date of publication of this notice (March 23, 2014). Submit comments to:

Washington Military Department Environmental Program  
Water Quality Program Manager  
Bldg 36 Quartermaster Rd  
Camp Murray, WA 98430  
Tel: (253)-512-8704; Fax: (253) 512-8904

#### ***4.2 URL for WMD’s website where SWMP will be posted***

The web site address for posting the SWMP on WMD website is:  
<http://mil.wa.gov/Environmental/Army.shtml>

### **5.0 ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE)**

This section describes the permit requirements related to illicit discharge detection and elimination, including current and planned compliance activities and policy changes.

#### ***5.1 Compliance with local jurisdiction***

*From the date of this permit, the Secondary Permittee will comply with all relevant ordinances, rules, and regulations of the local jurisdictions in which they are located.*

As a state agency, WMD is obligated to abide by all relevant federal, state and local laws, rules and regulations.

### ***5.2 Policies and Enforcement Plan***

*From the date of this permit, policies prohibiting illicit discharges and illegal dumping will be developed and adopted. Enforcement plans and mechanisms will be identified to ensure compliance with illicit discharge policies.*

The Military Department maintains and manages secure facilities. All hazardous material, pollutants, and products used are tracked and monitored. Nothing is to be dumped or disposed of without prior approval. WAARNG) and WAANG have policies that specifically address stormwater issues and protection of natural resources in compliance with all Federal, state and local laws and regulations regarding health, and environmental protection (CFR title 32, chapter 5, part 650, Army regulations AR 200-1, 194 Regional Support Wing (RSW), April 2008). Some of these policies are reviewed periodically by WMD and will be amended as necessary to meet stormwater regulations, or a new policy may be drafted specifically addressing the requirements of this permit. Existing policies include information on the reporting of spills and other illicit discharges to WMD, local government, or Ecology as appropriate.

### ***5.3 Stormwater System Mapping***

*No later than 180 days prior to the expiration of this permit, each Secondary Permittee will develop a storm sewer system map showing the locations of all known storm drain outfalls, labeled receiving waters, and delineated areas contributing runoff to each outfall. These maps must be available upon request to the Department of Ecology.*

In 2011, the Military Department manually mapped the stormwater infrastructure and outfalls for Camp Murray. The map is being reviewed periodically and will be updated as necessary to include the receiving waters and delineated areas contributing runoff to each outfall. The map is available for review upon request.

In 2014, the stormwater manager plans to migrate the existing stormwater map into a GIS format. New catchbasins, storm drains and outfalls that have been added during new construction, and some of the features that have been removed due to demolition projects, will also be included in the updated map.

### ***5.4 IDDE Inspection Program***

*The SWMP requires that each facility conduct field inspections and visually inspect each outfall for illicit discharges.*

WMD has developed inspection procedures for accomplishing these assessments on a regular basis. In addition, procedures to correct and report illicit discharges will be continually monitored and updated by WMD. All catch basins and storm drains are to be inspected and cleaned by September/October annually. All water features on Air National Guard leased property are inspected annually during the months of August and September.

Inspection of Camp Murray catch basins, storm drains, and outfalls is performed annually and after heavy storm events for visible pollutant discharges leaving the site. Should there be illicit discharge observed in any of the storm water features, the staff involved in inspection normally conducts an investigation to determine the source of the pollutant. A corrective action is then developed to eliminate the discharge. The appropriate local agency or Ecology is notified immediately when there is a discharge to waters of the state. Trained WMD military and state staff currently inspects one third (on average) of all water features annually.

Annual inspection of catch basins, storm drains, outfall, and other stormwater features include sediment depth measurements (if necessary) as well as documenting the general condition of the structures. Inspection criteria include the grate or lid cover, sheen or other foul odors, inlet and outlet pipes, flow line, erosion, trash and/or debris, overgrown vegetation, obstructions, and gravel or rip rap conditions.

As of March 2014, all of WAARNG's oil/water separators at Camp Murray had been decommissioned. WAANG still operates three oil/water separators at Camp Murray. WAANG's inspection process of OWS includes visually inspecting oil/water separators during weekly inspections of the compound. The information is recorded on the inspection sheet and filed with WMD stormwater program manager. Oil/water separators will be inspected monthly during the wet season of October 1-April 30 to ensure proper operation. The oil water separators will be inspected during and immediately after a large storm event of greater than or equal to one inch in 24-hour period.

The oil/water separators are to be cleaned regularly to keep accumulated oil from escaping during storms. They must be cleaned by October 15 to remove material that has accumulated during the dry season, after spills, and after a significant storm. Coalescing plates may be cleaned *in situ* or after removal from the separator. An eductor (vacuum) truck may be used for oil, sludge, and wash water removal. Replace wash water in the separator with clean water before returning it to service. The accumulated oil will be removed when the thickness reaches one inch. Also, sludge deposits are to be removed when the thickness reaches six inches.

In addition to the requirements of this paragraph, the WMD has established additional inspection requirements to ensure compliance and monitoring.

### ***5.5 Spill Response Plan***

*No later than 180 days prior to the expiration of this permit, a spill response plan must be developed and implemented which includes coordination with a qualified spill responder.*

WMD completed the spill response plan requirement in August 2011. Currently, WMD trains staff and Army National Guard Environmental Compliance Officers on spill response procedures annually. Spill response training has also been incorporated in new employee orientation for new federal and state employees. This spill response training complies with 40 CFR 112 and WAC 173-180C-050. In addition to the spill response plan, WMD hired a contractor to write a Stormwater Pollution Prevention Plan (SWPPP) for the Camp Murray site that was completed on May 15, 2012. This SWPPP is currently being revised to reflect the changes in stormwater features resulting from the demolition of the old Combined Support Maintenance Shop, decommissioning of three OWS owned and operated by the WAARNG, and the construction of the New Main Gate.

The Air National Guard's spill response planning and training is conducted in accordance with current Federal (CFR), Air Force and Air National Guard (AFI), State (WAC), local , and the 194<sup>th</sup> RSW Spill Prevention Control and Countermeasures Plan emergency spill response criteria. Training is conducted, at a minimum of annually in addition to at least one Field Training Exercise (FTX) or Major Accident Response Exercise (MARE) to assess and evaluate the current training objectives.

### **5.6 Staff training**

*Provide staff training by coordinating with existing training efforts to educate relevant staff on proper best management practices for preventing spills and illicit discharges.*

Army National Guard Environmental Compliance Officers are trained every two years in accordance with 40 CFR 122.34 and AR 200-1. Designated employees are trained on appropriate oil/water separator operation, inspection, record keeping, and maintenance procedures. Army policy is to integrate environmental stewardship with the mission in accordance with AR 200-1, AR 200-2, AR 200-3, AR 200-4, AR 200-5, and AR 350-4. This includes reduction or elimination of pollution at the source, conservation and protection of natural and cultural resources, integration of environmental consideration into all activities, conducting operations that are environmentally acceptable and that enhance the soldier's and the civilian's quality of life, complying with all applicable environmental laws, restoring previously contaminated sites, and allocating resources and training to protect the environment. The Army environmental program has four areas of concentration: compliance with all federal and state environmental regulations, pollution prevention, conservation and restoration.

WMD staff and military personnel involved in industrial operations or maintenance projects are trained in industrial stormwater awareness. This training includes topics such as sustainability, stormwater pollution prevention, water quality management, oil water separator sampling, spill response, waste management, disposal of dangerous and hazardous waste, pest control best management practices, natural and cultural resources, and record keeping.

The Air National Guard's spill response planning and training is conducted in accordance with current Federal (CFR), Air Force and Air National Guard (AFI), State (WAC), local , and the 194<sup>th</sup> RSW Spill Prevention Control and Countermeasures Plan emergency spill response criteria, dated April 2008, Section 8.1. Training is conducted at least annually. Air National Guard Unit Environmental Coordinators are provided additional training information and updates, as necessary. The Unit Environmental Coordinators are responsible to provide unit members with sustainment and additional training throughout the year in addition to the annual requirements.

## **6.0 CONSTRUCTION SITE STORMWATER RUNOFF CONTROL**

### **6.1 Compliance with Requirements of Local Jurisdictions**

*From the date of this permit, the Secondary Permittee will comply with all relevant ordinances, rules, and regulations of the local jurisdictions in which they are located.*

As a state agency, WMD is obligated to abide by all rules and regulations of all jurisdictions where they reside including 40 CFR 122.26 and RCW 90.48.

## **6.2 NPDES Construction Permitting Requirement**

*For construction projects one acre or larger, the Secondary Permittee is required to obtain coverage under the NPDES General Permit for Stormwater Discharges Associated with Construction Activities.*

WMD requests NPDES Construction Stormwater General Permit for construction and demolition projects that impacts one acre or more in accordance with Washington State Water Pollution Control Law (RCW 90.48) and the Federal Water Pollution Control Act (Title 33 USC Section 1251 et seq.). Latest NPDES CSWGP obtained/to be obtained are for the demolition of the Combined Support Maintenance Shop as well as the construction of Pierce County Readiness Center.

The Washington Air National Guard has applied for and received the appropriate NPDES Construction Storm-water General Permits for approved construction project(s).

## **6.3 Coordination with Local Jurisdictions on Outside Projects**

*Coordinate with local jurisdictions regarding projects owned and operated by other entities which discharge in to the Secondary Permittee's municipal stormwater system.*

WMD's new main gate is the only project that is owned and operated by another entity (the City of Lakewood) that discharge stormwater runoff into Camp Murray's municipal separate stormwater system. The new main gate for Camp Murray was constructed on the northwest side of the installation that was completed in January 2013. As part of the terms and conditions in the Right of Way permit issued to WMD by the City of Lakewood, WMD constructed a traffic circle in front of the main gate with two catch basins collecting storm water and discharges it to WMD's storm water collection pond. Although an agreement has been proposed by the City of Lakewood regarding the maintenance and pollution control of the storm water system in the circle, WMD will report to the City of Lakewood, by using stormwater management data from WMD's annual report to Ecology.

WMD, in coordination with Pierce County Public Works and Utilities Department, have entered into a memorandum of understanding in order to clarify the roles and responsibilities between interconnected Municipal Storm Sewers. This memorandum of understanding will meet the requirement to 'establish coordination mechanisms' contained in condition S.6.B (Stormwater Management Program for Co-permittees and Secondary Permittees-Coordination).

## **6.4 Construction Staff Training Requirements**

*Provide training or coordinate with existing training efforts to educate relevant staff in erosion and sediment control BMP's and requirements, or hire trained contractors.*

WMD requires all contractors for construction projects to have a trained staff (CESCL certified) in stormwater management and best management practices (BMP's) during project implementation. In addition, WMD has an Environmental Specialist who is trained and certified (Certified Erosion and Sediment Control Lead) to monitor the construction sites to ensure that the BMP's are followed.

## ***6.5 Coordination with Ecology and Local Jurisdictions for Inspection***

*Coordinate as requested with Ecology or the local jurisdiction to provide access for inspection of construction sites or other land disturbances, which are under the control of the Secondary Permittee.*

Any Federal, state, and local agency inspector will be allowed access to WMD facilities when requested for the purpose of conducting state business, after proper security clearances have been obtained.

## **7.0 POST-CONSTRUCTION STORMWATER MANAGEMENT FOR NEW DEVELOPMENT AND REDEVELOPMENT**

### ***7.1 Compliance with Local, Post-Construction Requirements***

*From the date of this permit, the Secondary Permittee will comply with all relevant ordinances, rules, and regulations of the local jurisdictions in which they are located.*

As a state agency, WMD is obligated to abide by all rules and regulations of all jurisdictions where they reside.

### ***7.2 Coordination with Local Jurisdictions on Outside Projects***

*Coordinate with local jurisdictions regarding projects owned and operated by other entities which discharge in to the Secondary Permittee's municipal stormwater system.*

Camp Murray's new main gate is the only project that has storm water features (catch basins at the traffic circle just outside the gate) owned and operated by other entities that discharge stormwater runoff into Camp Murray's municipal stormwater system. WMD coordinates with the City of Lakewood in the maintenance and pollution control at the traffic circle.

WMD, in coordination with Pierce County Public Works and Utilities Department, have entered into a memorandum of understanding in order to clarify the roles and responsibilities between interconnected Municipal Storm Sewers. This memorandum of understanding will meet the requirement to 'establish coordination mechanisms' contained in condition S.6.B (Stormwater Management Program for Co-permittees and Secondary Permittees-Coordination).

## **8.0 POLLUTION PREVENTION AND GOOD HOUSEKEEPING**

### ***8.1 Operation and Maintenance (O&M) Plans***

*No later than three years from the issuance of this permit, the Secondary Permittee will develop and implement a municipal operation and maintenance plan to minimize stormwater pollution from activities conducted by the Secondary Permittee.*

This section of the permit requires WMD to evaluate day-to-day activities and evaluate which Best Management Practices (BMPs) can be implemented in order to reduce stormwater pollution from those activities. The permit also requires preparation of an O&M plan that establishes maintenance standards. Inspections, maintenance actions, training, and record keeping are required to ensure implementation of the maintenance standards.

A visual inspection of one third of the drainage facilities, outfalls, storm drains, and catch basins will be conducted on an annual basis. The structures will be visually inspected for cracks, broken pieces, trash or debris, sedimentation, sheen, or odor that would signify that maintenance is required.

A visual inspection of Army National Guard operated oil/water separators will be conducted during regularly scheduled weekly inspections. The inspection information will be reported on an inspection sheet and e-mailed to WMD program manager. Inspections of the oil/water separators will occur monthly during the wet season of October 1-April 30 to ensure proper operation.

Inspections during and immediately after a large storm event of greater than or equal to one inch in 24- hour period will be conducted and recorded. The information will be sent to WMD program manager.

Cleaning of oil/water separators (by WAANG) will be done regularly to keep accumulated oil and sediments from escaping during storms. They must be cleaned by October 15 annually to remove material that has accumulated during the dry season, after spills, and after a significant storm.

Maintenance will be conducted when inspection reveals that the accumulated oil reaches a thickness of one inch. Also, cleaning will remove sludge deposits when those materials reaches a thickness of six inches.

Coalescing plates or baffles may be cleaned *in situ* or after removal from the separator. An eductor (vacuum) truck may be used for oil, sludge, and wash water removal. Any waste will be properly contained and disposed of by the contractor. Replace wash water in the separator with clean water before returning it to service.

Air National Guard's operations and maintenance for oil water separators follows the current 194<sup>th</sup> RSW Spill Prevention Control and Countermeasures Plan, dated April 2008 and the OWS manufacture's recommended maintenance program(s). The Camp Murray Air National Guard oil water separator is inspected and maintained on a monthly schedule. Cleaning of the oil water separator is based on the frequency of the oil water separator use and any significant findings uncovered during the routine inspection. Because of the limited use and no significant inspection findings, the last cleaning was conducted in October 2010. The Camp Murray Air National Guard continues to conduct monthly checks and maintenance to ensure compliance and assess when cleaning of the OWS is required.

## ***8.2 Compliance with NPDES Industrial Stormwater Permit Requirements***

*From the date of coverage, the Secondary Permittee shall have permit coverage for all facilities owned or operated by the Secondary Permittee, which require coverage under the General NPDES Permit for Stormwater Discharges Associated with Industrial Activities.*

Under current State regulations, Camp Murray is not required to apply for coverage under the NPDES Industrial Stormwater General Permit.

### ***8.3 Staff Training***

*Train all employees whose construction, operations, or maintenance job functions may impact stormwater quality.*

WMD staff and WA Army National Guard personnel involved in any industrial operation or maintenance project are trained in industrial stormwater awareness every two years and spill response annually. This training includes sustainability, stormwater pollution prevention, water quality management, oil water separator sampling, spill response, waste management, disposal of dangerous and hazardous waste, pest management best management practices, natural and cultural resources, and record keeping.

The Air National Guard personnel involved in operations and maintenance, receive training in accordance with the current 194 RSW Spill Prevention, Control and Countermeasure Plan, dated April 2008, Oil Water Separators.

## **9.0 COMPLIANCE WITH TOTAL MAXIMUM DAILY LOAD REQUIREMENTS**

### ***9.1 EPA requirements applicable TMDL list***

*All permittees shall be in compliance with the requirements of applicable TMDLs as identified by the permit.*

At present, Camp Murray is not within the EPA approved TMDL list in Western Washington. No monitoring or reporting of TMDL is required at this time.

## **10.0 MONITORING**

### ***10.1 Water sampling***

Water sampling is not required except for compliance with TMDL and to characterize illicit discharges for the term of the permit.

Camp Murray is not required to conduct TMDL monitoring or reporting. Characterizations of illicit discharges, if any, will be included in the annual report as per section 10.2.

### ***10.2 Annual report***

Annual reports shall include a description of any stormwater monitoring or studies conducted during the reporting period. An assessment of the appropriateness of BMPs identified for each component of the SWMP, any changes made and why.

## 11.0 REPORTING REQUIREMENTS

### *11.1 Annual reports and records*

WMD has prepared and adopted additional policies to prohibit illicit discharges and identifying enforcement mechanisms.

WMD staff will visually inspect one third of the outfalls annually, at which time the procedure to correct illicit discharges will be established. As of August 2009, catch basins, storm drains, outfalls, and oil water separators have been identified, inspected, cleaned, and mapped for annual inspections.

Air National Guard annually inspects, and cleans as necessary, the stormwater features within the confines of their leased property at Camp Murray.

Operation and maintenance (O&M) plan and training for system inspections and maintenance was adopted and implemented. Air National Guard's operations and maintenance of stormwater features is conducted in accordance with the current 194 RSW Spill Prevention, Control and Countermeasure Plan, dated April 2008.

A map of the storm sewer system, including contributing areas and receiving waters was completed in August 2011. This map will be compared to historical maps that were created by past contractors hired by WMD. This map is also being updated to reflect changes in stormwater features due to new constructions and demolition activities. Updates will include preparing the map in a GIS format.

Spill response plan and training was adopted and implemented in 2011. Spill response training has also been incorporated in new employee orientations for both new federal and state employees. In September 2008, WMD hired a contractor to update the training curriculum for Army National Guard facilities. The Air National Guard's operations spill response plan and training is conducted in accordance with the current 194 RSW Spill Prevention, Control and Countermeasure Plan, dated April 2008.

No later than March 31<sup>st</sup> of each year an annual report will be submitted on Department of Ecology's (Ecology) *Annual Report Form for Secondary Permittees*. No annual report is due in 2014. An updated SWMP will be submitted annually. These documents will be made available to the public and the records related to this permit will be kept for five years.

Two printed signed copies and a PDF electronic copy shall be submitted to Ecology no later than March 31. All submittals shall be delivered to:

Department of Ecology Water Quality Program  
Municipal Stormwater Permits  
PO Box 47696  
Olympia, WA 98504-7696

**Appendix A**  
**Sample Storm Water Education Flyer for Distribution to WMD Staff**

## Stormwater Pollution Prevention

by Rowena Valencia-Gica

*Did you know...*

- ...that stormwater can pollute surface waters?
- ...that you can help reduce stormwater pollution?

*When it rains, it drains*

When it rains or snow melts, water on the ground and everything it carries either seeps into our drinking water or goes into street drains. Not a problem, right? Well, not really...this stormwater and all pollutants with it eventually lead to our streams, lakes, seas and other bodies of water. Oils, detergents, pet wastes, plastics, pesticides...you name it and it all ends up in the water.

Stormwater pollution is a problem. A lot of our everyday routines can pollute the environment. Washing car, changing oil, filling gas, walking pets, building a structure, growing plants, and the list goes on. Many of these activities occur at our neighborhood as well as here at Camp Murray and other WMD facilities. We may not be aware, but these actions can cause pollutants to go to stormwater. This polluted water then flows to our streets, storm drains, waterways and oceans. The result? Contaminated drinking water, closed beaches, diseased or dead marine life, and sick people. But don't despair...

*You can be a solution to stormwater pollution!*

By sharing the responsibility and taking some simple actions, we can keep pollutants out of the stormwater and waterbodies.

*Just remember this:*



*How can we help?*



Pick up pet wastes.



Don't litter. Put trash in garbage bins.



Prevent spills of hazardous wastes. If a spill happens, clean it up right away.



Remove dirt and debris from sidewalks and drainage structures.



Stabilize bare or stockpiled soil—hydroseed or cover it.

Do not dump waste or chemicals to storm drains.



Oil and water do not mix. Fix vehicle leaks.

*Be a champion of stormwater pollution prevention...now.*

## **Stormwater Pollution Prevention Plan for CSMS Building Demolition**

# Stormwater Pollution Prevention Plan

**For**  
CSMS Building Demolition

**Prepared For**  
Southwest Regional Office  
300 Desmond Drive  
Lacey, WA 98503  
360-407-6300

<b>Owner</b>	<b>Architect</b>	<b>Operator/Contractor</b>
State of Washington, Military Dept Bldg #36 Quartermaster Road Camp Murray, WA 98430	TCF Architecture PLLC 902 N. 2 <sup>nd</sup> St Tacoma, WA 98403	Const. Grp. Intrn'l 19407 144 <sup>th</sup> Ave NE, Bldg D Woodinville, WA 98072

**Project Site Location**  
Camp Murray, WA

**Certified Erosion and Sediment Control Lead**  
Elsa Tibbits

**SWPPP Prepared By**  
Elsa Tibbits, Project Manager, CESCL  
Construction Group International LLC  
19407 144<sup>th</sup> Ave NE, Bldg D  
Woodinville, WA 98072

**SWPPP Preparation Date**  
November 25, 2013

**Approximate Project Construction Dates**  
December 9, 2013 -  
May 9, 2014

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**Appendix A Site plans**

- Vicinity map (with all discharge points)
- Site plan with TESC measures

**Appendix B Construction BMPs**

- Possibly reference in BMPs, but likely it will be a consolidated list so that the applicant can photocopy from the list from the SWMM.

**Appendix C Alternative Construction BMP list**

- List of BMPs not selected, but can be referenced if needed in each of the 12 elements

**Appendix D General Permit**

**Appendix E Site Log and Inspection Forms**

**Appendix F Engineering Calculations (if necessary)**

- Flows, ponds, etc...

## 1.0 Introduction

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared as part of the NPDES stormwater permit **WAR301439** requirements for the CSMS Building Demolition construction project in Camp Murray, Tacoma, Washington. The site is located on the south west side of Camp Murray and west of the interchange for Interstate 5 (I-5). The Site is bound by Infantry Drive, Ordinance Corp Way, 41<sup>st</sup> Division Way and Field Artillery Trail. The existing site is a 10-acre lot with nine (9) overheight concrete buildings and metal shops and associated sheds. The proposed deconstruction activities is to abate all buildings, demolish all structures and removal all asphalt and concrete from the site.

Construction activities will include abatement and demolition of buildings, removal of concrete and asphalt surfaces, removal of onsite services/utilities/ and stormwater structures and protection of an underground infiltration system. The purpose of this SWPPP is to describe the proposed construction activities and all temporary and permanent erosion and sediment control (TESC) measures, pollution prevention measures, inspection/monitoring activities, and recordkeeping that will be implemented during the proposed construction project. The objectives of the SWPPP are to:

1. Implement Best Management Practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.
2. Prevent violations of surface water quality, ground water quality, or sediment management standards.
3. Prevent, during the construction phase, adverse water quality impacts including impacts on beneficial uses of the receiving water by controlling peak flow rates and volumes of stormwater runoff at the Permittee's outfalls and downstream of the outfalls.

This SWPPP was prepared using the Ecology SWPPP Template downloaded from the Ecology website on November 25, 2013. This SWPPP was prepared based on the requirements set forth in the Construction Stormwater General Permit, Stormwater Management Manual for Western Washington (SWMMWW 2005). The report is divided into seven main sections with several appendices that include stormwater related reference materials. The topics presented in the each of the main sections are:

- Section 1 – INTRODUCTION. This section provides a summary description of the project, and the organization of the SWPPP document.
- Section 2 – SITE DESCRIPTION. This section provides a detailed description of the existing site conditions, proposed construction activities,

and calculated stormwater flow rates for existing conditions and post–construction conditions.

- Section 3 – CONSTRUCTION BMPs. This section provides a detailed description of the BMPs to be implemented based on the 12 required elements of the SWPPP (SWMMEW 2004).
- Section 4 – CONSTRUCTION PHASING AND BMP IMPLEMENTATION. This section provides a description of the timing of the BMP implementation in relation to the project schedule.
- Section 5 – POLLUTION PREVENTION TEAM. This section identifies the appropriate contact names (emergency and non-emergency), monitoring personnel, and the onsite temporary erosion and sedimentation control inspector
- Section 6 – INSPECTION AND MONITORING. This section provides a description of the inspection and monitoring requirements such as the parameters of concern to be monitored, sample locations, sample frequencies, and sampling methods for all stormwater discharge locations from the site.
- Section 7 – RECORDKEEPING. This section describes the requirements for documentation of the BMP implementation, site inspections, monitoring results, and changes to the implementation of certain BMPs due to site factors experienced during construction.

Supporting documentation and standard forms are provided in the following Appendices:

- Appendix A – Site plans
- Appendix B – Construction BMPs
- Appendix C – Alternative Construction BMP list
- Appendix D – General Permit
- Appendix E – Site Log and Inspection Forms
- Appendix F – Engineering Calculations

## **2.0 Site Description**

### **2.1 Existing Conditions**

The proposed site is located west of Interstate 5 (I-5) and is bound by Infantry Drive, Ordinance Corp Way, 41<sup>st</sup> Division Way and Field Artillery Trail of Camp Murray located in Tacoma, Washington. A site vicinity map and coordinates are provided in Appendix A. The site is 10 acres in size and 9 one-story industrial maintenance buildings are thought the site, and a mixture of a large gravel parking lot on the west side of the site and asphalt/concrete pavement thought the rest of the site. The topography of the site and surrounding properties gently slopes to northeast and southwest. Surficial soils consist of gravel and sand mixture.

Runoff from the site generally drains from the northeast to southwest to a series of catch basins. The catch basins convey runoff to a storm drain system that flows to the east part of the site and discharges to an underground infiltration system. Stormwater does not discharge into the city storm system or any body of water.

There are no critical areas on the site such as high erosion risk areas, wetlands, streams, or steep slopes (potential landslide area).

### **2.2 Proposed Construction Activities**

Construction activities will include site preparation, TESC installation, asbestos abatement, demolition of the existing maintenance structure, excavation for the building foundations and footers, cutting and capping of utilities, removal of stormwater basins and associated pipe, removal of concrete and asphalt paving, and site restoration with hydroseed. The schedule and phasing of BMPs during construction is provided in Section 4.0.

Stormwater runoff volumes were calculated using the Western Washington Hydrology Model (WVHM). The temporary sedimentation tank that will be used during construction was designed using the 2-year storm event since construction will not occur over a long time-frame (approximately 120 CD). The combined detention tank was designed using WVHM where the treatment sump was sized using the 6-month treatment volume and the live storage detention volume was designed by matching pre and post construction flows and durations for 50 percent of the 2-year flow and the 50-year flow.

After the building is constructed and all new utilities are installed, the site will be graded and paved. A landscape buffer area will be constructed on the north side of the site and the parking area will contain median lane divide planters.

The following summarizes details regarding site areas:

- Total site area: 10 acres
- Percent impervious area before construction: 30 %
- Percent impervious area after construction: 0 %
- Disturbed area during construction: 5 acres
- Disturbed area that is characterized as impervious (i.e., access roads, staging, parking): 2 acres

## **3.0 Construction Stormwater BMPs**

### **3.1 The 12 BMP Elements**

#### **3.1.1 Element #1 – 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:

High Visibility Plastic or Metal Fence (BMP C103)

Existing Site Fencing

Alternate BMPs for marking clearing limits are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

#### **3.1.2 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:

Stabilized Construction Entrance (BMP C105)

Construction Road/Parking Area Stabilization (BMP C107)

Alternate construction access BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the

NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

### **3.1.3 Element #3 – Control Flow Rates**

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

No discharge from site

Alternate flow control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, the project must comply with Minimum Requirement 7 (Ecology 2005).

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

### **3.1.4 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. The specific BMPs to be used for controlling sediment on this project include:

Silt Fence (BMP C233)

Straw Wattles (BMP C235)

Storm Drain Inlet Protection (BMP C220)

Portable Water Storage Tanks (e.g., Baker Tank) for Sedimentation.

Materials on Hand (BMP C150) may also be applicable

Alternate sediment control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize washoff of sediments from adjacent streets in runoff.

Whenever possible, sediment laden water shall be discharged into the onsite baker tank or vegetated areas (BMP C240 paragraph 5, page 4-102).

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or biofiltration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be restabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMPs will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls.

- Temporary Sediment Pond (BMP C241)
- Construction Stormwater Filtration (BMP C251)
- Construction Stormwater Chemical Treatment (BMP C 250)  
(implemented only with prior written approval from Ecology).

### **3.1.5 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 include:

Temporary and Permanent Seeding (BMP C120)

Mulching (BMP C121)

Plastic Covering (BMP C123)

Dust Control (BMP C140)

Alternate soil stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

### **3.1.6 Element #6 – Protect Slopes**

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. This project does not have any cut and fill with slopes.

### **3.1.7 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. The following inlet protection measures will be applied on this project:

#### Drop Inlet Protection

##### Catch Basin Filters

If the BMP options listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D), or if no BMPs are listed above but deemed necessary during construction, the Certified Erosion and Sediment Control Lead shall implement one or more of the alternative BMP inlet protection options listed in Appendix C.

### **3.1.8 Element #8 – Stabilize Channels and Outlets**

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. The specific BMPs for channel and outlet stabilization that shall be used on this project include:

#### Outlet Protection (BMP C209)

Alternate channel and outlet stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

### **3.1.9 Element #9 – Control Pollutants**

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. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

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).

Other:

- Other BMPs will be administered as necessary to address any additional pollutant sources on site.

The facility does not require a Spill Prevention, Control, and Countermeasure (SPCC) Plan under the Federal regulations of the Clean Water Act (CWA).

### **3.1.10 Element #10 – Control Dewatering**

There will be no dewatering groundwater as part of this construction project. Any accumulated stormwater will be pumped into a baker tank for onsite storage and proper disposal.

### **3.1.11 Element #11 – Maintain BMPs**

All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. Maintenance and repair shall be conducted in accordance with each particular BMPs specifications (attached). Visual monitoring of the BMPs 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 will be reduced to once every month.

All temporary erosion and sediment control BMPs shall be removed within 30 days after the final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil resulting from removal of BMPs or vegetation shall be permanently stabilized.

### **3.1.12 Element #12 – Manage the Project**

Erosion and sediment control BMPs for this project have been designed based on the following principles:

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

In addition, project management will incorporate the key components listed below:

As this project site is located west of the Cascade Mountain Crest, the project will be managed according to the following key project components:

#### Phasing of Construction

- The construction project is being phased to the extent practicable in order to prevent soil erosion, and, to the maximum extent possible, the transport of sediment from the site during construction.
- Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities during each phase of construction, per the Scheduling BMP (C 162).

#### Seasonal Work Limitations

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

the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

- Site conditions including existing vegetative coverage, slope, soil type, and proximity to receiving waters; and
  - Limitations on activities and the extent of disturbed areas; and
  - Proposed erosion and sediment control measures.
- Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance.
  - The following activities are exempt from the seasonal clearing and grading limitations:
    - Routine maintenance and necessary repair of erosion and sediment control BMPs;
    - Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
    - Activities where there is 100 percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

#### Coordination with Utilities and Other Jurisdictions

- Care has been taken to coordinate with utilities, other construction projects, and the local jurisdiction in preparing this SWPPP and scheduling the construction work.

#### Inspection and Monitoring

- All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. This person has the necessary skills to:
  - Assess the site conditions and construction activities that could impact the quality of stormwater, and

- Assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
- A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.
- Whenever inspection and/or monitoring reveals that the BMPs identified in this SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

#### Maintaining an Updated Construction SWPPP

- This SWPPP shall be retained on-site or within reasonable access to the site.
- The SWPPP shall be modified whenever there is a change in the 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 shall be modified 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 ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) days following the inspection.

### **3.2 Site Specific BMPs**

Site specific BMPs are shown on the TESC Plan Sheets and Details in Appendix A. These site specific plan sheets will be updated annually.

### **3.3 Additional Advanced BMPs**

The BMP implementation schedule is driven by the construction schedule. The following provides a sequential list of the proposed construction schedule milestones and the corresponding BMP implementation schedule. The list contains key milestones such as wet season construction.

BMP implementation schedule listed below is keyed to proposed phases of the construction project, and reflects differences in BMP installations and inspections that relate to wet season construction. The project site is located west of the Cascade Mountain Crest. As such, the dry season is considered to be from May 1 to September 30 and the wet season is considered to be from October 1 to April 30.

- Estimate of Construction start date: 12/16/2013
- Estimate of Construction finish date: 05/06/2014
- Mobilize equipment on site:  
and 01/21/2014 12/16/2014
- Mobilize and store all ESC and soil stabilization products  
(store materials on hand BMP C150): 12/17/13
- Install ESC measures: 01/22/2014
- Install stabilized construction entrance:  
existing hardscape Utilize
- Begin clearing and grubbing: N/A
- Demolish existing building structures: 01/23/2014
- Excavation for building foundations N/A
- Soil stabilization on excavated sideslopes (in idle, no  
work areas as shown on ESC plans) N/A
- Temporary erosion control measures (hydroseeding) 04/21/2014

## 5.0 Pollution Prevention Team

### 5.1 Roles and Responsibilities

The pollution prevention team consists of personnel responsible for implementation of the SWPPP, including the following:

- Certified Erosion and Sediment Control Lead (CESCL) – primary contractor contact, responsible for site inspections (BMPs, visual monitoring, sampling, etc.); to be called upon in case of failure of any ESC measures.
- Resident Engineer – For projects with engineered structures only (sediment ponds/traps, sand filters, etc.): site representative for the owner that is the project's supervising engineer responsible for inspections and issuing instructions and drawings to the contractor's site supervisor or representative
- Emergency Ecology Contact – individual to be contacted at Ecology in case of emergency.
- Emergency Owner Contact – individual that is the site owner or representative of the site owner to be contacted in the case of an emergency.
- Non-Emergency Ecology Contact – individual that is the site owner or representative of the site owner than can be contacted if required.
- Monitoring Personnel – personnel responsible for conducting water quality monitoring; for most sites this person is also the Certified Erosion and Sediment Control Lead.

## 5.2 Team Members

Names and contact information for those identified as members of the pollution prevention team are provided in the following table.

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Elsa Tibbits	<b>206-462-0380</b>
Resident Engineer	PBS Environmental; Brian Stanford	<b>206-233-9639</b>
Emergency Ecology Contact	Josh Klimek	<b>360-407-7451</b>
Emergency Owner Contact	Ron Cross	<b>253-512-8404</b>
Non-Emergency Ecology Contact	Josh Klimek	<b>360-407-7451</b>
Monitoring Personnel	Construction Grp International,; Elsa Tibbits	<b>206-462-0380</b>

## **6.0 Site Inspections and Monitoring**

Monitoring includes visual inspection, monitoring for water quality parameters of concern, and documentation of the inspection and monitoring 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; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book. This SWPPP may function as the site log book if desired, or the forms may be separated and included in a separate site log book. However, if separated, the site log book but must be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

### **6.1 Site Inspection**

All BMPs will be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The inspector will be a Certified Erosion and Sediment Control Lead (CESCL) per BMP C160. The name and contact information for the CESCL is provided in Section 5 of this SWPPP.

Site inspection will occur in all areas disturbed by construction activities and at all stormwater discharge points. Stormwater will be examined for the presence of suspended sediment, turbidity, discoloration, and oily sheen. The site inspector will evaluate and document the effectiveness of the installed BMPs and determine if it is necessary to repair or replace any of the BMPs to improve the quality of stormwater discharges. All maintenance and repairs will be documented in the site log book or forms provided in this document. All new BMPs or design changes will be documented in the SWPPP as soon as possible.

#### **6.1.1 Site Inspection Frequency**

Site inspections will be conducted at least once a week and within 24 hours following any discharge from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month. Weekly inspections will be performed for 4 weeks and will then be moved to a monthly inspection. The project site has no discharge.

### **6.1.2 Site Inspection Documentation**

The site inspector will record each site inspection using the site log inspection forms provided in Appendix E. The site inspection log forms may be separated from this SWPPP document, but will be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

## **6.2 Stormwater Quality Monitoring**

### **6.2.1 Turbidity**

Turbidity sampling and monitoring will not be conducted during the entire construction phase of the project since there is no discharge from the site. However, in the event that the site discharges due to a major rain event the following procedures will be followed and reported to Ecology in the monthly Discharge Monitoring Report (DMR) as “No Discharge”. Samples will be collected daily at the drainage ditch at the northwest corner of the site. Samples will be analyzed for turbidity using the EPA 180.1 analytical method.

The key benchmark turbidity value is 25 nephelometric turbidity units (NTU) for the downstream receiving water body. If the 25 NTU benchmark is exceeded in any sample collected from the drainage ditch, the following steps will be conducted:

1. Ensure all BMPs specified in this SWPPP are installed and functioning as intended.
2. Assess whether additional BMPs should be implemented, and document modified BMPs in the SWPPP as necessary.
3. Sample discharge daily until the discharge is 25 NTU or lower.

If the turbidity exceeds 250 NTU at any time, the following steps will be conducted:

1. Notify Ecology by phone within 24 hours of analysis (see Section 5.0 of this SWPPP for contact information).
2. Continue sampling daily until the discharge is 25 NTU or lower. Initiate additional treatment BMPs such as off-site treatment, infiltration, filtration and chemical treatment within 24 hours, and implement those additional treatment BMPs as soon as possible, but within a minimum of 7 days.
3. Describe inspection results and remedial actions taken in the site log book and in monthly discharge monitoring reports as described in Section 7.0 of this SWPPP.

### **6.2.2 pH**

Sampling and monitoring for pH will not occur during the phase of construction because there will be no concrete being poured and the site does not discharge.

## **7.0 Reporting and Recordkeeping**

### **7.1 Recordkeeping**

#### **7.1.1 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; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book.

#### **7.1.2 Records Retention**

Records of all monitoring information (site log book, inspection reports/checklists, etc.), this Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements will be retained during the life of the construction project and for a minimum of three years following the termination of permit coverage in accordance with permit condition S5.C.

#### **7.1.3 Access to Plans and Records**

The SWPPP, General Permit, Notice of Authorization letter, and Site Log Book will be retained on site or within reasonable access to the site and will be made immediately available upon request to Ecology or the local jurisdiction. A copy of this SWPPP will be provided to Ecology within 14 days of receipt of a written request for the SWPPP from Ecology. Any other information requested by Ecology will be submitted within a reasonable time. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with permit condition S5.G.

#### **7.1.4 Updating the SWPPP**

In accordance with Conditions S3, S4.B, and S9.B.3 of the General Permit, this SWPPP will be modified if the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site or there has been a change in design, construction, operation, or maintenance at the site that has a significant effect on the discharge, or potential for discharge, of pollutants to the waters of the State. The SWPPP will be modified within seven days of determination based on inspection(s) that additional or modified BMPs are necessary to correct problems identified, and an updated timeline for BMP implementation will be prepared.

### **7.2 Reporting**

#### **7.2.1 Discharge Monitoring Reports**

Water quality sampling results will be submitted to Ecology monthly on Discharge Monitoring Report (DMR) forms in accordance with permit condition S5.B. If there was no discharge during a given monitoring period, the form will be submitted with the words “no discharge” entered in place of the monitoring results. If a benchmark was exceeded, a brief summary of inspection results and remedial actions taken will be included. If sampling could not be performed during a monitoring period, a DMR will be submitted with an explanation of why sampling could not be performed.

#### **7.2.2 Notification of Noncompliance**

If any of the terms and conditions of the permit are not met, and it causes a threat to human health or the environment, the following steps will be taken in accordance with permit section S5.F:

1. Ecology will be immediately notified of the failure to comply.
2. Immediate action will be taken to control the noncompliance issue and to correct the problem. 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.

Any time turbidity sampling indicates turbidity is 250 nephelometric turbidity units (NTU) or greater or water transparency is 6 centimeters or less, the Ecology regional office will be notified by phone within 24 hours of analysis as required by permit condition S5.A (see Section 5.0 of this SWPPP for contact information).

In accordance with permit condition S4.F.6.b, the Ecology regional office will be notified if chemical treatment other than CO<sub>2</sub> sparging is planned for adjustment of high pH water (see Section 5.0 of this SWPPP for contact information).

## **Appendix A – Site Plans**

## **Appendix B – Construction BMPs**

High Visibility Plastic or Metal Fence (BMP C103)

Stabilized Construction Entrance (BMP C105)

Construction Road/Parking Area Stabilization (BMP C107)

Sediment Trap (BMP C240)

Silt Fence (BMP C233)

Straw Wattles (BMP C235)

Storm Drain Inlet Protection (BMP C220)

Portable Water Storage Tanks (e.g., Baker Tank) for Sedimentation.

Materials on Hand (BMP C150) may also be applicable

Temporary and Permanent Seeding (BMP C120)

Mulching (BMP C121)

Plastic Covering (BMP C123)

Dust Control (BMP C140)

Pipe Slope Drains (BMP C204)

Check Dams (BMP C207)

Straw Wattles (BMP C235)

Outlet Protection (BMP C209)

## **Appendix C – Alternative BMPs**

The following includes a list of possible alternative BMPs for each of the 12 elements not described in the main SWPPP text. This list can be referenced in the event a BMP for a specific element is not functioning as designed and an alternative BMP needs to be implemented.

**Element #1 - Mark Clearing Limits**

**Element #2 - Establish Construction Access**

**Element #3 - Control Flow Rates**

**Element #4 - Install Sediment Controls**

Advanced BMPs:

**Element #5 - Stabilize Soils**

**Element #6 - Protect Slopes**

**Element #8 - Stabilize Channels and Outlets**

**Element #10 - Control Dewatering**

Additional Advanced BMPs to Control Dewatering:

## **Appendix D – General Permit**

## Appendix E – Site Inspection Forms (and Site Log)

The results of each inspection shall be summarized in an inspection report or checklist that is entered into or attached to the site log book. It is suggested that the inspection report or checklist be included in this appendix to keep monitoring and inspection information in one document, but this is optional. However, it is mandatory that this SWPPP and the site inspection forms be kept onsite at all times during construction, and that inspections be performed and documented as outlined below.

At a minimum, each inspection report or checklist shall include:

- a. Inspection date/times
- b. Weather information: general conditions during inspection, approximate amount of precipitation since the last inspection, and approximate amount of precipitation within the last 24 hours.
- c. A summary or list of all BMPs that have been implemented, including observations of all erosion/sediment control structures or practices.
- d. The following shall be noted:
  - i. locations of BMPs inspected,
  - ii. locations of BMPs that need maintenance,
  - iii. the reason maintenance is needed,
  - iv. locations of BMPs that failed to operate as designed or intended, and
  - v. locations where additional or different BMPs are needed, and the reason(s) why
- e. A description of stormwater discharged from the site. The presence of suspended sediment, turbid water, discoloration, and/or oil sheen shall be noted, as applicable.
- f. A description of any water quality monitoring performed during inspection, and the results of that monitoring.
- g. General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- h. A statement that, in the judgment of the person conducting the site inspection, the site is either in compliance or out of compliance with the terms and conditions of the SWPPP and the NPDES

permit. If the site inspection indicates that the site is out of compliance, the inspection report shall include a summary of the remedial actions required to bring the site back into compliance, as well as a schedule of implementation.

- i. Name, title, and signature of person conducting the site inspection; and the following statement: "I certify under penalty of law that this report is true, accurate, and complete, to the best of my knowledge and belief".

When the site inspection indicates that the site is not in compliance with any terms and conditions of the NPDES permit, the Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

## Site Inspection Form

### General Information

**Project Name:** \_\_\_\_\_

**Inspector Name:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**CESCL # :** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Time:** \_\_\_\_\_

- Inspection Type:**
- After a rain event
  - Weekly
  - Turbidity/transparency benchmark exceedance
  - Other

**Weather** \_\_\_\_\_

**Precipitation** Since last inspection \_\_\_\_\_

In last 24 hours \_\_\_\_\_

**Description of General Site Conditions:** \_\_\_\_\_

### Inspection of BMPs

*Element 1: Mark Clearing Limits*

**BMP:** \_\_\_\_\_

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**BMP:** \_\_\_\_\_

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

*Element 2: Establish Construction Access*

**BMP:** \_\_\_\_\_

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**BMP:** \_\_\_\_\_

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**Element 3: Control Flow Rates**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**Element 4: Install Sediment Controls**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**Element 5: Stabilize Soils**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**Element 6: Protect Slopes**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	



**Element 7: Protect Drain Inlets**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

**Element 8: Stabilize Channels and Outlets**

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	


**Element 9: Control Pollutants**

BMP:

Location	Inspected			Functioning			Problem/Corrective Action
	Y	N		Y	N	NIP	

BMP:

Location	Inspected			Functioning			Problem/Corrective Action
	Y	N		Y	N	NIP	

**Element 10: Control Dewatering**

BMP:

Location	Inspected			Functioning			Problem/Corrective Action
	Y	N		Y	N	NIP	

BMP:

Location	Inspected			Functioning			Problem/Corrective Action
	Y	N		Y	N	NIP	

BMP:

Location	Inspected			Functioning			Problem/Corrective Action
	Y	N		Y	N	NIP	

Stormwater Discharges From the Site			
	Observed?		Problem/Corrective Action
	Y	N	
Location			
Turbidity	<input type="checkbox"/>	<input type="checkbox"/>	
Discoloration	<input type="checkbox"/>	<input type="checkbox"/>	
Sheen	<input type="checkbox"/>	<input type="checkbox"/>	
Location			
Turbidity	<input type="checkbox"/>	<input type="checkbox"/>	
Discoloration	<input type="checkbox"/>	<input type="checkbox"/>	
Sheen	<input type="checkbox"/>	<input type="checkbox"/>	

<b>Water Quality Monitoring</b>	
Was any water quality monitoring conducted? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If water quality monitoring was conducted, record results here:	
If water quality monitoring indicated turbidity 250 NTU or greater; or transparency 6 cm or less, was Ecology notified by phone within 24 hrs?	
<input type="checkbox"/> Yes <input type="checkbox"/> No	
If Ecology was notified, indicate the date, time, contact name and phone number below:	
Date:	
Time:	
Contact Name:	
Phone #:	
<b>General Comments and Notes</b>	
Include BMP repairs, maintenance, or installations made as a result of the inspection.	
Were Photos Taken? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If photos taken, describe photos below:	

## **Appendix F – Engineering Calculations**

N/A

## **Erosion Control Report for Camp Murray Entry Gate Project**



## ***Erosion Control Report***

*PREPARED FOR:*

State of Washington  
Military Department  
Facility Management Department  
Building 36 Quartermaster Drive  
Camp Murray, WA 98430

*PROJECT:*

Camp Murray Entry Gate  
Camp Murray, Washington  
210164.10

*PREPARED BY:*

Glenn C. Hume, PE  
Project Engineer

*REVIEWED BY:*

J. Matthew Weber, PE  
Principal

*DATE:*

June 2010

## ***Erosion Control Report***

*PREPARED FOR:*

State of Washington  
Military Department  
Facility Management Department  
Building 36 Quartermaster Drive  
Camp Murray, WA 98430

*PROJECT:*

Camp Murray Entry Gate  
Camp Murray, Washington  
210164.10

*PREPARED BY:*

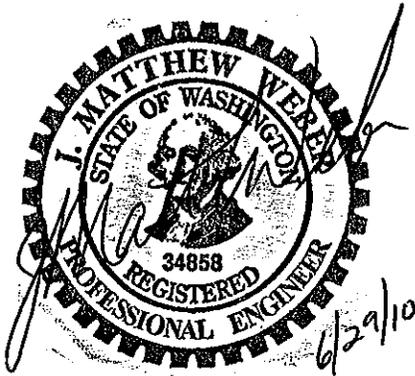
Glenn C. Hume, PE  
Project Engineer

*REVIEWED BY:*

J. Matthew Weber, PE  
Principal

*DATE:*

June 2010



I hereby state that this Erosion Control Report for the Camp Murray Entry Gate project has been prepared by me or under my supervision, and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that Pierce County does not and will not assume liability for the sufficiency, suitability, or performances of drainage facilities prepared by me.

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# ***Appendices***

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## **Appendix A**

### **Exhibits**

- A-1 ..... Vicinity Map
- A-2 ..... FEMA Flood Insurance Rate Map
- A-3 ..... Erosion Control Plan
- A-4 ..... Erosion Control Plan
- A-5 ..... Erosion Control Plan

## **Appendix B**

### **Exhibits**

- Selected Source and Erosion Control BMPs

## **Appendix C**

### **Exhibits**

- Inspection and Maintenance Report Forms

## 1.0 INTRODUCTION

In 1972, Congress passed the Federal Water Pollution Control Act (FWPCA), also known as the Clean Water Act (CWA), to restore and maintain the quality of the nation's waterways. The ultimate goal was to make sure rivers and streams were fishable, swimmable, and drinkable. In 1987, the Water Quality Act (WQA) added provisions to the CWA that allowed the Environmental Protection Agency (EPA) to govern stormwater discharges from construction sites. In 1998, the EPA published the final notice for General Permits for Storm Water Discharges from Construction Activities Disturbing 5 Acres or Greater (63 Federal Register 7898, February 14, 1998). The general permit includes provisions for development of a Stormwater Pollution Prevention Plan (SWPPP) to maximize the potential benefits of pollution prevention, and sediment and erosion control measures at construction sites.

Development, implementation, and maintenance of the Construction SWPPP will provide the selected General Contractor with the framework for reducing soil erosion and minimizing pollutants in stormwater during construction. The Construction SWPPP will:

- Define the characteristics of the site and the type of construction that will occur;
- Describe the practices that will be implemented to control erosion and the release of pollutants in stormwater;
- Create an implementation schedule to ensure that the practices described in this Construction SWPPP are, in fact, implemented, and to evaluate the plan's effectiveness in reducing erosion, sediment, and pollutant levels in stormwater discharged from the site; and
- Describe the final stabilization/termination design to minimize erosion and prevent stormwater impacts after construction is complete.

This Construction SWPPP includes the following:

- Identification of the SWPPP Coordinator with a description of this person's duties;
- Identification of the Stormwater Pollution Prevention (SWPP) Team that will assist in implementation of the Construction SWPPP during construction;
- Description of the existing site conditions, including existing land use for the site, soil types at the site, as well as the location of surface waters that are located on or next to the site;
- Identification of the body or bodies of water that will receive runoff from the construction site, including the ultimate body of water that receives the stormwater;
- Identification of drainage areas and potential stormwater contaminants;
- Description of stormwater management controls and various Best Management Practices (BMPs) necessary to reduce erosion, sediment, and pollutants in stormwater discharge;
- Description of the facility monitoring plan and how controls will be coordinated with construction activities; and
- Description of the implementation schedule and provisions for amendment of the plan.

## 2.0 PROJECT DESCRIPTION

The project site is located on Camp Murray, which is situated between Interstate 5 and American Lake, west of Berkeley Avenue SW, Parcel Nos. 0219201001, 0219212000, 0219213000, and 0219214000, located in Section 21, Township 19 North, Range 2 East, W.M. (see Vicinity Map, Exhibit A-1).

The project proposes relocating the main gate access to the intersection of Portland Avenue and Boundary Road. Construction of a new guard shack and security station is also proposed. Armor Drive will be extended west from the new gate facility approximately 1,700 feet to an intersection with Field Artillery Trail. Field Artillery Trail will be extended northward approximately 275 feet to the intersection with Armor Drive. Improvement and realignment is also proposed for a portion of Aviation Drive.

New asphalt paved road surfaces will be a minimum of 24 feet wide in compliance with the Pierce County Emergency Vehicle Access requirements. Roads are proposed to be sloped to one side to allow stormwater runoff to sheet flow from the paved surface into an adjacent bio-retention swale. The proposed swale is generally located between the road surface and the proposed pervious pedestrian path. Asphalt wedge curb will be provided on Armor Drive within the Murray Creek Stream Buffer area in order to convey the runoff from the pollution generating surfaces outside of the buffer for treatment.

The alignment of Armor Drive is designed to generally follow the existing gravel road alignment in order to minimize site disturbance.

Armor Drive will also be improved south of the proposed main entry gate through the two existing parking lot areas. The road alignment is proposed to be slightly modified to eliminate the 90-degree parking on the west side and replace it with parallel parking. Small areas of asphalt will be added to the two parking areas, and the parking lots will be re-stripped to eliminate the need for vehicles to back out onto Armor Drive from a parking stall.

## 3.0 EROSION CONTROL SPECIALIST

The Contractor shall appoint a Certified Erosion and Sediment Control Lead (CESCL) (BMP C160) for the project.

The duties of the CESCL include:

- Maintaining files onsite 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;
- Keeping daily logs and inspection reports;
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

To aid in the implementation of the Construction SWPPP, the members of the SWPP Team include the following: the Contractor; the CESCL; the Pierce County Inspector; AHBL; and Geotechnical Testing Laboratory, the project geotechnical engineering consultant. The General

Contractor will ensure all housekeeping and monitoring procedures are implemented, while the CESCL will ensure the integrity of the structural BMPs. The Pierce County Inspector, Geotechnical Testing Laboratory, and AHBL will observe construction and erosion control practices, and recommend revisions or additions to the Construction SWPPP and drawings.

## **4.0 EXISTING SITE CONDITIONS**

### **4.1 Existing Cover**

The Road improvements generally follow the routes of existing gravel roads. The areas around the existing gravel roads are vegetated with a variety of tree species including oak, fir, and madrona. The underbrush is moderate with areas of turn lawn. The proposed project will disturb vegetated areas adjacent to the existing gravel roads.

### **4.2 Topography and Drainage**

The existing topography is generally flat, with the exception of the slopes associated with Murray Creek. The general slope direction is to the northwest in the direction of American Lake.

### **4.3 Analysis of the 100-Year Flood**

The FEMA Flood Insurance Rate Map (Exhibit A-2) shows that there is a flood Zone A associated with Murray Creek through Camp Murray. Proposed work will be outside of the Zone A area.

## **5.0 ADJACENT AREAS**

American Lake is directly north of the project site, mixed residential and commercial properties are to the east, Joint Base Lewis-McChord military installation is to the west, and the Interstate 5 right-of-way is to the south.

## **6.0 CRITICAL AREAS**

Murray Creek flows through Camp Murray; the proposed improvements will require work within the Murray Creek buffer area. Improvements will also be constructed within oak conservation areas, and oak trees will be removed as part of this project. A mitigation plan has been prepared for replacement of the oak trees removed by this project. The project will intersect eagle nest setbacks; no trees are removed within these setback areas.

## **7.0 SOILS**

The Natural Resource Conservation Service (NRCS) identifies the area soils as Spanaway gravelly sandy loam (41A).

**41A-Spanaway gravelly sandy loam.** This nearly level to undulating soil is somewhat excessively drained. It formed in glacial outwash mixed in the upper part with volcanic ash on the very extensive plain from Lakewood to Roy.

The vegetation is grass and conifers. Elevation ranges from 100 to 500 feet. The annual precipitation is 35 to 45 inches, and the mean annual air temperature is about 51 degrees F. The frost-free season is about 170 days. Slopes range from 0 to 6 percent. In places, slopes are short and steep, with areas averaging more than 400 acres in size. Some have stones on the surface.

Included within this soil in mapping is about 8 percent somewhat poorly drained Spanaway loam in long, narrow depressions. A small area of Nisqually loamy sand is also included.

In a typical profile, the surface layer is black gravelly sandy loam 14 inches thick. The subsoil, to a depth of 18 inches, is dark grayish brown very gravelly sandy loam. The substratum, to a depth of more than 60 inches, is light brownish gray very gravelly sand.

Reaction is strongly acid to slightly acid. Permeability is moderately rapid. The available water capacity is low. Surface runoff is slow, and there is little erosion hazard. The effective rooting depth is more than 4 feet.

Large areas of this soil are under native vegetation of grass and conifers. Because this soil is suitable for onsite sewage disposal systems, much of it is being converted to urban uses, particularly in the Lakewood and Spanaway areas.

This soil has no limitations for urban development. However, septic water from drain fields endangers ground water supplies because the soil is moderately permeable. This soil is suitable as a source of gravel for construction purposes. Few, if any, cuts and fills are needed. Excavation is not difficult. In places, large stones are scattered on the surface.

Capability subclass IVs.

## **8.0 EROSION PROBLEM AREAS**

Special attention is required for all work adjacent to Murray Creek. Existing vegetation shall not be disturbed to the extent feasible, and cover and sediment prevention BMPs shall be strictly adhered to.

Other areas of potential erosion include the discharge locations to the infiltration ponds and side slopes of the proposed swales. The infiltration ponds and swales shall be stabilized by seeding as soon as feasible, and rock armoring shall be provided at all pipe outlets. If erosion is noted in these areas, they shall be stabilized by sod placement or other measures such as erosion control blankets.

## **9.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION ELEMENTS**

The purpose of this section is to describe how each of the 12 Stormwater Pollution Prevention (SWPP) Elements has been addressed, and to identify the type and location of BMPs used to satisfy the required element. If a SWPP Element is not applicable to the project, a reason is provided.

### **9.1 Mark Clearing Limits**

Prior to beginning land disturbing activities, clearing limits will be marked with high visibility flagging.

### **9.2 Establish Construction Access**

Access to the construction areas will be from Portland Avenue at the intersection with Boundary Street. Access will be provided by an opening in the existing security gate. A rock construction entrance will be provided to prevent sediment tracking onto the adjacent roads. If sediment is

noted on the pavement systems, it shall be removed by sweeping. After sweeping, the pavement may be washed with water. Washing alone is not permitted.

Dump trucks hauling material to and from the site will be covered by a tarp.

### **9.3 Control Flow Rates**

The project will utilize existing and proposed infiltration ponds to manage runoff from the proposed construction areas. Measures shall be taken to minimize sedimentation of the infiltration areas.

### **9.4 Install Sediment Controls**

Structural control measures will be used to reduce erosion and retain sediment on the construction site. The control measures are selected to fit specific site and seasonal conditions.

The temporary erosion and sediment control (TESC) plans provided as part of the construction plan set include the following structural measures:

- The primary sediment control measure will be to limit the disturbed area and maintain the existing vegetation adjacent to the proposed work.
- If the existing retained vegetation is not adequate to remove sediment prior to runoff entering the stormwater system, streams, or existing pavement areas, filter fabric fence shall be provided to remove sediment.
- The project will utilize existing and proposed infiltration areas to manage runoff from the proposed construction areas. Measures shall be taken to minimize sedimentation of the infiltration areas.
- Catch basin inlet protection will be provided for existing catch basins that are adjacent to construction work to prevent sedimentation of stormwater conveyance systems.

### **9.5 Stabilize Soils**

Because source control is the most important form of erosion control, construction practices must adhere to stringent cover requirements.

More specifically, during the period of May 1 through September 30, the Contractor will not be allowed to leave soils unprotected for more than 7 days, and immediate seeding will be required for areas brought to finish grade with no further work planned for the next 30 days. Areas to be paved may be armored with crushed rock subbase in place of other stabilizing measures. The area of clearing will be limited to the amount that can be stabilized by September 30 of that year.

During the period of October 1 through April 30, all disturbed soil areas will be covered or stabilized within 2 days or 24 hours when a major storm event is predicted. Cover measures may include mulching, netting, plastic sheeting, erosion control blankets, or free draining material. The extent of clearing shall be limited to the amount of land that can be covered or stabilized within 24 hours.

Soil stockpiles shall be stabilized by plastic covering or surrounded by filter fabric fence. The stockpiles shall be a minimum of 50 feet from critical areas, including wetland buffers and drainage swales.

The Contractor has the option of providing all required material for cover measures onsite at all times, or preparing a plan of action to submit to Pierce County. A plan of action shall contain the following:

- Contractor's name, address, phone number, and emergency phone number.
- Alternate contact with above information.
- Clearly defined plan of action designed to prevent offsite migration of sediments, which will be implemented in the event that a major storm is predicted or offsite erosion is observed by the Contractor, Contractor's employees, or the County.
- Description of materials to be used for cover and means by which it will be placed. List equipment to be used or number of personnel anticipated to be used to spread material.
- Vendor or supplier of materials to be used; list two alternates and include phone numbers.
- Means and time frame for cleanup of any materials that escape offsite and for repairs to the natural system if damages have occurred.

In order for the ESC facilities to function properly, they must be maintained and sediment removed on a regular basis. Inspection and sediment removal shall be performed on all ESC facilities as described in the inspection schedule located in Section 9.11 of this report.

## **9.6 Protect Slopes**

The site is generally flat with few slopes. Where they exist or are proposed, slopes and swales shall be stabilized as described above.

## **9.7 Protect Drain Inlets**

Existing storm drain inlets within 100 feet of proposed work areas shall be protected so surface water runoff does not enter the conveyance system without first being filtered. Inlets shall be inspected weekly, at a minimum, and daily during storm events.

## **9.8 Stabilize Channels and Outlets**

Rock armoring shall be provided at the new and extended culvert locations. Swales shall be stabilized through seeding or sodding. If erosion is noted at the discharge location of the swales to the infiltration areas, rock armoring shall be provided.

## **9.9 Control Pollutants**

The Contractor shall be responsible for controlling pollutants at the work site. Key elements, such as centralized areas for equipment and concrete truck washing, and temporary storage of debris and other stockpiled materials, are the responsibility of the Contractor.

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. Woody debris may be chopped and spread on proposed landscape areas of the site.

Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste). Onsite fueling tanks shall include secondary containment.

Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and degreasing cleaning operations, fuel tank drain down and removal, and other activities that may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed onsite using temporary plastic placed beneath and, if raining, over the vehicle.

Wheel wash or tire bath wastewater shall be discharged to a separate onsite treatment system or to the sanitary sewer.

Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application rates and procedures shall be followed.

BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters. Stormwater discharges shall not cause or contribute to a violation of the water quality standard for pH in the receiving water.

Construction sites with significant concrete work shall adjust the pH of stormwater if necessary to prevent violations of water quality standards.

The Contractor may elect to follow the detailed guidance on control of non-sediment pollutants as outlined in the Pierce County *Stormwater and Site Development Manual*, 2008 (selected BMPs are included as Appendix B).

Table #1 below lists several pollutants that are commonly found on construction sites that have the potential to contaminate storm runoff. These pollutants will be present mainly in areas of building and pavement construction. The Contractor and SWPPP/TESC Coordinator will be responsible for identifying areas where these pollutants are being used, and will monitor runoff coming from these areas. Pollutant sources will be covered with plastic if contaminated runoff is observed from these areas. If contaminated runoff is found in the sediment trap or soils, the CESCL will direct the Contractor to remove the polluted water/soil and dispose of it in an approved area offsite.

**Table #1 – Potential Construction Site Stormwater Pollutants**

Trade Name Material	Chemical/Physical Description <sup>(1)</sup>	Stormwater Pollutants <sup>(1)</sup>
Pesticides (insecticides, fungicides, herbicide, rodenticides)	Various colored to colorless liquid, powder, pellets, or grains	Chlorinated hydrocarbons, organophosphates, carbamates, arsenic
Fertilizer	Liquid or solid grains	Nitrogen, phosphorous

Trade Name Material	Chemical/Physical Description <sup>(1)</sup>	Stormwater Pollutants <sup>(1)</sup>
Plaster	White granules or powder	Calcium sulphate, calcium carbonate, sulfuric acid
Cleaning solvents	Colorless, blue, or yellow-green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates
Asphalt	Black solid	Oil, petroleum distillates
Concrete	White solid	Limestone, sand
Glue, adhesives	White or yellow liquid	Polymers, epoxies
Paints	Various colored liquid	Metal oxides, stoddard solvent, talc, calcium carbonate, arsenic
Curing compounds	Creamy white liquid	Naphtha
Wastewater from construction equipment washing	Water	Soil, oil & grease, solids
Wood preservatives	Clear amber or dark brown liquid	Stoddard solvent, petroleum distillates, arsenic, copper, chromium
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE
Diesel fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil & grease, naphthalene, xylenes
Kerosene	Pale yellow liquid petroleum hydrocarbon	Coal oil, petroleum distillates
Antifreeze/coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)
Erosion	Solid Particles	Soil, Sediment

<sup>(1)</sup> Data obtained from MSDS when available.

## 9.10 Control Dewatering

Dewatering is not anticipated for this project.

## 9.11 Maintain BMPs

In order for the ESC facilities to function properly, they must be maintained and sediment removed on a regular basis. Inspection and sediment removal shall be performed on all ESC facilities as described in the following inspection schedule.

ESC facilities shall not be allowed to fall into disrepair. All ESC facilities shall be inspected, at a minimum, according to the following schedule.

- Dry Season: Once a week
- Wet Season: Daily and after every storm event that produces runoff.

Needed repairs shall be made within 24 hours or immediately if possible. If necessary, the Engineer of Record or City will instruct the Contractor to provide additional facilities as warranted during field inspections.

The following inspection/maintenance schedules shall be utilized to ensure the ESC facilities are functioning as designed:

### Construction Entrance:

- The construction entrance shall be inspected once a week during the dry season and after every rainfall event during the wet season. If the entrance is not preventing sediment from being tracked onto adjacent pavement, then alternate measures to keep the pavement free of sediment shall be used. This may include street sweeping, an increase in the dimension of the entrance, or the installation of a wheel wash.
- Any quarry spalls that are loosened from the pad that end up on the roadway shall be removed immediately. Additional rock shall be added periodically to maintain proper function of the pad.
- If vehicles are entering or exiting the site at points other than the approved entrance, temporary fencing shall be installed to control traffic.

### Temporary and Permanent Seeding:

- Seeding may be used throughout the project on disturbed areas. During the dry season, areas that have reached final grade or are not being actively worked shall be seeded within 15 days. Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.
- During the wet season, all disturbed areas not being actively worked shall be seeded or stabilized with mulch or plastic sheeting.
- During the wet season, no more area shall be exposed than can be controlled and effectively stabilized by the end of each working day.
- To prevent seed from being washed away, confirm that all other approved erosion/sedimentation control facilities have been installed and are functioning properly.

- Any seeded areas that fail to establish 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) shall be reseeded. If reseeding is ineffective, an alternate method shall be used.
- Seeded areas shall be inspected after every rainfall event during the wet season. Any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeding shall not be used in areas subject to heavy vehicular traffic.

Mulching:

- Mulching shall be inspected once a week during the dry season and after every rainfall event during the wet season.
- Mulch shall be inspected to verify that the proper thickness is being maintained if applicable.
- Any areas that experience erosion shall be re-mulched and/or protected with a net or blanket. If the erosion problem is drainage related, the problem shall be fixed and the eroded area re-mulched.

Plastic Covering:

- Plastic sheeting shall be inspected once a week during both the wet and dry season.
- Torn sheets must be replaced and open seams repaired.
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
- When the plastic is no longer needed, it shall be completely removed.
- If tires are used to weight down the plastic sheeting, they must be disposed of properly.

Inlet Protection:

- Catch basin filter inserts shall be inspected frequently, especially after storm events. If the filter becomes clogged, it should be cleaned or replaced.
- Inserts shall be replaced when tears are detected.

Silt Fence:

- Any damage shall be repaired immediately.
- If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment pond.
- Check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow, and causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.

- Sediment deposits shall be removed when the deposit reaches approximately one-third the height of the silt fence, or a second silt fence shall be installed.
- If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

If the erosion control facilities are damaged, or if the Engineer of Record or Pierce County determines that existing controls are inadequate, the Contractor shall install additional measures as required.

A maintenance inspection report will be made after each inspection. Copies of the report forms to be completed by the SWPPP Coordinator are included in Appendix C of this Construction SWPPP. Completed forms will be provided to the County Inspector and will also be maintained onsite during the entire construction project. If construction activities or design modifications are made to the site plan that could impact stormwater, or if AHBL determines that the measures are not adequate to prevent erosion and the discharge of sediment from the site (based on turbidity measurements), this Construction SWPPP will be amended appropriately. The amended Construction SWPPP will have a description of the new activities that contribute to the increased pollutant loading and the planned source control activities.

## 9.12 Manage the Project

The following practices will be required during construction to properly manage activities:

- Comply with seasonal work limitations.
- Inspect, maintain, and repair BMPs.
- Identify a CESCL.
- Maintain the Construction SWPPP, including narrative and plans onsite at all times.

Erosion control procedures as described in this Construction SWPPP and illustrated on the design plans, if properly implemented, should mitigate anticipated erosion effects from the proposed filling on the project site.

The success of erosion control measures is usually related to the Contractor's attention to maintenance of such measures. However, in some instances, even with proper attention being paid to erosion control, measures such as those shown on the plans are unable to prevent the discharge of turbid water. In this event, secondary measures may be required such as Construction Stormwater Chemical Treatment (BMP C250) or Construction Stormwater Filtration (BMP C251). Also, additional cover measures may be implemented including Sodding (BMP C124) or Polyacrylamide for Soil Erosion Protection (BMP C126). Descriptions of the above-listed BMPs are provided in Volume II of the Pierce County *Stormwater Management and Site Development Manual*, 2008, and will be provided to the Contractor if required.

Water quality monitoring of the stormwater discharge from the project site shall be provided per the requirements of the National Pollutant Discharge Elimination System (NPDES) permit.

## 10.0 CONSTRUCTION PHASING

Site work is proposed to be completed in a single construction phase. A general construction sequence is as follows:

1. Survey and flag clearing limits.
2. Schedule and attend preconstruction meeting with Pierce County.
3. Provide miscellaneous demolition, and clear and grub the area within clearing limits required for installation of temporary erosion control facilities. All erosion and sediment control facilities shown on the erosion control plan shall be installed prior to, or as a first stage of site preparation.
4. The Contractor shall inspect erosion control measures weekly and provide repairs as needed.
5. Clear and grub the remainder of the site within the clearing limits and rough grade.
6. Provide cover measures to include armoring, mulching, and hydroseeding to stabilize denuded areas and prevent the transport of sediment-laden stormwater offsite.
7. Protect infiltration surfaces from over-compaction and sedimentation.
8. Provide storm system as shown on the plans. Provide 6-inch vertical and 3-foot horizontal clearance (outside surfaces) between storm drain lines and other utility pipes and conduits.
9. Fine grade site and pave. Coordinate with Pierce County for required inspections.
10. Stabilize all remaining disturbed areas.
11. Coordinate with Pierce County for final inspection.
12. Remove remaining temporary erosion control devices when area has been permanently stabilized with vegetation and removal is approved by Pierce County.

## 11.0 CONSTRUCTION SCHEDULE

Construction is anticipated to begin in the spring of 2011 and completed in the summer of 2011.

This analysis is based on data and records either supplied to or obtained by AHBL, Inc. These documents are referenced within the text of the analysis. The analysis has been prepared utilizing procedures and practices within the standard accepted practices of the industry.

AHBL, Inc.

*for*   
Glenn C. Hume, PE  
Project Engineer

GCH/lsk

June 2010

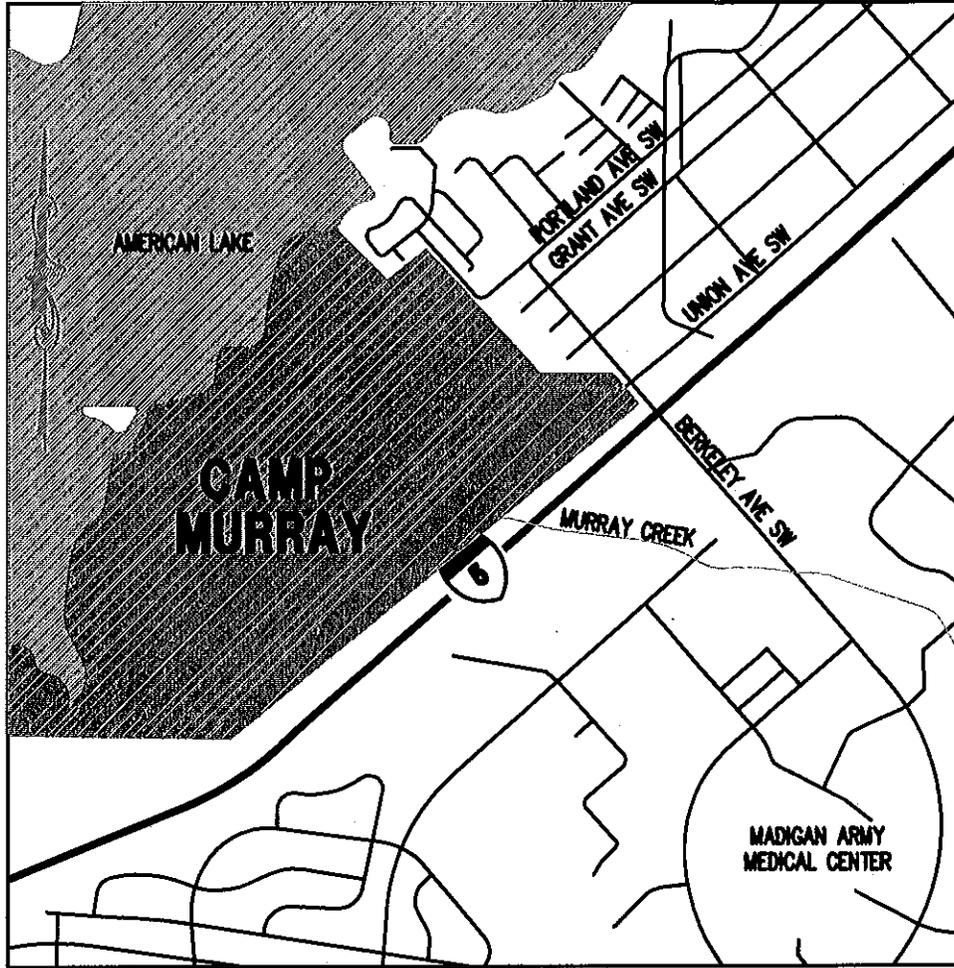
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# ***Appendix A***

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## **Exhibits**

- A-1 .....Vicinity Map
- A-2 .....FEMA Flood Insurance Rate Map
- A-3 .....Erosion Control Plan
- A-4 .....Erosion Control Plan
- A-5 .....Erosion Control Plan



## VICINITY MAP

SCALE: 1"=1/4 MILE



TACOMA · SEATTLE

2216 North 30th Street, Suite 300, Tacoma, WA 98403  
 1200 Sixth Avenue South, Suite 1620, Seattle, WA 98101

- Civil Engineers
- Structural Engineers
- Landscape Architects
- Community Planners
- Land Surveyors
- Neighbors

253.383.2422 TEL.  
 206.267.2425 TEL.

CAMP MURRAY ENTRY GATE  
 210164.10

**VICINITY MAP**

**A-1**

**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The Special Flood Hazard Areas to the areas subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, A1, A2, A99, V and VE. The base flood elevation is the water surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of sheet flow flooding, vehicle suspension determined.

**ZONE A1** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently destroyed. Zone A1 indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from the annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary  
Floodway boundary  
Zone B boundary  
Zone D boundary  
CBRS and OPA boundary  
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.  
Base Flood Elevation line and valley elevation in feet.  
Base Flood Elevation value where different within zone; elevation in feet.  
\* Referenced to the North American Vertical Datum of 1988 (NAVD 88).

①-② Cross section line  
①-② Traversed line  
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)  
1000-meter Universal Transverse Mercator grid ticks, zone 10  
500-foot grid ticks, Alabama State Plane coordinate system, east zone (FIPS/STATE 0101), Transverse Mercator

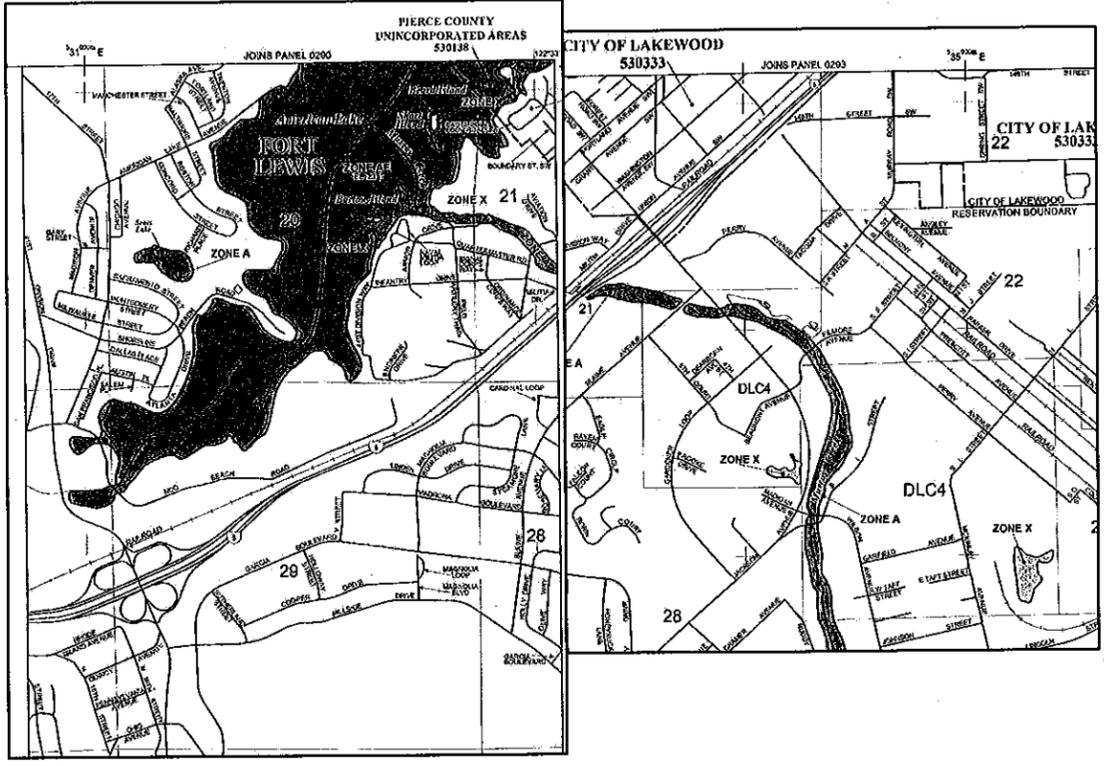
DMS510 Beach mark (see explanation in Notes to Users section of this FIRM panel)  
M15 River Mile

**MAP REPOSITORIES**  
Refer to Map Repositories section on Map Index

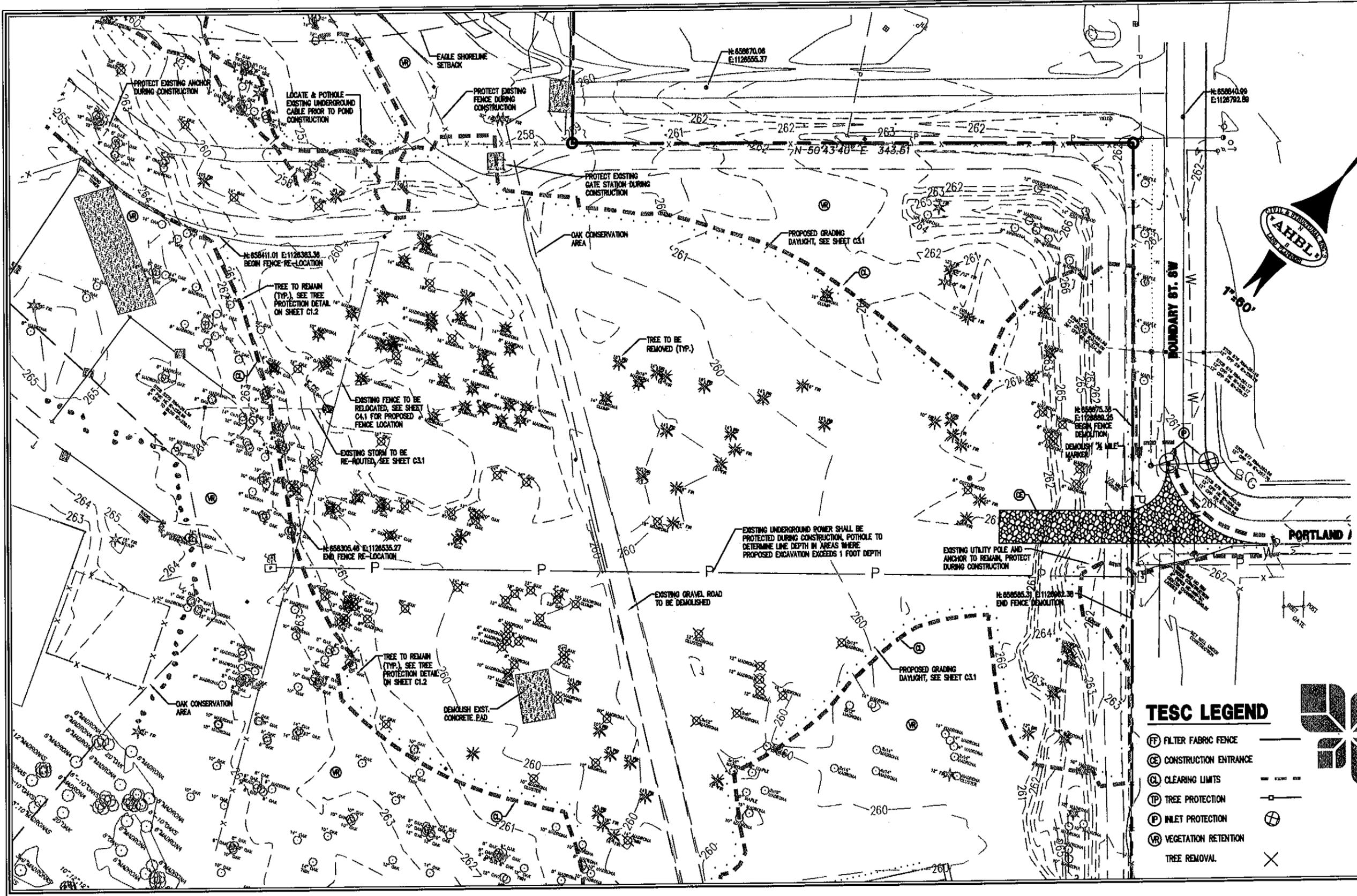
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for the jurisdiction.  
To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-426-8620.

**MAP SCALE 1" = 1000'**  
0 500 1000 2000  
0 500 1000  
FEET METERS



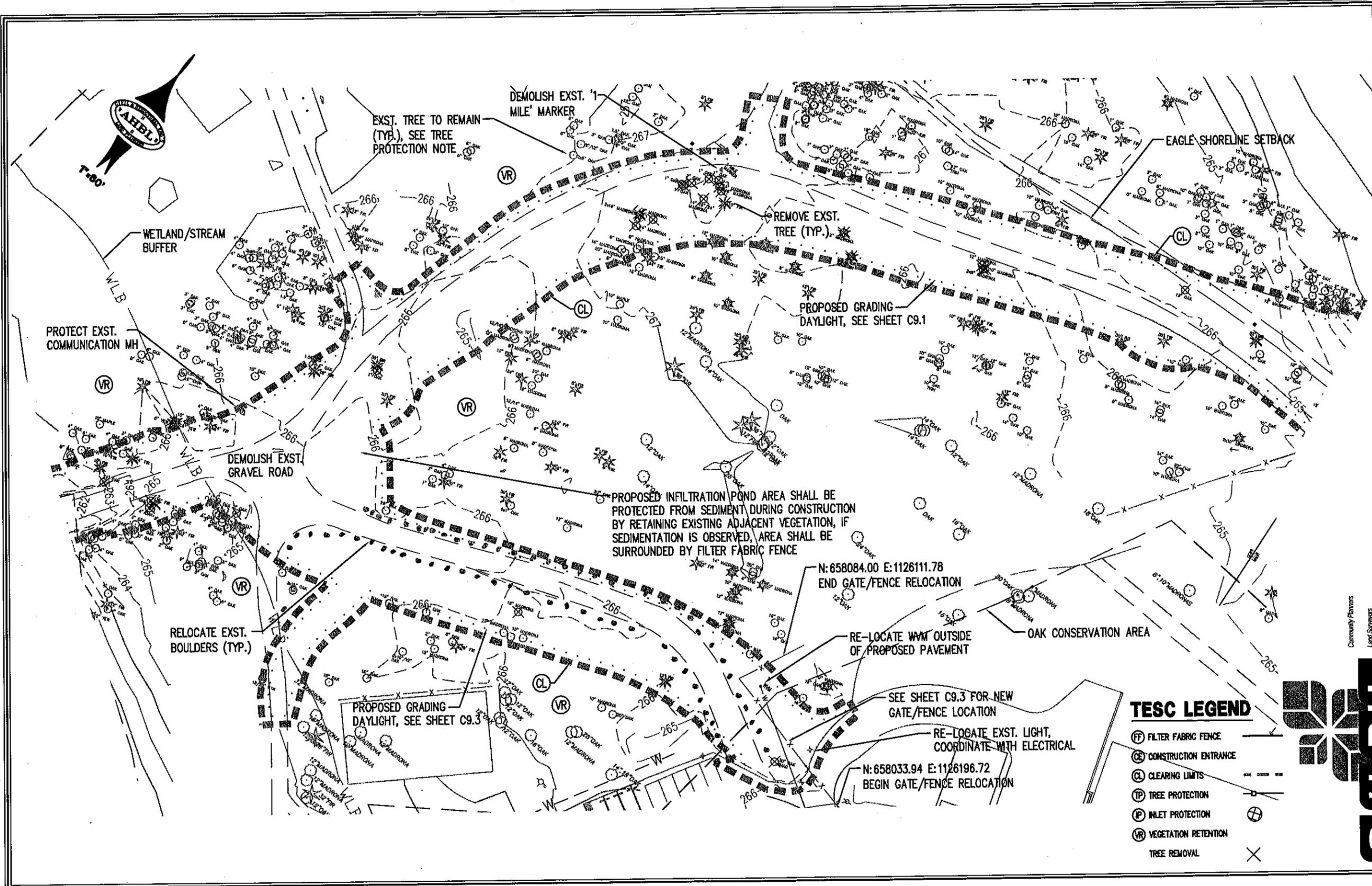
CAMP MURRAY ENTRY GATE  
210164.10  
EROSION CONTROL PLAN



**TESC LEGEND**

- (FF) FILTER FABRIC FENCE
- (CE) CONSTRUCTION ENTRANCE
- (CL) CLEARING LIMITS
- (TP) TREE PROTECTION
- (P) INLET PROTECTION
- (VR) VEGETATION RETENTION
- TREE REMOVAL





**TESC LEGEND**

- FF FILTER FABRIC FENCE
- CE CONSTRUCTION ENTRANCE
- CL CLEARING LIMITS
- TP TREE PROTECTION
- P INLET PROTECTION
- VR VEGETATION RETENTION
- TREE REMOVAL

Community Planners  
Land Surveyors  
Neighbors

**AHBL**  
TACOMA SEATTLE  
2215 North 30th Street, Suite 300, Tacoma, WA 98403  
316 Occidental Avenue South, Suite 320, Seattle, WA 98104  
253.383.2422 TEL  
206.267.2425 TEL

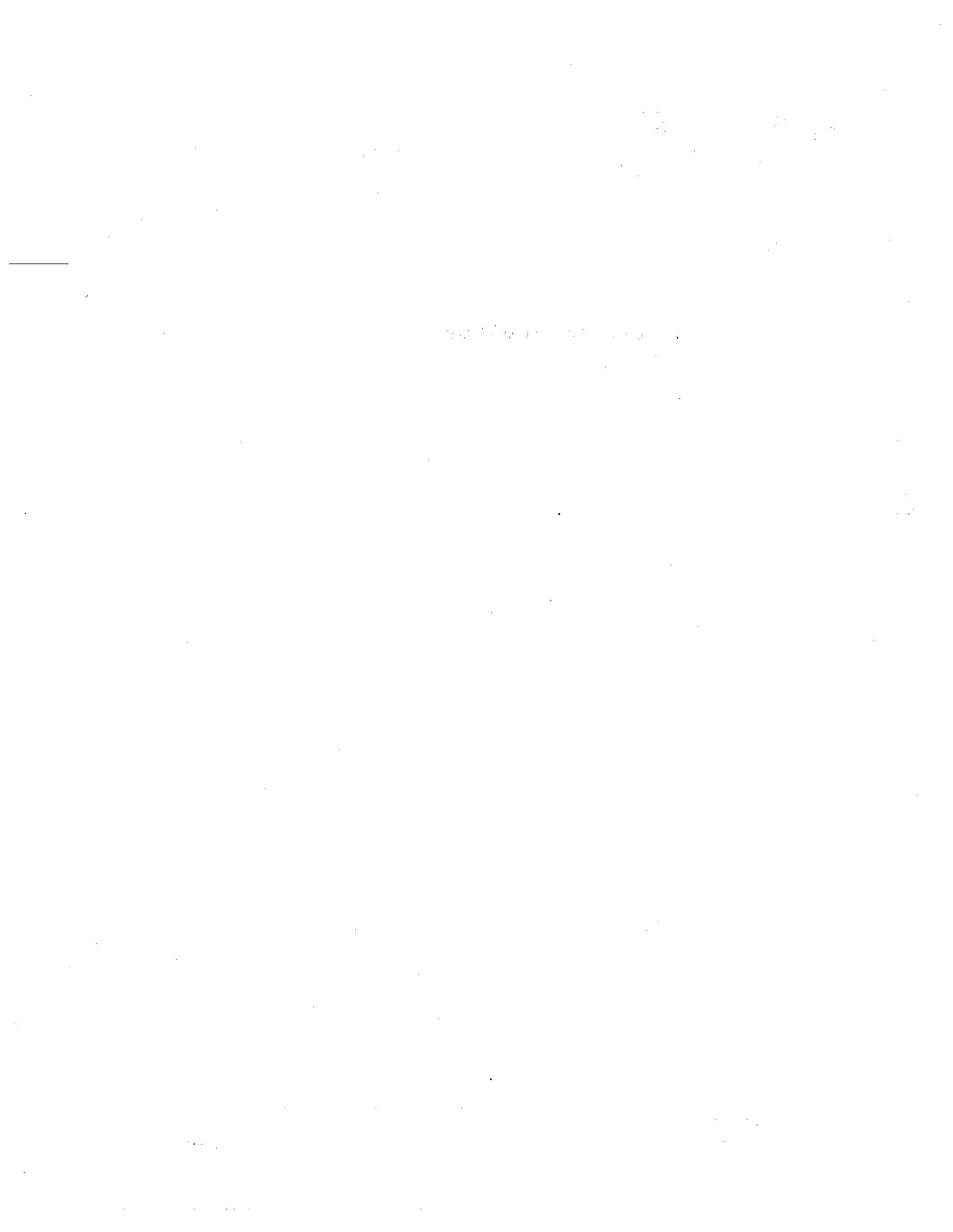


# ***Appendix B***

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## **Exhibits**

Selected Source and Erosion Control BMPs



### **A3.2 Concrete Pouring, Concrete Cutting, and Asphalt Application at Temporary Sites**

**Description of Pollutant Sources:** This activity applies to businesses and public agencies that apply asphalt or pour or cut concrete for building construction and remodeling, road construction, sidewalk, curb and gutter repairs and construction, sealing of driveways and roofs, and other applications. These activities are typically done on a temporary site-to-site basis where permanent BMP measures do not apply. Concrete pouring activities can not only severely alter the pH of receiving waters, but slurry from aggregate washing can harden in storm pipes, thus reducing capacity and creating flooding problems.

Pollutants of concern include toxic hydrocarbons, toxic organic compounds, oils and greases, heavy metals, suspended solids, and pH.

**Pollutant Control Approach:** Train employees on proper procedures, sweep or shovel aggregate chunks, collect accumulated runoff and solids, and wash equipment in designated areas.

#### ***Required BMPs***

The following BMPs or equivalent measures are required of all businesses and agencies doing concrete pouring and asphalt application at temporary sites:

- Employees must be educated on the pollution hazards of concrete and asphalt application and cutting.
- Loose aggregate chunks and dust must be swept or shoveled and collected (not hosed down a storm drain) for recycling or proper disposal at the end of each workday, especially at work sites such as streets, driveways, parking lots, sidewalks, curbs, and gutters where rain can readily pick up the loose material and carry it to the nearest stormwater conveyance. Small amounts of excess concrete, grout, and mortar can be disposed of in the trash.
- Storm drain covers or similarly effective containment devices must be placed over all nearby drains at the beginning of each day. Shovel or vacuum slurry and remove from the site. All accumulated runoff and solids must be collected and properly disposed of (see BMP S.2 in Chapter 5 for disposal options) at the end of each workday, or more often if necessary.
- Exposed aggregate washing, where the top layer of unhardened concrete is hosed or scraped off to leave a rough finish, must be done with a mechanism for containment and collection of the discarded concrete slurry (such as the storm drain covers

mentioned above). The easiest way to contain the washwater will be to direct the washings to a hole in the ground where the water can percolate into the ground and the solids later covered with soil.

- Cleaning of concrete application and mixing equipment or concrete vehicles on the work site must be done in a designated area where the rinse water is controlled. The rinse water must either be collected for proper disposal or put into a hole in the ground where the water can percolate away and the solids later covered with soil or recovered and disposed of or recycled.

The use of any treatment BMP must not result in the violation of groundwater or surface water quality standards.

***Suggested BMPs***

- Avoid the activity when rain is occurring or expected.
- If possible, portable asphalt mixing equipment should be covered by an awning, a lean-to, or another simple structure to avoid contact with rain. See BMP S.4 in Chapter 5 for further details on cover structures.
- Recycle broken concrete and asphalt. Look under Recycling Services in the Yellow Pages of the phone book to find the recycler nearest you.

### 3.1 Source Control Best Management Practices

#### 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 to 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 watercourses or swales, and on building sites in wooded areas.
- As required by the county.

##### *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. County ordinances to save natural vegetation and trees should be reviewed.
- 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 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. A tile system protects a tree from a raised grade. 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 to 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. 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***

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

### ***Conditions of Use***

Natural buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Vegetative buffer zones can be used to protect natural swales and can be incorporated into the natural landscaping of an area.

Critical-areas buffer zones should not be used as sediment treatment areas. These areas shall remain completely undisturbed. The county may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.

### ***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. High visibility plastic fencing is the most effective method in protecting 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 from burying and smothering.
- Vegetative buffer zones for streams, lakes or other waterways shall be established by the county 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.

**BMP C105: Stabilized Construction Entrance*****Purpose***

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or equipment by constructing a stabilized pad of quarry spalls at entrances to construction sites.

***Conditions of Use***

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 feet of the site.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances 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 Attachments Section C, Detail 4.0 for details. Note: the 100 foot minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100 feet).

- 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 following standards:
  - Grab Tensile Strength (ASTM D4751): 200 psi minimum
  - Grab Tensile Elongation (ASTM D4632): 30 percent maximum
  - Mullen Burst Strength (ASTM D3786-80a): 400 psi minimum
  - AOS (ASTM D4751): 20 to 45 (U.S. standard sieve size).
- Hog fuel (wood-based mulch) may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. Hog fuel is generally less effective at stabilizing construction entrances and should be used only at sites where the amount of traffic is very limited. Hog fuel is not recommended for entrance stabilization in urban areas. The effectiveness of hog fuel is highly variable and it generally requires more maintenance than quarry spalls. The inspector may at any time require the use of

quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause degradation of the subgrade support over time.

- Fencing (see BMP C103) shall be installed as necessary to restrict traffic to the construction entrance.
- Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.

***Maintenance Standards***

- Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
- If the entrance 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 an increase in the dimensions of the entrance or the installation of a 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 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 shall be considered. The sediment would then be washed into the sump where it can be controlled.
- 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 entrance(s), fencing (see BMP C103) 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.

## **BMP C120: Temporary and Permanent Seeding**

### ***Purpose***

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

### ***Conditions of Use***

- Seeding may be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a Bonded Fiber Matrix. The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch over hydromulch and blankets.
- Retention/detention ponds should be seeded as required.
- Mulch is required at all times because it protects seeds from heat, moisture loss, and transport due to runoff.
- All disturbed areas shall be reviewed in late August to early September and all seeding should be completed by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- At final site stabilization, all disturbed areas not otherwise vegetated or stabilized shall be seeded and mulched. 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.

### ***Design and Installation Specifications***

- Seeding should be done during those seasons most conducive to growth and will vary with the climate conditions of the region. Local experience should be used to determine the appropriate seeding periods.

- The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1. Seeding that occurs between July 1 and August 30 will require irrigation until 75 percent grass cover is established. Seeding that occurs between October 1 and March 30 will require a mulch or plastic cover until 75 percent grass cover is established.
- To prevent seed from being washed away, confirm that all required surface water control measures have been installed.
- The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 is not allowed if they are to be seeded.
- New and more effective restoration-based landscape practices rely on deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped 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 the rototilling process should be done in multiple lifts, or the prepared soil system shall be prepared properly and then placed to achieve the specified depth.
- Organic matter is the most appropriate form of “fertilizer” because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2 to 10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.
- In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts. It is recommended that areas being seeded for final landscaping conduct soil tests to determine the exact type and quantity of fertilizer needed. This will prevent the over-application of fertilizer. Fertilizer should not be added to the hydromulch machine and agitated more than 20 minutes before it is to be used. If agitated too much, the slow-release coating is destroyed.
- There are numerous products available on the market that takes 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 is a good source of long-term, slow-release, available nitrogen.

- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. Mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and 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. Any mulch or tackifier product used shall be installed per manufacturer's instructions. Generally, mulches come in 40 to 50 pound bags. Seed and fertilizer are added at time of application.
- Mulch is always required for seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.
- On steep slopes, BFM or Mechanically Bonded Fiber Matrix (MBFM) products should be used. BFM/MBFM products are applied at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Application is made so that a minimum of 95 percent soil coverage is achieved. Numerous products are available commercially and should be installed per manufacturer's instructions. Most products require 24 to 36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40 to 50 pound bags and include all necessary ingredients except for seed and fertilizer.
- BFMs and MBFMs have some advantages over blankets:
  - No surface preparation required
  - Can be installed via helicopter in remote areas
  - On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety
  - They are at least \$1,000 per acre cheaper installed.
- In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels. BFMs and MBFMs are good alternatives to blankets in most situations where vegetation establishment is the goal.
  - When installing seed via hydroseeding operations, only about one-third of the seed actually ends up in contact with the soil

surface. This reduces the ability to establish a good stand of grass quickly. One way to overcome this is to increase seed quantities by up to 50 percent.

- Vegetation establishment can also be enhanced by dividing the hydromulch operation into two phases:

- Phase 1 – Install all seed and fertilizer with 25 to 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.

- An alternative is to install the mulch, seed, fertilizer, and tackifier in one lift. Then, spread or blow straw over the top of the hydromulch at a rate of about 800 to 1,000 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 BFM/MBFMs (3,000 pounds per acre minimum).

- Areas to be permanently landscaped shall provide a healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetal health and vitality, improves hydrologic characteristics, and reduces the need for irrigation. This can be accomplished in a number of ways:

- Recent research has shown that the best method to improve till soils is to amend these soils with compost. The optimum mixture is approximately two parts soil to one part compost. This equates to 4 inches of compost mixed to a depth of 12 inches in till soils. Increasing the concentration of compost beyond this level can have negative effects on vegetal health, while decreasing the concentrations can reduce the benefits of amended soils. Please note: The compost should meet specifications for Grade A quality compost in Ecology Publication 94-038.

- Other soils, such as gravel or cobble outwash soils, may require different approaches. Organics and fines easily migrate through the loose structure of these soils. Therefore, the importation of at least 6 inches of quality topsoil, underlain by some type of filter fabric to prevent the migration of fines, may be more appropriate for these soils.
- Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.
- Areas that will be seeded only and not landscaped may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Native topsoil should be reinstalled on the disturbed soil surface before application.
- Seed that is installed as a temporary measure may be installed by hand if it will be covered by straw, mulch, or topsoil. Seed that is installed as a permanent measure may be installed by hand on small areas (usually less than 1 acre) that will be covered with mulch, topsoil, or erosion blankets. The seed mixes listed below include recommended mixes for both temporary and permanent seeding. These mixes, with the exception of the wetland mix, shall be applied at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Local suppliers or the local conservation district should be consulted for their recommendations because 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 county may be used.
- Table 3.1 represents the standard mix for those areas where just a temporary vegetative cover is required.

**Table 3.1. Temporary Erosion Control Seed Mix.**

	% Weight	% Purity	% Germination
Chewings or annual blue grass <i>Festuca rubra</i> var. <i>commutata</i> or <i>Poa annua</i>	40	98	90
Perennial rye <i>Lolium perenne</i>	50	98	90
Redtop or colonial bentgrass <i>Agrostis alba</i> or <i>Agrostis tenuis</i>	5	92	85
White dutch clover <i>Trifolium repens</i>	5	98	90

- Table 3.2 provides just one recommended possibility for landscaping seed.

**Table 3.2. Landscaping Seed Mix.**

	% Weight	% Purity	% Germination
Perennial rye blend <i>Lolium perenne</i>	70	98	90
Chewings and red fescue blend <i>Festuca rubra</i> var. <i>commutata</i> or <i>Festuca rubra</i>	30	98	90

- This turf seed mix in Table 3.3 is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

**Table 3.3. Low-Growing Turf Seed Mix.**

	% Weight	% Purity	% Germination
Dwarf tall fescue (several varieties) <i>Festuca arundinacea</i> var.	45	98	90
Dwarf perennial rye (Barclay) <i>Lolium perenne</i> var. <i>barclay</i>	30	98	90
Red fescue <i>Festuca rubra</i>	20	98	90
Colonial bentgrass <i>Agrostis tenuis</i>	5	98	90

- Table 3.4 presents a mix recommended for bioswales and other intermittently wet areas.

**Table 3.4. Bioswale Seed Mix.<sup>a</sup>**

	% Weight	% Purity	% Germination
Tall or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	75-80	98	90
Seaside/Creeping bentgrass <i>Agrostis palustris</i>	10-15	92	85
Redtop bentgrass <i>Agrostis alba</i> or <i>Agrostis gigantea</i>	5-10	90	80

<sup>a</sup> Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix

- The seed mix shown in Table 3.5 is a recommended low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Other mixes may be appropriate,

depending on the soil type and hydrology of the area. Recent research suggests that bentgrass (*agrostis* sp.) should be emphasized in wet-area seed mixes. Apply this mixture at a rate of 60 pounds per acre.

**Table 3.5. Wet Area Seed Mix. <sup>a</sup>**

	% Weight	% Purity	% Germination
Tall or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	60-70	98	90
Seaside/Creeping bentgrass <i>Agrostis palustris</i>	10-15	98	85
Meadow foxtail <i>Alepocurus pratensis</i>	10-15	90	80
Alsike clover <i>Trifolium hybridum</i>	1-6	98	90
Redtop bentgrass <i>Agrostis alba</i>	1-6	92	85

<sup>a</sup> Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix

- The meadow seed mix in Table 3.6 is recommended for areas that will be maintained infrequently or not at all and 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. The appropriateness of clover in the mix may need to be considered, as this can be a fairly invasive species. If the soil is amended, the addition of clover may not be necessary.

**Table 3.6. Meadow Seed Mix.**

	% Weight	% Purity	% Germination
Redtop or Oregon bentgrass <i>Agrostis alba</i> or <i>Agrostis oregonensis</i>	20	92	85
Red fescue <i>Festuca rubra</i>	70	98	90
White dutch clover <i>Trifolium repens</i>	10	98	90

***Maintenance Standards***

- Any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) shall be reseeded. If reseeding is ineffective, an alternate

method, such as sodding, mulching, or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the county when sensitive areas would otherwise be protected.

- After adequate cover is achieved, any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

## **BMP C121: Mulching**

### ***Purpose***

The purpose of mulching soils is to provide 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 is an enormous variety of mulches that can be used. Only the most common types are discussed in this section.

### ***Conditions of Use***

As a temporary cover measure, mulch should be used:

- On disturbed areas that require cover measures for less than 30 days
- As a cover for seed 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.

### ***Design and Installation Specifications***

For mulch materials, application rates, and specifications, see Table 3.7.

Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

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.

### ***Maintenance Standards***

- The thickness of the 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 3.7. Mulch Standards and Guidelines.

Mulch Material	Quality Standards	Application Rates	Remarks
Straw	Air-dried; free from undesirable seed and coarse material.	2"-3" thick; 5 bales per 1,000 sf or 2-3 tons per acre.	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. Straw should be used only if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1,000 sf or 1,500 – 2,000 lbs per acre.	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 0.75 to 1-inch clog hydromulch equipment. Fibers should be kept to less than 0.75 inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit (unless exempt).	2" thick min.; approx. 100 tons per acre (approx. 800 lbs per yard).	More effective control can be obtained by increasing thickness to 3 inches. Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fines to 6 inches in length for texture, variation, and interlocking properties.	2" minimum thickness.	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 percent because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.
Wood-Based Mulch	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.	2" thick; approx. 100 tons per acre (approx. 800 lbs. per cubic yard).	This material is often called "hog or hogged fuel." It is usable as a material for Stabilized Construction Entrances (BMP C105) and as a mulch. 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).

## **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. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than 6 months) applications.
- Clear plastic sheeting can be used over newly-seeded areas to create a greenhouse effect and encourage grass growth if the hydroseed was installed too late in the season to establish 75 percent grass cover, or if the wet season started earlier than normal. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
- Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to \$1.50 to \$2 per square yard.
- Whenever plastic is used to protect slopes, water collection measures must be installed 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. At no time is clean runoff from a plastic covered slope to be mixed 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:
  - Run plastic up and down slope, not across slope
  - Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet
  - Minimum of 8-inch overlap at seams
  - On long or wide slopes, or slopes subject to wind, all seams should be taped
  - 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
  - Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and pound a wooden stake through each to hold them in place
  - 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
  - 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
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced
- When the plastic is no longer needed, it shall be completely removed.

## **BMP C124: Sodding**

### ***Purpose***

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

### ***Conditions of Use***

Sodding may be used in the following areas:

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

### ***Design and Installation Specifications***

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

The following steps are recommended for sod installation:

- Shape and smooth the surface to final grade in accordance with the approved grading plan. The swale needs to be overexcavated 4 to 6 inches below design elevation to allow room for placing soil amendment and sod.
- Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than 10 percent or the permeability is less than 0.6 inches per hour. Compost used should meet Ecology publication 94-038 specifications for Grade A quality compost.
- Fertilize according to the supplier's recommendations.
- Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
- Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
- Roll the sodded area and irrigate.

- When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

***Maintenance Standards***

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

**BMP C125: Topsoiling*****Purpose***

The purpose is to provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling is an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but they also serve as effective biofilters for urban pollutants and, by supporting more vigorous plant growth, reduce the water, fertilizer and pesticides needed to support installed landscapes. Topsoil does not include any subsoils but only the material from the top several inches including organic debris.

***Conditions of Use***

- Native soils should be left undisturbed to the maximum extent practicable. Native soils disturbed during clearing and grading should be restored, to the maximum extent practicable, to a condition where moisture-holding capacity is equal to or better than the original site conditions. This criterion can be met by using onsite native topsoil, incorporating amendments into onsite soil, or importing blended topsoil.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.
- Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. If an existing soil system is functioning properly it shall be preserved in its undisturbed and uncompacted condition.
- Depending on where the topsoil comes from, or what vegetation was on site before disturbance, invasive plant seeds may be included and could cause problems for establishing native plants, landscaped areas, or grasses.
- Topsoil from the site will contain mycorrhizal bacteria that are necessary for healthy root growth and nutrient transfer. These native mycorrhiza are acclimated to the site and will provide optimum conditions for establishing grasses. Commercially available mycorrhiza products should be used when topsoil is brought in from off site.

***Design and Installation Specifications***

If topsoiling is to be done, the following items should be considered:

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil depth shall be at least 8 inches with a minimum organic content of 10 percent dry weight and pH between 6.0 and 8.0 or matching the pH of the undisturbed soil. This can be accomplished either by returning native topsoil to the site and/or incorporating organic amendments. Organic amendments should be incorporated to a minimum 8-inch depth except where tree roots or other natural features limit the depth of incorporation. Subsoils below the 12-inch depth should be scarified at least 2 inches to avoid stratified layers, where feasible. The decision to either layer topsoil over a subgrade or incorporate topsoil into the underlying layer may vary depending on the planting specified.
- If blended topsoil is imported, then fines should be limited to 25 percent passing through a 200 sieve.
- The final composition and construction of the soil system will result in a natural selection or favoring of certain plant species over time. For example, recent practices have shown that incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- Locate the topsoil stockpile so that it meets specifications and does not interfere with work on the site. It may be possible to locate more than one pile in proximity to areas where topsoil will be used.
- Allow sufficient time in scheduling for topsoil to be spread prior to seeding, sodding, or planting.
- Care must be taken not to apply to subsoil if the two soils have contrasting textures. Sandy topsoil over clayey subsoil is a particularly poor combination, as water creeps along the junction between the soil layers and causes the topsoil to slough.
- If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method to prevent a lack of bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- Ripping or restructuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.
- Field exploration of the site shall be made to determine if there is surface soil of sufficient quantity and quality to justify stripping.

Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, and clay loam). Areas of natural groundwater recharge should be avoided.

- Stripping shall be confined to the immediate construction area. A 4- to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All surface runoff control structures shall be in place prior to stripping.

Stockpiling of topsoil shall occur in the following manner:

- Side slopes of the stockpile shall not exceed 2:1.
- An interceptor dike with gravel outlet and silt fence shall surround all topsoil stockpiles between October 1 and April 30. Between May 1 and September 30, an interceptor dike with gravel outlet and silt fence shall be installed if the stockpile will remain in place for a longer period of time than active construction grading.
- Erosion control seeding or covering with clear plastic or other mulching materials of stockpiles shall be completed within 2 days (October 1 through April 30) or 7 days (May 1 through September 30) of the formation of the stockpile. Native topsoil stockpiles shall not be covered with plastic.
- Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.
- Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.
- When native topsoil is to be stockpiled and reused the following should apply to ensure that the mycorrhizal bacterial, earthworms, and other beneficial organisms will not be destroyed:
  - Topsoil is to be reinstalled within 4 to 6 weeks
  - Topsoil is not to become saturated with water
  - Plastic cover is not allowed.

#### ***Maintenance Standards***

Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.

## **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***

For use in areas (including roadways) subject to surface and air movement of dust where onsite and offsite 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, if stable. 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 surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- 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. Oil based products are prohibited from use as a dust suppressant. The county may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control. PAM has also shown to

be relatively affordable and thus an extremely cost-effective dust control method.

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.
- Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- 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.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.

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.

***Maintenance Standards***

Respray area as necessary to keep dust to a minimum.

**BMP C150: Materials on Hand**

*Purpose*

Quantities of erosion prevention and sediment control materials can be kept on the project site at all times to be used for emergency situations such as unexpected heavy summer rains. Having these materials on site reduces the time needed to implement 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 are stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A contractor or developer could keep a stockpile of materials that are available to be used 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 that will cover numerous situations includes:

Material	Measure	Quantity
Clear Plastic, 6 mil	100 foot roll	1-2
Drainpipe, 6 or 8 inch diameter	25 foot section	4-6
Sandbags, filled	each	25-50
Straw Bales for mulching	approx. 50# each	10-20
Quarry Spalls	ton	2-4
Washed Gravel	cubic yard	2-4
Geotextile Fabric	100 foot roll	1-2
Catch Basin Inserts	each	2-4
Steel T-Posts	each	12-24

***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.
- Restock materials used 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. This BMP is intended to minimize and eliminate concrete process water and slurry from entering waters of the state.

### ***Conditions of Use***

For use any time concrete is used, these management practices shall be utilized. Concrete construction projects include, but are not limited to, the following:

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

### ***Design and Installation Specifications***

- Concrete truck chutes, pumps, and internals shall be washed out only into formed areas awaiting installation of concrete or asphalt.
- Unused concrete remaining in the truck and pump shall be returned to the originating batch plant for recycling, as feasible.
- Hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels shall be washed off only into formed areas awaiting installation of concrete or asphalt.
- Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed stormwater conveyances.
- Washdown from areas such as concrete aggregate driveways shall not drain directly to natural or constructed stormwater conveyances.
- When no formed areas are available, washwater and leftover product shall be contained in a lined container or a hole dug on site. Contained concrete shall be disposed of in a manner that does not violate groundwater or surface water quality standards.

***Maintenance Standards***

Containers shall be checked for holes in the liner daily during concrete pours and repaired 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. This BMP is intended to minimize and eliminate process water and slurry from entering waters of the state.

### ***Conditions of Use***

Anytime sawcutting or surfacing operations take place, these management practices shall be utilized. Sawcutting and surfacing operations include, but are not limited to, the following:

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

### ***Design and Installation Specifications***

- Slurry and cuttings shall be vacuumed 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.
- Collected slurry and cuttings shall be disposed of in a manner that does not violate groundwater or surface water quality standards.
- Process water that is generated during hydro-demolition, surface roughening or similar operations shall not drain to any natural or constructed drainage conveyance and shall be disposed of in a manner that does not violate groundwater or surface water quality standards.
- Cleaning waste material and demolition debris shall be handled and disposed of in a manner that does not cause contamination of water. If the area is swept with a pick-up sweeper, the material must be hauled out of the area to 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 vacuum trucks.

## **BMP C160: Certified Erosion and Sediment Control Lead**

### ***Purpose***

The project applicant designates at least one person as the responsible representative in charge of ESC, and water quality protection. The designated person shall be the CESCL who is responsible for ensuring compliance with all local, state, and federal ESC and water quality requirements.

### ***Conditions of Use***

A CESCL shall be made available on projects disturbing ground 1 acre or larger and that discharge stormwater to surface waters of the state.

The CESCL shall:

- Have a current certificate proving attendance in an ESC training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).
- Ecology will maintain a list of ESC training and certification providers at: [www.ecy.wa.gov/programs/wq/stormwater](http://www.ecy.wa.gov/programs/wq/stormwater).

**OR**

- Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: [www.cpesc.net](http://www.cpesc.net).

### ***Specifications***

Certification shall remain valid for 3 years.

- The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, 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.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

- Maintaining permit file on site at all times which includes the 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.
- 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.
  - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
    - Locations of BMPs inspected
    - Locations of BMPs that need maintenance
    - Locations of BMPs that failed to operate as designed or intended, and
    - Locations of where additional or different BMPs are required.
  - 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.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

## **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 surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing, provide timely installation of erosion and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.

### ***Design Considerations***

- Avoid 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.

## **BMP C233: Silt Fence**

### ***Purpose***

Use of a 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. See Attachments Section C, Detail 8.0 for details on silt fence construction.

### ***Conditions of Use***

- Silt fence may be used downslope of all disturbed areas.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a silt fence, rather than by a sediment pond, is when the area draining to the fence is 1 acre or less and flow rates are less than 0.5 cubic feet per second.
- Silt fences should not be constructed in streams or used in V-shaped ditches. They are not an adequate method of silt control for anything deeper than sheet or overland flow.

### ***Design and Installation Specifications***

- Drainage area of 1 acre or less or in combination with sediment basin in a larger site.
- Maximum slope steepness (normal [perpendicular] to fence line) 1:1.
- Maximum sheet or overland flow path length to the fence of 100 feet.
- No flows greater than 0.5 cubic feet per second.
- The geotextile used shall meet 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 3.10).
- Standard strength fabrics shall be supported with wire mesh, chicken wire, 2 x 2-inch wire, safety fence, or jute mesh to increase the strength of the fabric. Silt fence materials are available that have synthetic mesh backing attached.

**Table 3.10. Geotextile Standards.**

Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for film wovens (#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 <sup>-1</sup> 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

- Filter fabric 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.
- 100 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 local regulations.
- Standard notes for construction plans and specifications follow. Refer to Attachments Section C, Detail 8.0 for standard silt fence details.
- The contractor shall install and maintain temporary silt fences at the locations shown in the plans. The silt fences shall be constructed in the areas of clearing, grading, or drainage prior to starting those activities. A silt fence shall not be considered temporary if the silt fence must function beyond the life of the contract. The silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- The minimum height of the top of silt fence shall be 2 feet and the maximum height shall be 2.5 feet above the original ground surface.
- The geotextile shall be sewn together at the point of manufacture, or at an approved location as determined by the engineer, to form geotextile lengths as required. All sewn seams shall be located at a support post. Alternatively, two sections of silt fence can be overlapped, provided the contractor can demonstrate, to the satisfaction of the engineer, that the overlap is long enough and that the adjacent fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.

- The geotextile shall be attached on the up-slope side of the posts and support system with staples, wire, or in accordance with the manufacturer's recommendations. The geotextile shall be attached to the posts in a manner that reduces the potential for geotextile tearing at the staples, wire, or other connection device. Silt fence back-up support for the geotextile in the form of a wire or plastic mesh is dependent on the properties of the geotextile selected for use. If wire or plastic back-up mesh is used, the mesh shall be fastened securely to the up-slope of the posts with the geotextile being up-slope of the mesh back-up support.
- The geotextile at the bottom of the fence shall be buried in a trench to a minimum depth of 4 inches below the ground surface. The trench shall be backfilled and the soil tamped in place over the buried portion of the geotextile, such that no flow can pass beneath the fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the trench a minimum of 3 inches.
- The fence posts shall be placed or driven a minimum of 18 inches. A minimum depth of 12 inches is allowed if topsoil or other soft subgrade soil is not present and a minimum depth of 18 inches cannot be reached. Fence post depths shall be increased by 6 inches if the fence is located on slopes of 3:1 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.
- Silt fences shall be located 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.
- If the fence must cross contours, with the exception of the ends of the fence, gravel check dams placed perpendicular to the back of the fence shall be used to minimize concentrated flow and erosion along the back of the fence. The gravel check dams shall be approximately 1-foot deep at the back of the fence. It 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. The gravel check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. The gravel check dams shall be located every 10 feet along the fence where the fence must cross contours. The slope of the fence line where contours must be crossed shall not be steeper than 3:1.

- Wood, steel or equivalent posts shall be used. Wood posts shall have minimum dimensions of 2 inches by 2 inches by 3 feet minimum length, and shall be free of defects such as knots, splits, or gouges. Steel posts shall consist of either size No. 6 reinforcement bar 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 pounds/feet or other steel posts having equivalent strength and bending resistance to the post sizes listed. The spacing of the support posts shall be a maximum of 6 feet.
- Fence back-up 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 pounds grab tensile strength. The polymeric mesh must be as resistant to ultraviolet radiation as the geotextile it supports.
- Silt fence installation using the slicing method specification details follow. Refer to Figure 3.12 for slicing method details.
- The base of both end posts must be at least 2 to 4 inches above the top of the silt fence 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.
- Install posts 3 to 4 feet apart in critical retention areas and 6 feet apart in standard applications.

#### ***Maintenance Standards***

- Install posts 24 inches deep on the downstream side of the silt fence, and as close as possible to the fabric, enabling posts to support the fabric from upstream water pressure.
- Install posts with the nipples facing away from the silt fence fabric.
- Attach the 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. In addition, each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
- Wrap approximately 6 inches of fabric around the end posts and secure with three ties.
- No more than 24 inches of a 36-inch fabric is allowed aboveground level.

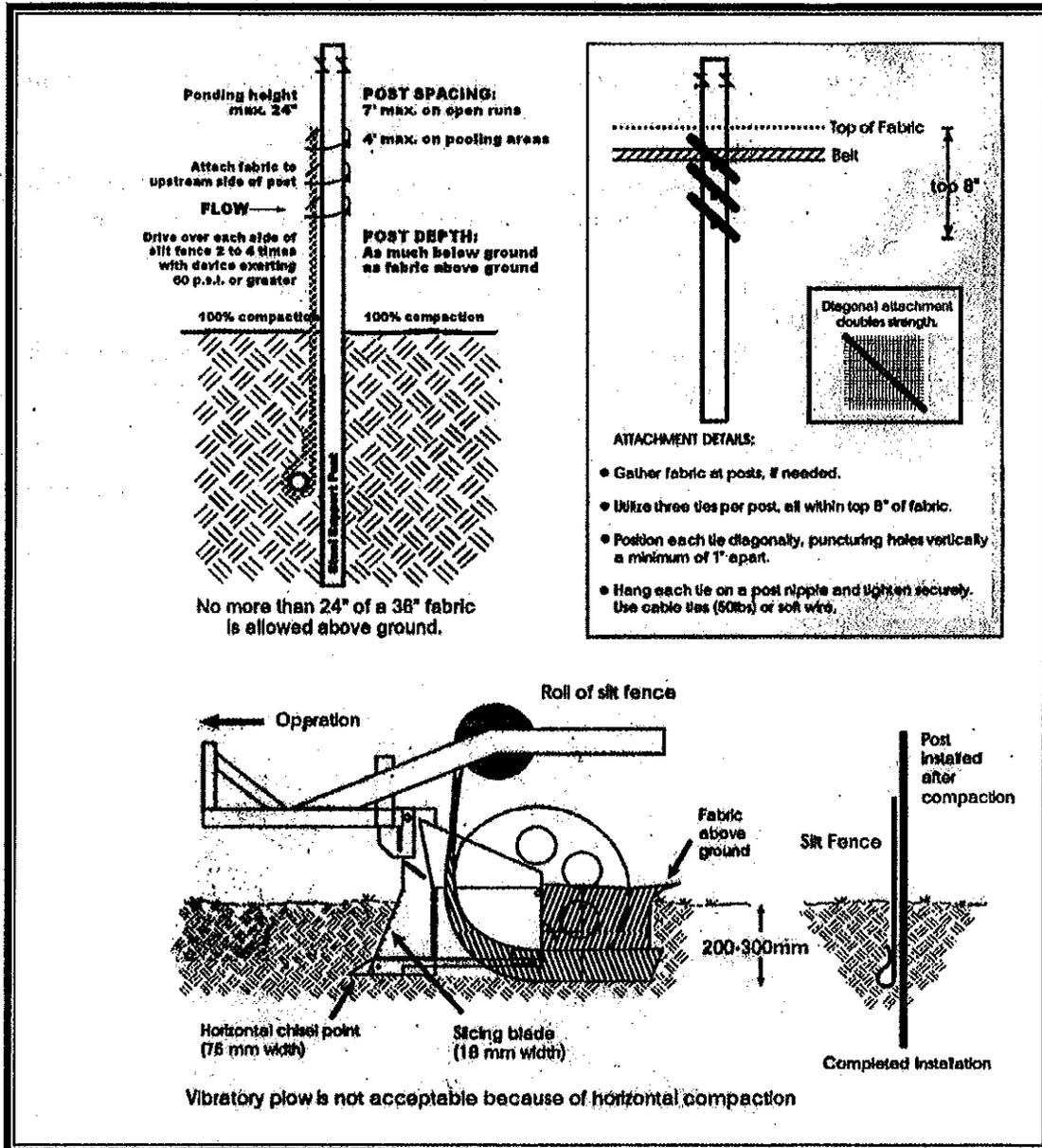


Figure 3.12. Silt Fence Installation by Slicing Method.

- The rope lock system must be used in all ditch check applications.
- The installation should be checked and corrected for any deviation before compaction. Use a flat-bladed shovel to tuck fabric deeper into the ground if necessary.
- Compaction is vitally important for effective results. Compact the soil immediately next to the silt fence 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.

- Any damage shall be repaired immediately.
- If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment pond.
- It is important to check the uphill side of the 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 or remove the trapped sediment.
- Sediment deposits shall either be removed when the deposit reaches approximately one-third the height of the silt fence, or a second silt fence shall be installed.
- If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

**BMP C234: Vegetated Strip**

***Purpose***

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

***Conditions of Use***

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a strip, rather than by a sediment pond, is when the following criteria are met (see Table 3.11):

**Table 3.11. Vegetated Strips.**

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

***Design and Installation Specifications***

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

***Maintenance Standards***

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.

- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the buffer, surface water controls must be installed to reduce the flows entering the buffer, or additional perimeter protection must be installed.

# ***Appendix C***

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## **Exhibits**

Inspection and Maintenance Report Forms

**Camp Murray Entry Gate – Pierce County  
 Stormwater Pollution Prevention Plan  
 Inspection and Maintenance Report Form**

To be completed every 7 days and within 24 hours of a rainfall event of 0.5 inches or more

Inspector: \_\_\_\_\_ Date: \_\_\_\_\_

Inspector's Qualifications:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Days since last rainfall: \_\_\_\_\_ Amount of last rainfall: \_\_\_\_\_ inches

**Stabilization Measures**

Drainage Area	Date Since Last Disturbance	Date of Next Disturbance	Stabilized (yes/No)	Stabilized With	Condition

Stabilization required:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

To be performed by: \_\_\_\_\_ On or before: \_\_\_\_\_

**Camp Murray Entry Gate – Pierce County  
Storm Water Pollution Prevention Plan  
Inspection and Maintenance Report Form**

**Perimeter Structural Controls:**

Date: \_\_\_\_\_

Silt Fence

Drainage Area Perimeter	Has Silt Reached 1/3 of Fence Height?	Is Fence Properly Secured?	Is There Evidence of Washout or Overtopping?

Maintenance required for silt fence and straw bails:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

To be performed by: \_\_\_\_\_ On or before: \_\_\_\_\_

**Camp Murrary Entry Gate – Pierce County**  
**Storm Water Pollution Prevention Plan**  
**Inspection and Maintenance Report Form**

Changes required to the pollution prevention plan:

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Reasons for changes:

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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 the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are signification penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: \_\_\_\_\_

Date: \_\_\_\_\_