WHATCOM COUNTY
Planning & Development Services
5280 Northwest Drive,
Bellingham, WA 98226-9097
360-676-6907, TTY 800-833-6384
360-738-2525 Fax

J.E. "Sam" Ryan
Director

LAND DISTURBANCE PERMIT

PERMIT NO: LDP2011-00054	**ISSUED: October 12, 2011**	**EXPIRES: April 11, 2012**
SITE ADDRESS: HENRY		**TAX PARCEL NO: 3901190925000000**

APPLICANT	PROPERTY OWNER	CONTRACTOR
PACIFIC INTERNATIONAL TERMINA HARBOR CENTER BLG, SUITE 156 BELLINGHAM, WA 98225		

PROJECT DESCRIPTION

08.16.11 - Work associated with terrestrial geotech investigation for proposed Gateway Pacific Terminal. Work includes approx 50 boreholes and 20 cone penetration tests. Temporary access paths/roads installed at 17-ft in width, including clearing of trees and shrubs in forested areas. In total, approx. 23,132-feet of access paths/roads needed with approx 4,369 CY of grading and 9.1 acres of clearing. Part of work already performed and part proposed. SEPA checklist also received.

TOTAL PROPERTY TO BE DISTURBED: 9.00

EROSION CONTROL METHODS
ASNED

MATERIAL DESTINATION: ON SITE

FILL INFORMATION				GRADE INFORMATION			
FILL	**LENGTH**	**WIDTH**	**CUBIC YRDS**	**GRADE**	**LENGTH**	**WIDTH**	**CUBIC YRDS**
				OTHER	**23,130.00**	**17.00**	**4,369.00**

PERMIT BECOMES NULL AND VOID IF WORK AUTHORIZED HEREIN HAS NOT COMMENCED WITHIN 180 DAYS, OR IF WORK IS SUSPENDED OR ABANDONED FOR A PERIOD OF 180 DAYS AT ANY TIME AFTER WORK HAS COMMENCED.

A COPY OF THIS PERMIT MUST BE POSTED ON-SITE AND BE CLEARLY VISABLE FROM THE ROAD ACCESS POINT (WCC 20.90.730.9)

FAILURE TO DO SO MAY RESULT IN PERMIT REVOCATION AND/OR OTHER PENALTIES

CONDITIONS OF APPROVAL

THIS PERMIT IS SUBJECT TO THE FOLLOWING CONDITIONS

IT IS IMPORTANT THAT YOU READ AND UNDERSTAND THE GOVERNING FACTORS OF THIS PERMIT. IF YOU HAVE ANY QUESTIONS REGARDING THESE CONDITIONS OR YOUR RESPONSIBILTIES, CONTACT WHATCOM COUNTY PLANNING AND DEVELOPMENT SERVICES.

INADVERTENT ARCH RESOURCE

If archaeological materials (bone, shell midden, cobble tools, etc.) are observed during site work, work in the area of discovery shall cease and the Whatcom County SEPA Administrator (676-6907) LNTHPO (384-2280) and Washington State Office of Archaeology and Historic Preservation (360-586-3065) shall be contacted immediately to determine the significance of the discovery. If human remains are observed, the Whatcom County Sheriff (911) and Lummi Sche'lan"en Department (384-2312) shall be contacted immediately. Compliance with all other applicable laws pertaining to archaeological resources is required.

LU - EXCAVATION WASTE

Any excess excavation waste or waste volume of any origin exported off site must be exported to a site with an ACTIVE LAND DISTURBANCE PERMIT for the approved fill volume or a site with a current Washington State approved Reclamation Plan. Whatcom County Planning and Development Services will require documentation of the approved disposal site.

LU - NOTIFY OF ADD FILL/GRADE

Notify Whatcom County Planning and Development Services, Natural Resource Division at (360) 676-6907 if any additional Fill and / or Grading to be included.

LU - EROSION CONTROL

Proper Erosion Control measures shall be installed prior to any land alteration and maintained throughout the entire land disturbance / construction process. Any evidence of sedimentation shall be controlled and kept on site.

LU - MULCHING

All exposed soils shall be mulched per Whatcom County Standards and maintained or until seeding or other stabilization methods are effective.

LU - RESEEDING

Reseeding of the area affected with native species by the work detailed in this permit is required. Erosion and sediment shall be controlled and contained within the work area through best management practices until stabilization through revegetation can occur. Documentation must be provided of the species used to revegetate the disturbed areas.

LU - FILL & GRADE EXTENSIONS

Per section 105.5 of the IBC Permit Expirations

Every permit issued under the provisions of this code shall expire and become null and void, if the work authorized by such permit is not commenced within 180 days from the date of issuance of such permit, or if the work authorized by such permit is suspended or abandoned at any time after the work is commenced for a period of 180 days. The building official is authorized to grant, in writing, one or more extensions of time, for a period not more than 180 days each. The extension request shall be in writing and justifiable causes demonstrated. If the permit has expired, before such work can recommence, a new permit shall be first obtained to do so, and the fee therefore shall be one - half the amount required for a new permit for such work, provided no changes have been made, or will be made in the original plans and specifications for such work; and provided, further that such suspension or abandonment has not exceeded one year.

LU - CONSTRUCTION ACCESS ROUTE

Construction vehicle access will be, whenever feasible, limited to one route. Access surfaces shall be stabilized to minimize the tracking of sediment onto adjacent roads. See Series 301 for Standard Drawings of alternative techniques.

NATURAL DRAINAGE PATTERNS

Natural drainage patterns shall be maintained and discharges from the site shall occur at the natural location, unless it can he shown that relocation will have no significant adverse impact to either built or natural systems as a result of the relocation. (WCC20.80.634(1)(e)

LU - CONFORMANCE WITH SITE PLAN

All activity on site shall be done in accordance with the site plan approved by the Whatcom County Planning and Development Land Use Division. Any alterations from the approved site plan will require further review by Planning and Development Services.

LU - OTHER AGENCY CONDITION

OBTAINING A COUNTY PERMIT DOES NOT SUPERCEDE OTHER LOCAL, STATE OR FEDERAL STATUTES AND REGULATIONS THAT MAY APPLY TO THIS PERMIT. ANY WETLAND OR STREAM IMPACTS REQUIRE NOTIFYING THE U.S. ARMY CORPS OF ENGINEERS (RANDALL PERRY 206-764-6985) AND WASHINGTON STATE DEPARTMENT OF ECOLOGY (SUSAN MEYER 425-649-7168). ANY IN STREAM ACTIVITY REQUIRES REVIEW BY THE WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (360-466-4345) AND ACTIVITY THAT INCLUDES CLASS II, III OR IV FOREST PRACTICES AS DEFINED IN WAC 222-16-050 MAY REQUIRE A FOREST PRACTICES APPLICATION / NOTIFICATION FROM THE WASHINGTON DEPARTMENT OF NATURAL RESOURCES.

CUSTOM CONDITION

Compliance with all other applicable State and Federal laws pertaining to archaeological resources is required. To provide specific measures to ensure compliance the following conditions will be required;

1. No ground disturbing may take place within 150 feet of the boundaries of 45WH1 within the Gateway Pacific Terminal (GPT) project area without a Memorandum of Agreement (MOA) between consulting parties under Section 106 of the National Historic Preservation Act and its implanting regulations 36CFR800, or an Excavation Permit from the Department of Archaeology and History Preservation (DAHP) under RCW 27.53. Ground disturbing activities including, but not limited to, clearing and grading, geotechnical borings, replanting and reforestation, development, and archaeological investigations including survey, testing, damage assessment and mitigation.

2. A professional archaeological damage assessment that meets state and federal requirements must be prepared and submitted to the interested affected parties prior to any further activities within the Gateway Pacific Terminal project area.

3. A professional archaeological survey of the unpermitted clearing (9.1 acres) and the already accomplished and proposed geo-technical work, must be prepared, submitted and approved to/by the lead agency and consulting parties prior to any ground disturbing activities, as defined above, within the GPT project area.

SEPA Threshold Determination

SEPA Threshold Determination of Mitigated Determination of Non-significance (MDNS) contains conditions to mitigate for potentially adverse environmental impacts for this project. All conditions of this MDNS, (SEP2011-00067) apply.

CA - MITIGATION INSTALL INSP

Mitigation shall be installed and an as-built report received and approved prior to Temporary Occupancy for single family residences and mobile homes. For detached structures, the as-built report must be received and approved prior to final inspection. For land disturbance activities, the mitigation must be installed and an as-built report received and approved prior to final inspection or by the date specified in the mitigation. For subdivisions, the mitigation must be installed and an as-built report received and approved prior to final plat approval.

CUSTOM CONDITION

All permits required by U.S. Army Corps of Engineers shall be submitted to the file prior to ground disturbing activities

I hereby certify that I have read and examined this application and know that the same to be true and correct. All provisions of laws and ordiances governing this type of work will be complied with whether specified herein or not.

I understand that the granting of a permit does not presume to give authority to violate or cancel the provisions of any other federal, state or local law regulating performance of this type of work.

Further, I hereby certify that I am a licensed contractor and that said license is in full force and effect, or that I am the legal owner or agent of the legal owner of the above-described real property.

CALL BEFORE YOU DIG! IT'S THE LAW! 1-800-424-5555

Skip Sahlin

APPLICANT'S SIGNATURE

26 October 2011

DATE

WHATCOM COUNTY REGULATIONS

1. All activity on site shall be done in accordance with the permit application and site plan approved by Whatcom County Planning and Development. Any alterations from the approved site plan will require further review by Whatcom County Planning and Development Services.

2. Issuance of this permit does not include review of any proposed use for conformity with Whatcom County Zoning Regulations. It is the property owners' responsibility to ensure that any use of the property is consistent with the requirements of WCC Title 20.

3. **This permit is not transferable without prior approval from Whatcom County Planning and Development Services.**

4. All work must be performed in accordance with WCC 20.80.730 and Whatcom County Development Standards, plans, specifications, ordinances and regulations.

5. **Hour of Operations: 7:00 AM to 10:00 PM, per WAC 173-60-050 unless otherwise prohibited.**

ENVIRONMENTAL REGULATIONS

1. Approved erosion control measures shall be installed prior to any land alteration and maintained througout the entire land disturbance / construction process. All sediment or erosion shall be controlled and kept on-site until stabilized through re-vegetation.

2. Appropriate drainage controls shall be installed on site prior to any land alteration. Natural drainage patterns shall not be altered without further review by Whatcom County Planning and Development Services.

Stormwater Pollution Prevention Plan

For

Terrestrial Geotechnical Investigations, Pacific International Terminals, Inc. Property

Prepared For
Northwest Regional Office
3190 - 160th Avenue SE
Bellevue, WA 98008-5452
425-649-7000

Owner	Developer	Operator/Contractor
Pacific International Terminals, Inc.	Pacific International Terminals, Inc.	Pacific International Terminals, Inc.
1131 SW Klickitat Way	1131 SW Klickitat Way	1131 SW Klickitat Way
Seattle, Washington 98134	Seattle, Washington 98134	Seattle, Washington 98134

Project Site Location
Adjacent to the Strait of Georgia, north of Henry Road, south of Aldergrove Road, and west of Kickerville Road near Ferndale in Whatcom County, Washington.

Certified Erosion and Sediment Control Lead
Al Jeroue, P.E.
Pacific International Terminals, Inc.
253.627.0406

SWPPP Prepared by
AMEC Earth & Environmental, Inc.
11810 North Creek Parkway North
Bothell, Washington 98011
(425) 368-1000

SWPPP Preparation Date
August 20, 2011
Revised 7 October 2011

Approximate Project Construction Dates
June 27, 2011
Unknown (depends on issuance of all permits)

Contents

1.0 INTRODUCTION

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared as part of the NPDES stormwater permit requirements for the Terrestrial Geotechnical Investigation and access path clearing at property owned by Pacific International Terminals, Inc., near Ferndale, Washington. The Geotechnical Investigation began in early July 2011, but work was stopped because various permits and approvals were determined to be needed.

The study area for the geotechnical investigation is located 18 miles northwest of Bellingham and 10 miles west of Ferndale (**Appendix A: A-1**). The area is approximately 1,200 acres in size. The project site covers portions of Sections 17, 18, and 19 of Township 39 North, Range 1 East, all in unincorporated Whatcom County. The project site is accessible from I-5 via Highway 548 (Grandview Road) west, and left on Kickerville Road.

Roughly rectangular in shape, the study area is bounded by County roads and industrial operations to the north, east, and south, and by the Strait of Georgia to the southwest:

- BP's Cherry Point refinery property is adjacent to the north and west;
- 70 acres owned by BP lie to the northwest;
- Kickerville Road, populated by private residences on approximately 5 acre plats, lies to the east;
- Pastures owned by others lie to the south;
- DNR lands lie to the northeast; and
- The Strait of Georgia lies to the south and southwest.

Investigation activities include advancing approximately 50 boreholes and 19 cone penetration tests (CPTs), creating approximately 22,400 feet of access paths for track-mounted equipment, and performing restoration work.

The purpose of this SWPPP is to describe the proposed 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 work. All temporary erosion and sediment control measures will be implemented and monitored prior to receipt of and throughout the life of an approval under the NPDES General Construction Stormwater Permit.

The objectives of this SWPPP are to:

1. Identify the appropriate Best Management Practices (BMPs) to be implemented that prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. Provide direction to field efforts so that actions are taken which prevent violations of surface water quality, ground water quality, or sediment management standards.

This SWPPP was prepared following the Ecology SWPPP Template downloaded from the Ecology website on August 9, 2011. The template was prepared based on the requirements set forth in the Construction Stormwater General Permit and the 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:

1. **Section 1 – INTRODUCTION.** This section provides a summary description of the project, and the organization of the SWPPP document.
2. **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.
3. **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 (SWMMWW 2005).
4. **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.
5. **Section 5 – POLLUTION PREVENTION TEAM.** This section identifies the appropriate contact names (emergency and non-emergency), monitoring personnel, and the on-site temporary erosion and sedimentation control inspector
6. **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.
7. **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 geotechnical and restoration work.

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

Appendix A – Maps
- Vicinity Map
- Site Plan with TESC measures

Appendix B – Construction BMPs
Appendix C – General Permit – *Once Received.*

1.1 EXISTING CONDITIONS

The study area is located on a relatively flat plateau adjacent to the Strait of Georgia in Whatcom County, Washington. The area roughly lies north of Henry Road, south of Aldergrove Road and west of Kickerville Road and covers roughly 1,200 acres.

The property is currently undeveloped, although some portions of the area are used for agriculture, including pastures and hayfields. The only impervious surfaces in the vicinity are rural County roads. Stormwater from these roadways drains to open roadside ditches. No other stormwater facilities, such as catch basins, exist in the vicinity.

Other features in the vicinity include an underground oil pipeline and a Bonneville Power Administration transmission line, which cross the project area approximately north to south. BNSF Railway's Custer Spur line transects the eastern edge of the project area.

Topography of the site is mostly flat. Subsurface conditions consist of reworked glaciomarine drift, clayey glaciomarine drift, Vashon Stade advance outwash, and Cherry Point silt. The glaciomarine drift is typical of normally consolidated silt and clay; the upper portion of the glaciomarine drift is typically stiff from desiccation or partial ice contact loading and grades to medium stiff or soft with depth. The advance outwash and Cherry Point silt are glacially consolidated and dense to very dense/hard.

Stormwater on the property generally infiltrates to soil. Streams and roadside ditches generally have no flows in the summer. During heavy prolonged rainfall, such as in late fall and early winter, soils become saturated and stormwater discharge occurs to wetlands and streams by sheetflow and throughflow. Stormwater also discharges from roadways to roadside ditches.

Because there are no impervious surfaces on the property, no stormwater control systems exist. No new impervious surface results from the geotechnical investigation or restoration of cleared areas.

The southern extent of the project site is adjacent to the Strait of Georgia. There are 7 streams within the project vicinity. Streams 1 (WRIA # 01.0100) and 2 (WRIA # 01.0101) are first order streams and flow into the Strait of Georgia. Streams 3 through 7 flow in County roadside ditches and drain to either Stream 1 or 2. The only fish-bearing stream on site is the lowest reach of Stream 1 south of Henry Road (Type Fs). Nine additional drainages flow in the vicinity and drain to one of the roadside streams or Stream 1 or 2. None of these drainages (Stream 1 north of Henry Road, Stream 2, all other Streams and Ditches) support fish.

Wetlands are found in the project area. Wetlands 1, 4B, 4C, 5B, 7B, 8B, 10B, 11B, 12, 13C, 13F, 13G, and 14 are depressional wetlands. Wetlands 2, 3, 4A, 4D, 4E, 4F, 5A, 5C, 6, 7A, 8A,

9A&C, 10A, and 13D are slope wetlands. Wetlands 11A, 13A, and 13E are riverine wetlands. Most of the wetlands are Class III, with the exception of wetlands in the lower reach of Stream 1 (Class II) and the coastal lagoon (Class I).Wetlands are associated with roadside drainages or to Streams 1 or 2, although there are almost no point discharges from the wetlands.

1.2 Proposed Construction Activities

The project includes clearing, geotechnical investigation, and restoration activities.

The proposed geotechnical investigation program entails advancing approximately 50 boreholes and 19 cone penetration tests (CPT) to evaluate subsurface soil and groundwater conditions at the site that are critical for design of future development. Boreholes are generally about 8 inches in diameter, and extend between 80 and 130 feet deep. The CPT explorations push a 1.4-inch-diameter rod into the ground to depths up to about 100 feet. No excavation is required for the CPT explorations and the rods are removed immediately upon completion of the exploration. The locations of explorations are scattered throughout the site, but are generally to be in the areas of proposed development as shown in the Geotechnical Investigation Plan (Appendix A).

Access paths were cleared in July 2011. Access paths with exposed soils will be covered using hydroseeding. Site entrances will be stabilized with Construction Entrance BMP C105 if they are not already stabilized.

Once agency approvals are received the geotechnical investigation will resume. Following completion of geotechnical investigation, cleared access paths will be restored. Restoration of access paths in both upland and wetland areas is planned. In wetland areas, side cast rootwads and some side cast root mats with soil will be moved to the clearings. Plantings appropriate to forested wetlands or shrub areas will be installed. Restoration in upland areas will include planting tree seedlings to accomplish reforestation at a stocking rate of 190 stems per acre by 2014 to meet Department of Natural Resources (DNR) reforestation requirements.

The following summarizes details regarding site areas:

Total site area:	~1,200 acres
Percent impervious area before project:	0.0%
Percent impervious area after project:	0.0%
Disturbed area during investigation:	9.2 acres
Disturbed area that is characterized as impervious (i.e., access roads, staging, parking):	0 acres

2.0 CONSTRUCTION STORMWATER BMPS

2.1 THE 12 BMP ELEMENTS

This SWPPP will be modified whenever there is a change in the design, construction, operation, or maintenance at the geotechnical project site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

Element #1 – Mark Clearing Limits

Borehole locations were determined and located by survey onsite. Clearing of paths was accomplished by pushing over vegetation in a 17-foot-wide corridor between marked borehole locations.

To avoid wetlands, streams, and buffers and minimize clearing disturbance, access routes were drawn onto base maps and evaluated prior to field work. It was not practicable to locate the proposed geotechnical boreholes with complete avoidance of wetlands because much of the area is wetland and geotechnical data is needed for subsurface conditions in those locations. Wetland boundaries were located in the field with pink "wetland delineation" flagging. However, to the extent feasible, proposed geotechnical boreholes were located outside of wetland and heavily vegetated areas in order to avoid direct vegetation impacts. When a boring hole was located within a wetland, existing roads and pastures and hayfields were used as access routes to the extent possible to minimize vegetation disturbance throughout the property. Only when no other alternative could be identified were access routes placed through forested or shrub vegetated wetland areas.

No further clearing activities are anticipated. However should any be determined to be required, appropriate authorization will be obtained. Clearing limits would be clearly marked with flagging prior to initiation of any future clearing. In addition the following BMP will be used

- Preserving Natural Vegetation (BMP C101)

Element #2 – Establish Construction Access

Erosion control installation, geotechnical borings, and site restoration will require access from County roads (4 locations) and access from other roads located behind gates that bar public access (approximately 8 locations).

The BMP to be employed at all of these locations are:

- Stabilized Construction Entrance (BMP C105)
- Preserving Native Vegetation (BMP C101)

Entrances will be stabilized using quarry spalls or wood chips placed to prevent tracking of dirt onto County roads. Access from public roads will cross an approximate 100 foot-long strip of

quarry spalls or wood chips, where appropriate. Where wetlands are adjacent to entrances, temporary metal plates will be placed to protect soils. Existing native vegetation adjacent to access points will be protected and provide additional soil stabilization near entrances.

If soil materials are tracked onto County Roads, roads will be thoroughly cleaned daily or more frequently during wet weather, to prevent soil materials washing into adjacent roadways. Soil materials will be removed by shovel and disposed of in an appropriate upland location disposal area away from water.

Element #3 – Control Flow Rates

Stormwater will infiltrate or disperse to vegetated areas. The property has no pollution generating impervious surfaces. In addition, most portions of the area, vegetated buffers provide infiltration capacity and protection from sedimentation to roadside ditches. No land conversion occurs as a result of clearing temporary access paths for the geotechnical investigation. The geotechnical investigation will result in no construction of pollution generating impervious surfaces.

The specific BMP to be used for controlling flow on this project is:

- Interceptor Dike and Swale (C200)

If specific areas are determined to be likely to discharge concentrated stormwater from areas of exposed soils, interception dike and swales will be installed and used to redirect water to preferably vegetated locations that allow sediment trapping and infiltration.

Element #4 – Install Sediment Controls

Stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the work site or prior to being discharged to an infiltration facility.

The specific BMPs to be used for controlling sediment on this project include:

- Mats and Blankets (BMP C122)
- Temporary and Permanent Seeding (BMP C120)
- Check Dams (C207)
- Channel Lining (C202)

Soils will be stabilized through revegetation including hydroseeding, seeding, and natural regeneration. Mats and blankets will be used to cover exposed soils in appropriate locations that require additional stabilization such as near ditches or slopes.

Check dams will be constructed in roadside drainage ditches adjacent to where construction entrances are located. 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 wash-off of sediments from adjacent streets in runoff.

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)
- Mats and Blankets (BMP C122)

Temporary seeding will be applied to all exposed soil in access roads. It will be applied at an application rate of 1,500 pounds per acre of wood fiber mulch, 150 pounds per acre of wet area seed, 200 pounds per acre of 25-5-15 fertilizer, and 15 pounds per acre of tackifier. No water is available onsite for the application and must be obtained in the vicinity of Ferndale. Access paths will be inspected for excessive rutting prior to hydroseeding and remedied by hand raking, if needed. Irrigation of the hydroseed is not proposed. The seed mixtures are intended to germinate once there is enough natural moisture in the air (e.g., dew, fog, or rain); in the interim, the wood fiber mulch and tackifier control any dust.

Mats will be placed over sensitive areas where vehicle transport is required such as construction entrances that cross drainage ditches, agricultural drainages adjacent to the construction activities, and areas in which rutting may occur.

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.

Prior to hydroseeding, access paths are to be inspected for excessive rutting and remedied. Vehicular traffic associated with this action will be restricted to only the access paths and will not extend onto any additional surface areas not already tracked. Use of mats to span across sensitive areas for vehicle transport will be required to prevent additional rutting. Turning of equipment will be limited to avoid additional rutting.

Element #6 – Protect Slopes

The site is fairly level, but where steep slopes occur, they will be stabilized if bare soils are exposed. One area of slope is the Stream 1 ravine north of Henry Road. In this area and other areas as needed, slope protection will include the following BMPs:

- Temporary and Permanent Seeding (BMP C120)

- Mats and Blankets (BMP C122)
- Preserving Natural Vegetation (C101)

Hydroseeding and/or seeding will be used to stabilize soils. Where additional protection is needed, mats or blankets will be installed to protect soils from washing into stormwater. For the slope adjacent to the Stream 1 ravine, native vegetation will be preserved along the slope.

Element #7 – Protect Drain Inlets

There are no drain inlets located on the project site. There are no storm drain inlets near the site that could potentially receive surface runoff from the geotechnical work site. There is no stormwater system on-site as the site is undeveloped and has no impervious surfaces. County stormwater conveyance on adjacent roadways is comprised of open roadside ditches and no drains have been installed. Nonetheless, the first priority is to keep all paved roads clean of sediment.

Element #8 – Stabilize Channels and Outlets

Any channels located within the cleared areas will be stabilized with one of the following BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Mats and Blankets (BMP C122)
- Preserving Natural Vegetation (BMP C101)
- Grass lined Channels (BMP C201)

Most of the channels adjacent to county roadways are lined with vegetation and this vegetation will be preserved. The established grass-lined channels provide soil stability and filtration capacity to stormwater.

Element #9 – Control Pollutants

Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. All vehicles and other equipment will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills. Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment. In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage

Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall

have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

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 procedures and rates shall be followed.

Solid Waste

Solid waste will be stored in secure, clearly marked containers.

Other

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

Element #10 – Control Dewatering

There will be no dewatering as part of the geotechnical investigation or restoration.

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 BMP's specifications.

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.

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.

- No major earthwork.

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 Geotechnical Work

The geotechnical and restoration work 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 work.

Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities during each phase of work, 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;
- 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 geotechnical and restoration 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 geotechnical and restoration work that could impact the quality of stormwater.
- 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.

This SWPPP shall be modified whenever there is a change in the design, work, 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.

This 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.

This 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.

Site Specific BMPs

Site specific BMPs are shown on the Site Plan with TESC Measures in Appendix A.

The following notes are included:

- The implementation of these ESC plans and the construction, maintenance, replacement, and upgrading of these ESC facilities is the responsibility of the applicant/contractor until all construction is completed and approved and vegetation/landscaping is established.
- The ESC facilities shown on this plan must be constructed in such a manner as to insure that sediment and sediment laden water do not enter the drainage system, roadways, or violate applicable water standards.

- Stabilized construction entrances shall be installed and maintained for the duration of the project. Additional measures may be required to insure that all paved areas are kept clean for the duration of the project.
- The ESC facilities shown on this plan are the minimum requirements for anticipated site conditions. During the geotechnical or restoration work period, these ESC facilities shall be upgraded as needed for unexpected storm events and to ensure that sediment and sediment-laden water do not leave the site.
- The ESC facilities shall be inspected daily by the applicant/contractor and maintained as necessary to ensure their continued functioning.
- The ESC facilities on inactive sites shall be inspected and maintained a minimum of once a month or within the 48 hours following a major storm event.

The Site Plan with TESC Measures will be updated as needed.

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

3.0 CONSTRUCTION PHASING AND BMP IMPLEMENTATION

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.

Action	Date
Construction start date	7/05/2011
Estimate of project completion	To be determined*
Cleared access paths start	7/05/2011
Geotechnical investigation start	7/07/2011
Geotechnical investigation stop	7/22/2011
Site inspections and monitoring to be conducted beginning	9/01/2011
Mobilize equipment on-site	8/26/2011
Mobilize and store all ESC and soil stabilization products	8/26/2011
Install stabilized construction entrances	8/26/2011
Temporary erosion control measures	8/29/2011

Wet season starts	10/1/2011
Further geotechnical investigation	To be determined*
Begin restoration activities	To be determined*
Permanent erosion control measures	To be determined*

* Dependent on all permits being issued.

4.0 POLLUTION PREVENTION TEAM

4.1 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.

4.2 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)	Al Jeroue, P.E. Pacific International Terminals, Inc.	253.627.0406
Resident Engineer	Al Jeroue, P.E.	253.627.0406
Emergency Ecology Contact	Kurt Baumgarten	360.715.5200

Title	Name(s)	Phone Number
Emergency Owner Contact	Skip Sahlin or Ari Steinberg, Pacific International Terminals, Inc.	206.654.3510 206.654.3689
Non-Emergency Ecology Contact	Shawn Hopkins	360.407.6442
Monitoring Personnel	Al Jeroue	253.627.0406

5.0 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 geotechnical and restoration work and will include:

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

The site monitoring log is bound separately and will be maintained within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

5.1 SITE INSPECTION

All BMPs will be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections will be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. The onsite inspector will have the skills to assess the potential for water quality impacts as a result of the type of geotechnical and restoration work occurring on site, and the knowledge of the appropriate and effective ESC measures needed to control the quality of stormwater discharges.

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 4.2 of this SWPPP.

Site inspection will occur in all areas disturbed by geotechnical work and at all pre-determined sampling 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.

5.2 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 if the site operator has successfully applied for inactive status for the site using the Permit Fee Activity Status Change Form, which can be found at the following web site:
http://www.ecy.wa.gov/programs/wq/permits/permit_fees/ConstructionActivityStatusChangeForm.pdf

5.3 Site Inspection Documentation

The site inspector will record each site inspection using the site log inspection forms provided in the site log book and on-line.

5.4 Stormwater Quality Monitoring

When stormwater is observed leaving the property into roadside drainages, samples will be taken of flows leaving the site. Sampling points will generally be located where concentrated flows are observed leaving the property.

Turbidity Sampling

Monitoring requirements for the proposed project will include either turbidity or water transparency sampling to monitor site discharges for water quality compliance with the 2005 Construction Stormwater General Permit. Sampling will be conducted at all discharge points at least once per calendar week. Turbidity or transparency monitoring will follow the analytical methodologies described in Section S4 of the 2005 Construction Stormwater General Permit.

The key benchmark values that require action are 25 nephelometric turbidity units (NTU) for turbidity (equivalent to 32 cm transparency) and 250 NTU for turbidity (equivalent to 6 cm transparency). If the 25 NTU benchmark for turbidity (equivalent to 32 cm transparency) is exceeded, 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 revisions to the SWPPP as necessary.
3. Sample discharge location daily until the analysis results are less than 25 NTU (turbidity) or greater than 32 cm (transparency).

If the turbidity is greater than 25 NTU (or transparency is less than 32 cm) but less than 250 NTU (transparency greater than 6 cm) for more than 3 days, additional treatment BMPs will be implemented within 24 hours of the third consecutive sample that exceeded the benchmark value. Additional treatment BMPs to be considered will include, but are not limited to, off-site treatment, infiltration, filtration and chemical treatment.

If the 250 NTU benchmark for turbidity (or less than 6 cm transparency) is exceeded at any time, the following steps will be conducted:

1. Notify Ecology by phone within 24 hours of analysis (see Section 4.0 of this SWPPP for contact information).
2. Continue daily sampling until the turbidity is less than 25 NTU (or transparency is greater than 32 cm).
3. Initiate additional treatment BMPs such as off-site treatment, infiltration, filtration and chemical treatment within 24 hours of the first 250 NTU exceedance.
4. Implement additional treatment BMPs as soon as possible, but within 7 days of the first 250 NTU exceedance.
5. 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.

pH Sampling

No pH sampling is anticipated because no concrete or engineered soils are planned to be installed. However, if concrete or engineer soils are installed Stormwater runoff will be monitored for pH starting on the first day of any activity that includes more than 40 yards of poured or recycled concrete, or after the application of "Engineered Soils" such as, Portland cement treated base, cement kiln dust, or fly ash. This does not include fertilizers. For concrete work, pH monitoring will start the first day concrete is poured and continue until 3 weeks after the last pour. For engineered soils, the pH monitoring period begins when engineered soils are first exposed to precipitation and continue until the area is fully stabilized.

Stormwater samples will be collected daily from all points of discharge from the site and measured for pH using a calibrated pH meter, pH test kit, or wide range pH indicator paper. If the measured pH is 8.5 or greater, the following steps will be conducted:

1. Prevent the high pH water from entering storm drains or surface water.
2. Adjust or neutralize the high pH water if necessary using appropriate technology such as CO_2 sparging (liquid or dry ice).
3. Contact Ecology if chemical treatment other than CO_2 sparging is planned.

6.0 REPORTING AND RECORDKEEPING

6.1 RECORDKEEPING

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 (Ecology's site inspection checklist is included in Appendix D); and,
- Stormwater quality monitoring.

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.

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.

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 7 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.

7.0 REPORTING

7.1 DISCHARGE MONITORING REPORTS

Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly via the WAWebDMR system. If there was no discharge during a given monitoring period, Pacific International Terminals, Inc. shall submit the form as required, with the words "No discharge" entered in the place of monitoring results.

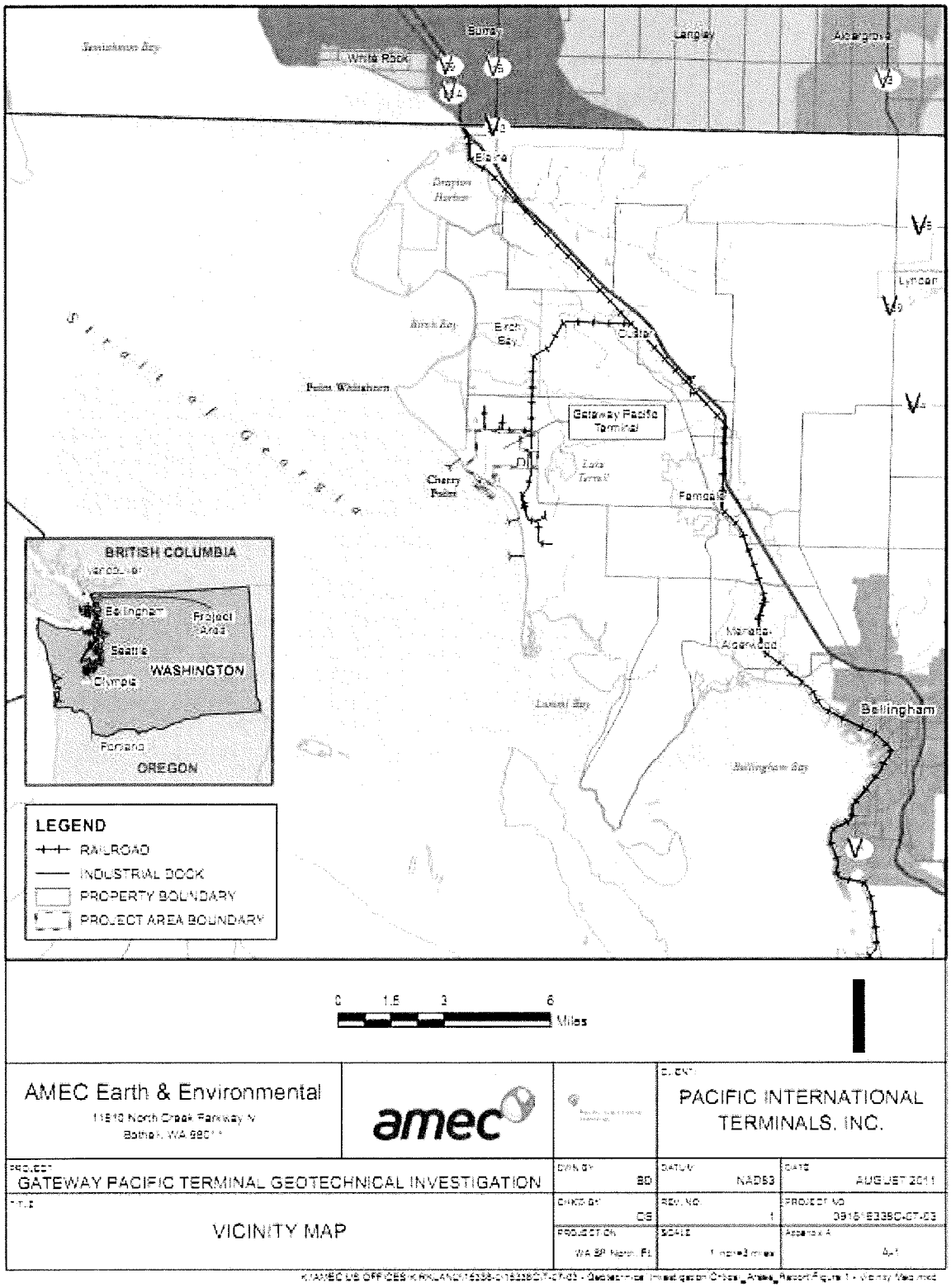
The DMR due date is 15 days following the end of each month.

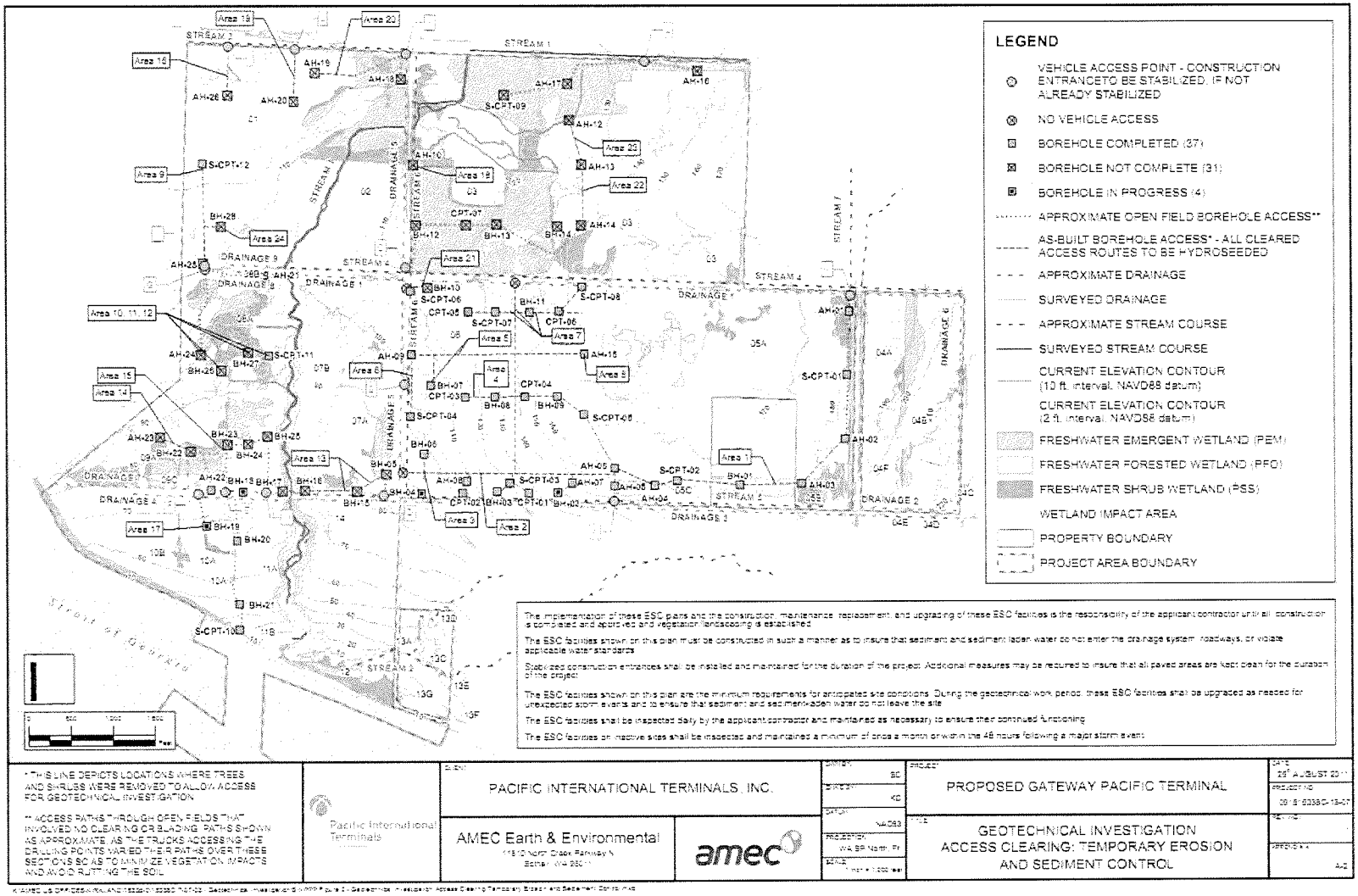
7.2 NOTIFICATION OF NONCOMPLIANCE

If any of the terms and conditions of the permit is 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:

- Ecology will be immediately notified of the failure to comply.
- 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.
- A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.
- In accordance with permit condition S2.A, a complete application form will be submitted to Ecology and the appropriate local jurisdiction (if applicable) to be covered by the General Permit.

APPENDIX A – MAPS


Blaine
Birch Bay
Custer
Ferndale
Bellingham
Gateway Pacific Terminal
Cherry Point
Lynden
Sumas
Langley
Aldergrove
White Rock
Strait of Georgia
BRITISH COLUMBIA
Vancouver
Bellingham
Project Area
Seattle
WASHINGTON
Olympia
Portland
OREGON
LEGEND
RAILROAD
INDUSTRIAL DOCK
PROPERTY BOUNDARY
PROJECT AREA BOUNDARY
0 1.5 3 6
Miles
AMEC Earth & Environmental
amec
PACIFIC INTERNATIONAL TERMINALS, INC.
GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION
VICINITY MAP
DWN BY BD
CHKD BY CS
DATUM NAD83
REV NO 1
DATE AUGUST 2011
SCALE 1 inch=3 miles
Appendix A A-1


LEGEND
VEHICLE ACCESS POINT - CONSTRUCTION ENTRANCE TO BE STABILIZED, IF NOT ALREADY STABILIZED
NO VEHICLE ACCESS
BOREHOLE COMPLETED (37)
BOREHOLE NOT COMPLETE (31)
BOREHOLE IN PROGRESS (4)
APPROXIMATE OPEN FIELD BOREHOLE ACCESS**
AS-BUILT BOREHOLE ACCESS* - ALL CLEARED ACCESS ROUTES TO BE HYDROSEEDED
APPROXIMATE DRAINAGE
SURVEYED DRAINAGE
APPROXIMATE STREAM COURSE
SURVEYED STREAM COURSE
CURRENT ELEVATION CONTOUR (10 ft. interval, NAVD88 datum)
CURRENT ELEVATION CONTOUR (2 ft. interval, NAVD88 datum)
FRESHWATER EMERGENT WETLAND (PEM)
FRESHWATER FORESTED WETLAND (PFO)
FRESHWATER SHRUB WETLAND (PSS)
WETLAND IMPACT AREA
PROPERTY BOUNDARY
PROJECT AREA BOUNDARY
The implementation of these ESC plans and the construction, maintenance, replacement, and upgrading of these ESC facilities is the responsibility of the applicant/contractor until all construction is completed and approved and vegetation/landscaping is established.
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Stabilized construction entrances shall be installed and maintained for the duration of the project. Additional measures may be required to insure that all paved areas are kept clean for the duration of the project.
The ESC facilities shown on this plan are the minimum requirements for anticipated site conditions. During the geotechnical work period, these ESC facilities shall be upgraded as needed for unexpected storm events and to ensure that sediment and sediment-laden water do not leave the site.
The ESC facilities shall be inspected daily by the applicant/contractor and maintained as necessary to ensure their continued functioning.
The ESC facilities on inactive sites shall be inspected and maintained a minimum of once a month or within the 48 hours following a major storm event.
* THIS LINE DEPICTS LOCATIONS WHERE TREES AND SHRUBS WERE REMOVED TO ALLOW ACCESS FOR GEOTECHNICAL INVESTIGATION.
** ACCESS PATHS THROUGH OPEN FIELDS THAT INVOLVED NO CLEARING OR BLADING. PATHS SHOWN AS APPROXIMATE AS THE TRUCKS ACCESSING THE DRILLING POINTS VARIED THEIR PATHS OVER THESE SECTIONS SO AS TO MINIMIZE VEGETATION IMPACTS AND AVOID RUTTING THE SOIL.
Pacific International Terminals
PACIFIC INTERNATIONAL TERMINALS, INC.
AMEC Earth & Environmental
amec
PROPOSED GATEWAY PACIFIC TERMINAL
GEOTECHNICAL INVESTIGATION
ACCESS CLEARING: TEMPORARY EROSION AND SEDIMENT CONTROL

APPENDIX B – CONSTRUCTION BMPS

- Preserving Natural Vegetation (BMP C101)
- Buffer Zones (BMP C102)
- Stabilized Construction Entrance (BMP C105)
- Construction Road/Parking Area Stabilization (BMP C107)
- Temporary and Permanent Seeding (BMP C120)
- Mats and Blankets (BMP C122)
- Material Delivery, Storage and Containment (BMP C153)
- Certified Erosion and Sediment Control Lead (BMP C160)
- Scheduling (BMP C162)
- Interceptor Dike and Swale (BMP C200)
- Grass Lined Channels (BMP C201)
- Channel Lining (BMP C202)
- Check Dams (BMP C207)

4.1 Source Control BMPs

BMP C101: Preserving Natural Vegetation

Purpose

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

Conditions of Use

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
- As required by local governments.

Design and Installation Specifications

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

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

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

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

- *Excavations* - Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

  Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint.

  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 madronna 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.

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Purpose

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

Conditions of Use

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
- As required by local governments.

Design and Installation Specifications

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

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

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

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.

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- *Excavations* - Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

  Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint.

  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 madronna 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 local permitting authority 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. Steel construction 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 drip line 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 local permitting authority or other state or federal permits or approvals.

Maintenance Standards

- Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed.

BMP C103: High Visibility Plastic or Metal Fence

Purpose

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

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

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

Design and Installation Specifications

- High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 lbs./ft. using the ASTM D4595 testing method.
- Metal fences shall be designed and installed according to the manufacturer's specifications.
- Metal fences shall be at least 3 feet high and must be highly visible.
- Fences shall not be wired or stapled to trees.

Maintenance Standards

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

BMP C105: Stabilized Construction 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 Figure 4.2 for details. Note: the 100' 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').
- 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 min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will paved; this can be used as a stabilized entrance. Also, consider the installation of excess concrete as a stabilized entrance. During large concrete pours, excess concrete is often available for this purpose.
- 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 BMPs C103 and C104) 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 street sweeping, 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 BMPs C103 and C104) shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

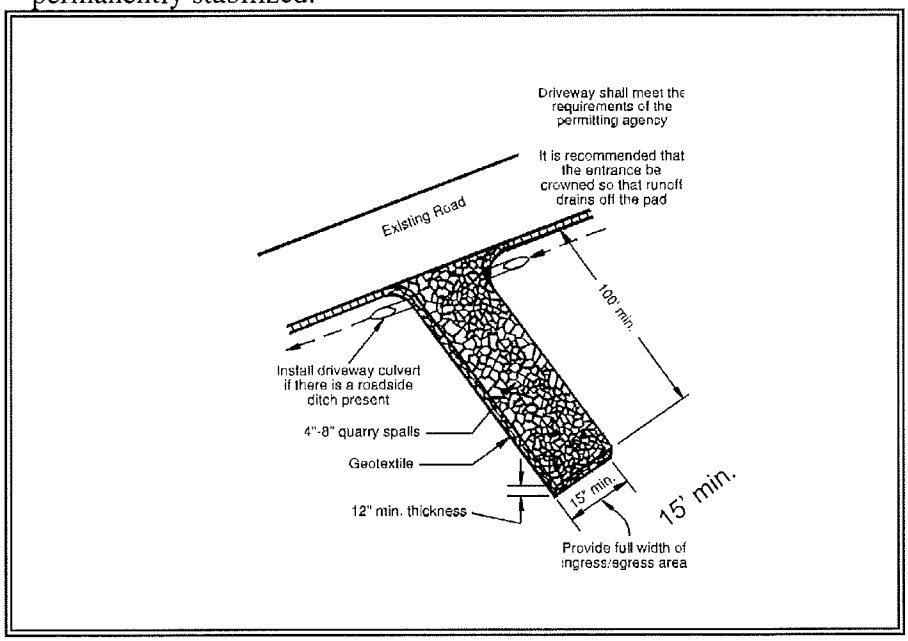


Figure 4.2 – Stabilized Construction Entrance

BMP C107: Construction Road/Parking Area Stabilization

Purpose

Stabilizing subdivision roads, parking areas, and other onsite vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

Conditions of Use

- Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
- Fencing (see BMPs C103 and C104) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

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

Maintenance Standards

- Inspect stabilized areas regularly, especially after large storm events.
- Crushed rock, gravel base, hog fuel, etc. shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.
- Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

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 2-10 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 take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal 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 40-50 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, Bonded Fiber Matrix (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 24-36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40-50 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 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. 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:
  1. Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift;
  2. 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 800-1000 pounds per acre. Hold straw in place with a standard tackifier. Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

1. Irrigation
2. Reapplication of mulch
3. 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 re-installed 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 local authority may be used.

Table 4.1 represents the standard mix for those areas where just a temporary vegetative cover is required.

Table 4.1
Temporary Erosion Control Seed Mix

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

Table 4.2 provides just one recommended possibility for landscaping seed.

Table 4.2
Landscaping Seed Mix

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

This turf seed mix in Table 4.3 is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

Table 4.3
Low-Growing Turf Seed Mix

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

Table 4.4 presents a mix recommended for bioswales and other intermittently wet areas.

Table 4.4
Bioswale Seed Mix*

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

** Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The seed mix shown in Table 4.5 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 4.5
Wet Area Seed Mix*

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

** Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix*

The meadow seed mix in Table 4.6 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 4.6
Meadow Seed Mix

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

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 local authority 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 C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to reinforce permanently turf to protect drainage ways during high flows. Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Synthetic nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap. 100 percent synthetic blankets manufactured for use in ditches may be easily reused as temporary ditch liners.

Disadvantages of blankets include:

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

Advantages of blankets include:

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

Design and Installation Specifications

- See Figure 4.4 and Figure 4.5 for typical orientation and installation of blankets used in channels and as slope protection. Note: these are typical only; all blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of Blankets on Slopes:

  1. Complete final grade and track walk up and down the slope.
  2. Install hydromulch with seed and fertilizer.
  3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
  4. Install the leading edge of the blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal,"U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
  5. Roll the blanket slowly down the slope as installer walks backwards. NOTE: The blanket rests against the installer's legs. Staples are installed as the blanket is unrolled. It is critical that the proper staple pattern is used for the blanket being installed. The blanket is not to be allowed to roll down the slope on its own as this stretches the blanket making it impossible to maintain soil contact. In addition, no one is allowed to walk on the blanket after it is in place.
  6. If the blanket is not long enough to cover the entire slope length, the trailing edge of the upper blanket should overlap the leading edge of the lower blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.

- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer consults the manufacturer's information and that a site visit takes place in order to insure that the product specified is appropriate. Information is also available at the following web sites:

  1. WSDOT: http://www.wsdot.wa.gov/eesc/environmental/
  2. Texas Transportation Institute: http://www.dot.state.tx.us/insdtdot/orgchart/cmd/erosion/contents.htm

- Jute matting must be used in conjunction with mulch (BMP C121). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Good contact with the ground must be maintained, and erosion must not occur beneath the net or blanket.
- Any areas of the net or blanket that are damaged or not in close contact with the ground shall be repaired and stapled.
- If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

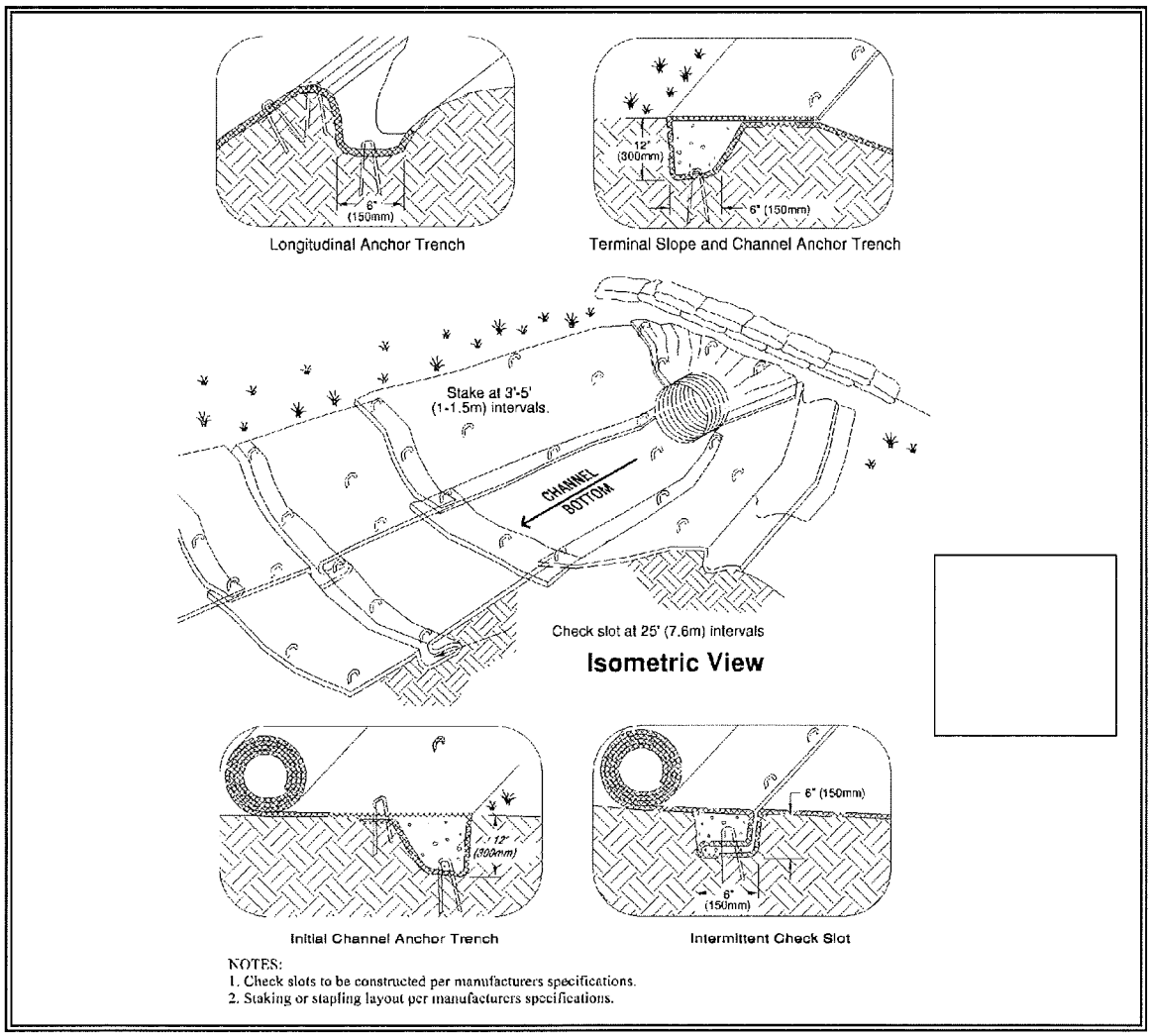


Figure 4.4 – Channel Installation

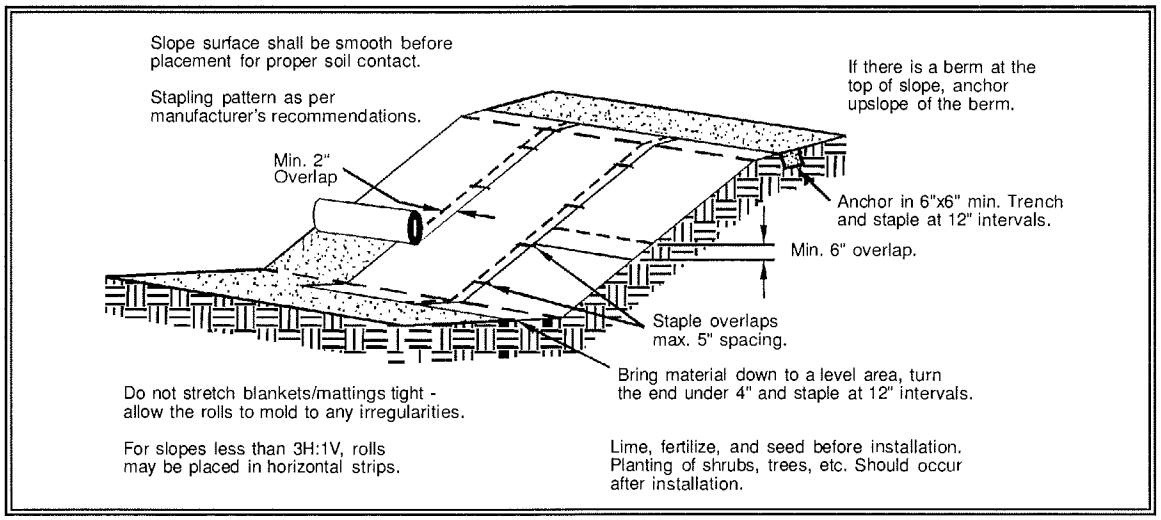


Figure 4.5 – Slope Installation

BMP C153: Material Delivery, Storage, and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, and installing secondary containment.

Conditions of Use

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

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

Design and Installation Specifications

The following steps should be taken to minimize risk:

- Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

Material Storage Areas and Secondary Containment Practices:

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain precipitation from a 25 year, 24 hour storm event, plus 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3"x 4'
    - 2-Oil Absorbent Socks 3"x 10'
    - 12-Oil Absorbent Pads 17"x19"
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state

- The CESCL shall:
  - Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).

    Ecology will maintain a list of ESC training and certification providers at: 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

Specifications

- Certification shall remain valid for three 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:

    1) Locations of BMPs inspected,

    2) Locations of BMPs that need maintenance,

    3) Locations of BMPs that failed to operate as designed or intended, and

    4) 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.

Minimum Requirements for ESC Training and Certification Courses

General Requirements

1. The course shall teach the construction stormwater pollution prevention guidance provided in the most recent version of:
    a. The Washington State Dept. of Ecology Stormwater Management Manual for Western Washington,
    b. Other equivalent stormwater management manuals approved by Ecology.

2. Upon completion of course, each attendee shall receive documentation of certification, including, at a minimum, a wallet-sized card that certifies completion of the course. Certification shall remain valid for three years. Recertification may be obtained by completing the 8-hour refresher course or by taking the initial 16-hour training course again.

3. The initial certification course shall be a minimum of 16 hours (with a reasonable time allowance for lunch, breaks, and travel to and from field) and include a field element and test.
    a. The field element must familiarize students with the proper installation, maintenance and inspection of common erosion and sediment control BMPs including, but not limited to, blankets, check dams, silt fence, straw mulch, plastic, and seeding.
    b. The test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.

4. The refresher course shall be a minimum of 8 hours and include a test.
    a. The refresher course shall include:
        i. Applicable updates to the Stormwater Management Manual that is used to teach the course, including new or updated BMPs; and
        ii. Applicable changes to the NPDES General Permit for Construction Activities.
    b. The refresher course test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.
    c. The refresher course may be taught using an alternative format (e.g. internet, CD ROM, etc.) if the module is approved by Ecology.

Required Course Elements

1. Erosion and Sedimentation Impacts
    a. Examples/Case studies

2. Erosion and Sedimentation Processes
    a. Definitions
    b. Types of erosion
    c. Sedimentation
        i. Basic settling concepts
        ii. Problems with clays/turbidity

3. Factors Influencing Erosion Potential
    a. Soil
    b. Vegetation c.
    Topography d.
    Climate

4. Regulatory Requirements
    a. NPDES - Construction Stormwater General Permit
    b. Local requirements and permits
    c. Other regulatory requirements

5. Stormwater Pollution Prevention Plan (SWPPP)
    a. SWPPP is a living document – should be revised as necessary
    b. 12 Elements of a SWPPP; discuss suggested BMPs (with examples)
        1. Mark Clearing Limits
        2. Establish Construction Access
        3. Control Flow Rates
        4. Install Sediment Controls
        5. Stabilize Soils
        6. Protect Slopes
        7. Protect Drain Inlets
        8. Stabilize Channels and Outlets
        9. Control Pollutants
        10. Control De-watering
        11. Maintain BMPs
        12. Manage the Project

6. Monitoring/Reporting/Recordkeeping
    a. Site inspections/visual monitoring
        i. Disturbed areas
        ii. BMPs
        iii. Stormwater discharge points
    b. Water quality sampling/analysis
        i. Turbidity
        ii. pH
    c. Monitoring frequency
        i. Set by NPDES permit
        ii. Inactive sites - reduced frequency

d. Adaptive Management
   i. When monitoring indicates problem, take appropriate action (e.g. install/maintain BMPs)
   ii. Document the corrective action(s) in SWPPP
e. Reporting
   i. Inspection reports/checklists
   ii. Discharge Monitoring Reports (DMR)
   iii. Non-compliance notification

Instructor Qualifications

1. Instructors must be qualified to effectively teach the required course elements.

2. At a minimum, instructors must have:

   a. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC), or
   b. Completed a training program for teaching the required course elements, or
   c. The academic credentials and instructional experience necessary for teaching the required course elements.

3. Instructors must demonstrate competent instructional skills and knowledge of the applicable subject matter.

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.

4.2 Runoff Conveyance and Treatment BMPs

BMP C200: Interceptor Dike and Swale

Purpose

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

Conditions of Use

Where the runoff from an exposed site or disturbed slope must be conveyed to an erosion control facility which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment basin.

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Channel requires a positive grade for drainage; steeper grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Sub-basin tributary area should be one acre or less.
- Design capacity for the peak flow from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution, for temporary facilities. Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model. For facilities that will also serve on a permanent basis, consult the local government's drainage requirements.

Interceptor dikes shall meet the following criteria:

Top Width	2 feet minimum.
Height	1.5 feet minimum on berm.
Side Slope	2:1 or flatter.
Grade	Depends on topography, however, dike system minimum is 0.5%, maximum is 1%.
Compaction	Minimum of 90 percent ASTM D698 standard proctor.

Horizontal Spacing of Interceptor Dikes:

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

Stabilization depends on velocity and reach

Slopes <5% Seed and mulch applied within 5 days of dike construction (*see BMP C121, Mulching*).

Slopes 5 - 40% Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap or other measures to avoid erosion.

- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.
- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.

Interceptor swales shall meet the following criteria:

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

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.

Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C201: Grass-Lined Channels

Purpose

To provide a channel with a vegetative lining for conveyance of runoff. See Figure 4.7 for typical grass-lined channels.

Conditions of Use

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

- When a vegetative lining can provide sufficient stability for the channel cross section and at lower velocities of water (normally dependent on grade). This means that the channel slopes are generally less than 5 percent and space is available for a relatively large cross section.
- Typical uses include roadside ditches, channels at property boundaries, outlets for diversions, and other channels and drainage ditches in low areas.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a bonded fiber matrix (BFM). The vegetation should be well established (i.e., 75 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 in lieu of hydromulch and blankets.

Design and Installation Specifications

Locate the channel where it can conform to the topography and other features such as roads.

- Locate them to use natural drainage systems to the greatest extent possible.
- Avoid sharp changes in alignment or bends and changes in grade.
- Do not reshape the landscape to fit the drainage channel.
- The maximum design velocity shall be based on soil conditions, type of vegetation, and method of revegetation, but at no times shall velocity exceed 5 feet/second. The channel shall not be overtopped by the peak runoff from a 10-year, 24-hour storm, assuming a Type 1A rainfall distribution." Alternatively, use 1.6 times the 10-year, 1-hour flow indicated by an approved continuous runoff model to determine a flow rate that the channel must contain.
- Where the grass-lined channel will also function as a permanent stormwater conveyance facility, consultant the drainage conveyance requirements of the local government with jurisdiction.
- An **established** grass or vegetated lining is required before the channel can be used to convey stormwater, unless stabilized with nets or blankets.

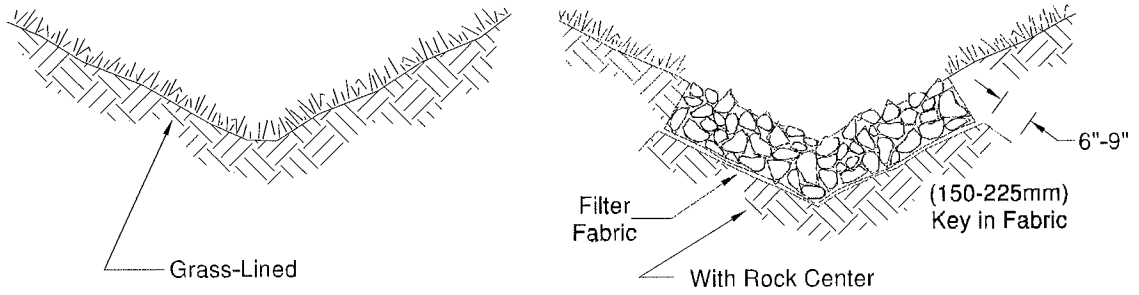
- If design velocity of a channel to be vegetated by seeding exceeds 2 ft/sec, a temporary channel liner is required. Geotextile or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established. See Figure 4.9.
- Check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- If vegetation is established by sodding, the permissible velocity for established vegetation may be used and no temporary liner is needed.
- Do not subject grass-lined channel to sedimentation from disturbed areas. Use sediment-trapping BMPs upstream of the channel.
- **V-shaped grass channels** generally apply where the quantity of water is small, such as in short reaches along roadsides. The V-shaped cross section is least desirable because it is difficult to stabilize the bottom where velocities may be high.
- **Trapezoidal grass channels** are used where runoff volumes are large and slope is low so that velocities are nonerosive to vegetated linings. (Note: it is difficult to construct small parabolic shaped channels.)
- Subsurface drainage, or riprap channel bottoms, may be necessary on sites that are subject to prolonged wet conditions due to long duration flows or a high water table.
- Provide outlet protection at culvert ends and at channel intersections.
- Grass channels, at a minimum, should carry peak runoff for temporary construction drainage facilities from the 10-year, 24-hour storm without eroding. Where flood hazard exists, increase the capacity according to the potential damage.
- Grassed channel side slopes generally are constructed 3:1 or flatter to aid in the establishment of vegetation and for maintenance.
- Construct channels a minimum of 0.2 foot larger around the periphery to allow for soil bulking during seedbed preparations and sod buildup.

Maintenance Standards

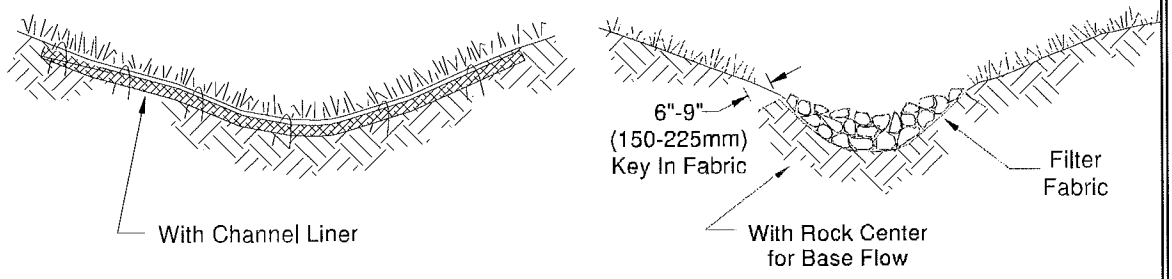
During the establishment period, check grass-lined channels after every rainfall.

- After grass is established, periodically check the channel; check it after every heavy rainfall event. Immediately make repairs.
- It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes.
- Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.

Typical V-Shaped Channel Cross-section



Typical Parabolic Channel Cross-Section



Typical Trapezoidal Channel Cross-Section

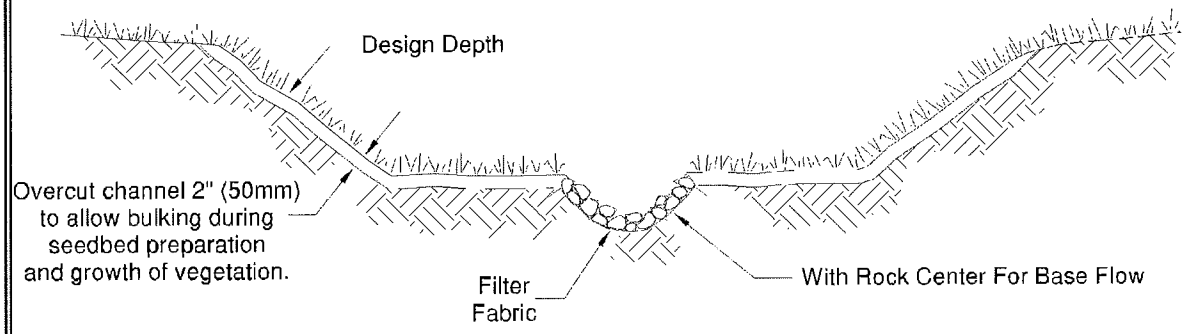
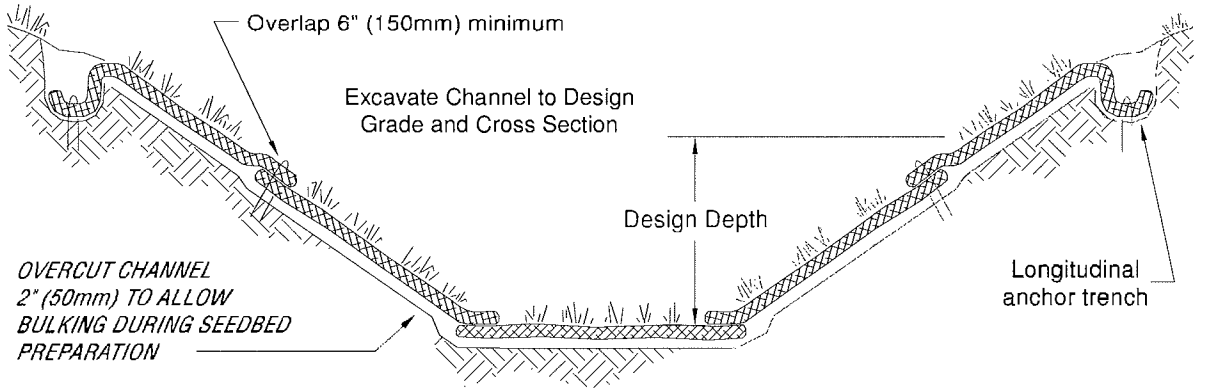
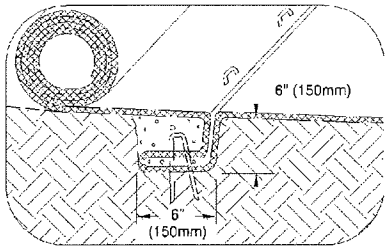


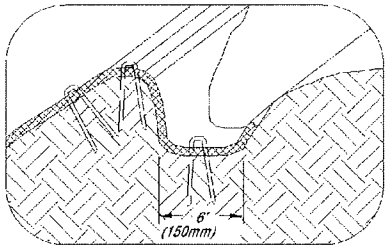
Figure 4.8 – Typical Grass-Lined Channels



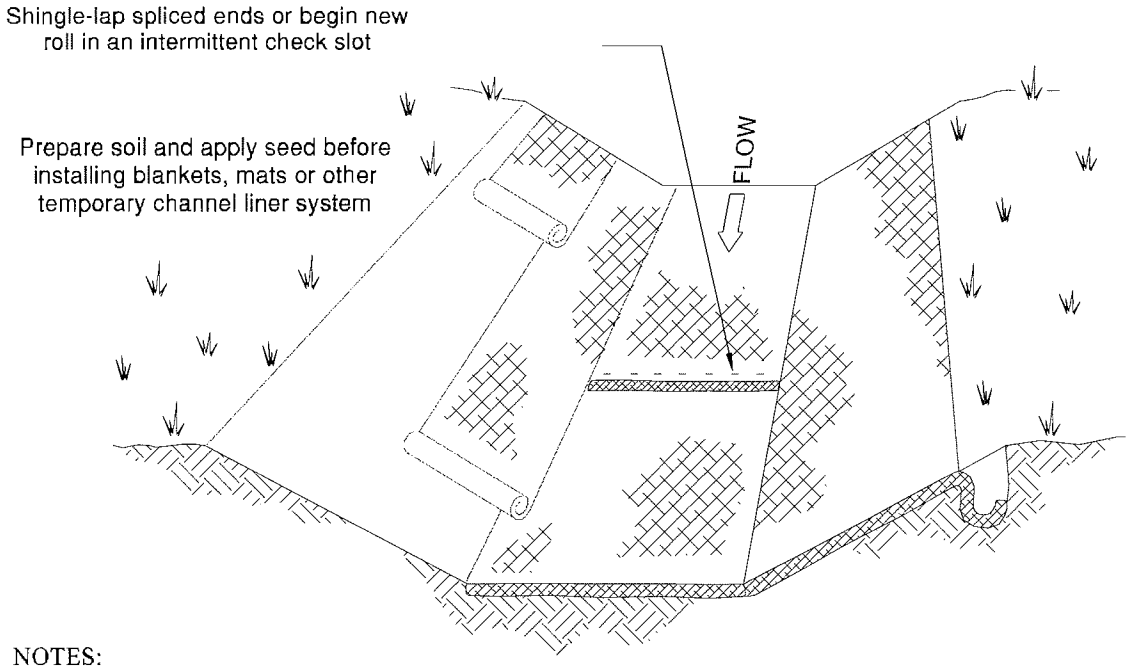


Intermittent Check Slot

TYPICAL INSTALLATION WITH EROSION CONTROL BLANKETS OR TURF REINFORCEMENT MATS



Longitudinal Anchor Trench



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

Figure 4.9 – Temporary Channel Liners

BMP C202: Channel Lining

Purpose

To protect erodible channels by providing a channel liner using either blankets or riprap.

Conditions of Use

When natural soils or vegetated stabilized soils in a channel are not adequate to prevent channel erosion.

- When a permanent ditch or pipe system is to be installed and a temporary measure is needed.
- In almost all cases, synthetic and organic coconut blankets are more effective than riprap for protecting channels from erosion. Blankets can be used with and without vegetation. Blanketed channels can be designed to handle any expected flow and longevity requirement. Some synthetic blankets have a predicted life span of 50 years or more, even in sunlight.
- Other reasons why blankets are better than rock include the availability of blankets over rock. In many areas of the state, rock is not easily obtainable or is very expensive to haul to a site. Blankets can be delivered anywhere. Rock requires the use of dump trucks to haul and heavy equipment to place. Blankets usually only require laborers with hand tools, and sometimes a backhoe.
- The Federal Highway Administration recommends not using flexible liners whenever the slope exceeds 10 percent or the shear stress exceeds 8 lbs/ft^2.

Design and Installation Specifications

See BMP C122 for information on blankets.

Since riprap is used where erosion potential is high, construction must be sequenced so that the riprap is put in place with the minimum possible delay.

- Disturbance of areas where riprap is to be placed should be undertaken only when final preparation and placement of the riprap can follow immediately behind the initial disturbance. Where riprap is used for outlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that it is in place when the pipe or channel begins to operate.
- The designer, after determining the riprap size that will be stable under the flow conditions, shall consider that size to be a minimum size and then, based on riprap gradations actually available in the area, select the size or sizes that equal or exceed the minimum size. The possibility of drainage structure damage by children shall be considered in selecting a riprap size, especially if there is nearby water or a gully in which to toss the stones.
- Stone for riprap shall consist of field stone or quarry stone of approximately rectangular shape. The stone shall be hard and angular and of such quality that it will not disintegrate on exposure to water or

weathering and it shall be suitable in all respects for the purpose intended.

- Rubble concrete may be used provided it has a density of at least 150 pounds per cubic foot, and otherwise meets the requirement of this standard and specification.
- A lining of engineering filter fabric (geotextile) shall be placed between the riprap and the underlying soil surface to prevent soil movement into or through the riprap. The geotextile should be keyed in at the top of the bank.
- Filter fabric shall not be used on slopes greater than 1-1/2:1 as slippage may occur. It should be used in conjunction with a layer of coarse aggregate (granular filter blanket) when the riprap to be placed is 12 inches and larger.

BMP C207: Check Dams

Purpose

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

Conditions of Use

Where temporary channels or permanent channels are not yet vegetated, channel lining is infeasible, and velocity checks are required.

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

Design and Installation Specifications

Whatever material is used, the dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the dam rather than falling directly onto the ditch bottom.

Check dams in association with sumps work more effectively at slowing flow and retaining sediment than just a check dam alone. A deep sump should be provided immediately upstream of the check dam.

- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.
- Check dams can be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose. They tend to be re-usable, quick and easy to install, effective, and cost efficient.
- Check dams should be placed perpendicular to the flow of water.
- The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- Keep the maximum height at 2 feet at the center of the dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2:1 or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.

- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, this is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- Rock check dams shall be constructed of appropriately sized rock. The rock must be placed by hand or by mechanical means (no dumping of rock to form dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges. The rock used must be large enough to stay in place given the expected design flow through the channel.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones. Figure 4.13 depicts a typical rock check dam.

Maintenance Standards

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

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

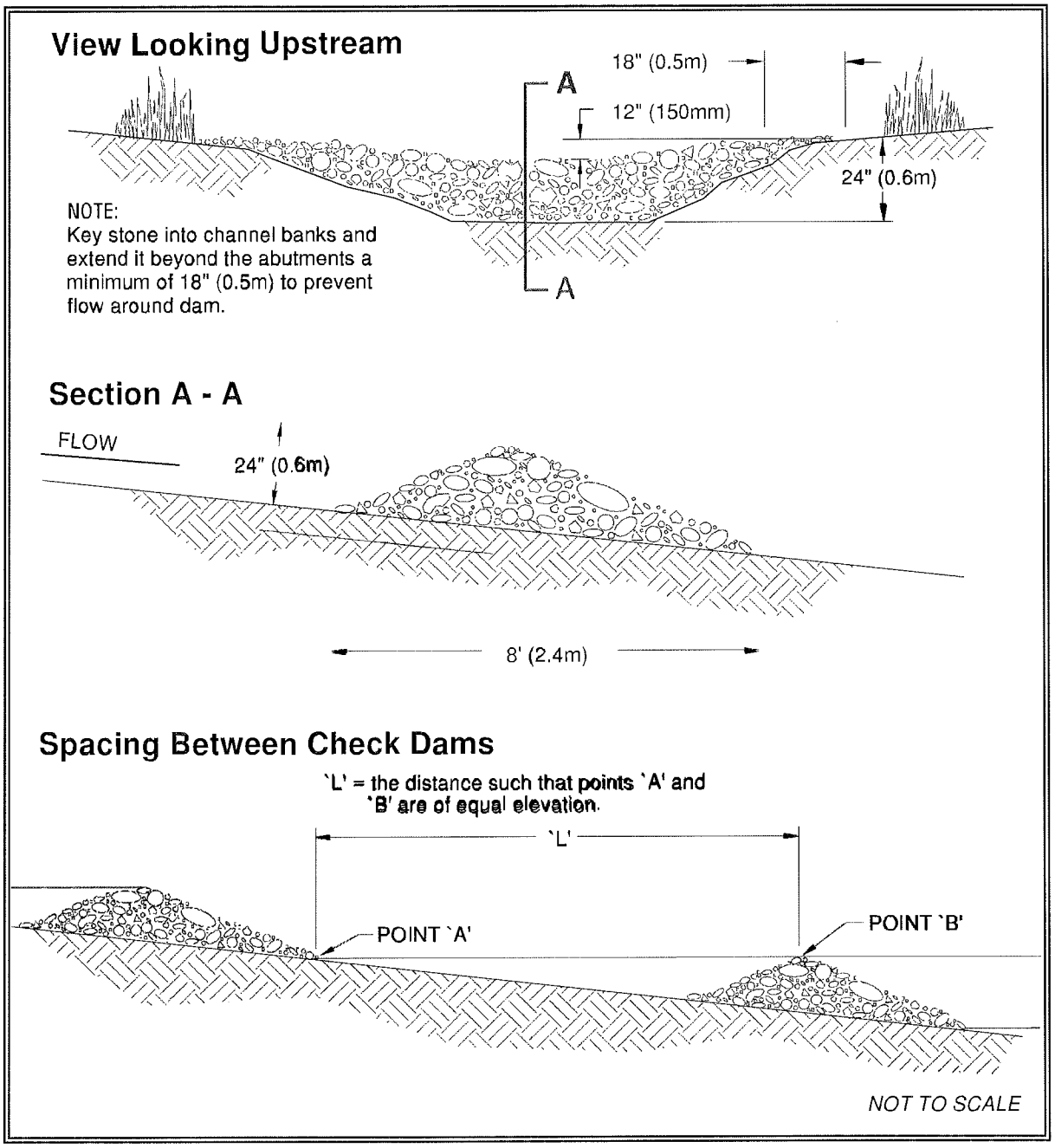


Figure 4.13 – Check Dams

APPENDIX C – GENERAL PERMIT (TO BE ADDED WHEN RECEIVED)

APPENDIX D – ECOLOGY SITE INSPECTION CHECKLIST

Geotechnical Investigation Access Clearing

CRITICAL AREAS STUDY AND MITIGATION PLAN

Gateway Pacific Terminal

Prepared for:

Pacific International Terminals, Inc.
1131 SW Klickitat Way
Seattle, Washington 98134

Prepared by:

AMEC Earth & Environmental, Inc.
11810 North Creek Parkway North
Bothell, Washington 98011

August 19, 2011

Project No. 0-915-15338 C

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FIGURES

APPENDICES

CONTACT INFORMATION AND RESPONSIBLE PARTIES

Following are the name and addresses of the responsible parties and contact persons for the proposed.

Owner of site, contact for contract purposes, and party responsible for long-term maintenance and monitoring:

Pacific International Terminals, Inc.
1131 SW Klickitat Way
Seattle, WA 98134
(206) 623-0304
Skip Sahlin
Skip.Sahlin@ssamarine.com

This *Critical Areas Study and Mitigation Plan* was prepared by:

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Kristie Dunkin, Ph.D., PMP
Project Manager
kristie.dunkin@amec.com

CRITICAL AREAS STUDY AND MITIGATION PLAN
Geotechnical Investigation Access Clearing
Gateway Pacific Terminal

1.0 INTRODUCTION

This Critical Areas Assessment Report and Mitigation Plan is being submitted to support permit applications to Whatcom County for after-the-fact permitting to authorize existing and proposed impacts to regulated areas associated with geotechnical investigations on site. Pacific International Terminals, Inc. (Pacific International Terminals), received a Notice of Violation (NOV) - Reissue (ENF2011-00047), dated August 17, 2011, from Whatcom County Planning and Development Services (PDS) for unauthorized activities at the proposed Gateway Pacific Terminal property site; specifically, violation of Section 20.80.734 (4) of the Whatcom County Code (WCC) regarding site clearing. Pacific International Terminals received a second NOV (ENF2011-00047), dated August 3, 2011, from Whatcom County PDS for violation of the Critical Areas Ordinance; specifically, Section 16.16.225 of the WCC.

Corrective actions required per the August 17, 2011, NOV include soil erosion and sediment control measures and the completion and submission of a land disturbance application and a State Environmental Policy Act (SEPA) environmental checklist to Whatcom County PDS. These documents are being submitted under a separate cover.

Corrective actions required per the August 3, 2011, NOV include the completion and submission of a land disturbance application and a critical areas report and restoration plan for temporary impacts to wetlands and wetland buffers. The Critical Areas Report section of this report has been completed in accordance with Section 16.16.255 (Critical Areas Assessment Reports) of the WCC. The Mitigation Plan section of this report includes the contents required in the NOV (restoration activities, performance standards, monitoring, and maintenance requirements), and has been completed based on the requirements for mitigation projects as listed in Section 16.16.260 and 16.16.690 of the WCC.

2.0 PROJECT DESCRIPTION

The geotechnical investigation entails advancing approximately 50 boreholes and approximately 20 cone penetration tests (CPT) to evaluate subsurface soil and groundwater conditions. The investigation will provide information regarding subsurface conditions that will be critical for design of future development on the property. Geotechnical boreholes are generally about 8 inches in diameter and extend to depths of 80 to 130 feet. The CPTs push a 1.4-inch-diameter rod into the ground to depths up to about 100 feet. Two shallow test pit excavations to depths of about 15 feet will be used

to confirm near-surface soil profiles. The locations of the explorations are shown in Figure 1 (Geotechnical Investigation Site Access As-Built Plan).

The boreholes and CPT explorations are advanced with track-mounted equipment, which is approximately 8 feet wide by 25 feet long. To allow equipment to access test locations in forested and shrub vegetated areas, access paths approximately 17 feet wide are required to accommodate the equipment and provide safe working clearance.

To prepare access paths in forest and shrub areas, a tracked excavator was used to knock over trees and to pick up smaller vegetation and push it to the perimeter of the access path. These access paths are temporary and no improvements were made to create roadways. Following initiation of clearing, data collection was begun and boreholes and CPT work initiated. Field work was halted on July 22, 2011. At that time, access to all borehole locations was completed while approximately half of the intended data was collected.

2.1.1.1 Work Plan Development and Implementation

To avoid wetlands, streams and buffers and minimize clearing disturbance, access routes were drawn onto base maps and evaluated. It is not practicable to locate the proposed geotechnical boreholes with complete avoidance of wetlands because much of the proposed terminal development area is wetland and geotechnical data is needed for subsurface conditions in those locations. However, to the extent feasible, proposed geotechnical boreholes were located outside of wetland and heavily vegetated areas in order to avoid direct vegetation impacts. When a boring hole was located within a wetland, existing roads and pastures and hay fields were used as access routes to the extent possible to minimize vegetation disturbance throughout the property. Only when no other alternative could be identified were access routes placed through forested or shrub vegetated wetland areas.

Clearing for access paths to the geotechnical boring locations was initiated on July 5, 2011, and was completed on July 22, 2011. In total, approximately 23,132 lineal feet of access paths were cleared in both uplands and in wetland forest and shrub areas. The average width of clearing was determined to be 17 feet and the total area cleared was approximately 9.1 acres. Of this total cleared area, approximately 2.8 acres of vegetation and soil in forested and shrub wetlands and approximately 0.96 acres of wetland buffers were disturbed. At this time, no additional access paths are anticipated to be necessary to complete the geotechnical investigation.

LEGEND

- BOREHOLE COMPLETED (37)
- BOREHOLE NOT COMPLETED (32)
- BOREHOLE IN PROGRESS (4)
- VEHICLE ACCESS POINT
- NO VEHICLE ACCESS
- AS-BUILT BOREHOLE ACCESS*
- APPROXIMATE DRAINAGE
- SURVEYED DRAINAGE
- APPROXIMATE STREAM COURSE
- SURVEYED STREAM COURSE
- CURRENT ELEVATION CONTOUR (10 ft. interval, NAVD88 datum)
- CURRENT ELEVATION CONTOUR (2 ft. interval, NAVD88 datum)
- APPROXIMATE WETLAND BOUNDARY
- FRESHWATER EMERGENT WETLAND (PEM)
- FRESHWATER FORESTED WETLAND (PFO)
- FRESHWATER SHRUB WETLAND (PSS)
- PROPERTY BOUNDARY
- PROJECT AREA BOUNDARY

*THIS LINE DEPICTS LOCATIONS WHERE TREES AND SHRUBS WERE REMOVED TO ALLOW ACCESS FOR GEOTECHNICAL INVESTIGATION. NO ACCESS ROUTE IS SHOWN WHERE ACCESS WAS ACROSS OPEN FIELDS.

Pacific International Terminals
A Gemis Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY: SD
CHK'D BY: KD
DATUM: NAD83
PROJECTION: WA SP North, Ft.
SCALE: 1 inch = 1,000 feet

PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION

TITLE: 2011 GEOTECHNICAL INVESTIGATION SITE ACCESS AS-BUILT PLAN AND WETLAND IMPACT AREAS

DATE: AUGUST 2011
PROJECT NO.: 091515338C-07-03
REV. NO.: 3
FIGURE NO.: FIGURE 1

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-07-03 - Geotechnical Investigation\Critical_Areas_Report\Figure 2 - 2011 Geotechnical Investigation Site Access As-Built Plan.mxd

Borings were made onsite starting on July 7, 2011 through July 22, 2011. As of July 22, 19 (of the 50 planned) boreholes and 19 (of the 20 planned) CPT explorations were completed. Several boreholes were in progress and are not completed. Two test pit explorations were also completed.

To reduce the risk of erosion or sedimentation from cleared areas, best management practices (BMPs), including stabilized construction entrances and covering bare soils, will be implemented. Bare soil areas will be covered by hydroseeding. Seed mixes will include fast germinating grasses suitable for forest or shrub wetlands and a separate seed mix for forested upland areas, as described in the planting scheme, later in this document. Entrance areas will be stabilized with chipped wood and bark.

The proposed work to complete geotechnical testing includes advancing approximately 30 boreholes and 1 CPT, which would take approximately 6 work weeks.

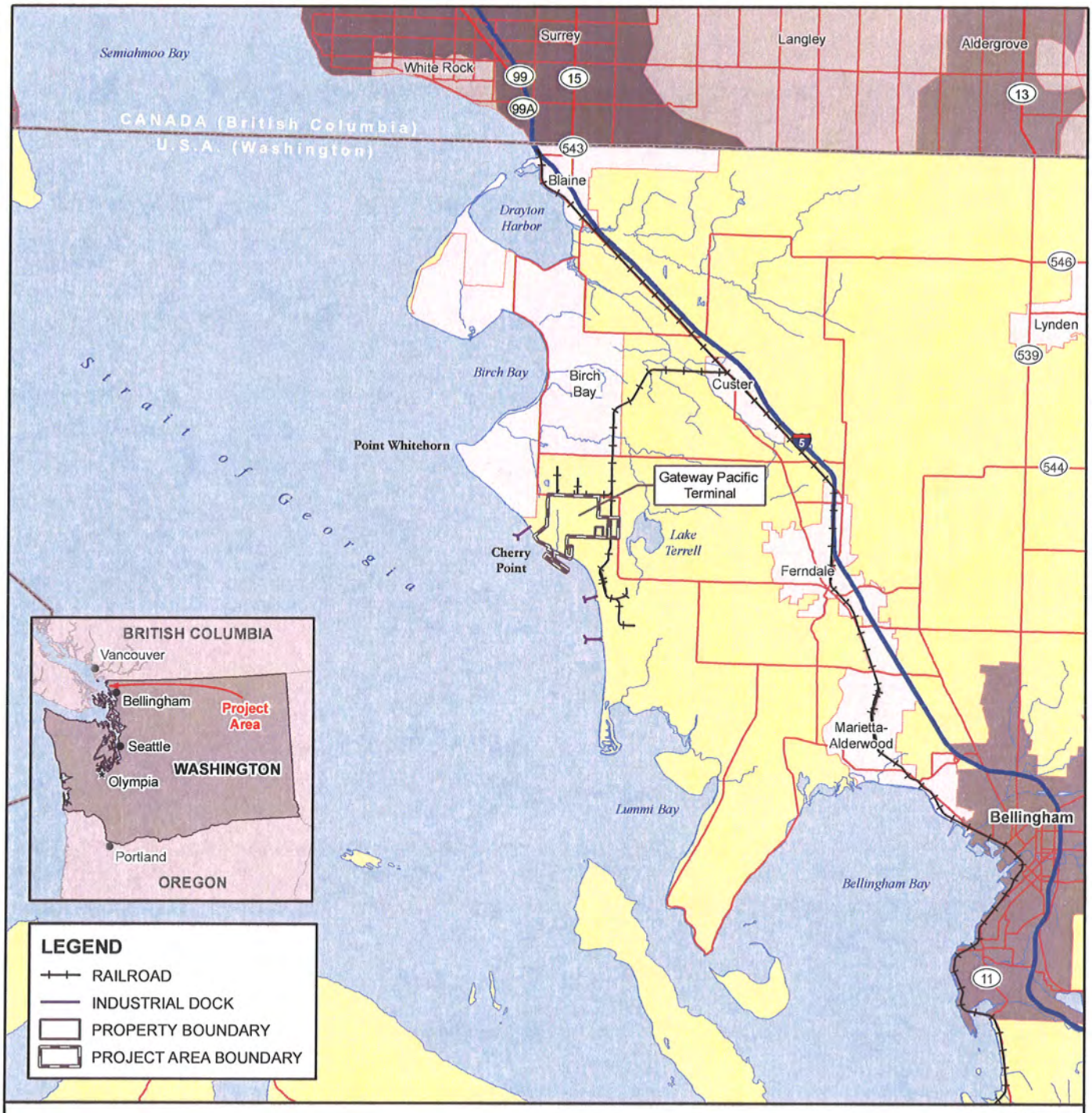
Following completion of field testing, cleared areas will be restored. In wetland areas, side cast rootwads and some side cast root mats with soil will be moved to the clearings to reduce the size of adjacent piles. Plantings appropriate to forested wetlands or shrub areas will be installed. In upland areas, trees seedlings will be planted to accomplish reforestation at a stocking rate of 190 stems per acre in 3 years to meet the Department of Natural Resources (DNR) reforestation requirements.

3.0 DESCRIPTION OF THE PROJECT SITE

The project site is located 18 miles northwest of Bellingham and 10 miles west of Ferndale (Figure 2). The proposed Gateway Pacific Terminal project area is approximately 1,200 acres in size. The project site covers portions of Sections 17, 18, and 19 of Township 39 North, Range 1 East, all in unincorporated Whatcom County. The project site is accessible from I-5 via Highway 548 (Grandview Road) west, and left on Kickerville Road.

Roughly rectangular in shape, the project site is bounded by roads and industrial operations to the north, east, and south, and by the Strait of Georgia to the southwest:

- BP's Cherry Point refinery property is adjacent to the north and west;
- 70 acres owned by BP lie to the northwest;
- Kickerville Road, populated by private residences on approximately 5 acre plats, lies to the east;
- Pastures owned by others lie to the south;
- DNR lands lie to the northeast; and
- The Strait of Georgia lies to the south and southwest.



AMEC Earth & Environmental 11810 North Creek Parkway N Bothell, WA 98011	amec	Pacific International Terminals	CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION	DWN BY: SD	DATUM: NAD83	DATE: AUGUST 2011
TITLE: VICINITY MAP	CHK'D BY: CS	REV. NO.: 1	PROJECT NO.: 091515338C-07-03
	PROJECTION: WA SP North, Ft.	SCALE: 1 inch=3 miles	FIGURE No.: FIGURE 2

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-07-03 - Geotechnical Investigation\Critical_Areas_Report\Figure 1 - Vicinity Map.mxd

Cherry Point, a small promontory of land south of Point Whitehorn, forms the southwest corner of the project site. Roads, pipelines, power line corridors, and railroads, further define the project site. Gulf Road (formerly Powder Plant Road) and the BNSF Railway's Custer Spur runs north-south in the eastern portion of the site, and Lonseth Road bisects the project site east-west. A BPA transmission-line corridor runs north-south through the eastern portion.

The current land use proposal is for upland geotechnical investigations, and does not include the Strait of Georgia, or shoreline. Therefore, this document does not evaluate Critical Areas such as those Fish and Wildlife Habitat Conservation Areas (FWHCAs) associated with the shoreline, and is focused on the portion of the site above ordinary high water. Furthermore, throughout this document, any reference to the project site excludes the marine shoreline.

3.1.1 Study Area

This study describes the critical areas located with the Gateway Pacific Terminal project area with emphasis on those relevant to the geotechnical investigation and associated clearing. The current proposal is for an upland geotechnical investigation that does not include investigations in the marine area. Therefore, this document does not evaluate Critical Areas associated with the marine environment but is focused on the portions of the property at elevations higher that the marine higher high tide.

The restoration plan described here focuses on the forested and shrub areas within the Gateway Pacific Terminal project area and especially in wetlands and wetland buffers, which were cleared to perform the geotechnical investigation.

3.1.1.1 Historical Land Use

Archaeological studies indicate that portions of the study area have been used by a group of Salish Indians, known by the post-reservation name of Lummi, for at least 3,000 years. The Salish Indians at Cherry Point were noted for reef-netting and other fishing practices. According to homestead records, the earliest account of Euroamerican occupation of Cherry Point was documented in the 1870s. Between 1902 and 1934, European settlers used a portion of the study area as a camp for fishermen tending off-shore fish traps (Markham 1993). One site with potential archaeological significance is within the study area.

Beginning in the late 1800s, the site was logged and homesteaded for farming by European settlers. Several abandoned orchards remain throughout the study area. Farming included crops such as rye, potatoes, hay, dairy and chicken farms, and scattered woodlots for firewood and logging. Farming activities continued through the mid-1940s, when large portions of land in the vicinity of the study area were acquired for industrial use. Based on historical aerial photographs, the present condition of the

study area, with open fields and wooded areas, appears to have been stable for at least the last 50 years.

3.1.1.2 Current Land Use

Land use of the study area has included pastures, hay farming, and firewood production. In general, the study area is a mix of young red alder forest, pastures, hayfields, and abandoned fields. The pastures and hayfields still in use are occasionally tilled and reseeded.

4.0 CRITICAL AREAS STUDY

Critical Areas regulated under WCC 16.16 include

- Geologically hazardous areas,
- Frequently flooded areas,
- Critical aquifer recharge areas (CARAs),
- Wetlands, and
- Fish and wildlife habitat conservation areas (FWHCAs).

As indicated in the introduction to this document, Whatcom County has requested a Critical Areas Study and a Restoration Plan for temporary impacts to wetlands and wetland buffers. This Critical Areas Study describes Critical Areas identified within the project site, as identified through a review of published information, and field investigations.

4.1.1.1 Approach

Available site information was reviewed to identify any documented wetlands, streams, or other site characteristics (e.g., vegetation patterns, topography, soils, or water courses) that would indicate the presence of wetlands within the study area, as well as the presence of geologically hazardous areas, CARAs, and FWHCAs. Based on Whatcom County Critical Areas Maps, there are no frequently flooded areas identified by Whatcom County on the project site.

The Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) database (WDFW 2009) was searched for the documented occurrence of sensitive wildlife and/or habitats in the vicinity of the project footprint. The following section summarizes the available information. Figure 3 shows the Critical Areas on a map of the project site.

4.1.2 Geologically Hazardous Areas

Based on preliminary site review and information published in the Whatcom County Critical Areas Maps (Whatcom County 2006), the project area contains one small portion of land considered a Marine Landslide Hazard Area with Modified Shoreline Stability just north and west of Henry Road (Figure 3 – Critical Areas and Buffers). No geotechnical drilling was conducted, nor is any geotechnical drilling planned in this area. Geologically hazardous areas are not discussed further in this report.

4.1.3 Critical Aquifer Recharge Areas

A Critical Aquifer Recharge Area (CARA) is defined by the Washington Administrative Code (WAC) Chapter 365-190 as follows:

> "Areas with a critical recharging effect on aquifers used for potable water are areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water."

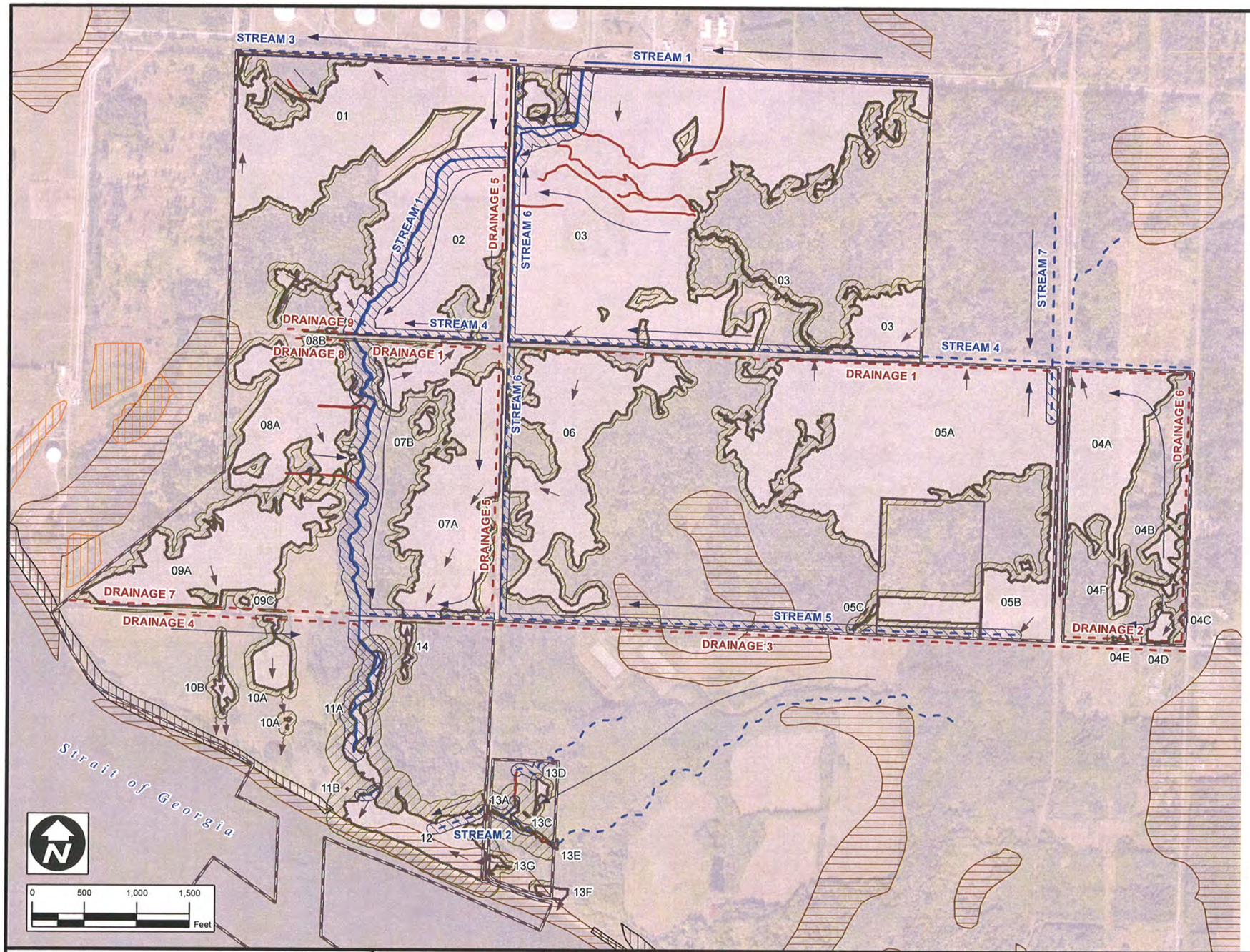
According to Whatcom County critical areas maps and position in the watershed (Whatcom County 2006), no CARAs appear to be present within the study area. Surficial aquifers are located along the shoreline of the project area and north of Henry Road (Figure 3).

4.1.4 Wetlands

Comprehensive site investigations were used to identify and delineate the wetlands throughout the project study area from 2006 to present, with most of the work completed between 2006 and 2008. Potential wetland areas were evaluated in the field using the methods outlined in the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987) and the Washington State Wetlands Identification and Delineation Manual (Ecology 1997).

According to these manuals, hydrophytic (wetland) vegetation, hydric (wetland) soils, and wetland hydrology must be present for a significant duration during the growing season for an area to be considered a wetland. Data used to evaluate these parameters were collected from plots representative of typical conditions in each wetland. Additional data collected in areas adjacent to wetlands documented upland conditions.

Wetlands were rated using the *Washington State Wetlands Rating System for Western Washington* (Hruby 2004, revised), which evaluates wetlands based on rarity, sensitivity, and wetland function. Wetlands were categorized as Category I, II, III, or IV, based on the results of the evaluation. Wetlands were rated to develop and apply standards for protecting and managing wetlands, and for establishing wetland buffers.



LEGEND

- APPROXIMATE DRAINAGE
- SURVEYED DRAINAGE
- APPROXIMATE STREAM COURSE
- SURVEYED STREAM COURSE
- STREAM BUFFER
- STREAM AND DRAINAGE FLOW DIRECTION
- 05A WETLAND FLOW DIRECTION
- EXISTING WETLAND AREA
- WETLAND BUFFER *
- SURFICIAL AQUIFER (Mainland Only)

SHORELINE STABILITY:

- MODIFIED
- UNSTABLE SLOPE
- PROPERTY BOUNDARY
- PROJECT AREA BOUNDARY

*THE STANDARD WETLAND BUFFERS SHOWN ARE BASED ON WETLAND FUNCTIONS AND VALUES AND LOW-INTENSITY LAND USE ASSOCIATED WITH GEOTECHNICAL ACTIVITIES (per WCC 16.16.630).

Source:
Surficial Aquifer and Shoreline Stability data obtained from Whatcom County Planning & Development Services.

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AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	MG
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,000 feet

PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION

TITLE: CRITICAL AREAS AND BUFFERS

DATE:	AUGUST 2011
PROJECT NO.:	091515338C-07-03
REV. NO.:	1
FIGURE NO.:	FIGURE 3

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-07-03 - Geotechnical Investigation\Critical_Areas_Report\Figure 3 - Critical Areas and Buffers.mxd

A more detailed description of the wetland delineation approach is provide in the *Wetland Determination and Delineation Report* (AMEC 2008), and is available upon request.

4.1.4.1 Wetland Buffers

Whatcom County Code Section 16.16.630(D) designates wetland buffers from the edges of all wetlands to protect the integrity, functions, and values of the wetland. Per the WCC, wetland buffers are to be measured perpendicular to the wetland edge on all sides as marked in the field. The standard wetland buffer is determined based on the intensity of the proposed land use and the functions and values provided by the wetland (wetland rating), particularly with respect to wildlife function. The results of the wetland investigation and wetland maps were used to determine the width and to map the extent of the required wetland buffer.

4.1.5 Fish and Wildlife Habitat Conservation Areas

Whatcom County Code Section 16.16.710 defines FWHCAs as, "those areas identified as being of critical importance to the maintenance of certain fish, wildlife, and/or plant species," and includes:

- Streams,
- Areas that support federally and/or state-listed species,
- State priority habitats and areas with state priority species,
- Commercial and recreational fishing areas,
- Kelp and eelgrass beds,
- Forage fish spawning areas,
- Naturally occurring ponds under 20 acres,
- Naturally occurring lakes and other waters of the state,
- Natural area preserves, and
- Locally important species and habitats with recreational, cultural, and/or economic value.

Based on general site characteristics and position of the project site in the watershed, FWHCAs in the project area include streams, areas that support state-listed species, and state priority habitats and areas with priority species. Whereas other FWHCAs (commercial and recreational fishing areas, kelp and eelgrass beds, forage fish spawning areas) occur adjacent to the site, they are beyond the limits of the current Critical Areas Study because they are not affected by the subject geotechnical investigation and vegetation clearing.

An investigation of streams and waterways was conducted in conjunction with the wetland determination and delineation described previously, and subsequent habitat studies and fish presence surveys have been conducted. The detailed discipline report is currently in preparation and will be available at a later date. Preliminary information was provided in the *Gateway Pacific Terminal Project Information Document* (AMEC 2011) and is on file with Whatcom County and the Army Corps.

In addition, bird surveys were conducted to determine the presence of priority bird species and to characterize their use of the site. Similar to the investigation of streams and waterways, the bird discipline report is in preparation and preliminary observations are provided in the *Gateway Pacific Terminal Project Information Document* (AMEC 2011).

The *Gateway Pacific Terminal Project Information Document* (AMEC 2011) also provides an analysis of baseline characteristics relative to areas that support state-listed species and state priority habitats and areas with priority species and we refer the reader to that document.

4.1.5.1 Stream Buffers

Stream buffers are established in WCC Section 16.16.740 to protection the integrity, functions, and values of the resource. The WCC states that buffers do not include areas that are disconnected from the habitat area by a road or other developed surface. The WCC provides guidelines for establishing stream buffers based on position in the watershed and whether the stream supports fish.

4.1.5.2 Description of Critical Areas

Based on the review of available site characteristics and field investigations, as well as communication with a Whatcom County Technical Administrator, the description of Critical Areas provided herein is focused on wetlands and their associated buffers. This was determined because while streams, drainages, and other FWHCAs are present onsite, they were not impacted by the subject geotechnical investigation and vegetation clearing. As mentioned previously, more information about streams, drainages, and wildlife is provided in the *Gateway Pacific Terminal Project Information Document* (AMEC 2011).

4.1.6 Wetlands

Wetlands comprise approximately 530.6 acres of the study area. Wetlands were classified as riverine, slope, and depressional hydrogeomorphic (HGM) classes. Palustrine forested (PFO) wetlands were most common, followed by wet pastures and hayfields (PEM), and a small amount of scrub-shrub wetlands (PSS). One wetland was identified as an estuarine emergent system (Wetland 12).

Table 1 provides the typical plant community compositions for forested wetlands, shrub wetlands, and wet pastures.

Table 1 Typical Plant Communities in Forested, Shrub and Wet Pasture Wetlands.

Red Alder Wetland Forest Community		
Common Name	***Scientific Name***	**Wetland Indicator Status**
Red alder	*Alnus rubra*	FAC
Black cottonwood	*Populus trichocarpa*	FAC
Western red cedar	*Thuja plicata*	FAC
Twinberry	*Lonicera involucrata*	FAC
Salmonberry	*Rubus spectabilis*	FAC
Red-osier dogwood	*Cornus stolonifera*	FACW
Pacific willow	*Salix lucida*	FACW+
Sitka willow	*Salix sitchensis*	FACW
Wetland Shrub Community		
Common Name	***Scientific Name***	**Wetland Indicator Status**
Nootka rose	*Rosa nutkana*	FAC
Douglas spirea	*Spiraea douglasii*	FACW
Himalayan blackberry	*Rubus armeniacus*	FACU-
Salmonberry	*Rubus spectabilis*	FAC
Lady fern	*Athyrium filix-femina*	FACW
Slough sedge	*Carex obnupta*	OBL
Pacific silverweed	*Potentilla pacifica*	OBL
Stinging nettle	*Urtica dioica*	FAC+
Wet Pasture Community		
Common Name	***Scientific Name***	**Wetland Indicator Status**
Bentgrass	*Agrostis* sp.	FACW-FACU
Meadow foxtail	*Alopecurus pratensis*	FACW
Sweet vernal grass	*Anthoxanthum odoratum*	FACU
Tall buttercup	*Ranunculus acris*	FACW-

Note: OBL = obligate; FACW = facultative wetland; FAC = facultative wetland/upland; FACU = facultative upland

Table 2 provides a summary of wetland ratings for each of the delineated wetlands.

Table 2 Characteristics and Ratings of Wetlands on the Pacific International Terminals, Inc., Property as Confirmed by the USACE (USACE 2009)

		Area by Cowardin[1] Classification				
Wetland Name	Hydrogeomorphic Class	Palustrine Scrub-Shrub (acres)	Palustrine Emergent (acres)	Palustrine Forested (acres)	Rating[2]	Total Area (acres)
1	Flats/Depressional	1.3	5.1	37.8	III	44.2
2	Slope	5.0	11.3	37.0	III	53.2
3	Slope	15.1	72.3	63.2	III	150.7
4A	Slope	2.2	5.0	19.5	III	26.6
4B	Depressional	0.7	0	3.7	III	4.4
4C	Depressional	0.1	0	0.1	III	0.2
4D	Slope	0	0	1.3	III	1.3
4E	Slope	0	0.2	0	III	0.2
4F	Slope	0.3	0.8	0	IV	1.1
5A	Slope	8.6	3.2	83.4	III	95.2
5B	Depressional	0	0	0.1	III	0.1
5C	Slope	0	0	0.2	III	0.2
6	Slope	0	0	36.9	III	36.9
7A	Slope	2.1	3.5	34.5	III	40.1
7B	Depressional	0	0	0.6	III	0.6
8A	Slope	9.8	5.9	9.1	III	24.8
8B	Depressional	0.1	0	0	III	0.1
9A	Slope	6.9	8.6	12.7	III	28.2
10A	Slope	0.5	0.2	3.1	III	3.7
10B	Depressional	0.6	0.3	0.3	III	1.1
11A	Riverine	0	0	3.5	I	3.5
11B	Depressional	<0.1	0	0	III	<0.1
12	Depressional[3]	4.7	0.7	5.8	I	11.2
13A	Riverine	0	0	0.6	I	0.6
13C	Depressional	0	0	<0.1	III	<0.1
13D	Slope	0	0	0.4	III	0.4
13E	Riverine	0	0	0.1	II	0.1
13F	Depressional	0	0	0.6	III	0.6
13G	Depressional	0	0	0.4	III	0.4
14	Depressional	0	0	0.7	III	0.7
Total Wetland		**57.9**	**117.1**	**355.6**		**530.6**

A description of the characteristics and values of each of the delineated wetlands is provided in the *Wetland Determination and Delineation Report* (AMEC 2008), which is available upon request.

Additional wetland boundaries were delineated in August 2011 on Parcel 14, an area excluded from the original wetland delineation due to property access limitations. Parcel 14 is located on the eastern side of the project area, and abuts the north side of Henry Road. Wetland boundaries of Wetland Units 5A, 5B, and 5C extended onto Parcel 14 as shown on Figure 3. The additional wetland delineations resulted in the connection of Wetland 5A to Wetland 5C, and are thus combined as one wetland for the remainder of this report. The descriptions of Wetlands 5A/5C and 5B in the following section of this report are representative of the extended wetland areas on Parcel 14. Whereas these additional wetland boundaries have not yet been confirmed by the US Army Corps of Engineers (USACE), preliminary, revised area calculations for Wetlands Units 5A/5C and 5B are as shown in Table 3.

Table 3 Revised, preliminary characteristics and ratings of wetlands 5A, 5B, and 5C, including previously excluded area on Parcel 14 on the Pacific International Terminals property, subject to confirmation by the USACE

		Area by Cowardin[1] Classification				
Wetland Name	Hydrogeomorphic Class	Palustrine Scrub-Shrub (acres)	Palustrine Emergent (acres)	Palustrine Forested (acres)	Rating[2]	Total Area (acres)
5A/5C	Slope	8.7	3.2	97.0	III	108.9
5B	Depressional	-	-	0.1	III	0.1

The following section provides a description of the wetlands impacted by the subject geotechnical investigation and vegetation clearing. Wetlands locations are shown on Figures 1 and 3.

4.1.6.1 Wetland 1

PFO and PEM
Category III
Abuts Stream 3
Continues off-site and appears to infiltrate to groundwater north of Lonseth Road.

Wetland 1 is a 44.27-acre shallow-depressional area that abuts Stream 3 in the northwestern most portion of the study area (Figure 3). The red alder community typical of the area is present across most of the wetland. Heavily grazed wet meadows in the northeastern extent are vegetated with the study area's typical pasture mixture, as described in AMEC 2008.

The wetland is flat, with a topographic gradient of less than 1 percent over most of the study area. While this area could be classified as a slope, the hydrodynamics are more similar to the conditions found in a depressional system. During high flows, a 6-inch culvert beneath Aldergrove Road conveys surface flow from the ditch on the north side of the road into the wetland. However, this inflow does not generate well-defined drainage channels. It appears that wetland hydrologic conditions exist primarily due to a seasonally high ground water table and local precipitation.

This wetland is hydrologically separated from the rest of the study area by a watershed boundary that occurs along a northeast-southwest trending ridgeline that lies southeast of the wetland. This is the only wetland within the study area that does not drain southward via a stream located within the study area. The wetland continues southwest onto the adjacent property, where it appears to infiltrate to groundwater north of Lonseth Road.

Wetland 1 occupies a large portion of its drainage basin, and may potentially function to improve water quality by processing nutrients. Wetland 1 could also provide wildlife habitat due to the presence of multiple Cowardin classes, hydroperiods, and relatively high habitat interspersion.

4.1.6.2 Wetland 2

PFO and PEM
Category III
Abuts Streams 1 and 4
Drains to Streams 1 and 4, then to the Strait of Georgia.

Wetland 2 is a large (49.0-acre), mostly-forested slope wetland located north of Lonseth Road, south of Aldergrove and west of Gulf Road (Figure 3). Within Wetland 2, Stream 1 is characterized as a very low gradient, slow flowing stream with a poorly defined channel for most of the area. Water collects in Wetland 2 as a result of a seasonally high groundwater table, precipitation, and some contribution of overbank flooding. The area was saturated during the first field effort in June 2006, and almost completely inundated in winter 2007, with depths of 2 to 8 inches in most portions.

The forested portion is vegetated by the young alder forest community typical of the forested wetlands in the study area (AMEC 2008). The northern-most extent is heavily grazed wet pasture. Small thickets of rose, snowberry, and Himalayan Blackberry are common along the transition from forest to pasture and along the roadway. Reed canarygrass dominates the area surrounding Stream 1 in the pasture.

Soils are mapped as Whitehorn silt loam. Soils are black (10 YR 2/1) loam and silt loam in the top approximate 6 inches. The surface of soil near Stream 1 is high in organic content. The upper part of the subsoil varies by location and is loam or clay loam with redox features present, generally starting at approximately 6 inches.

Wetland 2 has a relatively shallow slope, dense, woody vegetation, and very few surface depressions. Functions provided by Wetland 2 may include the attenuation of overland flow velocity, thereby decreasing erosion and sediment deposition in areas downslope. Multiple Cowardin classes, hydroperiods, habitat features, and interspersion contribute to the habitat value of Wetland 2.

4.1.6.3 Wetland 3

PFO, PSS, and PEM.
Category III
Abuts Streams 1, 3, 4, and 6
Drains to Streams 1, 3, 4, and 6, then to the Strait of Georgia.

Wetland 3 is a large (143.44 acres) wetland located north of Lonseth Road, south of Aldergrove Road, and east of Gulf Road (Figure 3). Stream 1 originates in Wetland 3 through the confluence of many small, undefined drainages into one constructed, well-defined stream just prior to flowing out of the wetland on the east side of Gulf Road.

Wetland 3 is actively-grazed pasture in the western half and forested wetland in the eastern half. The pasture vegetation is the typical mixed grass community found in the study area (AMEC 2008). The forested wetland has the red alder community typical of the study area (AMEC 2008). The slightly wetter conditions in the vicinity of the outlet at Gulf Road support a willow shrub community interspersed with small, open water areas with cattail, rushes, and sedges.

Soils are mapped as Whitehorn silt loam for most of the area in the western and central portions. Soils on the eastern most extent are mapped as Birchbay Silt loams on 0 to 3 percent slopes. Soils are a compact, very dark brown (10 YR 2/2) clay loam in the top approximate 6 inches. Below 6 inches, soils are a dark brown silt loam with redoximorphic features indicating saturated conditions.

Wetland 3 has a relatively shallow gradient, very little dense or rigid vegetation, and surface depressions are present throughout. Wetland 3 provides some attenuation of overland flow due to its ability to retain a limited amount of water. Multiple Cowardin classes and hydroperiods, plant diversity and habitat interspersion contribute to the habitat value of Wetland 3.

4.1.6.4 Wetland 5A/5C

PFO and PEM
Category III
Wetland 5A abuts RPW tributary on the south side of Lonseth Road
Water in the northern portion of the wetland drains north to the roadside ditch on the south side of Lonseth Road, then to Stream 6 and ultimately to the Strait of Georgia.
Water in the southern portion of the wetland appears to infiltrate to groundwater, then flow south to Stream 5, then to Stream 1 and ultimately to the Strait of Georgia.

Wetland 5A/5C is a large (108.9-acre), primarily forested slope wetland that abuts the roadside ditch on the south side of Lonseth Road to the north, and lies adjacent to Stream 5 to the south (Figure 3). Old logging roads and skid trails are common throughout this wetland, and result in linear areas of ponding throughout the area. Wetland 5A/5C receives some water from the roadside ditch on the north side of Henry, which empties into the wetland via a culvert under the railroad tracks.

Wetland 5A/5C includes forested, scrub shrub, and emergent habitat types. Forest vegetation is the typical community for almost all of the area (AMEC 2008) as forested wetlands cover 97.0 of the 108.9-acre wetland complex. The southeast corner of this wetland unit contains a wet pasture dominated by reed canarygrass (*Phalaris arundinacea*), meadow foxtail (*Alopecurus pratensis),* and bentgrass species (*Agrostis spp.).* A 100-foot-wide easement adjacent to the rail embankment, vegetated mainly with reed canarygrass, is mowed annually.

Soils are mapped as Whitehorn silt loam. Soils were very dark brown (10 Y/R 2/2) or black (10 YR 2/1) in the upper 5 to 6 inches. In some areas, depth below 6 inches had a depleted matrix (10 YR 4/1) with distinct redox features. Most areas had redox features within 6 inches of the surface, and some small depressional features showed increased organic matter at the surface.

Wetland 5A/5C, located on a shallow slope, has dense, rigid vegetation throughout most of its area, and many small surface depressions that can trap water. Wetland 5A/5C may function to improve downstream water quality by trapping nutrients and sediments, and to decrease downstream erosion by attenuating overland flow velocity. Multiple Cowardin classes and hydroperiods, plant diversity, and habitat interspersion and features contribute to the habitat value of Wetland 5A/5C.

4.1.6.5 Wetland 5B

PFO and PSS
Category III
Isolated
No apparent outlet – infiltrates to groundwater that likely drains to the RPW on the south side of Lonseth Road, and ultimately to the Strait of Georgia.

Wetland 5B is a small, isolated wetland (0.13 acres) with vegetation typical of forested wetlands in the study area with hydrophytic emergent species. The soils are mapped as Whitehorn silt loam, and field observations are generally consistent with the mapped description. It is likely that Wetland 5B is connected to Wetland 5A/5C by shallow interflow, groundwater, or surface runoff during large storm events. Drainage patterns were assumed based on topographic gradients and field observations.

Wetland 5B has a relatively constricted outlet, and consists of dense, persistent vegetation, multiple Cowardin classes and hydroperiods, and includes areas of occasional ponding greater than 0.5 feet. Functions provided by Wetland 5B include slight flood attenuation, erosion control, some nutrient and sediment removal, and organic matter and terrestrial invertebrates production.

4.1.6.6 Wetland 6

PFO
Category III
Abuts Stream 6 and the RPW tributary on the south side of Lonseth Road
Drains to Stream 6, then Stream 5 and ultimately the Strait of Georgia.

Wetland 6 is a large (36.93-acre), forested, slope wetland that abuts Stream 6 and the roadside ditch on the south side of Lonseth Road (Figure 3). Gulf Road borders the area on the west and Lonseth Road on the north. Upland forests border the south and eastern portions. Old logging roads and skid trails are common and result in linear areas of ponding throughout the area. Forest vegetation is the area's typical plant community. The overstory consists of red alder and black cottonwood, with a shrub community that includes salmonberry, Douglas spirea, and twinberry. The herbaceous layer includes slough sedge and Hood's sedge.

Wetland 6, located on a shallow slope, has dense, rigid vegetation throughout most of its area, and many small surface depressions that can trap water. Wetland 6 functions to improve downstream water quality by trapping nutrients and sediments, and to decrease downstream erosion by attenuating overland flow velocity. Multiple Cowardin classes and hydroperiods, plant diversity and habitat features contribute to the habitat value of Wetland 6.

4.1.6.7 Wetland 7A

PFO, PSS, and PEM.
Category III
Abuts Stream 5 and other RPW tributaries on Gulf and Lonseth roads
Drains to Stream 5, then to Stream 1, and to the Strait of Georgia. Water may also infiltrate and drain towards the Stream 1 ravine, ultimately to be expressed as base flow for Stream 1.

Wetland 7A, a 40.06-acre slope wetland, abuts Stream 5, the roadside ditch on the east side of Gulf Road, and the roadside ditch on the south side of Lonseth Road (Figure 3).

Vegetation in the wetland consists of the area's typical forest and shrub communities. The overstory includes a canopy of red alder, with an understory shrub community of Douglas spirea, and twinberry and slough sedge. Indicators of wetland hydrology include water-stained leaves observed during the June survey and observations of inundation in January 2007. The soils are mapped as Whitehorn silt loam. Field observations indicate that the soils have higher clay content and the matrix is darker than the mapped type. Redoxymorphic features were observed below 8 inches.

Wetland 7A, located on a shallow slope, has dense, woody vegetation throughout most of its area, and many small surface depressions that trap water. Wetland 7A may function to improve downstream water quality by trapping nutrients and sediments, decreasing downstream erosion by

attenuating overland flow velocity. Multiple hydroperiods, plant diversity, and habitat interspersion contribute to the habitat value of Wetland 7A.

4.1.6.8 Wetland 8A

PFO, PSS, and PEM
Category III
Abuts Stream 1
Drains southeast to Stream 1 via constructed drainages, then to the Strait of Georgia.

Wetland 8A is a 24.69-acre forest, shrub, and emergent complex slope wetland abutting Stream 1 (Figure 3). Vegetation for most of the area is succeeding from old field to forest and shrub communities. Some parts in the northern extent were hayed and one area was scraped in the summer of 2006.

Vegetation in the forested portions is typical of the study area. Emergent portions have a mixed grass community with some of the lower portions and ditches supporting thick stands of sedge, reed, and rushes. Some small portions support pure stands of reed canarygrass. Indicators of wetland hydrology include water within 2.5 inches of the surface and saturated soil throughout the soil profile. Soils in the wetland are mapped as a Whitehorn silt loam. Field observations indicate that the soil profile was homogenous throughout a 16-inch sample hole, with no redoxymorphic features. The texture of the soil is a silt loam or loam.

Wetland 8A is located on a shallow slope with patchy vegetation and many surface depressions that can retain water. Wetland 8A may function to improve the water quality in Stream 1 by removing some nutrients and sediments. The wetland may also attenuate downstream flooding, scouring, and erosion by retaining a small amount of water. Multiple Cowardin classes and hydroperiods, high levels of plant diversity and habitat interspersion, habitat features, and relatively undisturbed buffers contribute to the habitat value of Wetland 8A.

4.1.6.9 Wetland 9A

PFO, PSS, and PEM.
Category III
Abuts Stream 5
Drains south to Stream 5, then to Stream 1 via and ultimately to the Strait of Georgia.

Wetland 9A (25.69 acres) is a forest, shrub, and pasture area that abuts Stream 5 in the western portion of the study area (Figure 3).

During the 2006 investigation, a portion the southern extent had recently been plowed while the adjacent field was likely turned and reseeded the previous year. The area was seeded in spring 2006. Vegetation in the plowed area was sparse and young during our 2007 field investigation, and

consisted of weedy annuals, reed canarygrass, and Himalayan blackberry. The remaining portions of the wetland are forested with the typical red alder forest community (AMEC 2008).

Soil in the vicinity is mapped as Whitehorn silt loam. During the field investigation, soils were hard and compacted. The plowed area was inundated with up to 10 inches of water during the 2007 field investigation. Most of the wetland was inundated with up to 6 inches of water during the 2007 investigation.

Wetland 9A has a shallow slope, patches of dense, woody vegetation, and surface depressions throughout that trap water. Wetland 9A may function to improve water quality downstream by removing nutrients and sediments, and by attenuating overland flow velocity. Wetland 9A also provides organic matter and terrestrial invertebrates to downstream communities. Multiple Cowardin classes and hydroperiods, high levels of plant diversity and habitat interspersion, special habitat features, and relatively undisturbed buffers contribute to the habitat value of Wetland 9A.

4.1.6.10 Wetland 10A

PFO, PSS, and PEM.
Category III
Abuts RPW tributary on the south side of Henry Road
No apparent outlet; likely drains to Strait of Georgia downslope via groundwater.

Wetland 10A is a 3.73 acre forested wetland that abuts the roadside ditch on the south side of Henry Road (Figure 3). The wetland may receive water from the ditch during high flows. The wetland appears to be the site of a former homestead or residence. A small fruit orchard and concrete foundation are situated in the southern portion of the wetland.

The dominant vegetation in Wetland 10A consists of wetland species including slough sedge and common rush, as well as facultative species typical of forested communities in the study area. Indicators of wetland hydrology include saturated soil in the upper 12 inches, and free water in the sampling pit. The soil is mapped as Whitehorn silt loam, and field observations generally confirm the mapped soil type.

Wetland 10A has a shallow slope, dense, woody vegetation, and surface depressions throughout can trap water. Wetland 10A functions to improve water quality downstream by removing nutrients and sediments, and attenuating overland flow velocity. Wetland 10A also provides organic matter and terrestrial invertebrates to downstream communities. Multiple hydroperiods, a high degree of habitat interspersion, special habitat features, and relatively undisturbed buffers contribute to the habitat value of Wetland 10A.

4.1.7 Wetland Buffers

As described previously, the WCC Section 16.16.630(D) designates buffers from the edges of all wetlands to protect the integrity, functions, and values of the wetland. The results of the wetland investigation (AMEC 2008), wetland functions and values (overall wetland classification and habitat score), and wetland maps were used to determine the width, and to map the extent of the required wetland buffer. The presumed widths of wetland buffers based on functions and values provided in Table 4, below, assume a low-intensity land use as is characteristic of the subject project description (geotechnical investigations).

Wetland buffer areas are consistent with other upland areas of the site. Similar to wetlands, the upland plant communities in the study area are a result of historical land use, soil characteristics, and geomorphic and hydrologic conditions. Vegetation of buffer areas within pastures that are occasionally seeded and hayed annually consists of grasses including red fescue, bentgrass, sweet vernalgrass, velvetgrass, and plantain. In less extensively managed pastures, dominant grass species include red fescue, foxtail, Canadian thistle, bentgrass, quackgrass, and orchardgrass.

Vegetated buffers provide protection to wetland functions by providing an area to attenuate the effects of disturbance from human activities and development. Buffers adjacent to the forested wetlands are contiguous with the wetlands and upland forest for most of the area. Vegetation in forested buffer areas is predominantly red alder along with black cottonwood (deciduous forest) and with relatively rare occurrences of western red cedar and Douglas fir trees. Understory species include vine maple, common snowberry, salmonberry, English holly, clustered rose, bracken fern, and red elderberry. Appendix B of the *Wetland Determination and Delineation Report* (AMEC 2008) provides a summary of all plant species (common and scientific names) identified in the study area.

The following Mitigation Plan includes the restoration of wetlands and wetland buffers impacted by vegetation clearing associated with the geotechnical investigation. A re-vegetation plan for forested upland areas impacted by the vegetation clearing is also included herein, in response to violation of Section 20.80.734(4) of the WCC regarding site clearing. The following plan includes an assessment of impacts and a restoration strategy for Critical Areas (wetlands and buffers), as well as an implementation plan, goals, objectives, performance standards, a monitoring and maintenance plan, and a contingency plan.

Table 4 Wetland Unit Numbers, Ratings, Habitat Scores, and Buffer Widths

Wetland Name	Wetland Rating	Habitat Score	Applied Buffer Width
1	III	19	50
2	III	23	60
3	III	21	60
4A	III	18	50
4B	III	14	50
4C	III	14	50
4D	III	14	50
4E	III	10	50
4F	IV	7	50
5A	III	21	60
5B	III	17	50
5C	III	21	50
6	III	19	50
7A	III	21	50
7B	III	18	50
8A	III	23	60
8B	III	11	50
9A	III	24	60
9B	III	18	50
10A	III	18	60
10B	IV	16	50
11A	I	32	150
11B	III	10	50
12	I	*	150
13A	I	27	150
13C	III	16	50
13D	III	18	50
13E	III	26	60
13F	III	15	50
13G	III	18	50
14	IV	14	50

* Category 1 wetland rating due to special characteristics. An automatic 150-foot buffer is applied.

4.1.8 Streams and Stream Buffers

As mentioned previously, the *Project Information Document* for the Gateway Pacific Terminal provides detailed information about streams on the Gateway Pacific Terminal Site (AMEC 2011). The purpose of this section is to provide information for establishment of stream buffers only. Per WCC Section

16.16.740(B), stream buffers were measured landward horizontally on both sides of the streams from the ordinary high water mark.

The WCC provides the following guidelines for establishing stream buffers:

- Shoreline Streams: 150-feet
- Fish-bearing streams: 100-feet
- Non-fish bearing streams: 50-feet

Based on these guidelines, the buffer for Stream 1 is established at 100-feet because it is a non-shoreline, fish-bearing stream. All other streams on site are non fish-bearing streams, and will have a buffer of 50-feet (Figure 3). Where buffers are interrupted by roads, such as the case with Streams 1, 3, 4, 5, and 6, the buffer does not extend beyond the road.

4.1.8.1 Impact Assessment

4.1.9 Approach

An impact assessment was performed to evaluate effects to wetlands and buffers that resulted from the temporary access roads. Pre-disturbance conditions were assessed by examining previous wetland delineation reports and inspecting on-site and adjacent off-site undisturbed areas.

AMEC staff conducted field investigations on August 2, 3, and 9, 2011, to directly measure the impacts to forest and shrub wetlands and their buffers on the property. The general conditions of all cleared paths were visually assessed, and wetland boundaries determined by the location of wetland flagging from the 2008 wetland delineation, and wetlands delineated in the previous exclusion area on July 27, 28, and 29, 2011. Wetland impact measurements included the width of the access path impacted by heavy equipment as indicated by the tracking footprint, and the rootwads and soil mounds that parallel the paths.

Twenty-four separate wetland impact areas were established due to differences in tree age stand, soil conditions, proximity to other areas of wetland impacts, and vegetation density across the Gateway Pacific Terminal property. These physical variations resulted in differences in soil displacement and rootwad size along the access paths. The 24 assessment areas have been lumped together by Wetland Unit in order to describe impacts to Wetland Units as described in previous reports submitted to Whatcom County PDS. Multiple widths were measured in the field with a tape measure in each wetland impact area to determine the average width of impacts for each wetland/buffer impact area.

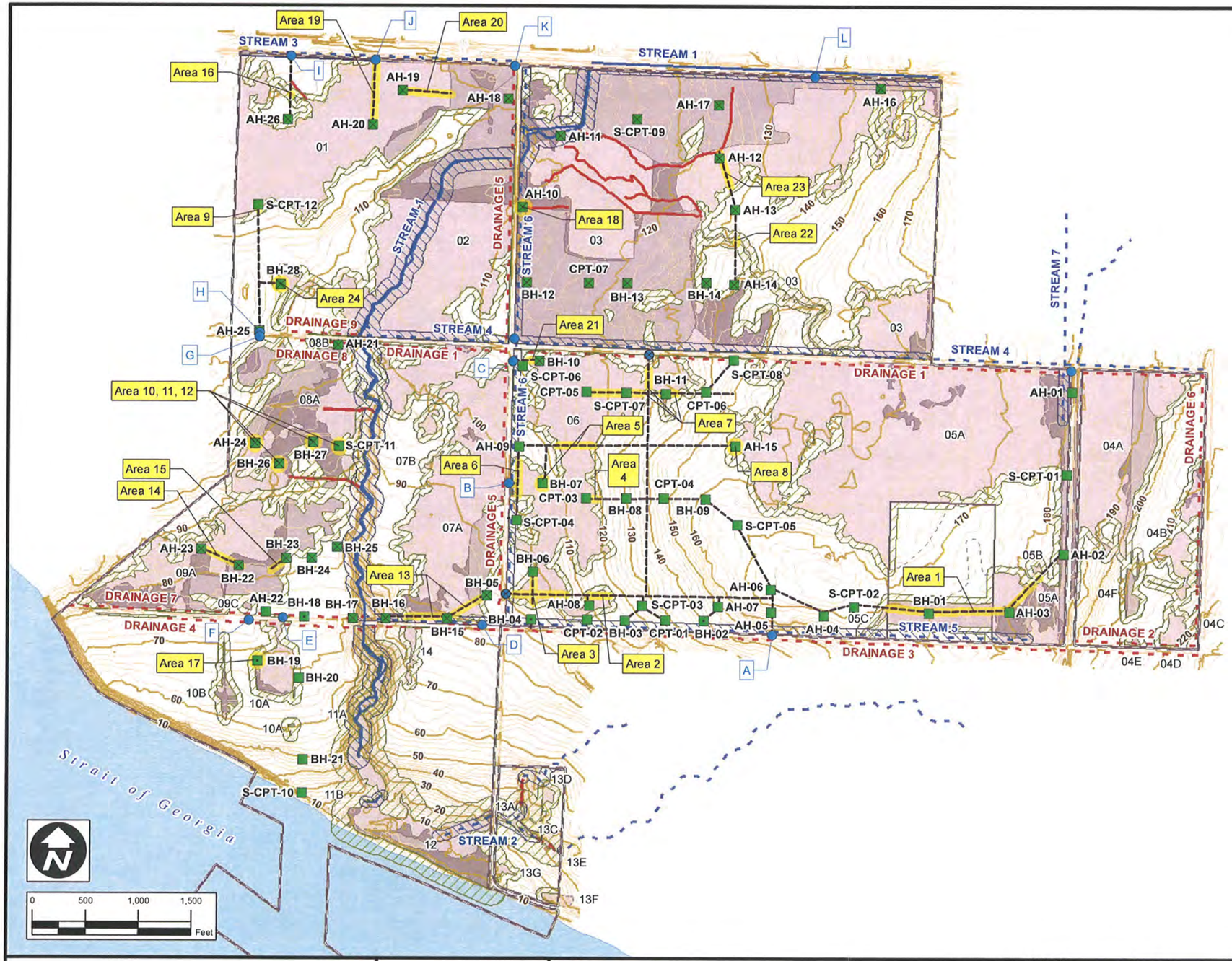
To calculate the area of wetland impact, the linear feet of access paths through forested and shrub wetlands was determined through surveyed borehole locations and surveyed access routes. Wetland boundaries from the 2009 Jurisdictional Determination (Appendix B) and approximate, unsurveyed boundaries from the 2011 delineation of the previous exclusion area (Parcel 14) were then juxtaposed with the surveyed borehole locations and related access routes to determine linear feet of impacts to wetlands. In three instances, impact areas were rectangular polygons that minimally clipped wetland areas, and were thus measured directly in the field (Impact Areas 8, 10, and 12). In three other instances, divots and uprooted trees were not contiguous impacts, and thus each feature was measured (Impact Areas 11, 17, and 18). Impacts to Critical Areas are shown in Figure 4.

4.1.10 Wetlands

The average width of the access paths that resulted from tracking heavy equipment through forested and shrub wetland areas was 17 feet. This number was consistent across all wetland impact areas because the same piece of equipment was used to clear the access paths in each of the wetland impact areas. The clearing associated with access paths and boring holes resulted in a total of 7,097 linear feet and 120,649 square feet of wetland impacts.

Each wetland impact area had variable widths outside of the access paths. This variability resulted from the various sizes of displaced soil mounds and rootwads along each access path. Table 1 shows the average width of the access path plus rootwads and soils mounds for each impact area. This table also shows the linear feet of each impact area, and the total square feet of impacts. As such, the total impact to forest and shrub wetlands is 170,756 square feet.

The total temporary discharge (soil mounds and rootwads) to wetlands as a result of these activities was determined by subtracting the impacts solely from tracking (120,649 square feet) from the total impacts (170,756 square feet), which is calculated to be 50,107 square feet.



LEGEND

- BOREHOLE COMPLETED (37)
- BOREHOLE NOT COMPLETED (32)
- BOREHOLE IN PROGRESS (4)
- VEHICLE ACCESS POINT
- NO VEHICLE ACCESS
- AS-BUILT BOREHOLE ACCESS*
- APPROXIMATE DRAINAGE
- SURVEYED DRAINAGE
- APPROXIMATE STREAM COURSE
- SURVEYED STREAM COURSE
- STREAM BUFFER
- CURRENT ELEVATION CONTOUR (10 ft. interval, NAVD88 datum)
- CURRENT ELEVATION CONTOUR (2 ft. interval, NAVD88 datum)
- APPROXIMATE WETLAND BOUNDARY
- FRESHWATER EMERGENT WETLAND (PEM)
- FRESHWATER FORESTED WETLAND (PFO)
- FRESHWATER SHRUB WETLAND (PSS)
- WETLAND IMPACT AREA (see text)
- WETLAND BUFFER **
- PROPERTY BOUNDARY
- PROJECT AREA BOUNDARY

*THIS LINE DEPICTS LOCATIONS WHERE TREES AND SHRUBS WERE REMOVED TO ALLOW ACCESS FOR GEOTECHNICAL INVESTIGATION. NO ACCESS ROUTE IS SHOWN WHERE ACCESS WAS ACROSS OPEN FIELDS.

**THE STANDARD WETLAND BUFFERS SHOWN ARE BASED ON WETLAND FUNCTIONS AND VALUES AND LOW-INTENSITY LAND USE ASSOCIATED WITH GEOTECHNICAL ACTIVITIES (per WCC 16.16.630).

Pacific International Terminals. A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC Earth & Environmental
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	KD
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,000 feet

PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION

TITLE: CRITICAL AREAS IMPACT ASSESSMENT

DATE:	AUGUST 2011
PROJECT NO.:	091515338C-07-03
REV. NO.:	4
FIGURE NO.:	FIGURE 4

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-07-03 - Geotechnical Investigation\Critical_Areas_Report\Figure 4 - Critical Areas Impact Assessment.mxd

Table 5 below shows the total amount of impacts to forest and shrub wetlands by Wetland Impact Area as a result of geotechnical investigations.

Table 5 Details of Forested Wetland and Shrub Clearing and Debris Piles

Wetland Impact Area	Wetland Unit	Length (LF)	Acres	Average Width	Area (SF)	Acres
Wetland Impact Area 1	5B/5C	1,488	0.3	25	37,200	0.9
Wetland Impact Area 2	6	251	0.0	24	6,024	0.1
Wetland Impact Area 3	6	809	0.2	25	20,225	0.5
Wetland Impact Area 4	6	82	0.0	25	2,050	0.0
Wetland Impact Area 5	6	339	0.1	23	7,797	0.2
Wetland Impact Area 6	6	367	0.1	18	6,606	0.2
Wetland Impact Area 7	6	812	0.2	22	17,864	0.4
Wetland Impact Area 8	6	48	0.0	42	2,016	0.0
Wetland Impact Area 9	1	33	0.0	35	1,155	0.0
Wetland Impact Area 10	8A	45	0.0	30	1,350	0.0
Wetland Impact Area 11	8A	*	*	*	150	0.0
Wetland Impact Area 12	8A	51	0.0	27	1,377	0.0
Wetland Impact Area 13	7A	659	0.1	19	12,521	0.3
Wetland Impact Area 14	9A	409	0.1	24	9,816	0.2
Wetland Impact Area 15	9A	161	0.0	21	3,381	0.1
Wetland Impact Area 16	1	12	0.0	23	276	0.0
Wetland Impact Area 17	10A	*	*	*	270	0.0
Wetland Impact Area 18	3	*	*	*	110	0.0
Wetland Impact Area 19	1	605	0.1	29	17,545	0.4
Wetland Impact Area 20	1	459	0.1	23	10,557	0.2
Wetland Impact Area 21	6	78	0.0	28	2,184	0.1
Wetland Impact Area 22	3	32	0.0	29	928	0.0
Wetland Impact Area 23	3	333	0.1	26	8,658	0.2
Wetland Impact Area 24	2	24	0.0	29	696	0.0
Total Wetland Impact Area		**7,097**	**1.3**		**170,756**	**3.9**

* divots and uprooted trees were not contiguous impacts, and thus each feature was measured independently

Table 6 below shows the consolidated area of impacts to forested and shrub wetlands by Wetland Unit as a result of geotechnical investigations.

Table 6 Details of Wetland Impacts by Wetland Unit

Wetland Unit Number	Area (SF)	Acres
1	29,533	0.7
2	696	0.1
3	9,696	0.2
5B/5C	37,200	0.8
6	64,766	1.5
7A	12,521	0.3
8A	2,877	0.1
9A	13,197	0.3
10A	270	<0.1
Total Wetland Impact Area	**170,756**	**3.9**

The impacts from the clearing activities resulted in temporary loss of wetland functions due to compacted soil, fallen vegetation, and discarded soil and rootwads in areas adjacent to the access paths. Loss of wetland functions include reduced wildlife habitat from the fallen vegetation, reduced groundwater infiltration and biochemical processing from compacted soils, loss of flood storage due to compacted soils, and reduced water quality functioning as a result of reduced infiltration from compacted soils. The reduction in function was to a small proportion of the total wetland area and the majority of wetland areas were undisturbed. Vegetation is expected to fully reoccupy the cleared areas as a result of hydroseeding, planting and natural regrowth from roots and shoots and reseeding. Once revegetated the wetland functions are anticipated to be fully restored to pre-disturbance levels.

4.1.11 Wetland Buffers

Table 7 shows the total amount of impacts to wetland buffers by Wetland Impact Assessment Unit as a result of geotechnical investigations. Approximately 2,474 linear feet of forested upland buffer were cleared of vegetation for the use of temporary access paths. The total impact to forested wetland buffers as a result of clearing activities was 42,029 square feet, or 0.96 acres. The clearing activities compacted the soil and side-casted fallen vegetation and soil along the temporary access paths.

The impacts to values and functions provided by forested wetland buffers include the temporary loss of wildlife habitat and water quality function. Wetland buffer slows the run-off of stormwater from uplands into wetlands, and filters sediments and contaminants. Impacts to wetland buffers that did not contain forested or shrub habitat are not included in the restoration plan because impacts to these grass-dominated habitats were minimal.

Table 7 below shows the total amount of impacts to wetland buffers by Wetland Unit as a result of geotechnical investigations.

Table 7 Details of Impacts to Wetland Buffers by Wetland Unit

Wetland Unit Number	Length (LF)	Miles	Average Width	Area (SF)	Acres
1	218	0.04	17	3706	0.09
2	71	0.01	17	1207	0.03
3	284	0.05	17	4828	0.11
5A/5B/5C	429	0.09	17	8398	0.19
6	1208	0.23	17	20536	0.47
7A	194	0.04	17	3298	0.08
8A	44	<0.01	17	748	0.02
9A	26	<0.01	17	442	0.01
Total Wetland Buffer Impact	**2,474**		**17**	**42,029**	**0.96**

4.1.12 Stream Buffers

Impacts to stream buffers occurred as a result of the clearing associated with the geotechnical investigation (Figure 4). Approximately 924 linear feet of impacts occurred to stream buffers only, whereas 201 linear feet of impacts occurred to combined stream buffer and wetland buffer areas. Because the cleared access paths averaged 17 feet wide, the estimated impact solely to stream buffers was 15,708 square feet.

3.92
.96
8

5.0 RESTORATION STRATEGY

5.1.1.1 Wetlands and Wetland/Stream Buffers

Compensation for unauthorized impacts to wetlands and wetland/stream buffers will be provided onsite. Opportunities for restoration were determined through on-site investigation and the limit of disturbance to regulated Critical Areas. Reforestation to upland areas that are not wetland or stream buffer will be addressed in a separate plan to be submitted to DNR.

5.1.1.2 Proposed Wetland Restoration

The following section describes the goals, objectives, and design of the restoration activities. Restoration design plans are included in Appendix A.

5.1.2 Restoration Design

The general approach for the restoration design is to remove soil mounds and side-casted rootwads from existing wetland and wetland/stream buffers, and to restore the wetlands and wetland/stream

buffers to their pre-existing conditions. Restoring hydrological connections within wetland units will help facilitate recovery. The soil mounds will be dispersed within the access paths to restore pre-existing grades, and the rootwads will be placed in divots that were created when the rootwads were removed. Vegetation debris piles will be removed, chipped, or dispersed so as to allow those areas to restore naturally. Additional restoration activities include remediating compacted soils, stabilizing soils to reduce erosion, replanting temporarily impacted areas to restore wildlife and water quality functions, and managing invasive plant species. Restoring pre-existing hydrologic and drainage patterns in the wetlands will be closely monitored during restoration activities.

An abundant native seed stock is available from the existing seed bank in the soil, and from the existing forest stands that abut the impact areas. A relatively lower seedling stocking rate is proposed within the 2.8 acres of cleared wetlands because the existing native seed stock is expected to succeed rapidly along with the plantings. Even though they are currently rare on site, conifers are proposed in the wetland and wetland/stream buffer areas to mimic the historical plant community. Impacted areas outside of the 17-foot wide cleared access path will be allowed to restore naturally following the removal of soil mounds and side-casted rootwads. Any disturbed soils in these areas will be hand-seeded as necessary for soil erosion control.

5.1.2.1 Wetlands

Temporarily impacted wetland areas will be restored to pre-existing conditions. Soil mounds and stockpiles will be moved back to within the access paths to restore pre-existing wetland elevations. After separating the tree rootwads from the tree trunks with a chainsaw, the rootwads will be returned to divots that formed when they were removed and side-casted along the temporary access paths.

The compacted soil portion of the temporary access paths in all wetlands will be de-compacted by scarifying the soil surface with manual raking where needed. The temporary access paths will then be replanted with a variety of native trees. All planted tree seedlings will be protected from wildlife browsing through a combination of seedling protector tubes, tubex tree shelters, and/or deer fencing. See Appendix A for cross sections and proposed conditions following restoration activities.

Planting Scheme

To restore wetlands to their pre-disturbance condition, the proposed restoration includes planting locally dominant plant species with the goal of accelerating forest succession. This approach will facilitate the rapid development of pre-disturbance, forested plant communities. Tree seedlings to be planted include: red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera*), Sitka spruce (*Picea sitchensis*), Western red cedar (*Thuja plicata*), and Western hemlock (*Tsuga heterophylla*). A total of 542 tree seedlings are proposed to be planted 15 feet-on-center across 2.8 acres, or 193 stems per acre.

do not appear to be native

The seed mix will contain a mix of native emergent species suitable for wetland conditions, including: sterile wheatgrass (*Poa spp.),* meadow foxtail (*Alopecurus pratensis*), alsike clover (*Trifolium hybridum),* and creeping bentgrass (*Agrostis stolonifera*). The site will be hydroseeded immediately (prior to implementation of the planting plan) for erosion control purposes. It is anticipated that the hydroseeded areas will be impacted when implementing the proposed mitigation design. However, no additional hydroseeded is planned following installation of plantings due to anticipated, rapid succession. If bare areas are noted during post construction monitoring, those areas will be seeded by hand with the seed mix described previously.

No shrubs are included in the proposed planting scheme due to anticipated aggressive re-colonization by shrubs. Conversations with the Washington DNR suggest that shrub control may be necessary to improve survival of forest species (Personal communication between Kristie Dunkin (AMEC), and Boyd Norton (DNR), August 12, 2011). The site will be closely monitored after planting, and if shrub control appears necessary, methods will be employed as described in monitoring and maintenance sections of this document. Sheet 2 in Appendix A provides the planting plan for proposed on-site restoration in wetland areas.

5.1.2.2 Wetland and Stream Buffers

Temporarily impacted wetland and stream buffers will be restored to pre-existing conditions. Impacts to wetland and stream buffers include the access paths that crossed wetland buffers to access wetland areas. Buffer areas cleared of vegetation will be revegetated with new trees after pre-existing grades are restored. To restore pre-existing grades, soil mounds or other areas of displaced soil will be returned to the cleared access path to replace any divots caused by tree removal. Any remaining side-casted soil will be dispersed in the immediate vicinity. Discarded vegetation in the wetland and stream buffers on the sides of the access paths is anticipated to remain in place. Compacted soil in the access paths within the buffers will be decompacted by scarifying the soil surface with manual raking, a backhoe, or other piece of agricultural equipment. The access paths within wetland and stream buffers will then be hydroseeded after planting trees and shrubs

Planting Scheme

To restore wetland and stream buffers to their pre-disturbance condition, the proposed restoration includes planting locally dominant plant species with the goal of accelerating forest succession. This approach will facilitate the rapid development of pre-disturbance plant communities that would take years to develop on their own. Tree seedlings will be planted, including: big-leaf maple (*Acer macrophyllum),* black cottonwood (*Populus balsamifera*), Douglas fir (*Psuedotsuga mensizaii),* Western red cedar (*Thuja plicata*), and Western hemlock (*Tsuga heterophylla*). A total of 271 tree seedlings are proposed to be planted 15 feet-on-center, or 193 stems per acre, in the stream and wetland buffer areas.

Disturbed soils in wetland and stream buffer areas will be stabilized with a buffer seed mix. The seed mix will contain a mixture of blue wildrye (*Elymus glaucus*), red fescue (*Festuca rubra*), and Western fescue (*Festuca occidentalis*).

Sheet 3 in Appendix A provides the planting plan for proposed on-site restoration in wetland and stream buffer areas.

6.0 IMPLEMENTATION

6.1.1.1 Construction Observation

A qualified biologist, usually a restoration specialist, should be present during various stages in the implementation of the restoration plan. The onsite biologist will help in the field to identify wetland boundaries, compacted soil areas, rootwads to be replaced, soil mounds to be removed, and debris piles to be dispersed. The onsite biologist will also be present during planting to ensure that tree seedlings receive the required protection from animal browse, and specific plant species are located in the appropriate habitats. Existing drainage patterns in wetlands will be maintained and restored where necessary.

Tree seedlings will be kept cool and moist during transport and storage prior to planting. During transport, storage, and planting, all seedlings will be protected with a moist material around the roots consisting of wet burlap, peat moss, a planting bag, or similar material.

The phases appropriate for field visits are: (1) soil mound re-grading, debris pile dispersal, and rootwad replacement; (2) approval of all plants and of their locations by the onsite biologist before planting; (3) installation of trees seedlings, protection, seeding by hand, if needed; and (4) final inspection, including observations of active recruitment of pioneer species, soil stabilization, and wetland hydrology.

6.1.1.2 Restoration Sequence

Restoration activities will commence immediately following the conclusion of the geotechnical investigation. Wetlands and wetland buffer areas will be accessed from upland locations so as to limit any further disturbance to wetland or buffers. Restoration activities will start at the furthest locations from access points off of county roads.

Sequencing will be as follows:

- Removal of rootwads and soil mounds from wetland areas to cleared access paths;
- Re-grading using rakes or suitable machinery to restore pre-existing grades, as needed;

- Restoration of compacted soils using rakes or a backhoe, as needed;
- Soil stabilization with upland and wetland seed mixes as appropriate; and,
- Planting of tree seedlings according to plan details.

6.1.1.3 Proposed Time Schedule and Expected Completion Dates

Restoration activities will commence immediately following the completion of the geotechnical activities. Geotechnical activities are anticipated to be completed 6 weeks following receipt of all authorizations from the USACE and Whatcom County PDS to complete the field work in regulated areas. The planting of trees is therefore anticipated to occur immediately following the completion of fieldwork, which assuming it is late fall, is a suitable time for successful establishment of plant species.

7.0 GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

7.1.1.1 Restoration Goals

The overall goal of the restoration plan is to restore the functions of on-site wetlands and wetland buffers to their pre-disturbance condition. 3.9 acres of wetlands will be restored by revegetating 2.8 acres of cleared wetlands, and removing rootwads and soil mounds from 1.1 acres of wetlands that were side-casted during the geotechnical investigation activities.

The specific goals of the proposed restoration are to:

- Restore pre-disturbance wetland hydrologic conditions to all wetland areas by removing fill;
- Re-establish wetland vegetation communities within all wetlands; and
- Re-establish wetland buffer vegetation in disturbed areas.

7.1.2 Restoration Objectives

Restoration goals would be attained through achieving the following objectives:

1. Remove rootwads and soil mounds from wetlands;
2. Hand replace soil materials and root mats where fallen vegetation contributed to fill along the access roads; and
3. Restore approximately 2.8 acres of cleared wetlands by scarifying compacted soil and planting native vegetation.

7.1.3 Performance Standards

7.1.3.1 Native Tree Vegetation

The wetland and wetland buffer areas will be planted and maintained to ensure an 80-percent survivorship of replanted trees following installation. According to WAC 222-34-010 regarding reforestation, cleared areas must contain an average of 190 seedlings per acre that have survived on site for at least one growing season, with no portion of the restoration area containing less than 150 seedlings per acre. 80-percent survivorship per acre must be maintained throughout the 5-year monitoring period, unless the monitoring period is reduced to three years by the technical administrator per WCC Section 16.16.260. If 80-percent survivorship is not met in any year during the monitoring period, the mitigation area will be replanted as necessary to achieve this standard.

7.1.3.2 Control of Non-native Species

Cover by invasive species is expected to be maintained below a threshold throughout the five-year mitigation monitoring period. Invasive species likely to be present on the mitigation site include, but are not limited to, reed canarygrass, Himalayan blackberry, and Japanese knotweed. Invasive plant species are anticipated to cover less than 15 percent of restoration area in any given monitoring year, and exceeding this 15 percent cover would result in maintenance activities of the restoration areas. Invasive species aggressively grow in disturbed areas and would prohibit the regeneration of preferred forest tree species.

Providing control of invasive non-native species eliminates these unwanted species from competing with preferred native species. Control measures that could be implemented include removal of unwanted species by hand, or other means of control as necessary.

7.1.3.3 Monitoring plan

A monitoring program will be implemented to assess the performance of restoration following construction. Monitoring results will be compared to the performance standards to judge the success of the restoration effort. An annual report describing the level of success will be written and submitted to Whatcom County PDS for review and approval within 60 days of completion of each year's monitoring.

Monitoring would begin by providing as-built plans immediately following completion of the installation and completing an initial baseline compliance report within 30 days following construction. Subsequent monitoring would occur at 6, 12, and 24 months following installation. Parties responsible for monitoring and report submittal would be Pacific International Terminals and the consultant of their choice. Monitoring would be conducted and reported by a qualified wetland biologist.

A 5-year monitoring plan will be implemented that will focus on 80-percent survival of planted tree seedlings and shrub management.

7.1.4 As-built Plans

As-built plans that detail typical final site topography, changes made to the planting plan, or other alterations made to the restoration plan will be made following construction. These as-built plans will be included in the report for each year of monitoring, and will be submitted to Whatcom County PDS for review.

7.1.4.1 Vegetation Monitoring Procedure

Standardized procedures will be used to measure the survival and growth of plant material and the success of the mitigation plantings. The vegetation monitoring strategy will consider plant species composition and survivorship.

The location of sampling plots will be established by the monitoring biologist during the first monitoring period (6 months after installation). The center of the plot will be marked with rebar and a tall polyvinyl chloride (PVC) pipe. This will identify the location of sample plots during subsequent monitoring periods. Photopoints would be established in conjunction with the sample plots and will be used to obtain representative photographs of the project at each monitoring event. Sampling plots will be 30 linear feet of restored cleared access path, with the rebar and PVC pipe established in the middle of each plot. Approximately 12 sampling plots will be established across the wetland and wetland buffer restoration areas or approximately 4 per acre.

Vegetation data for seedling survivorship will be collected from each plot. Native tree species within each plot will be listed and counted. Non-native species will be listed and absolute coverage by these species estimated for each plot.

7.1.5 Monitoring Schedule

A proposed monitoring schedule is presented in Table 8.

Table 8 Proposed Monitoring Schedule for the First 5 Years Following Installation

Year	Anticipated Date	Action
Installation	Fall 2011	Prepare site and install
Year 1	March 2012	Monitor site hydrology and plant growth
	September 2012	Monitor plant growth
	December 2012	Year 1 report
Year 2	September 2013	Monitor plant growth
	December 2013	Year 2 report
Year 3	September 2014	Monitor plant growth
	December 2014	Year 3 report
Year 4	September 2015	Monitor plant growth
	December 2016	Year 4 report
Year 5	September 2016	Monitor plant growth
	December 2016	Year 5 report

8.0 SITE PROTECTION

To protect the site throughout the restoration process, all temporary access paths will be closed to public access. During mitigation construction, the access paths will be barricaded with a locked chain extending between two concrete jersey barriers. Post construction, the access paths will be barricaded with a dirt berm at all access points.

8.1.1.1 maintenance plan

For any restoration site to succeed, control of invasive species year round is recommended until the desired vegetation on the site is completely established. Establishment is usually indicated by documented plant survival from one year to the next over the monitoring period and a low prevalence of invasive species.

8.1.1.2 Schedule for Maintenance

Site maintenance will be conducted monthly between March 15 and October 15 during the growing season during the first 2 years following installation. Site maintenance will be conducted semi-annually for years 3 through 5 pending seedling survivorship and on the ground conditions. Maintenance activities will include the identification and removal of shrub species and non-native species, and other tasks as needed.

8.1.1.3 Maintenance Activities - Non-native Plant Control

One common reason why restoration installations fail is they become overrun by invasive non-native plants during the early years. Aggressively growing plants shade and out-compete the planted natives. To help facilitate the success of the mitigation, maintenance is anticipated to include removing invasive species to decrease competition with non-planted species. The method of removal could include the use of a herbicide by a qualified applicator, or other means of removal as necessary to ensure the success of the planted seedlings.

8.1.1.4 Shrub Control

To encourage survival and growth of trees, it may be necessary to implement shrub control measures. It is anticipated that native shrubs may emerge aggressively from existing roots and seed bank, and potentially shade and out-compete the planted trees. Similar to non-native plant control, if native shrubs appear to be out competing planted trees, shrubs would be removed to decrease competition with planted trees.

9.0 CONTINGENCY PLAN

Depending on monitoring results, it may be necessary to implement contingency measures to ensure that the original goals of the restoration project are met. Several factors, both artificial and natural, could have detrimental effects on the success of the restoration plantings.

Table 9 lists the components of the mitigation plan, related factors that may have an adverse effect on the restoration areas, and contingencies for success of the project. No contingency plan can foresee all problems or their solutions. In all cases, if a more effective remedy is identified, it would be considered.

Table 9 Contingency Plan

Mitigation Component	Potential Factors	Contingency
Hydrologic Conditions	Insufficient	Drought, lack of runoff from adjacent uplands and wetlands, and incorrect soil elevations could result in insufficient hydrologic support. Contingency measures could include excavations to a deeper level, if necessary, or surface and subsurface runoff could be redirected to the area.
Hydrologic Conditions	Excessive	After identification of the cause, soil elevations could be modified or excess water could be directed away from the area.
Hydrologic Conditions	Pollution	The type and source of the pollutants would be determined and proper corrective measures established. These measures would include cleanup, biofiltration, or placement of erosion-control measures.
Soils	Erosion	Causes of erosion would be identified, and remedies could include use of erosion-control fabric and seeding of plant species with dense, strong root systems conducive to erosion control. Other appropriate BMPs would be considered.
Vegetation	Competition from Shrubs	Shrub species are anticipated to compete with the planted tree seedlings. Shrubs would be identified and removed from restoration areas to ensure the success of the planted tree seedlings.
Vegetation	Competition from Invasive Species	Invasive species would be identified and eradicated or controlled during the monitoring period. If herbicides were determined to be necessary, a detailed application plan would be developed in coordination with Whatcom County, Ecology, and other resource agencies.
Disturbances	Wildlife	Excessive predation or grazing could have an adverse effect on the success of plant species. Depending on the disturbance, fencing could be installed or wire mesh cylinders could be placed around individual plants.
Disturbances	Human	Human intrusion could be controlled with fencing the mitigation sites and or signage.

10.0 REFERENCES

AMEC Earth & Environmental, Inc. (AMEC) (2011) Project Information Document, Gateway Pacific Terminal, Whatcom County, Washington. Prepared for Pacific International Terminals, Inc.

AMEC Earth & Environmental, Inc. (AMEC) (2008) Wetland Determination and Delineation, Gateway Pacific Terminal, Whatcom County, Washington. Prepared for Pacific International Terminals, Inc.

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Markham, M.V. (1993) A Historic Euroamerican Fish Trap Camp at Cherry Point (45WH1). MS on file. Department of Anthropology, Western Washington University, Bellingham.

US Army Corps of Engineers (USACE) (2009) Letter from Matthew Bennett (USACE) to Skip Sahlin (Pacific International Terminals) confirming wetland boundaries and assuming jurisdiction of delineated wetlands. USACE Reference NWS-2008-260-NO. March 5, 2009.

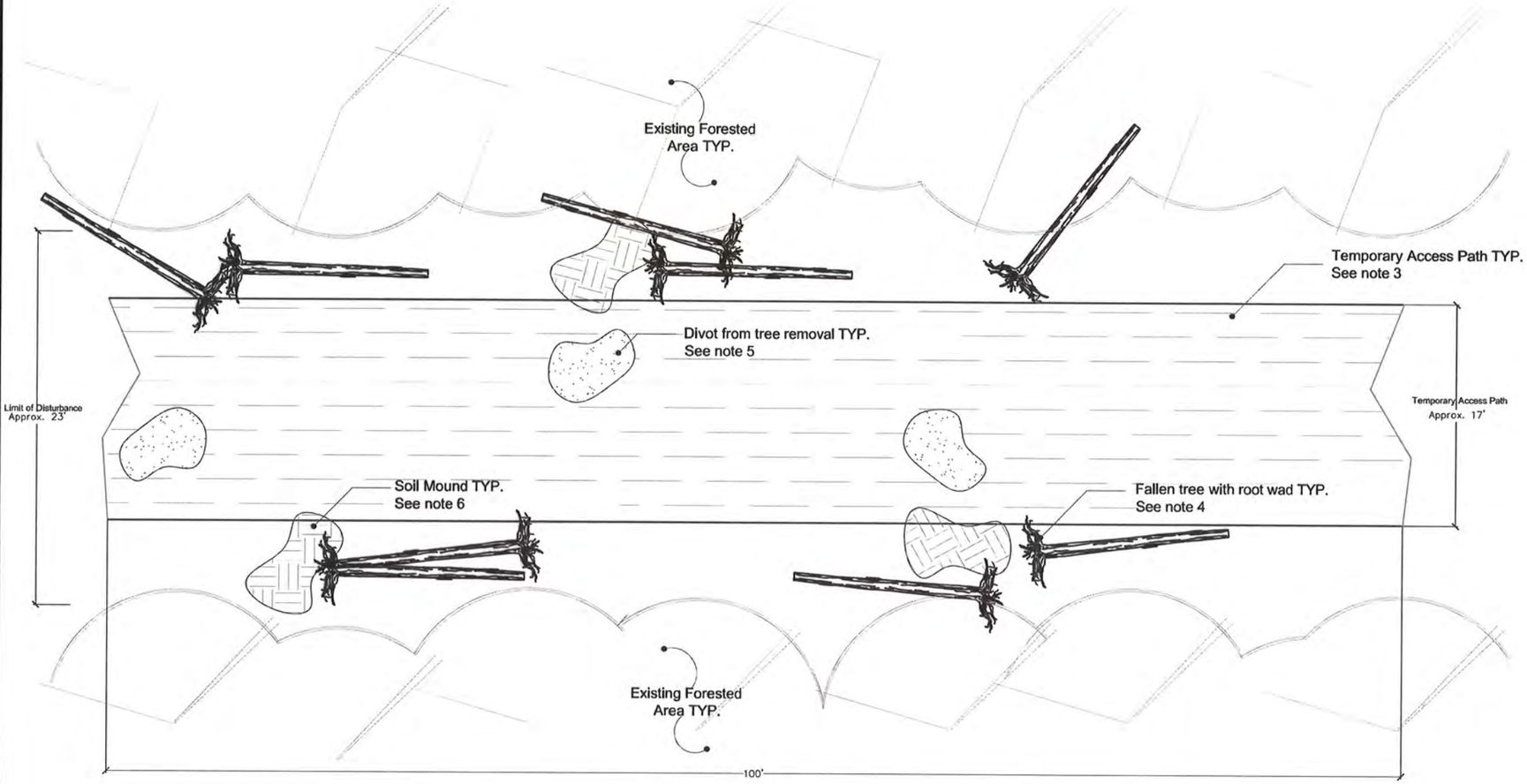
Washington Department of Ecology (1997). Washington State wetlands identification and delineation manual. Publication No. 96-94. Olympia, Washington: Washington Department of Ecology.

Washington Department of Fish and Wildlife (2009). Priority Habitat and Species – Whatcom County. Olympia. May 2009.

Whatcom County (2006) Critical Areas Ordinance Maps. Whatcom County Planning & Development Natural Resource Management. February 2006.

APPENDIX A

Restoration Plan



Legend

- Temporary Access Path TYP.
- Divot TYP.
- Soil Mound TYP.

NOTES:

1. TYP. = Typical
2. Approx. = Approximate
3. Temporary Access Path to be graded, hydro-seeded and planted. Meet and match pre-disturbance grades.
4. Fallen trees to be replaced in temporary access path.
5. Divots to be backfilled with soil and root wads.
6. Soil mounds to be dispersed in temporary access path.
7. Drawing shows typical/representative area of wetland and wetland buffer impacts.

	CLIENT LOGO: Pacific International Terminals, A Carrix Enterprise	CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.	DWN BY: DP CHK'D BY: KD DATUM: NONE PROJECTION: NONE SCALE: AS SHOWN	PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION	DATE: AUGUST 2011 PROJECT NO: 0-915-15338-C
		AMEC Earth & Environmental 11810 North Creek Parkway North Bothell, WA, U.S.A. 98011-8201		TITLE: EXISTING CONDITIONS TYPICAL STRETCH OF TEMPORARY ACCESS PATH	REV. NO.: 1 FIGURE No. 1

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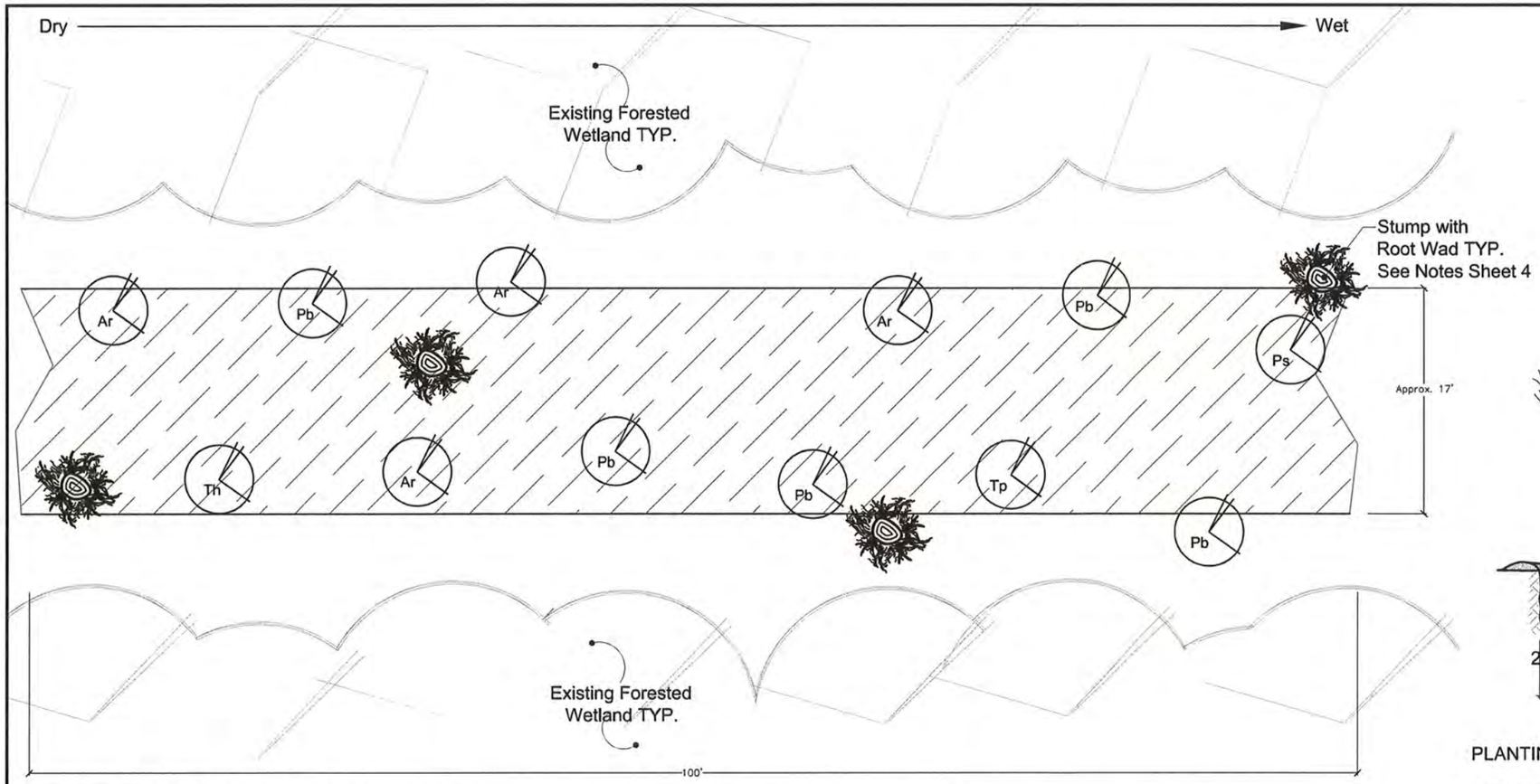
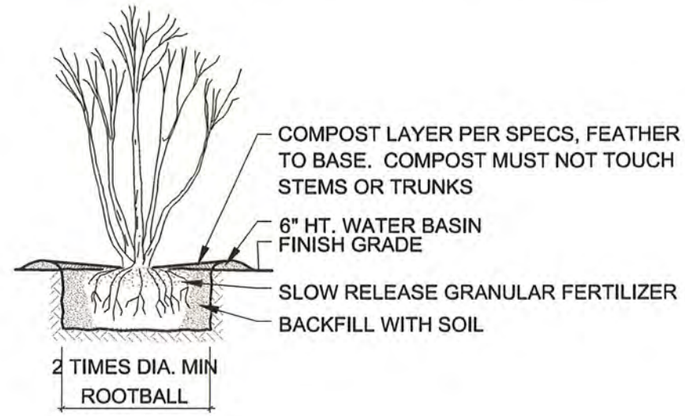


Qty. per 1,700 square feet

4	Ar - Alnus rubra	Red Alder
1	Ps - Picea sitchensis	Sitka Spruce
5	Pb - Populus balsamifera	Black Cottonwood
1	Tp - Thuja plicata	Western Red Cedar
1	Th - Tsuga heterophylla	Western Hemlock

NOTES:

1. TYP. = Typical
2. Approx. = Approximate
3. Drawing shows typical/representative area of wetland to be planted.



PLANT LIST FOR WETLAND IMPACT AREAS: 2.8 acres

Type	Scientific Name	Common Name	Size	Spacing	* W1 18,853 sf	W2 408 sf	W3 6,205 sf	5A/ 5B/5C 25,296 sf	W6 47,362 sf	W7A 11,203 sf	W8A 1,632 sf	W9A 9,690 sf	Total:
Tree	Alnus rubra	Red Alder	Seedling	18' o.c.	20		5	26	42	10	2	9	**114**
Tree	Picea sitchensis	Sitka Spruce	Seedling	18' o.c.	15		5	20	40	10	2	9	**101**
Tree	Populus balsamifera	Black Cottonwood	Seedling	18' o.c.	20	1	10	26	46	10	2	9	**124**
Tree	Thuja plicata	Western Red Cedar	Seedling	18' o.c.	15	1	5	23	42	10	2	9	**107**
Tree	Tsuga heterophylla	Western Hemlock	Seedling	18' o.c.	14		3	20	40	10		9	**96**
				Total:	**84**	**2**	**28**	**115**	**210**	**50**	**8**	**45**	**542**

*See Figure 1 of Critical Areas Assessment Report & Draft Mitigation Plan for wetland locations.

WETLAND SEED MIX: 2.8 acres

67%	Sterile Wheatgrass	
17%	Agrostis stolonifera	Creeping Bentgrass
10%	Alopecurus pratensis	Meadow Foxtail
6%	Trifolium hybridum	Alsike Clover

PLANTING NOTES FOR WETLANDS AND BUFFERS:

1. PLANTING PIT SIZES WILL BE A MINIMUM OF TWICE THE ROOT BALL WIDTH AND HAVE THEIR TOP TRUE ROOT NO MORE THAN 1 INCH ABOVE THE SOIL SURFACE.
2. PRIOR TO PLANTING, CONTAINERS SHALL BE COMPLETELY REMOVED AND THE ROOTS LOOSENED BY APPROPRIATE PRUNING.
3. PLANTING PITS WILL BE BACKFILLED WITH EXISTING SOILS THAT ARE FREE OF ROCKS OVER 2 INCHES, LUMPS, AND OTHER FOREIGN MATERIALS. BACKFILLING AROUND TRUNKS OR STEMS IS NOT PERMITTED.
4. THE BACKFILL MATERIAL AND ROOT BALL SHALL BE THOROUGHLY WATERED ON THE SAME DAY THAT PLANTING OCCURS REGARDLESS OF SEASON.

1/2 **SHRUB & TREE PLANTING DETAIL**
NTS

CLIENT LOGO: Pacific International Terminals, A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

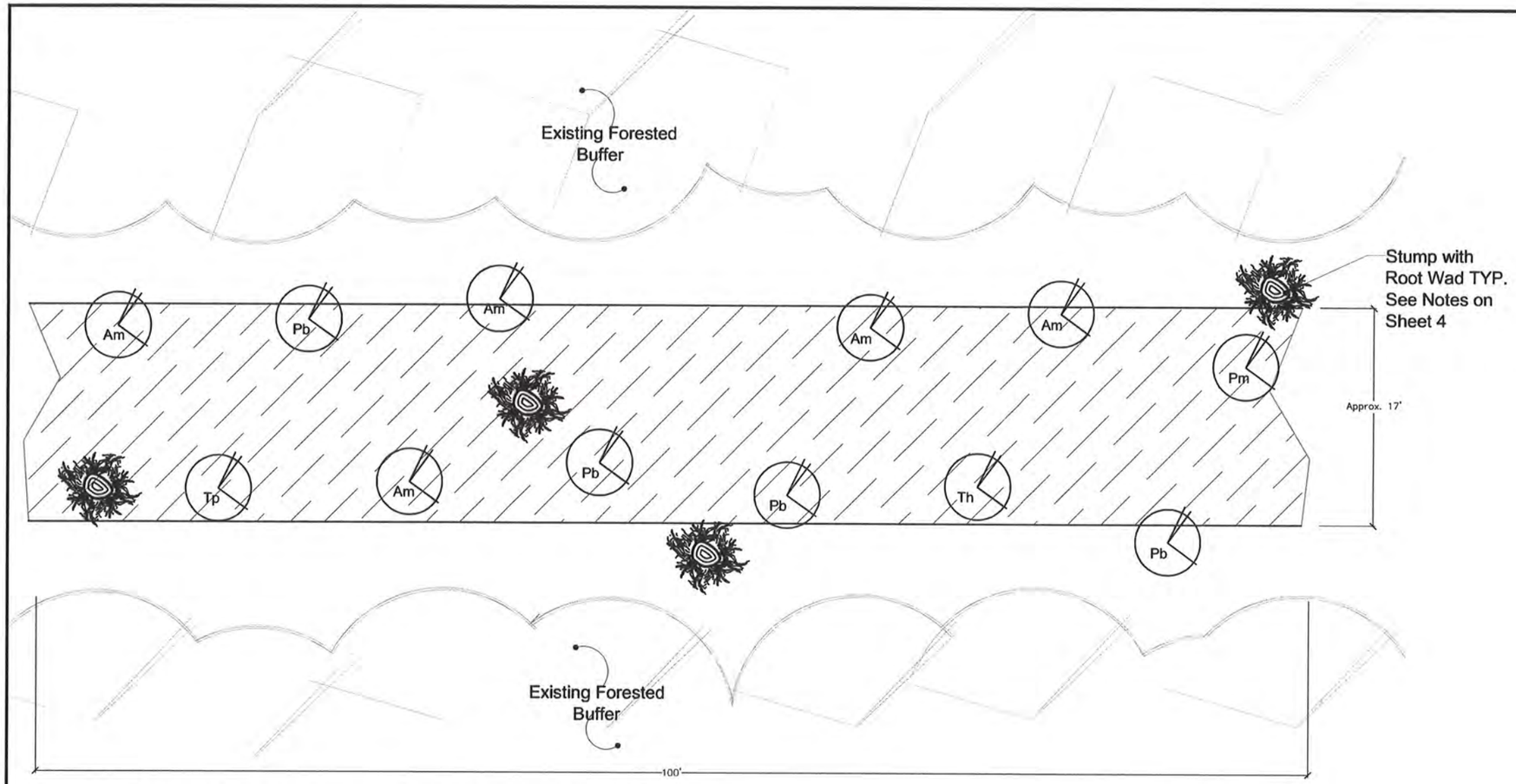
AMEC Earth & Environmental
11810 North Creek Parkway North
Bothell, WA, U.S.A. 98011-8201

DWN BY:	DP
CHK'D BY:	KD
DATUM:	NONE
PROJECTION:	NONE
SCALE:	AS SHOWN

PROJECT: GATEWAY PACIFIC TERMINAL
GEOTECHNICAL INVESTIGATION

TITLE: PROPOSED PLANTING PLAN
WETLAND AREA TYP.

DATE:	AUGUST 2011
PROJECT NO:	0-915-15338-C
REV. NO.:	1
FIGURE No.	2



Qty. per 1,700 square feet

5	Am - Acer macrophyllum	Big Leaf Maple
4	Pb - Populus balsamifera	Black Cottonwood
1	Pm - Psuedotsuga menziesii	Douglas Fir
1	Tp - Thuja plicata	Western Red Cedar
1	Th - Thuja heterophylla	Western Hemlock

NOTES:

1. TYP. = Typical
2. Approx. = Approximate
3. Drawing shows typical/representative area of wetland buffer to be planted.

PLANT LIST FOR WETLAND AND STREAM BUFFER IMPACT AREAS: 1.32 acres

Type	Scientific Name	Common Name	Size	Spacing	* W1 3,698 sf	W2 1,205 sf	W3 4,828 sf	5A/ 5B/5C 7,293 sf	W6 20,529 sf	W7A 3,295 sf	W8A 724 sf	W9A 434 sf	Stream Buffer 15,708 sf	Total:
Tree	Acer macrophyllum	Big Leaf Maple	Seedling	18' o.c.	6	2	5	10	25	5	1	1	20	**75**
Tree	Populus balsamifera	Black Cottonwood	Seedling	18' o.c.	6	1	5	10	20	3	1		20	**66**
Tree	Psuedotsuga menziesii	Douglas Fir	Seedling	18' o.c.	4	1	5	5	20	3	1	1	15	**55**
Tree	Thuja plicata	Western Red Cedar	Seedling	18' o.c.	2	1	5	5	15	2	1		15	**46**
Tree	Tsuga heterophylla	Western Hemlock	Seedling	18' o.c.	2		5	5	15	2				**29**
				Total:	**20**	**5**	**25**	**35**	**95**	**15**	**4**	**2**	**70**	**271**

*See Figure 1 of Critical Areas Assessment Report & Draft Mitigation Plan for wetland buffer locations.

WETLAND AND STREAM BUFFER SEED MIX: 1.32 acres

60%	Elymus glaucus	Blue Wildrye
10%	Festuca occidentalis	Western Fescue
30%	Festuca rubra	Native Red Fescue

CLIENT LOGO: Pacific International Terminals, A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

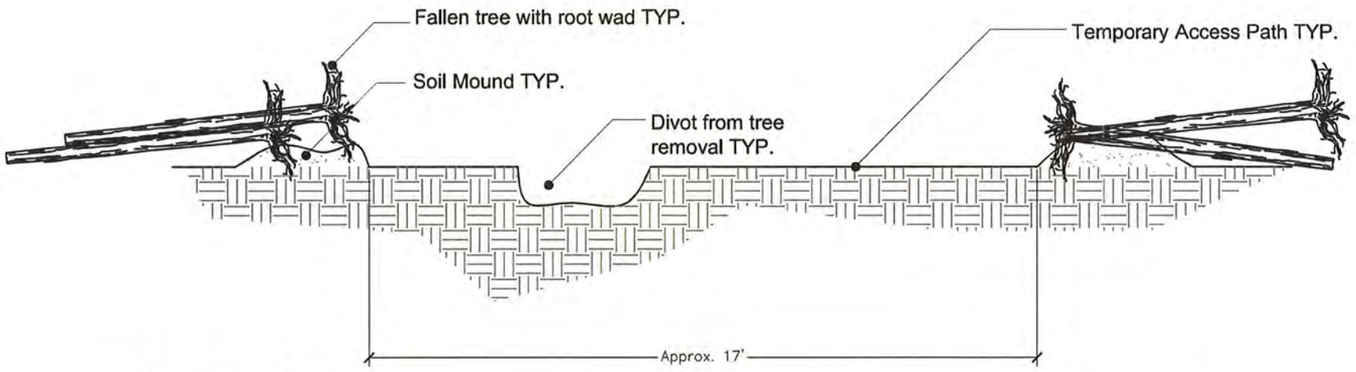
AMEC Earth & Environmental
11810 North Creek Parkway North
Bothell, WA, U.S.A. 98011-8201

DWN BY: DP
CHK'D BY: KD
DATUM: NONE
PROJECTION: NONE
SCALE: AS SHOWN

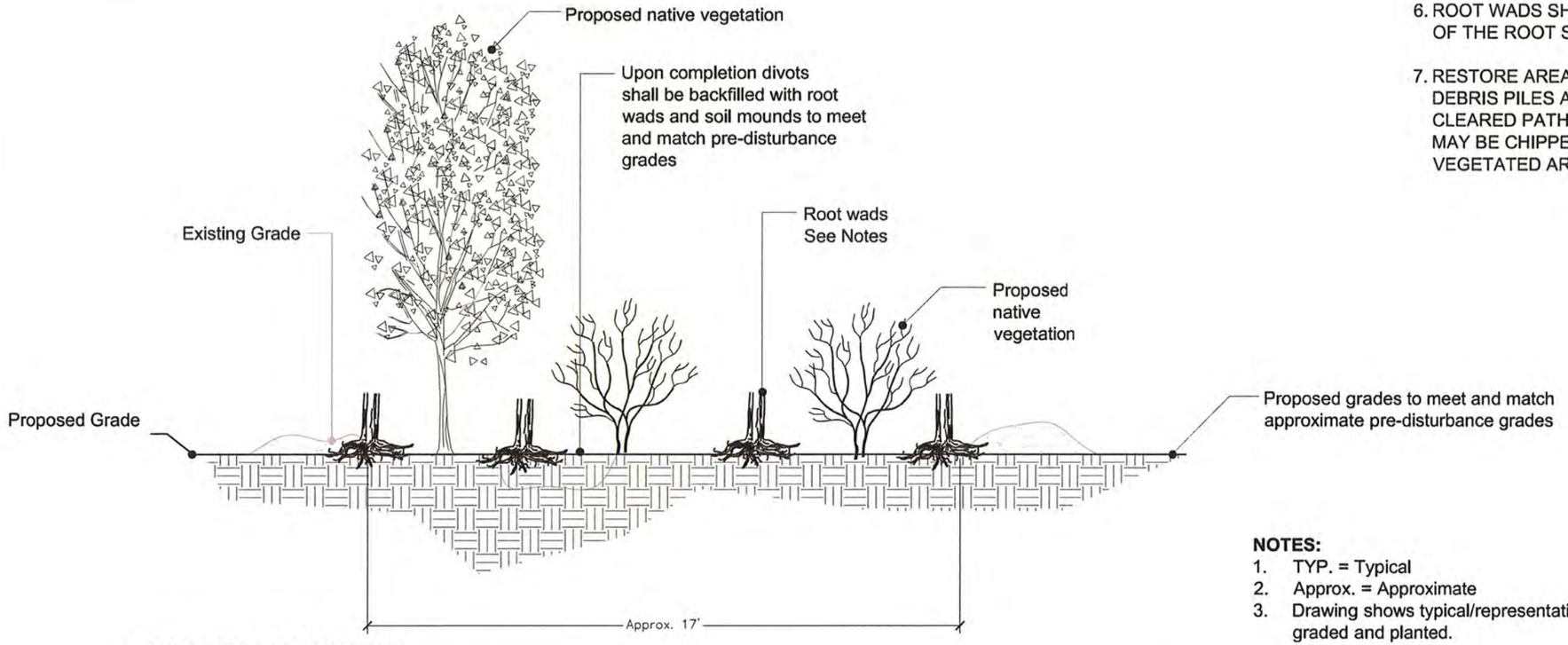
PROJECT: GATEWAY PACIFIC TERMINAL
GEOTECHNICAL INVESTIGATION

TITLE: PROPOSED PLANTING PLAN
WETLAND AND STREAM BUFFER TYP.

DATE: AUGUST 2011
PROJECT NO: 0-915-15338-C
REV. NO.: 1
FIGURE No. 3



EXISTING CROSS SECTION



PROPOSED CROSS SECTION

GENERAL NOTES:

1. MANUALLY BACKFILL AROUND REPLACED ROOT WADS WHEN NECESSARY WITH HAND TOOLS.
2. PLACE VEGETATED SOIL MATS AND ROOT WADS IN CLEARED PATHS.
3. SCARIFY COMPACTED SOILS.
4. FOR EXISTING DOWNED TREES, ROOT WADS SHALL BE CUT 2 FEET ABOVE TRUNK FLARE. REMAINING TREE TRUNKS SHALL BE LEFT IN PLACE. IF TRUNKS ARE CLUMPED TOGETHER THEY SHALL BE EVENLY DISPERSED WITHIN EXISTING VEGETATED AREAS.
5. CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT ADDITIONAL DAMAGE TO EXISTING VEGETATION.
6. ROOT WADS SHALL BE PLACED UPRIGHT. AT MINIMUM ONE HALF OF THE ROOT STRUCTURE SHALL BE BURIED.
7. RESTORE AREAS ADJACENT TO CLEARED PATHS BY REMOVING DEBRIS PILES AND DISTRIBUTING MATERIAL WITHIN THE CLEARED PATHS. TREE LIMBS OR OTHER WOODY MATERIALS MAY BE CHIPPED OR MANUALLY PLACED WITHIN EXISTING VEGETATED AREAS.

NOTES:

1. TYP. = Typical
2. Approx. = Approximate
3. Drawing shows typical/representative area to be graded and planted.

	CLIENT LOGO: Pacific International Terminals, A Cantx Enterprise	CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.	DWN BY: DP CHK'D BY: KD DATUM: NONE PROJECTION: NONE SCALE: AS SHOWN	PROJECT: GATEWAY PACIFIC TERMINAL GEOTECHNICAL INVESTIGATION	DATE: AUGUST 2011 PROJECT NO: 0-915-15338-C REV. NO.: 1 FIGURE No. 4
		AMEC Earth & Environmental 11810 North Creek Parkway North Bothell, WA, U.S.A. 98011-8201		TITLE: CROSS SECTIONS TYP.	

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APPENDIX B

2009 Jurisdictional Determination from the USACE

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Regulatory Branch

MAR 5 2009

Pacific International Terminals
Mr. Skip Sahlin
1131 Southwest Klickitat Way
Seattle, Washington 98134

Reference: NWS-2008-260-NO
Pacific International
Terminals

Dear Mr. Sahlin:

On March 23 and 24, 2008 and November 6, 2008, Mr. Randel Perry and I conducted a site visit in response to your request for a jurisdictional determination for wetlands and streams on property located near Ferndale, Whatcom County, Washington. The information provided by your agent, AMEC Earth and Environmental, Inc., indicated that some of the wetlands may be "isolated" and outside the U.S. Army Corps of Engineers (Corps) jurisdiction.

We have confirmed that wetlands and jurisdictional streams exist on your property. After reviewing the submitted information and our office resources and after visiting the site, we have determined the all delineated on-site wetlands shown on the enclosed drawing dated April 2008 abut or are adjacent to unnamed tributaries of the Strait of Georgia, a navigable waterway used for interstate and foreign commerce. These wetlands have a significant nexus to down stream traditional navigable waters (the Strait of Georgia) and, as such, are regulated by the Corps under Section 404 of the Clean Water Act.

We have also confirmed that all waterbodies identified as "Streams" and "Drainages" on the enclosed drawing dated April 2008 are tributaries to down stream navigable waters (the Strait of Georgia) and/or have a significant nexus to down stream traditional navigable waters. These tributaries are jurisdictional waters of the U. S. and are regulated by the Corps under Section 404 of the Clean Water Act.

This approved jurisdictional determination is valid for a period of 5 years from the date of this letter unless new information warrants revisions of the determination. A copy of this jurisdictional determination can be found on our website at http://www.nws.usace.army.mil/ click on Regulatory, Regulatory/Permits, Recent Jurisdictional Determinations. If you object to this determination, you may request an administrative appeal under our regulations 33 CFR 331

as described in the enclosed *Appeal Process Fact Sheet* and the *Notification of Administrative Appeal Options and Process and Request for Appeal* form.

A copy of this correspondence with enclosure will be furnished to Ms. Kristie Dunkin of AMEC Earth and Environmental, Inc. at 11810 North Creek Parkway North, Bothell, Washington 98011. Because Department of the Army authorization may be necessary for work in jurisdictional wetlands and drainages, do not commence construction before written authorization is received.

If you have any questions, please contact Mr. Randel Perry at (206) 764-6985 or by email at randel.j.perry@usace.army.mil.

Sincerely,

Matthew Bennett
Senior Scientist
Regulatory Branch

Enclosures