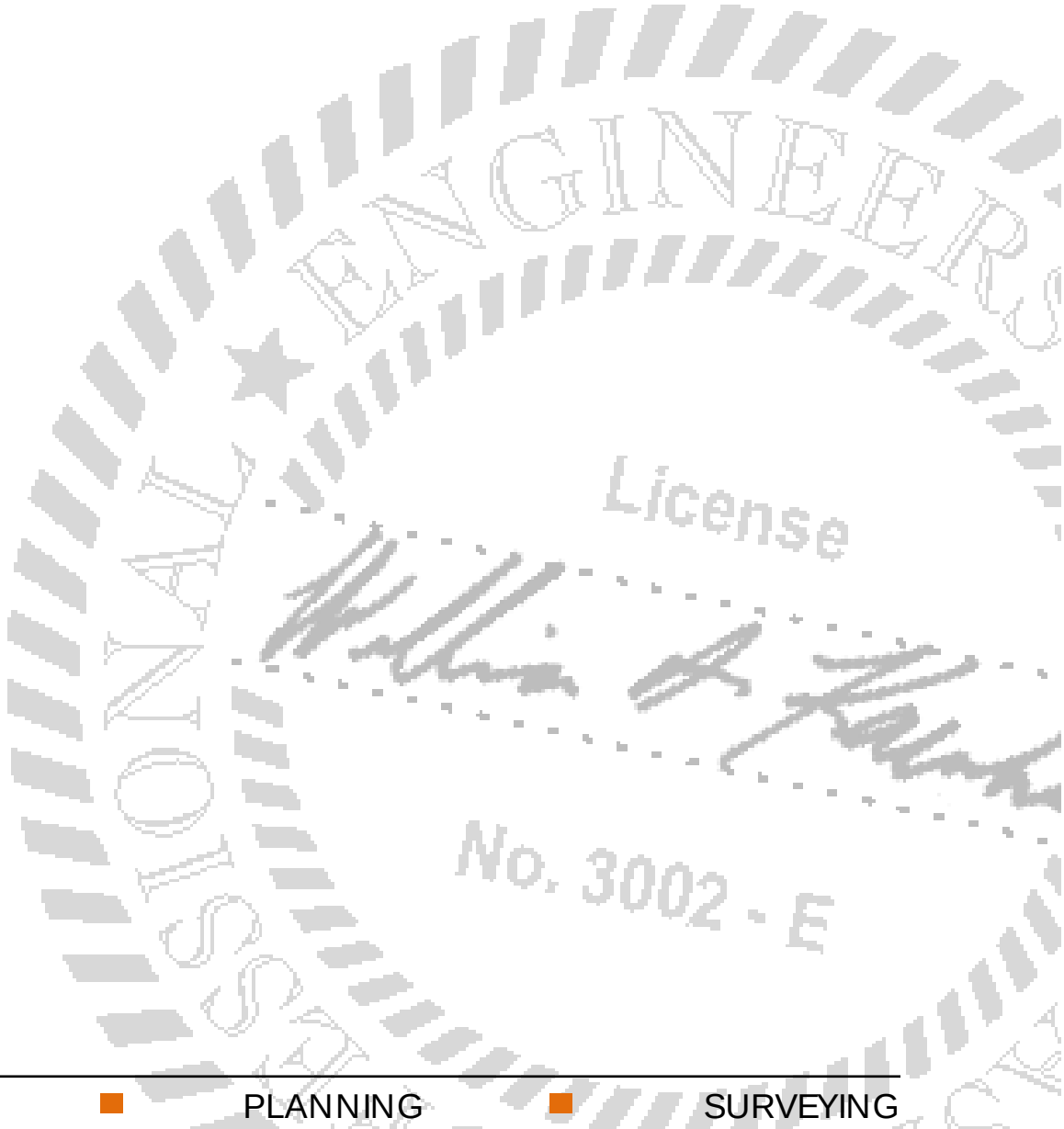
DOWL HKM

EROSION AND SEDIMENT CONTROL PLAN
JUNEAU INTERNATIONAL AIRPORT
RUNWAY SAFETY AREA IMPROVEMENTS
PHASE 2A
JUNEAU, ALASKA

May 2012



EROSION AND SEDIMENT CONTROL PLAN
JUNEAU INTERNATIONAL AIRPORT
RUNWAY SAFETY AREA IMPROVEMENTS PHASE 2A
JUNEAU, ALASKA

CITY AND BOROUGH OF JUNEAU CONTRACT NO. E012-240
AIRPORT IMPROVEMENT PROGRAM NO. 3-02-0133-056-2012

Prepared for:

Juneau International Airport
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May 2012

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APPENDICES

LIST OF ACRONYMS

ACGP ..... Alaska Construction General Permit
APDES ..... Alaska Pollution Discharge Elimination System
BMP ..... Best Management Practices
CBJ ..... City and Borough of Juneau
DEC ..... State of Alaska Department of Environmental Conservation
DOT&PF ..... State of Alaska Department of Transportation and Public Facilities
ESCP ..... Erosion and Sediment Control Plan
FAA ..... Federal Aviation Administration
FEIS ..... Federal Environmental Impact Statement
HMCP ..... Hazardous Material Control Plan
JNU ..... Juneau International Airport
MALSR ..... Medium Intensity Approach Lighting System Runway
MS4 ..... Municipal Separate Storm Sewer Systems
NOI ..... Notice of Intent
NPDES ..... National Pollution Discharge Elimination System
NTU ..... Nephelometric Turbidity Units
RGLs ..... runway guard lights
RSA ..... Runway Safety Area
RW ..... runway
SPCC ..... Spill Prevention Control and Countermeasures Plan
SWPPP ..... Stormwater Pollution Prevention Plan
TMDL ..... Total Maximum Daily Load
TW ..... taxiway
USEPA ..... United States Environmental Protection Agency
UST ..... underground storage tank

1.0 GENERAL INFORMATION

This is the site specific Erosion and Sediment Control Plan (ESCP) for the Juneau International Airport (JNU) Runway Safety Area (RSA) Improvements Phase 2A project. DOWL HKM, on behalf of the City and Borough of Juneau (CBJ), developed the following plan based on permit requirements, anticipated construction sequencing, available materials, and equipment. This plan contains construction site information that may be used by the Contractor in developing a Stormwater Pollution Prevention Plan (SWPPP), in accordance with Item P-157 Erosion, Sediment, and Pollution Control. This document does not cover erosion and sediment control for the material sites. The Contractor is responsible for a separate SWPPP for material sites.

The Contractor shall submit a completed SWPPP and SWPPP checklist to CBJ for review. Contractor is encouraged to use the resources located on the State of Alaska Department of Transportation and Public Facilities (DOT&PF) Construction Forms website http://www.dot.state.ak.us/stwddes/dcsconst/pop_constforms.shtml for SWPPP Checklist and other forms necessary for the plan. The Stormwater Construction Site Inspection Report form will be used for stormwater site inspections during construction.

2.0 PROJECT INFORMATION

2.1 Project Information

Project/Site Name: Juneau International Airport - Runway Safety Area Improvements Phase 2A

Project Street/Location: 1873 Shell Simmons Drive

City: Juneau State: Alaska Zip Code: 99801

County or Similar Subdivision: City and Borough of Juneau

Latitude: Longitude:

58º 21' 17" N (degrees, minutes, seconds) 134º 34' 43" W (degrees, minutes, seconds)

Method for determining latitude/longitude:

☐ USGS topographic map (specify scale: _____) ☐ EPA Web site ☐ GPS

☒ Other (please specify): Topographic survey performed by DOWL HKM between October and November 2011.

2.2 Project Site-Specific Conditions

Mean annual precipitation based on nearest weather stations (inches): 57 inches

Soil Type(s) and Slopes (describe soil type(s) and current slopes; note any changes due to grading or fill activities):

The soil conditions vary throughout the site; fill ranging in thickness from 2 to as much as 16 feet has been placed on native soils. The fill placed at the Duck Creek Bridge location varies from poorly graded sand with silt and gravel to silty gravel with sand. The fill is loose to medium dense.

The majority of the fill placed in Taxiway (TW) G and Runway (RW) 26 threshold consists of poorly graded sand with silt and poorly graded sand with silt and gravel. This dredged sand fill contains between 5 and 10% gravel and between 5 and 10% fines. Construction debris buried in the fill or layers of gravel fill as much as 4 feet thick were encountered at three boring locations. For more details see the geotechnical report. Moisture content of the fill ranges between 4 and 14%. The fill density varies over a wide range of medium dense to very dense with N-values (penetration resistance) ranging from a low of 12 to more than 50 blows per foot.

The fill encountered in the Northwest Development Area and TW B ranges in classification from a clean sand with gravel, to sand with silt and gravel or gravel with silt and sand, to silty sand with gravel. This fill contains distinctly more gravel than the dredged material placed in TW G and RW 26 threshold. The gravel content ranges from 20 to nearly 50% and silt contents range from about 4 to as much as 20%. Moisture content ranges between 3 and 18%. The density of this fill also varies over a wide range of loose to very dense with N-values ranging from a low of 7 to more than 50 blows per foot.

Existing fill slopes range from 2:1 and 3:1 to essentially flat. This project will:

- Add structural section for RW 26 extension, TW B, and TW G relocations.
- Realign TW E.
- Grade and surface the Northwest Development Area.
- Surface the RSA.

These activities will require reworking small portions of existing fill slopes. The fill for lateral RSA between stations 49+74 and 84+60 will be installed with a side slope of 2:1.

Landscape Topography:

The airport is situated in a mountainous region. Topography in the vicinity of JNU is relatively flat and is bordered by the Mendenhall River to the west, a seaplane base to the south, and the Gastineau Channel to the southeast and east. Steep terrain exists directly north of the airport and beyond the Gastineau Channel to the east and southeast. Lower lying terrain is located to the west past the Mendenhall River. The runway sits at an elevation of 25.3 feet and slopes to the east at approximately 0.01%. The RSA is graded away from the runway with a maximum grade of 3%. Side slopes have a maximum of 2:1 where the RSA meets the Gastineau Channel and the Mendenhall River. The project areas consist of flat or low-slope paved areas and unpaved, newly constructed areas of development.

Drainage patterns (describe current drainage patterns and note any changes due to grading or fill activities):

The project area drains in multiple directions. The main apron, terminal area, and terminal parking all drain to a series of storm drains that lead to several ditches north of TW A. These ditches drain to the east through several culverts and eventually into Jordan Creek. The general aviation, commercial, and air cargo areas northwest of the runway mostly drain south toward ditches north of TW A as well, but the ditches drain to the west into a storm drain system the flows into the seaplane base.

Approximate growing season:

The average growing season by the JNU is approximately 146 days, from May 4 to September 28, based on data from the National Climate Center.

Type of Existing Vegetation:

Areas affected by construction were previously developed as part of the airport, and are seeded grassland. The airport is bordered on the west, south and east sides by the Mendenhall Wetlands State Game Refuge. The refuge supports river and tidal marsh lands with associated vegetation, such as Beach Rye, coastal grass meadows, Lyngbye Sedge, Pacific Alkali Grass – Lyngbye Sedge, Deciduous Shrub-Scrub, Coastal Forb Meadow, and Unvegetated Tidal.

Historic site contamination evident from existing site features and known past usage of the site: A search of the State of Alaska Department of Environmental Conservation (DEC) Contaminated Sites Program Database show the following contaminated sites cases:

Location	Status	Concern
Federal Aviation Administration (FAA) Juneau Station	Open	Heating oil tank removed in 1992 oily soil stockpiled
Wings Aircargo Building	Complete	Petroleum contamination, 5 cu yd soil removed
Mike's Airport Express	Complete	Service bay floor drain outlet
Juneau Airport Fueling Facility	Open	1,400 cu yd of soil contaminated
Alaska Airlines – Juneau Cargo Facility	Open	Gasoline and diesel in soils 8-12 feet below ground surface
Aero Services, Juneau Airport	Complete	10,000 gallon aviation gasoline underground storage tank (UST) removed, minor contamination found
Aero Services Incorporated	Complete	4 UST closure assessment performed in 1988, 25 cubic yards of contaminated soil excavated
Temsco Helicopters	Complete (2 cases)	Leaking UST; leaking underground fuel pipe
Alaska Airlines – Juneau Cargo Facility	Complete	Leaking underground pipe connection
Chevron – Airport (Paul's Chevron)	Complete	Waste oil contamination
Ward Air	Complete	Leaking UST, petroleum
PTI – Juneau Cessna Drive	Complete	Leaking UST, petroleum
CBJ Juneau Airport Maintenance facility	Complete	Leaking 1,000 gallon diesel UST

None of the cases listed above are located in areas directly impacted by construction under this project.

3.0 NATURE OF CONSTRUCTION ACTIVITY

3.1 Scope of Work

The project site is located within JNU, which is located on the northeastern side of Gastineau Channel in southeastern Alaska. The airport lies at about 58º 21' 17" N, 134º 34' 43" W approximately 7 miles northwest of Juneau's city center. The runway is approximately 8,457 feet long by 150 feet wide with adjoining taxiways and support areas.

This project will extend RW 26 520 feet to the east and relocate RW 8 120 feet to the east. This runway shift and extension will bring the RSA into compliance with current FAA standards and provide a longer runway. The shift and extension require TW B and TW G relocations, a new RW 8 Medium Intensity Approach Lighting System with Runway (MALSR) (provided by FAA), and new runway marking and signage. As the MALSR is relocated, embankment

currently in the Mendenhall River will be removed and riprap placed to protect the river bank in the disturbed area. Other developments to be accomplished by the project are:

- Realignment of TW E.
- All new runway signs.
- Reconstruction and rehabilitation of the North Seaplane Base Road.
- Grading and capping of the Northwest Development Area.
- Construction of wigwags and runway guard lights (RGLs) at runway/taxiway intersections (additive alternate).
- Rehabilitation of South Seaplane Base Road (additive alternate).
- Construction of Pavement Sensor System for RW 08/26 (additive alternate).

3.2 Project Function

☐ Residential ☐ Commercial ☐ Industrial ☐ Road Construction

☐ Linear Utility ☒ Other (please specify): Airport Construction

3.3 Sequence and Timing of Soil-disturbing Activities

The Contractor is responsible for developing a construction schedule that incorporates the SWPPP requirements, including the SWPPP requirements for utility work. Erosion prevention and control measures should be installed as quickly as is practicable, and before earth disturbing activities, if possible. Each Best Management Practice (BMP) shall be included in the master construction schedule within each appropriate construction activity, with subtasks to install and maintain them. The plan shall address both temporary and permanent control measures, and should include any revisions made to the schedule during the project. A copy of the construction schedule will be included in the SWPPP.

The JNU RSA Improvements Phase 2A construction activities generally include:

- Construction and paving of relocated and extended runways and taxiways.
- Realignment of taxiways.
- Grading existing areas, where indicated.
- Resurfacing existing roads.

- Importing and compacting subbase, crushed aggregate base course, and crushed aggregate surface course.
- Soil stabilization.
- Topsoiling, seeding, and mulching.

The Mendenhall River MALSR embankment removal construction activities generally include:

- Establishment of siltation dam, if required.
- Removal of existing riprap.
- Excavation and grading.
- Placement of riprap.
- Restoration of disturbed areas above stream bank.

Temporary stabilization measures must be instituted within 14 days on all portions of the site where construction activities have temporarily or permanently ceased. All temporary erosion control measures will remain in place until the soil is stabilized, or work resumes at the site.

Sensitive areas to be protected include fill slopes and disturbed soil embankments. Disturbed areas with high silt content will be particularly vulnerable. Similarly, protection measures are required around culvert inlets and outlets, existing water channels and surfaces, especially during large storm events.

The work included for the JNU RSA Improvements Phase 2A project is proposed for two construction seasons as indicated below. A proposed construction staging and safety plan will be included in the construction drawings. The work will be divided into several stages to accommodate the construction activities while maintaining airport operations to the fullest extent possible.

Estimated Project Start Date: 7/01/2012

Estimated Project Completion Date: 10/30/2013

Identification and Coordination with Other Work in Project Vicinity

Utility relocation will occur in this project. The Contractor is responsible for including ESCP measures in their SWPPP to account for other work that is ongoing or will be undertaken within

or adjacent to the project during the contract period. The Contractor shall coordinate erosion and sediment control measures with the other operators.

3.4 Size of Property and Total Area Expected to be Disturbed

The following are estimates of the construction site:

Total project area: 104.2 acres

Construction site area to be disturbed: 59.1 acres

Percentage impervious area before construction: 51.9%

Runoff coefficient before construction: 0.68

Percentage impervious area after construction: 57.9%

Runoff coefficient after construction: 0.71

3.5 Identification of All Potential Pollutant Sources

A minimal amount of water will also be used for compaction of crushed aggregate surface course, crushed aggregate base course, subbase, embankment, and in-surface watering for dust control. Little runoff is expected from these activities. Based on the limited amount of construction runoff expected and the erosion and sedimentation control measures proposed, no construction runoff exceeding State Water Quality Standards is expected to reach open water as a result of this project.

Other potential sources of sediment to storm water runoff may include:

- Installation of culverts and storm drain system.
- Excavation for utilities.

The following is a list of construction materials, and activities that will be performed, that have the potential to contribute pollutants, other than sediment, to stormwater runoff:

- Vehicle and equipment fluids, including oil, grease, fuel, solvents, and coolants.
- Materials and production plants associated with paving operations.
- Materials and production plants associated with concrete work.
- Placement and removal of striping and pavement markings.
- BMP materials.
- General site litter and waste.

Industrial activities at the airport include:

- RW, TW, and apron maintenance.
- Aircraft maintenance and fueling.
- Aircraft and vehicle washing.
- Building maintenance.
- Vehicle maintenance and fueling.
- Cargo shipping and receiving.
- Fuel storage and delivery.

4.0 SITE MAPS

Site maps should be created by the Contractor and included in the SWPPP for compliance with the Alaska Pollutant Discharge Elimination System (APDES) Construction General Permit. The ESCP site map is provided as Attachment A.

5.0 DISCHARGES

5.1 Locations of Other Industrial Stormwater Discharges

Additional potential sources of pollution identified by the Contractor shall be included in the SWPPP. The SWPPP shall ensure the implementation of appropriate pollution prevention measures. Activities that will require additional evaluation and BMP development include dry weather deicing, and aircraft vehicle and ground support equipment washdown.

5.2 Allowable Non-Stormwater Discharges

Allowable non-stormwater discharges should be eliminated or reduced to the extent feasible. Identified non-stormwater discharges include:

- Waters used to wash vehicles where detergents are not used.
- Water used to control dust.
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used.
- Uncontaminated ground water or spring water.
- Uncontaminated excavation dewatering.

Control measures to be implemented to manage non-stormwater pollution are described in Section 10: Control Measures/Best Management Practices of this ESCP. Any additional non-stormwater discharges identified by the Contractor shall be included in the SWPPP. The SWPPP shall ensure the implementation of appropriate pollution prevention measures for the non-stormwater components of the discharge.

6.0 DOCUMENTATION OF PERMIT ELIGIBILITY RELATED TO TOTAL MAXIMUM DAILY LOADS (TMDL)

6.1 Identify Receiving Waters

The current drainage of the airport varies depending on tidal conditions. In general, the airport drains to Duck Creek, Jordan Creek and then to the Mendenhall River and Gastineau Channel. Jordan Creek and Duck Creek are the main waterways that carry runoff from the airport. Jordan Creek empties into the Gastineau Channel. Duck Creek empties into the Mendenhall River which empties into the Gastineau Channel and Fritz Cove.

Duck Creek enters airport property from the northwest, through a culvert under Berners Avenue. Duck Creek has been relocated and runs along the northwest edge of the airport property and discharges to the Mendenhall River.

Jordan Creek enters airport property from the north approximately 1,400 feet east of Duck Creek. Jordan Creek crosses Yandukin Drive and meanders for approximately 1,300 feet before crossing underneath Crest Street through a culvert. Jordan Creek is channelized along portions of the reach below Yandukin Drive. The floodplain is especially constricted below Crest Street. The channel bends sharply as it travels through airport property. The creek passes through long culverts under the taxiway and the runway prior to leaving airport property and entering the Mendenhall Wetlands State Game Refuge.

Vegetated ditches drain most of the runways and taxiways and discharge stormwater into the Seaplane Base and Jordan Creek. High tides create backwater conditions on Jordan Creek that can cause ponding in these ditches.

The Seaplane Base is surrounded by the runway to the north, the Mendenhall River to the west, the dike to the south, and the mouth of Jordan Creek to the east. A dike separates the seaplane base from tidal wetland and the Gastineau Channel. The seaplane base is approximately 5,300

feet long by 430 feet wide, with an average depth of 4 to 5 feet. A 30-foot-deep pocket of water is located in the south end of the seaplane base. Several sloughs and side channels extend from the main body of the seaplane base into the wooded area to the south. The total surface area of the seaplane base is approximately 80 acres, including sloughs and side channels. A tide gate at the west end of the seaplane base controls the water level. During high tide conditions, brackish water from the Mendenhall River enters the seaplane base through this structure. According to the Juneau Federal Environmental Impact Statement (FEIS) April 2007, the existing tide gate at the west end of the existing seaplane base contains a one-way check valve that does not allow water to exit the seaplane base from the east. The tide gate also serves as an emergency overflow control device for the seaplane base.

6.2 Identify TMDLs

According to the DEC's "Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report", Duck Creek and Jordan Creek are waters subject to TMDLs in the project area. Both are listed as Category 4a Waterbodies, which has been determined to be impaired has an established TMDL.

Duck Creek was removed from the Section 303(d) list and placed in Category 4a in 2002/2003. Priority actions identified for this water include implementing the Duck Creek Management Plan and addressing loadings identified in TMDLs. These actions include the following items; conducting monitoring program to determine whether recovery actions are improving water quality; maintaining stream flow to provide fish rearing habitat in the stream, dilute pollutants, and prevent salt water intrusion; and working with the CBJ and others to ensure adequate stormwater permitting practices and controls are implemented to restore water quality.

A TMDL addressing residues in Jordan Creek was developed and approved in May 2005. As a result, Jordan Creek was removed from the Section 303(d) list and relisted as a Category 4a Impaired Waterbody for residues. A separate TMDL for sediment and dissolved gas was completed in 2009.

7.0 DOCUMENTATION OF PERMIT ELIGIBILITY RELATED TO ENDANGERED SPECIES

7.1 Information on Endangered or Threatened Species or Critical Habitat

Are endangered or threatened species and critical habitats on or near the project area?

☐Yes ☒No

No federal or state listed threatened or endangered plants are known to occur in the project or landscape areas (http://www.fws.gov/endangered/). There is the potential for several of the listed Alaska Natural Heritage Program rare plant species and Tongass National Forest sensitive plant species to occur based on these species having been documented in the Juneau area in the past, and the similarity of their habitat requirements to that of the project area. However, the agencies have no record of their occurrence within the project or landscape areas and none were identified during field studies in support of the FEIS dated April 2007.

No fish or aquatic organisms found in the Airport vicinity are federally-listed threatened or endangered species. Steller sea lions (threatened) and humpback whales (endangered) may be indirectly affected by impacts to some of their forage fish that do use habitats within and near the Airport. These include immature and adult salmon (chum, coho salmon, pink, sockeye) and adult Pacific herring, capelin, sandlance, and eulachon migrating from the vicinity of the Airport.

8.0 HISTORICAL PROPERTIES

Are there any historic sites on or near the construction site?

☐Yes ☒No

The National Register of Historic Places lists 23 sites in Juneau, none of which are in the project area.

How this determination was made?

The determination was made through a March 16, 2012 search of the National Register of Historic Places available through the National Park Service website.

9.0 APPLICABLE FEDERAL, STATE, TRIBAL, OR LOCAL REQUIREMNETS

The Contractor's SWPPP shall comply with the 2011 Alaska CGP and the DOT&PF's Consent Decree with the United States Environmental Protection Agency (USEPA). This project has no further State, Tribal, or Local requirements.

Is the project located in Indian country? ☐ Yes ☒ No

Is this project considered a federal facility? ☒ Yes ☐ No

10.0 CONTROL MEASURES/BEST MANAGEMENT PRACTICES

The following section discusses control measures that should be implemented based on our knowledge of site conditions, expected construction sequencing, and other factors relevant to this project. Actual construction methods, sequencing, materials, and equipment used by the selected Contractor may vary from assumptions used in the preparation of this ESCP.

Erosion control consists of control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Soil stabilization BMPs protect the soil surface by covering and/or binding soil particles. Temporary slope stabilization measures may include roughening techniques such as tracking and grooving or terracing. Matting may be considered where immediate seeding is not practical.

Temporary erosion control BMPs should be installed as needed during construction. The Contractor should develop and implement strategies that include an effective combination of temporary erosion control and sediment control BMPs depending on the site conditions. The project will implement several BMPs for erosion control including, but not limited to, the BMPs described in this section.

Sediment controls are structural measures that are intended to complement and enhance the selected erosion control measures and reduce sediment discharges from construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by water. This project will implement several controls for effective temporary sediment control during construction including, but not limited to, those described in this section.

Permanent stormwater management measures should be installed as needed during the construction process to control pollutants in stormwater discharges after construction operations

have been completed. The Contractor should develop and implement strategies that include a combination of structural and/or non-structural BMPs depending on the site conditions.

10.1 Minimizing the Amount of Soil Exposed During Construction Activity

Soil exposure will be limited through staging construction, and requiring completion of earlier stages before moving on to later stages.

10.2 Maintaining Natural Buffer Areas

The proposed improvements will minimize disturbance of adjacent vegetated cover to the maximum extent possible. The natural vegetation between the earth disturbing work and wetlands should be maintained as completely as possible.

10.3 Control Stormwater Discharges and Flow Rates

10.3.1 Protection of steep slopes

10.3.1.1 Biodegradable Fiber Matting

All slopes with a 2:1 slope or a height greater than five feet are to be protected from soil erosion. Erosion control blankets may be applied directly after embankment construction, and prior to seeding.

Blanketed areas, with or without seed, will be inspected frequently for failure and, if needed, replaced as soon as possible. Where practicable, permanent seeding will be applied, containing a mixture of annual and permanent seed.

10.3.1.2 Compost Blanket

A compost blanket, comprised of loosely applied composted material, could be applied to control runoff and erosion on all disturbed areas that will be left for longer than 14 days. Compost blankets retain a large volume of water, act as a buffer to absorb rainfall energy, and provide both nutrients and a suitable microclimate for seed germination. Ideally seeded with a temporary or permanent seed mix, compost blankets would be desirable for slopes disturbed during construction.

Composted areas, with or without seed, will be inspected frequently for failure and, if needed, replaced as soon as possible. Where practicable, permanent, instead of temporary, seeding will be applied, containing a mixture of annual and permanent seed.

10.4 Storm Drain Inlet Protection Measures

10.4.1 Gravel Bag Barrier Inlet Protection

Gravel bag barriers may be used to prevent sediment from entering the drainage structures. Gravel bag barriers shall be made of geotextile fabric (not burlap) filled with gravel 3/4 to 1/2 inch in diameter. Gravel bag barriers shall be stacked at least one foot high.

10.4.2 Storm Drain Manufactured Inlet Protection Systems

Storm drain manufactured inlet protection systems may be used to prevent sediment from entering the drainage structures. Inlet protection, where possible, should be installed prior to beginning work on the project. New curb inlets should have protection installed in coordination with construction. Inlet protection systems should be inspected regularly and within 24 hours of the end of a storm event that results in a discharge from the site. Sediment should be periodically removed as recommended by the manufacturer and disposed of in an approved manner.

10.4.3 Temporary Culvert Inlet Sediment Trap

Culvert inlet sediment traps should be employed along the length of the project to trap any waterborne sediment prior to entering the culvert and moving through the project. The sediment traps should be regularly inspected and maintained. Sediment collected in the traps should be removed and disposed of as necessary using an approved disposal method.

10.5 Water Body Protection Measures

10.5.1 Silt Fence, Fiber Rolls or Other Linear Sediment Barriers

Silt fence or other linear sediment barrier such as fiber rolls or compost socks should be used to keep sediment out of any water crossings or adjacent water bodies or wetlands. If disturbed soil areas slope away from the water or there is a physical barrier such as a berm in between the disturbed soil area and water, then a linear sediment barrier may not be necessary at that location

Linear sediment barriers should be inspected regularly and within 24 hours of the end of a storm event that results in a discharge from the site, to make sure that they are intact. No gaps or tears along the length of the barrier, including where the barrier meets the ground, should exist. Any gaps or tears should be immediately repaired or replaced.

Compost socks or other similar products may be substituted for silt fence or fiber roll.

10.6 Down-Slope Sediment Controls

10.6.1 Riprap Outlet Protection

Permanent riprap stabilization will be placed in select areas. These permanent rock installations prevent erosion and scour, reduce the velocity and/or energy of stormwater flows, trap sediment, and allow water to infiltrate the ground. These should be installed concurrently with pipe installation.

10.7 Stabilized Construction Vehicle Access and Exit Points

Construction site entrance/exit stabilization will be provided, as necessary, to minimize the amount of sediment leaving the construction area from material attached to vehicles. Vehicle tracking entrances/exits will also be constructed at entrances to material and disposal sites.

Maintain stabilization of the site entrances until the rest of the construction site has been fully stabilized. Stone and gravel may need to be added periodically to each stabilized construction site entrance to keep the entrance effective. Sweep up soil tracked offsite immediately and periodically remove sediment from the traps for proper disposal.

10.8 Dust Generation and Track-Out from Vehicles

Off-site paved roads used by construction equipment and the general public traveling through the project shall be cleaned with a street cleaner capable of removing any excess mud, dirt, or rock left from project activities. Power brooming this material to the roadside is not acceptable. Sediment tracked onto paved surfaces within the project area as a result of construction activities performed must be swept up as well. The project roadway and affected off-site roads shall be inspected a minimum of once a day.

10.9 Soil Stockpiles

10.9.1 Wind Erosion Control

If necessary, mulching, silt fences, geotextile, plastic covers, tackifiers, watering, or other methods should be used to prevent wind dispersal of sediment from stockpiles.

10.10 Sediment Basins

10.10.1 Sediment Disposal Control

Sediment removed from temporary sediment control amenities or during temporary sediment control operations shall be disposed of in an approved manner and at approved locations off the project. Any off site permits or clearances for disposal areas will need to be obtained by the Contractor.

10.11 Dewatering

When dewatering is used, measures such as silt fence, straw wattles, and riprap shall be utilized to diffuse the discharge to ensure that no erosion is caused by the discharge and to trap any sediment suspended in the discharge.

10.12 Soil Stabilization

10.12.1 Soil Roughening

Soil roughening is a temporary erosion control practice often used in conjunction with grading. Soil roughening reduces runoff velocity, increases infiltration, reduces erosion, traps sediment, and prepares the soil for seeding and planting by giving seed an opportunity to take hold and grow. Soil roughening involves increasing the relief of a bare soil surface with horizontal grooves by either stair-stepping or using construction equipment to track the surface.

Inspect roughened areas after storms to see if re-roughening is needed. Regular inspection shall indicate where additional erosion and sediment control measures are needed. Soil roughening provides moderate erosion protection for bare soils while vegetative cover is being established. It is inexpensive and simple for short-term erosion control when used with other erosion and sediment controls.

10.12.2 Temporary Seeding

Temporary seeding, establishing quick-germinating vegetative cover, should be applied to control runoff and erosion on all disturbed areas that will be left for longer than 14 days (or other control method). Mulching with materials such as grass, hay, wood chips, wood fibers, compost blankets, or straw may be used to stabilize exposed or recently planted soil surfaces. Mulching is highly recommended and is most effective when used in conjunction with seeding.

Seeded areas will be inspected for failure and, if needed, reseeded as soon as possible. Inspect mulched areas frequently to identify areas where it has loosened or been removed, especially after rainstorms. Reseed these areas if necessary and replace the mulch cover immediately. Where practicable, permanent, instead of temporary, seeding should be applied, containing a mixture of annual and permanent seed.

10.12.3 Final Stabilization

If disturbed, all exposed erodible areas of the project shall be permanently seeded and composted, mulched, or matted. The Contractor shall initiate stabilization measures as soon as practicable, but at least within 14 days, on all portions of the site where construction activities have ceased. All temporary erosion control measures will remain in place until the soil is stabilized.

10.12.4 Seeded Ground Cover: Mulching, Straw Matting, or Compost Blankets

Seeded ground cover such as mulch, compost blankets, or knitted straw matting may be used to cover the soil surface, reduce erosion from rainfall impact, stabilize soils, and ensure permanent vegetation is established.

10.13 Treatment Chemicals

10.13.1 Treatment Chemicals

Treatment chemicals include, but are not limited to: paints, solvents, pesticides, fuels and oils, and other hazardous materials or any building materials that have the potential to contaminate stormwater.

10.13.2 Treatment Chemical Use Procedures

Treatment chemicals should be stored indoors or under cover whenever possible, or in areas with secondary containment to prevent spills from spreading across the site. Secondary containment includes dikes, berms, curbing or other containment methods. Secondary containment techniques should also ensure the protection of ground water. Designate staging areas for activities such as fueling vehicles, mixing paints etc. Designated areas will simplify monitoring of the use of materials and to clean up spills.

10.13.3 Project Site Conditions

Active awareness of the project site condition and the treatment chemical use procedures is necessary to prevent spills.

10.13.4 Application of Treatment Chemicals

Treatment chemicals shall be used according to manufacturer's recommended storage, handling, application, and cleanup procedures. Training employees and subcontractors is essential to the success of pollution prevention.

10.14 Active Treatment System Information

All employees and subcontractors using treatment chemicals shall be trained on the product as well as plans and procedures for storage, handling, application, and cleanup.

10.15 Good Housekeeping Measures

10.15.1 Washing of Equipment and Vehicles

Designate areas for washing of equipment and vehicles, such that complete restoration is possible at the completion of the project. Designate special area for washout of concrete delivery trucks. Ensure that pollutants from the washing are contained in the designated area, and that they can be removed or mitigated during site restoration.

10.15.2 Fueling and Maintenance Areas

Proper vehicle maintenance procedures and practices can help prevent construction site spills of fuel, coolant, or other contaminants. Construction vehicles should be inspected daily and leaks shall be repaired immediately. Dispose of all used oil, antifreeze, solvents, and other automotive-related chemicals in accordance with State and Federal regulations.

No vehicles or equipment shall be fueled or serviced within 100 feet of wetlands or other waters of the United States. Fueling and service vehicles shall be equipped with adequate materials (such as absorbent pads, booms, etc.) to immediately contain and commence cleanup of spilled fuels and other petroleum products. Cover and store all fuels, oils, solvents, and other automotive-related chemicals within a secondary containment system to prevent mixing with stormwater.

10.15.3 Washout of Applicators/Containers Used For Paint, Concrete, and Other Materials

Temporary concrete washout facilities should be constructed to contain concrete waste and liquids generated when concrete construction materials are cleaned. Temporary concrete washout facilities should be lined, contained, and constructed with sufficient volume to contain all liquid and concrete waste generated.

Washout areas should be located at least 150 feet from storm drain inlets, open ditches, or water bodies and away from construction traffic or access areas to prevent disturbance or tracking.

All concrete washout facilities should be checked daily to determine if they have been filled to 75% capacity, wherein materials are removed and disposed of properly. Concrete washout facilities are temporary structures and should be removed when they are no longer required for the project. Materials used to construct the washout facility should be disposed of in an approved manner.

10.15.4 Fertilizer or Pesticide Use

Use of fertilizer and/or pesticides as required and/or allowed by specifications shall be in accordance with manufacturers recommendations and at application rates provided by specifications, or by manufacturer. Fertilizer or pesticide shall be treated as treatment chemical described above.

10.16 Spill Notification

Fuel storage facilities are not anticipated to be necessary for this project. However, if fuel storage facilities are used for the project, a Spill Prevention Control and Countermeasure Plan (SPCC) shall be prepared providing measures to stop the source of a spill, contain and clean up a spill, dispose of contaminated materials, and train personnel to prevent and control future spills. The Contractor will submit a copy of the SPCC Plan to the Engineer as required under Item P-157 section 157-2.3 SPCC Plan Requirements, of the contract specifications.

10.17 Construction and Waste Materials

10.17.1 Material Delivery and Storage

Proper handling and storage of construction materials will minimize the discharge of these materials into nearby water bodies. The contractor must establish proper building and material

storage areas to avoid pollutants coming in contact with rainfall or flowing storm water. Any materials that have the potential to pollute stormwater will be covered to prevent rainfall from coming into contact with them. Garbage containers will be covered to prevent debris from blowing away. Any contractor-supplied staging area must be included in inspections and the SWPPP.

10.17.2 Staging, Materials Site, and Waste Site Management

The Contractor is responsible for developing construction staging and selecting appropriate controls to prevent erosion and sediment discharge at staging sites, material sites, and material disposal sites used for the project.

10.17.3 General Construction Site Waste Management

Building materials and other construction site wastes will be properly managed and disposed of to reduce the risk of pollution. Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for stormwater runoff to mobilize construction site wastes and contaminate surface or groundwater.

10.17.4 Hazardous Waste Management

The Contractor will develop a Hazardous Material Control Plan (HMCP) in accordance with Item P-157 section 157-2.2 HMCP Requirements, of the contract specifications.

11.0 INSPECTIONS

11.1 Inspection Schedules

The Contractor shall perform inspections and compile reports in compliance with the project SWPPP, and Item P-157 Erosion, Sediment, and Pollution Control, of the contract specifications.

Inspection Frequency:

For JNU, where the mean annual precipitation is greater than 40 inches, inspection must be conducted at least once every 7 calendar days. For periods of relatively continuous precipitation or sequential storm events, inspection must be conducted at least twice every 7 calendar days. The schedule for site inspections will be established and updated daily as necessary to meet the requirements of the Alaska Construction General Permit (ACGP).

Estimated date of winter shutdown:

December to March

11.2 Inspection Form or Checklist

Attach to SWPPP.

11.3 Corrective Action Procedures

The Contractor shall attach a corrective action log to the SWPPP, which will describe repairs, replacements, and maintenance of BMPs undertaken based on the inspections and maintenance procedures described above. This log should describe actions taken, dates completed, and note the person that completed the work.

The Contractor shall select qualified individuals who will be responsible for inspections, maintenance, and repair activities, and filling out the inspection and maintenance report. These people will be trained in all inspection and maintenance practices necessary for keeping the erosion and sediment controls used on site in good working order.

11.4 Inspection Recordkeeping

The Contractor shall maintain a list of records to be kept available at the project site for inspectors to review. Reference Item P-157 of the standard modifications and special provisions to the Standard Specifications for Airport Construction for a complete list of necessary documentation.

12.0 MONITORING PLAN

12.1 Determining of Need for Monitoring Plan

DEC gives two criteria to determine the need for a Monitoring plan. Is there a TMDL for the body of water? Is the disturbed acreage more than 20 acres? There is a TMDL for turbidity in Duck Creek and Jordan Creek, and the area disturbed under this project is greater than 20 acres. Based on these criteria a Monitoring Plan is needed.

12.2 Monitoring Plan Development

The Contractor must develop a written site-specific monitoring plan for analytical monitoring that includes all the requirements of ACGP Part 7.0 and follows the applicable DEC Quality

Assurance Guide for a Water Quality Monitoring Plan, see http://dec.alaska.gov/wateRWqapp/wqapp_index.htm. Most monitoring projects should fall under the Tier 2 Water Quality Monitoring Quality Assurance Project Plan criteria. A Generic Tier 2 Quality Assurance Project Plan.

http://dec.alaska.gov/wateRWqapp/Generic_Tier_2_WQ_QAPP_Rev_1.pdf has been developed to assist applicants in developing a project specific Water Quality Monitoring Quality Assurance Plan.

Also see the DEC stormwater website http://dec.alaska.gov/wateRWnpspc/stormwater/index.htm for information to use in developing the monitoring plan.

The monitoring plan must be included as a part of the SWPPP as either an appendix or separate SWPPP section. At a minimum, the SWPPP must document the person(s) responsible for conducting monitoring, schedules to be followed for monitoring, any checklist or form that will be used to record monitoring results, and correct action procedures.

12.3 Monitoring Considerations

Locate upstream/upgradient sampling point(s) to determine background turbidity in the receiving water body. The location should be reasonably close to discharge but not so close as to experience increased turbidity from discharge. Clearly mark in field and on map in SWPPP.

- Sample the discharge where it enters the receiving water body or where it leaves the construction site. Clearly mark in field and on map in SWPPP.
- The discharge entering the water body impaired for turbidity or sediment must not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than a 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.

If Turbidity exceeds allowable levels:

- Correct control measures within 7 calendar days, update your SWPPP to reflect improvements, submit a Corrective Action Report consistent with the ACGP, and continue daily sampling until discharge meets allowable turbidity.

- If a specific waste-load allocation has been established for turbidity or sediment that would apply to the discharge of stormwater from the construction site, the contractor must implement necessary steps to meet that allocation.
- If there is only a general waste-load allocation applicable to construction stormwater discharges, the contractor must consult the DEC to confirm consistency with approved TMDL.

13.0 POST-AUTHORIZATION RECORDS

13.1 Additional Documentation Requirements

13.1.1 Records of Employee Training

The Contractor is responsible for ensuring that all employees are aware of all control measures that are being used during the construction of this project. Training for on-site employees should be provided and should address topics including good housekeeping and preventative maintenance in addition to other structural and non-structural BMPs.

Describe Training Conducted:

Annual employee training should be designed to:

- Familiarize new employees with applicable BMPs and other SWPPP requirements.
- Remind existing employees of applicable BMPs and other SWPPP requirements.
- Introduce new stormwater pollution prevention techniques recently incorporated into the plan.
- Provide a forum where new ideas for improving stormwater management can be shared.

13.1.2 Grading and Stabilization Activities Log

The Contractor shall provide and maintain a current grading activities log for the project in the SWPPP. This log may contain, but is not limited to:

- Dates when grading activities occur.
- Dates when construction activities temporarily or permanently cease.
- Dates when stabilization measures are initiated.
- Date of beginning and ending period for winter shutdown.
- Copies of inspection reports.

- Copies of monitoring reports, if applicable.
- Documentation in support of chemical-treatment processes.
- Documentation of maintenance and repairs of control measures.
- Copy of DEC Letter of Non-Objection.

13.1.3 Daily Weather Observation Log

The Contractor shall provide and maintain a Daily Weather Observation log for the project in the SWPPP.

This log may contain, but is not limited to:

- Sunrise and sunset
- Temperature, min and max
- Precipitation accumulation during the day
- Significant storm events

14.0 MAINTAINING AN UPDATED SWPPP

14.1 Log of SWPPP Modifications

The Contractor shall maintain a log showing the dates of all SWPPP modifications. The log must include the name of the person authorizing each change and a brief summary of all changes. In addition to modifications, include amendments as stated in Item P-157 section 157-3.3 SWPPP Inspections, Amendments, Reports, and Logs of the contract specifications.

14.2 Deadlines of SWPPP Modifications

Revisions to the SWPPP must be completed within 7 days of the inspection that identified the need for a SWPPP modification or within 7 days of substantial modifications to the construction plans or changes in site conditions.

15.0 ADDITIONAL SWPPP REQUIREMENTS

15.1 Retention of SWPPP

A copy of the SWPPP (including a copy of the permit), Notice of Intent (NOI), and acknowledgement letter from DEC must be retained at the construction site.

15.2 Main Entrance Signage

A sign or other notice must be posted conspicuously near the main entrance of the site. The sign or notice must include a copy of the completed NOI.

15.3 Availability of SWPPP

The Contractor must keep a current copy of the SWPPP at the site. The SWPPP must be made available to subcontractors, government and tribal agencies, and Municipal Separate Storm Sewer System (MS4) operators, upon request.

15.4 Signature and Certification

The SWPPP must be signed and certified in accordance with the requirements of the 2011 ACGP Appendix A, Part 1.12.

16.0 REFERENCES

Alaska Department of Transportation and Public Facilities (2006), *Alaska Storm Water Pollution Prevention Plan Guide.*

California Stormwater Quality Association (2003), *California Stormwater Quality Association Stormwater Best Management Practice Handbook.*

Caltrans Division of Construction, *Stormwater and Water Pollution Control.*

http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

Department of Environmental Conservation (2010), *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report.*

http://www.dec.state.ak.us/wateRWqsar/Docs/2010_Integrated_Report_Final_20100715_corrected_july_19.pdf

EPA Best Management Practices:

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/

EPA Stormwater Menu of BMPs:

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=118&minmeasure=4

U.S. Environmental Protection Agency (2007), *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites.*

http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

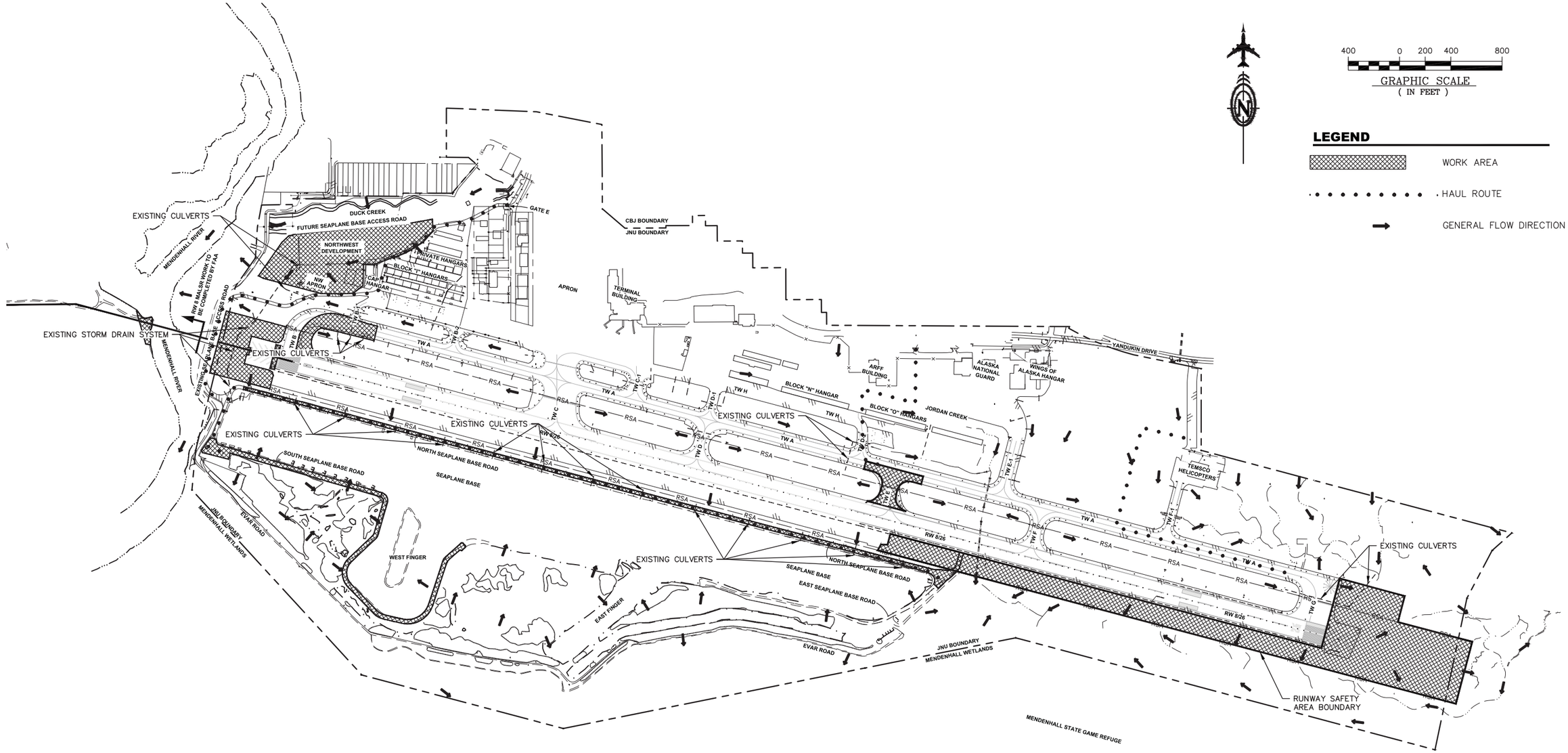
U.S. Environmental Protection Agency (2007), *National Menu of Stormwater Best Management Practices.* http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Western Regional Climate Center (2010), *Period of Record Monthly Climate Summary.* http://www.wrcc.dri.edu/summary/Climsmak.html

Subsurface Exploration and Geotechnical Recommendations (2012), *DOWL HKM.*

APPENDIX A

Erosion and Sediment Control Plan Site Map



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Drawn By: BRN/SGO
Checked By: CCW

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Script File:
Plot Date: April 26, 2012

BY	DATE	REVISIONS

SCALE
HORZ. SCALE
VERT. SEE GRAPHIC
W.O. NO. D59440
FILE NO. 232-89

STATE OF ALASKA 49TH
Brian R. Hanson CE 11132 April 26, 2012
REGISTERED PROFESSIONAL ENGINEER

DOWL HKM
5368 Commercial Blvd Juneau, Alaska 99801
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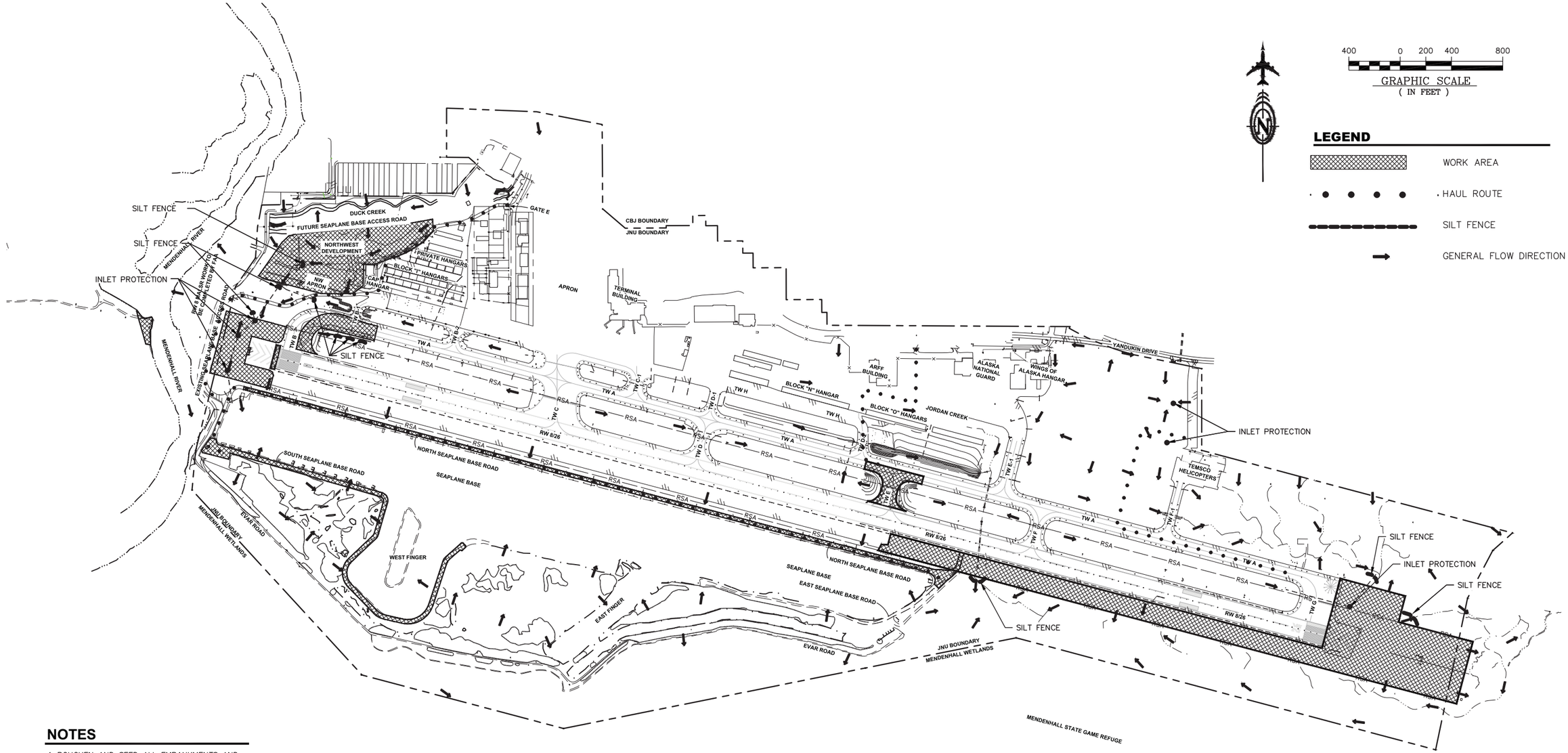
Juneau International Airport
CITY/BOROUGH OF JUNEAU
ALASKA'S CAPITAL CITY

JUNEAU INTERNATIONAL AIRPORT
JUNEAU, ALASKA
RUNWAY SAFETY AREA IMPROVEMENTS – PHASE 2A
CONTRACT NO. E12-240
AIP No. 3-02-0133-056-2012
EROSION & SEDIMENT CONTROL PLAN
PRE-CONSTRUCTION CONDITIONS

SHEET 1 OF 2



NOTES

1. ROUGHEN AND SEED ALL EMBANKMENTS AND SLOPES GREATER THAN 10%.
2. MAINTAIN BMP'S LISTED IN EROSION AND SEDIMENT CONTROL PLAN NARRATIVE
3. CONTROL FLOW RATES TO REDUCE SEDIMENT TRANSPORT.
4. PROTECT DRAIN INLETS AND EXISTING PONDS AND WATER CHANNELS.
5. STABILIZE CHANNELS AND OUTLETS.
6. PLACE SILT FENCE 15 FEET FROM THE TOE OF NEW EMBANKMENT.

Designed By: CCW
Drawn By: BRN/SGO
Checked By: CCW
DOWL File No. 232-89
File: Q:\24\606333\Engineering\03 Drawings\ESCP-JNU RSA IIA.dwg
Script File:
Plot Date: April 26, 2012

BY	DATE	REVISIONS

SCALE
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STATE OF ALASKA 49TH
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AIP No. 3-02-0133-056-2012

EROSION & SEDIMENT CONTROL PLAN

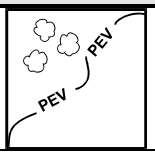
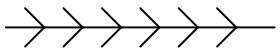
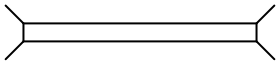
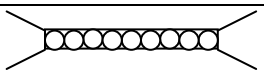
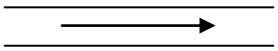
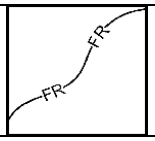
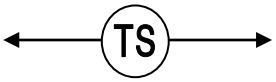
POST-CONSTRUCTION CONDITIONS

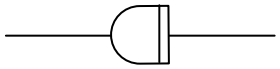
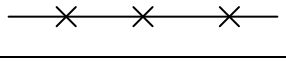
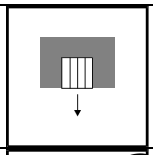
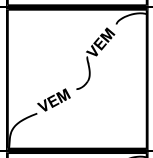
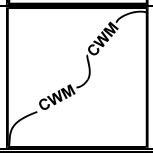
SHEET 2 OF 2

APPENDIX B

Best Management Practice Details

Table B-1
Matrix of Uses and Suggested Drawing Symbols

Erosion and Sediment Control Measures	Pg.	Structural Measures		Erosion Control	Pollution Prevention	Temporary/ Permanent	Symbol
		Velocity Control	Sediment Control				
Preservation of Existing Vegetation (BMP AK-1)	B-4			X		P	
Interception/ Diversion Ditch (BMP AK-2)	B-6	X				T, P	
Slope Drain (BMP AK-3)	B-9	X				T	
Rock Flume (BMP AK-4)	B-12	X				T, P	
Outlet Protection (BMP AK-5)	B-14	X				T, P	
Stormwater Conveyance Channel (BMP AK-6)	B-17	X				T, P	
Check Dam (BMP AK-7)	B-21	X				T, P	
Fiber Rolls (BMP AK-8)	B-24	X	X	X		T, P	
Mulching (BMP AK-9)	B-26			X		T	
Temporary Seeding (BMP AK-10)	B-28			X		T	
Seeding Around Culverts (BMP AK-11)	B-30			X		T,P	
Surface Roughening and Terracing (BMP AK-12)	B-32			X		T	
Compost Blankets (BMP AK-13)	B-37			X		T,P	
Rolled Erosion Control Products (BMP AK-14)	B-39			X		T, P	

Temporary Sediment Trap (BMP AK-15)	B-43		X			T	
Vegetative Buffer Strip (BMP AK-16)	B-46		X			T, P	
Filter Berm (BMP AK-17)	B-49		X			T	
Silt Fence (BMP AK-18)	B-50		X			T	
Inlet Protection (BMP AK-19)	B-54		X			T	
Brush Barrier (BMP AK-20)	B-59		X			T	
Vehicle Tracking Entrance/Exit (BMP AK-21)	B-61		X			T	
Tire Wash (BMP AK-22)	B-63		X			T	
Vehicle and Equipment Maintenance (BMP AK-23)	B-64				X	T	
Concrete Washout (BMP AK-24)	B-65				X	T	

BMP AK-1
Preservation of Existing Vegetation

Purpose and Description

- The purpose of preserving existing vegetation is to limit site disturbance and to minimize soil erosion by identifying and protecting pre-existing vegetation on the construction site.[1]

Applicability

- Natural vegetation must be preserved in all areas where no construction is planned or will occur at a later date.
- Clear only land that is needed for building activities or vehicle traffic.[2]
- This BMP is not to supersede existing guidelines, restrictions or law, preserve vegetation as required by local governments (such as stream buffers).
- The preservation of existing vegetation is an applicable practice in all regions and climates in Alaska.

Design and Installation

- Before any clearing begins, vegetation selected for preservation must be clearly marked with established barriers.[3] These barriers must be about 1 meter in height, must be highly visible and be anchored by wood or metal fence posts at spacing and depth that will adequately support the fence for the entirety of the project.[1]
- A site map must be prepared clearly outlining all areas of vegetation that is to be preserved.[2]
- Vehicle traffic, equipment storage and parking shall be kept away from these areas to prevent soil and root compaction.[1]
- Ground disturbance must be kept from these areas at least as far out as the leaf drip line.[3]
- Maintain pre-existing irrigation systems that may supply water to vegetation selected for preservation.[1]
- To increase chances of survival it is best to limit grade changes in these areas and areas within the drip line.[3]

Maintenance and Inspection

- Repair or replace damaged vegetation immediately.[2]
- Inspect preservation areas regularly, if barrier has been removed or visibility reduced repair or replace barrier so that visibility is restored.[3]
- If roots are exposed or damaged, prune ends just above damage with pruning shears or loppers and recover with native soil.[3]

References

[1]Caltrans Storm Water Quality Handbooks, March 2003, Construction Site Best Management Practices Manual, SS-2 Preservation of Existing Vegetation, Uhttp://www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

(Continued on next page)

[2]USEPA (United States Environmental Protection Agency), October 2000, National Menu of Best Management Practices, Preserving Natural Vegetation, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=34&minmeasure=4

[3]Washington State Department of Ecology, February 2005, Storm Water Management Manual for Western Washington, Construction Storm Water Pollution Prevention, BMP C101: Preserving Natural Vegetation, http://www.ecy.wa.gov/pubs/0510030.pdf

BMP AK-6
Storm Water Conveyance Channel

Objectives and Applications

A storm water conveyance is a channel lined with vegetation, riprap, or other flexible material designed for the conveyance and safe disposal of concentrated surface runoff to a receiving system without damage from erosion.

The main design considerations are the volume and velocity of the water expected in the channel. All conveyance channels should be designed to carry at least the appropriate peak flow. Other factors to be considered include availability of land, aesthetics, safety, maintenance requirements, and soil characteristics. There are two types of cross sections for channel linings, trapezoidal and triangular ("V" shaped). All channels should discharge through a stabilized outlet that should be designed to handle the expected runoff velocities and volumes from the channel without resulting in scouring.

Channel linings function to protect drainage channels against erosion through the use of flexible linings (vegetation, riprap, gravel, or flexible, porous mats), and may be used as either a temporary or a permanent sediment control measure. The selection of a type of lining should be based upon the design flow velocities.

Common Failures *- Generally due to faulty maintenance.*

- Sediment accumulation – channel capacity is reduced, resulting in over topping and erosion
- Failure of lining

Other Considerations

- Channels should be located to conform with and use the natural drainage system.
- Grass lined channels should not be subject to sedimentation from disturbed areas.
- Grass-lined channels may be unsuitable if channel slopes over 5% predominate, continuous or prolonged flows occur, potential exists for damage from traffic (people or vehicles), or soils are erodible.
- Channel side slopes should be 2:1 or flatter in the case of rock-riprap lining. Vegetated channel side slopes should be 4:1 or flatter.
- When using riprap as a liner, a geotextile filter blanket or one or more layers of granular filter should be placed before placing the riprap. The thickness and gradation of the granular filter, or specifications for the geotextile, should be included in the plans.
- Vegetation in grass lined channels should be established before flows are introduced.

Relationship to Other ESC Measures

All channels should discharge through a stabilized outlet. The outlet should be designed so that it will handle the expected runoff velocities and volumes without scouring. An energy dissipator may be needed if flow velocities exceed the allowable velocity of the receiving channel.

Alternate Sediment Control Measures

Grass Lined Swale

Other Names

Channel Stabilization

Design

The following information is needed to design channel linings.

- *Expected runoff peak flow*
  Temporary: 2-year frequency storm
  Permanent: 10-year frequency storm
- *Desired channel capacity*
- *Slope of the channel*
- *The type of cross-sectional design of channel*
- *The type of lining*
- *Design depth or design cross sectional area*

Design Guidelines – *Design procedures should be consistent with steps outlined in chapter 8.6.3.1 of the Alaska Highway Drainage Manual. Basic steps will include:*

1. *Establish a roadside plan*
2. *Obtain or establish cross section data*
3. *Determine initial channel grades*
4. *Check flow capacities and adjust as necessary*
5. *Determine channel lining/protection needed (following procedures in FHWA Hydraulic Engineering Circular No. 15, "Design of Roadside Channels with Flexible Linings")*
6. *Analyze outlet points and downstream effects*

Materials

Filter blanket or geotextiles, flexible, porous mats (fiberglass, plastic, or jute), staples, riprap, gravel, seed, fertilizer, mulch.

Installation

Remove all unsuitable material, such as trees, brush, roots, or other obstructions prior to installation. Shape the channel to proper grade and cross-section as shown in the plans, with no abrupt deviations from design grade or horizontal alignment. Compact all fills to prevent unequal settlement. Remove any excess soil and dispose of properly.

Grass lined channels – Seed, fertilize and mulch.

Riprap lined channels – Place a geotextile filter blanket or a granular filter, prior to placement of riprap.

Mat lined Channels –Seed and fertilize. Apply the matting from the upper end of the channel and continue downgrade. Secure the top end of the matting by excavating a 6 in. trench, followed by back-filling and compacting. Overlap rolls of matting at least 6 in. And use a double row of staples. Staple securely on 6 in. centers, using minimum 6 in. long staples, then backfill and compact. Roll channel lining with a heavy roller after seeding, mat placement, and stapling are complete.

Inspection

Inspect channels weekly as well as after major rains for sediment accumulation, material displacement, bank failures, and scour at inlet and outlet sections.

Maintenance

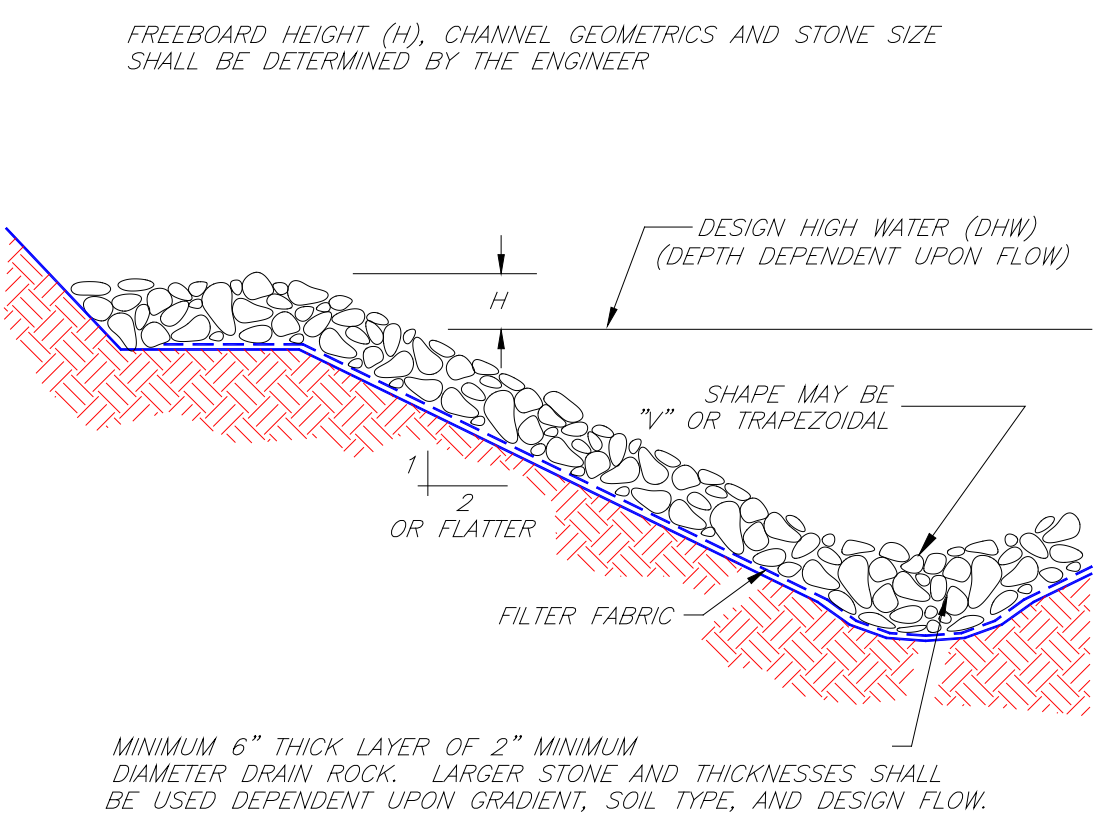
Grass Lined Channels – During the initial establishment, grass lined channels should be repaired immediately and grass re-established if necessary. After grass has become established, the channel should be checked periodically to determine if the grass is withstanding the flow velocities without damage. The channel should be repaired if scour is found to be present, and any debris or sediment accumulation should be removed.

Riprap Lined Channels – Riprap lined channels should be checked periodically to ensure that scouring is not occurring beneath the fabric underlying the riprap layer, or that the stones have not been displaced by the flow. Sediment should be removed from the riprap lined channel if it reduces the capacity of the channel.

Mat Lined Channels – Inspect channel linings following each major storm or snowmelt event and repair as necessary. If the desired grass has not become established through a mat, replace the matting, taking care not to disturb any areas of established grass.

Removal

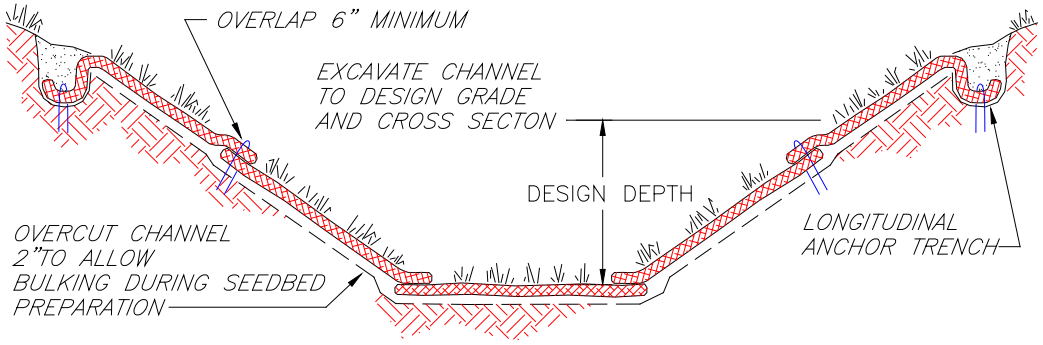
Temporary channels - Provide and compact fill to existing or constructed grade. Seed and mulch.



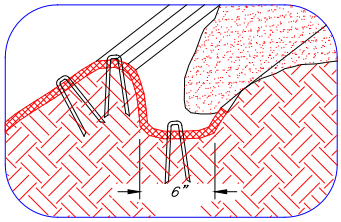
TYPICAL SECTION

FILE: RCKCHNEL

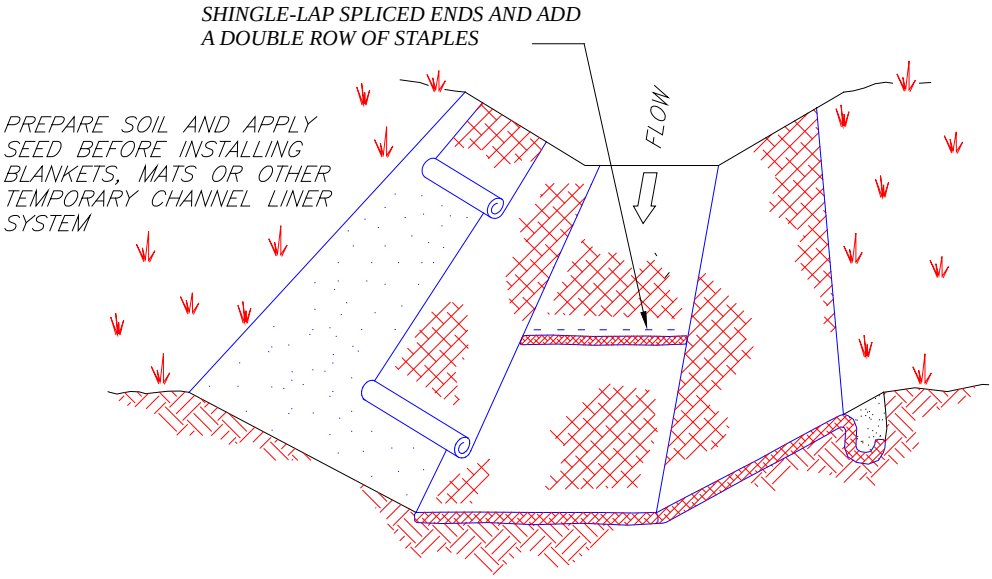
STORM WATER CONVEYANCE CHANNEL, RIPRAP



TYPICAL INSTALLATION
WITH EROSION CONTROL
BLANKETS OR TURF
REINFORCEMENT MATS



LONGITUDINAL ANCHOR TRENCH



NOT TO SCALE

NOTES:
1. DESIGN VELOCITIES EXCEEDING 2.0 FT/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 6.0 FT/SEC SHOULD INCLUDE TURF REINFORCEMENT MATS.

FILE: GRSSINST

BMP AK-7
Check Dam

Objectives and Applications

A check dam is an expedient (or emergency) temporary measure to protect narrow erosion-susceptible waterways and/or reduce the sediment loads in channeled flows. Check dams may also be used as permanent measures. Rock or a triangular silt dike may be used.

Temporary check dams are placed in series in ditches, swales, gullies, or other minor drainageways intended to be filled or stabilized at a later time. They are used to slow stormwater velocities and direct scouring flows away from channel surfaces. The dam configuration supports sediment settling from silted waters pooled behind the weir. When rock is used, small sediment particles become lodged in the dam's interior.

Permanent check dams may be used as gradient control structures in ditches adjacent to elevated roadway sections.

Common Failures - Check dams are vulnerable to failure from concentrated flow.

- Undercut/washout of channel banks beside the structure due to improper installation (e.g. dam not built high enough onto the banks).
- Increased bank erosion (e.g. at channel bends) or inadequate protection of channel surfaces due to improper location or installation of check dams.
- Water backup and bank overflow due to overly tall dam structure.
- When rock is used, rocks washed downstream may clog culverts, misdirect flow, etc.
- Check dams installed in grass lined structures may kill the vegetative lining if siltation is excessive or the dam remains submerged for extended periods of time.

Other Considerations

- Check dams are used in narrow ditches and gullies.
- Check dam rocks interfere with the establishment of vegetation.
- Check dams left as permanent structures interfere with grass mowing (maintenance).
- Steep channel slopes reduce effectiveness.
- Coupling check dams with a small adjacent upstream sump improves velocity slowing and sediment trapping ability.
- The area downstream from the last dam should be stabilized or flow diverted.

Relationship to Other ESC Measures

As part of the perimeter control ESC network, check dams are used for channel protection prior to establishment of permanent or stabilized erosion controls. Although check dams do some sediment filtering, they are not intended to replace filters or sediment basins. A depression in the bottom of the channel at the upstream edge of a check dam augments velocity slowing and sediment removal. Digging a sump through stabilized in-channel protection (e.g. grassed lining) should be avoided, however. Check dams interfere with localized vegetative channel protection. Rocks prohibit establishment of in-situ vegetation and the protective lining is subject to disturbance/ destruction during check dam removal.

Alternate Sediment Control Measures

- Drainage diversion during channel stabilization.
- Protective channel linings (e.g. grassed waterway, concrete or rock-lined ditch, erosion control blankets or mattings), , sediment settling ponds, permanent ditch blocks, brush barriers or combinations or these measures.

Other Names

In Stream/Channel Energy Dissipator

Design

The design of rock check dams (high at channel banks, lower in the middle) directs overtopping flows centrally to avert scouring of channel surfaces. The dam is keyed into channel slopes to prevent bank undercut and erosion.

Spacing between dams is based on waterway grade, height of adjacent check dams and desired length of backwater effect. The distance shown in the table below has been calculated for the protection of channel banks between successive structures. Placement of check dams at abrupt bends should be avoided since erosive waters could be misdirected by the check dam into channel banks.

Check dam structures are sized to stay in place during peak flow and should pass 2-year storm runoff without overtopping the roadway or ditch side-slopes. Generally, dams are not constructed higher than recommended as follows since excessive weir depth seriously impacts the flow characteristics of the ditch.

The following dimensions may be modified for site-specific applications:

Standard Check Dam

Maximum drainage area: *not to exceed 10 acres*

Normal flow velocity*: no greater than* 6 ft/sec.

Maximum height at dam center*: not greater than 2 ft. or one half the channel depth*

Minimum height difference between center and (bank) sides*: 6 in.*

Structure slope*: 1:2*

Maximum spacing between standard (2 ft. high) check dams: *align top of check dam level with toe elevation of the upstream dam*

Channel Slope (%)				
2	*3*	*4*	*5*	*6*
Spacing (ft.)				
100	*67*	*50*	*40*	*33*

.

Materials

Rock. Clean hard angular (e.g. crushed, shot) rock graded according to expected flows. Two- to three-inch stone is usually adequate.
Alternate materials: logs, brush and twigs, sandbags partially filled with pea gravel. Use only clean materials. Avoid introduction of fines.

Tirangular Silt Dike. These are foam encased in geotextile, with extra fabric to make an apron. They are usually 10 to 14" high at the center and 20 to 28" at the base.

Installation

Install dams as soon as drainage routes are established. Place rock by hand or mechanical means, distributing smaller rocks to the upstream side to prevent transport. Attach the leading edge of the triangular silt dike with rocks, sandbags or staples and a key slot. Check structures key into a trench that spans the complete width of the channel. Extend dams high onto the channel banks (above anticipated high water level) to prevent localized undermining and erosion. In unlined channels, a small sump dug at the upstream side of the dam facilitates sediment collection and removal.

Inspection

Observe dam function during/after each rainfall event that produces runoff and note conditions of channel surfaces. Visually compare upstream and downstream flows to determine relative turbidity levels and effectiveness of velocity checks. Inspect channel banks for evidence of undermining and erosion. Look for dam deterioration and for migration of structural components downstream. Observe level of sediment buildup behind dam. It should not exceed ½ dam height. Observe ESC effectiveness during flows to determine if adjunct measures are needed. The dam should be stable and appropriately sized to withstand high velocity events.

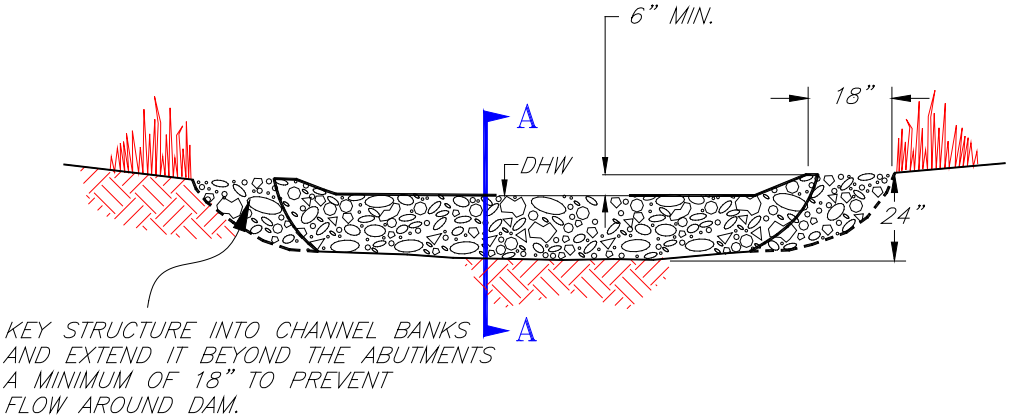
Maintenance

Rock. Repair check dam voids and bank undercuts. Fortify disintegrating dams and install additional dams or other ESC measures as needed. Correct undesirable effects of rock migration (e.g. clogged culvert, flow construction). Periodically remove sediment deposits.

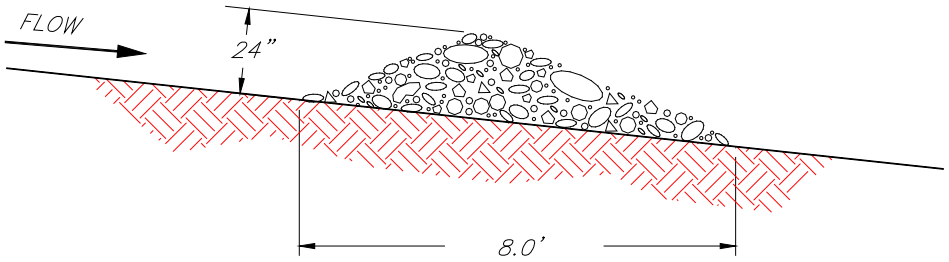
Triangular Silt Dike. Remove accumulated sediment when it reaches half the height of the dam. Repair right away if there is any undercutting or flow around the edges.

Removal

Care should be taken since the waterway surfaces are susceptible to damage during check dam removal. Damaged or unprotected areas should be seeded immediately or other forms of protection provided as warranted. Some check dams are left as a permanent control measure. Removal may be indicated because of unsightliness or interference with maintenance activities.

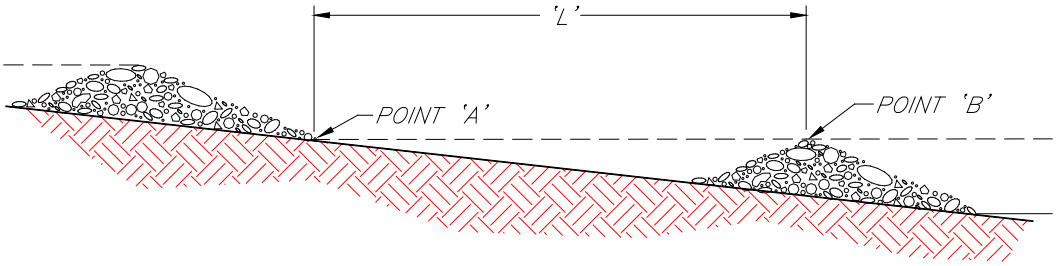


VIEW LOOKING UPSTREAM



SECTION A – A

'L' = THE DISTANCE SUCH THAT POINTS 'A' AND 'B' ARE OF EQUAL ELEVATION.



SPACING BETWEEN CHECK DAMS

NOT TO SCALE

FILE: RCKCHKDM

ROCK CHECK DAM

BMP AK-8

Fiber Roll

Objectives and Applications

Fiber rolls are long rolls of material such as straw, flax, rice, coconut or compost wrapped in plastic or biodegradable netting. They are placed and staked along the contour of disturbed slopes.

The purpose of a fiber roll is to shorten the slope and help to slow, filter and spread overland flows. They capture organic matter and seeds that might otherwise be washed downslope.

Fiber rolls can be applied to steep or long slopes and slopes that are susceptible to freeze/thaw activity, sheet and rill erosion or dry ravel. They can be placed along the toe, top, face and at grade-breaks on disturbed slopes. They can be placed at the perimeter of a project and around temporary stockpiles. They can be used as check dams in unlined ditches

Common Failures - Generally due to faulty installation or maintenance.

- Without being placed in a trench, runoff can flow underneath the roll and cause failure.
- Water can flow between rolls is they are not abutted tightly together.
- Rolls must be placed perpendicular to flow (parallel to the slope contour).
- Rolls will not work if the slope is slumping, creeping or sliding.

Other Considerations

- Use in areas of low shear stress.
- Avoid use on slopes that could build up ice.
- They are effective for one to two seasons.
- Fiber rolls can be stakes to the ground using willow cuttings to increase the revegetation. Since the fiber roll will retain moisture, it will provide a good site for the willow.
- Rolls will be difficult to move once they are saturated.
- The quantity of sediment that a roll can capture is limited. They are typically about 8 inches in diameter.

Relationship to Other ESC Measures

Fiber rolls are best used in combination with seeding, mulch and/or erosion control blankets. They can be used to stabilize slopes until the permanent vegetation becomes established.

Alternate Sediment Control Measures

Silt fence -- the advantage of fiber rolls over silt fence is that installation is much easier, they do not have to be removed and hydroseeding can be done after their installation.

Other Names

Straw Wattle, Straw Roll

Design

Design life: *1 or 2 seasons*

Contributing flow drainage area*:*

Diameter: 8 to 10 inches up to 20 inches

Length: 20 to 30 feet

Materials

Fiber rolls: The netting may be UV-degradable polypropylene, biodegradable burlap, jute or coir. The filling may be straw, flax, rice, coconut-fiber or compost.

Stakes: 1”x1” wooden stakes 24” long (18” if soils are rocky) or 3/8” rebar or ¾” to 1 ½” diameter live willow cuttings

Installation

Dig trenches across the slope (on the contour) to a depth of 3 to 5 inches. If the slope is steep or there is high rainfall, make trenches 5 to 7 inches deep. Add a slight downward angle to the trench at the ends to avoid ponding in the middle of the slope.

Start installation downslope. Determine the spacing of the rolls based on the slope gradient and soil type. Typically, place rolls 10 feet apart on 1:1 slopes, 20 feet apart on 2:1 slopes, 30 feet apart on 3:1 slopes. Space rolls closer in softer soils, farther in rocky soils.

Place the rolls in the trenches. Where two rolls meet, place the ends abutted tightly, not overlapped. At the end of the roll, turn the end upslope to prevent runoff from going around the roll end.

Stake the roll every four feet. Leave 3 inches of the stake above the roll. It may be easier to make a pilot hole through the roll and into the soil first. Fiber rolls around storm drains and inlets must be staked into the ground

Inspection

Ensure that the roll ends remain abutted tightly. Ensure that the rolls are in contact with the soil and thoroughly entrenched. Rolls need to be inspected after a significant rainfall. Look for scouring underneath the rolls.

Maintenance

Equipment cannot drive over the installed fiber rolls. If inspections reveal crushed, torn, slumping or split rolls, the damaged sections must be replaced.

Remove sediment accumulated upslope of the roll when it reaches one-half the distance between the top of the fiber roll and the ground surface.

Removal

Usually fiber rolls are left in place. If they are removed, the accumulated sediment must first be collected and disposed. After removal, the trenches and stake holes should be filled to blend with the slope and revegetated

BMP AK-9
Mulching

Objectives and Applications

Mulching is the application of a uniform protective layer of straw, wood fiber, wood chips, or other acceptable material on or incorporated into the soil surface of a seeded area to allow for the immediate protection of the seed bed.

The purpose of mulching is to protect the soil surface from the forces of raindrop impact and overland flow, foster the growth of vegetation, increase infiltration, reduce evaporation, insulate the soil, and suppress weed growth. Mulching also helps hold fertilizer, seed, and topsoil in place in the presence of wind, rain, and runoff, and reduces the need for watering. Mulching may be utilized in areas that have been seeded either for temporary or permanent cover.

Mulches include straw, hay, wood fiber, paper fiber, wood/ paper fiber blends, peat moss, wood chips, bark chips, shredded bark, manure, compost and corn stalks. This type of mulch is usually spread by hand or by machine (mulch blower) after seed, water, and fertilizer have been applied. Soil binders or tackifiers, composed of a variety of synthetic and organic materials, including emulsions or dispersions of vinyl compounds, rubber, asphalt, or plastics mixed with water are often added to commercial mulch products. Tackifiers aid in the stabilization process, and are not used as a mulch alone, except in cases where temporary dust and erosion control is required. Hydroseeding, sometimes referred to as hydromulching, consists of mixing a tackifier, specified organic mulch, seed, water, and fertilizer together in a hydroslurry and spraying a layer of the mixture onto a surface or slope with hydraulic application equipment. The choice of materials for mulching should be based on soil conditions, season, type of vegetation, and the size of the area.

Common Failures - Generally due to faulty installation or maintenance.

- Mulches are not properly watered after application, resulting in drying out and possible blowing or washing away of materials.
- Depth of mulching material is either insufficient or excessive, resulting in low seed germination rates.
- Hydroseeding slurry not applied uniformly, resulting in spotty germination and inadequate ground cover.

Other Considerations

- Mulch should be applied immediately after seeding to improve seed germination.
- Hydroseeding can be performed in one step, and is effective provided that materials are properly mixed and equipment is in good working order.
- Depth of the applied mulch should be not less than 1 in. and not more than 2 in.
- Chemical soil stabilizers or soil binders, when used alone, are less effective than other types of mulches. These products are primarily useful for tacking organic mulches.
- A tackifier should be used in conjunction with seeding, fertilizing, and mulching or hydro-seeding on any slopes steeper than 3:1.
- Check labels on chemical mulches and binders for environmental concerns. Take precautions to avoid damage to fish, wildlife, and water resources.
- Some materials such as wood chips may absorb nutrients necessary for plant growth.

Relationship to Other ESC Measures

Mulching may be performed in conjunction with seeding, fertilizing, surface roughening, and grading practices. Concentrated flows of runoff should be directed away from mulched areas.

Alternate Sediment Control Measures

Erosion Control Blankets; Sodding

Other Names

Hydromulching; Chemical Stabilization

Design

Design life: *1 season (6 months) or less*

Site applicability: *Areas which have been disturbed and require temporary or permanent cover*

Materials and application rates: *as per Section 619 and Section 727 of Alaska Standard Specifications for Highway Construction, and Special Provisions for project*

Materials

Most Commonly Specified Mulches – Wood Fiber, Paper Fiber, Wood/Paper Fiber Combination Blends, Peat Moss

Other Mulches – Straw, Hay, Wood Chips, Bark Chips, Shredded Bark, Corn Stalks, Compost, Manure

Tackifiers – Vinyl Compounds, Rubber, Asphalt, or Plastics mixed with water

Installation

Complete the required grading as shown on the plans and ensure that erosion control measures intended to minimize runoff over the area to be mulched are in place. Apply mulch at the rates specified in the special provisions either by hand or by machinery immediately after the seed and fertilizer have been applied (two step method), or as part of the hydroslurry incorporating seed, fertilizer, mulch, and water (one step method). Apply specified tackifier if not already incorporated into the mulch matrix or hydroslurry. Provide additional watering as specified to ensure optimal seed germination conditions.

Inspection

Inspect all mulches weekly, and after each rainstorm to check for rill erosion, dislocation, or failure.

Maintenance

Replace mulch that has been loosened or dislodged. In addition, reseed areas if necessary. Water mulched areas periodically to ensure that moisture content will be maintained and seed germination and grass growth will continue.

Removal

Mulching is usually left in place to naturally decompose and become part of the soil structure.

BMP AK-10
Temporary Seeding

Objectives and Applications

To establish a temporary vegetative cover on disturbed areas by seeding with appropriate and rapid growing annual grasses, usually annual ryegrass.

The purpose of temporary seeding is to eventually stabilize the soil once the vegetation is established and reduce damage from wind and/or water until permanent stabilization is accomplished. By itself, temporary seeding is not soil stabilization, because the seeds aren't effective until they sprout and grow. Seeding is applicable to areas that are exposed and subject to erosion and not being actively worked. It is usually accompanied by surface preparation, fertilizer, and mulch. Temporary seeding may be accomplished by hand or mechanical methods, or by hydraulic application (hydroseeding), which incorporates seed, water, fertilizer, and mulch into a homogeneous mixture (slurry) that is sprayed onto the soil.

Common Failures - Generally due to faulty installation or maintenance.

- Seed is not properly watered after application, resulting in drying out and low germination rates.
- Depth of mulching material is either insufficient or excessive, resulting in low seed germination rates.
  Hydroseeding slurry is not applied uniformly, resulting in spotty germination and inadequate ground cover.

Other Considerations

- Proper seedbed preparation and the use of high quality seed are essential to the success of this practice.
- Temporary seeding should take place as soon as practicable after the last ground-disturbing activities in an area.
- Once seeded, protect the area from foot and equipment traffic.
- Temporary seeding is not recommended if permanent seeding will be completed in the same growing season. Other temporary stabilization measures should be considered.

Relationship to Other ESC Measures

Seeding should be performed in conjunction with mulching, fertilizing, surface roughening, and grading practices. Concentrated flows of runoff should be directed away from seeded areas using diversions.

Alternate Sediment Control Measures

Erosion Control Matting, Plastic Sheeting

Other Names

Temporary Stabilization

Design

Seed Selection: *Annual Ryegrass (Lolium multiflorum)*

Seed Application Rate: *60 lbs/acre (average rate, site specific conditions may require more or less)*

Fertilizer Application Rate: *600 lbs/acre 20-20-10 (nitrogen-phosphorous-potassium [average rate, site specific conditions may require more or less])*

Materials

Seed, water, fertilizer, mulch

Installation

Grade as needed where it's feasible to permit the use of equipment for seedbed preparation. Prepare the seedbed by using surface roughening if soil has been compacted by machinery or heavy foot traffic. If using hand or mechanical methods, apply fertilizer in order to optimize growing conditions, followed by seed, mulch, and water. If using hydroseeding, mix seed, mulch, fertilizer, and water as per the manufacturer's recommendations. Apply slurry as per the manufacturer's recommendations.

Inspection

Inspect newly seeded areas on a regular basis and after each storm event to check for areas where protective measures (mulch) have failed or where plant growth is not proceeding at the desired rate.

Maintenance

Water seeded areas daily until initial ground cover is established if rainfall does not provide moisture for seed germination. Reseed areas where growth is absent or inadequate. Provide additional fertilizer if needed.

Removal

Removal of temporary vegetation is usually not necessary. Continue inspections and remedial action until the site is stabilized by permanent vegetation.

BMP AK-11
Seeding Around Culverts

Objectives and Applications

To establish a temporary vegetative cover on disturbed areas around culverts by seeding with appropriate and rapid growing annual grasses, usually annual ryegrass.

The purpose of seeding around culverts is to minimize the erosion potential in an area of concentrated flows of storm water.

Common Failures - Generally due to faulty installation or maintenance.

- Seed is not properly watered after application, resulting in drying out and low germination rates.
- Depth of mulching material is either insufficient or excessive, resulting in low seed germination rates.
- Hydroseeding slurry is not applied uniformly, resulting in spotty germination and inadequate ground cover.

Other Considerations

- Proper seedbed preparation and the use of high quality seed are essential to the success of this practice
- Temporary seeding should take place within 24 hours after culvert installation, or maintenance, is complete.
- Seed 25 feet from the end of the pipe, or the disturbed area, whichever is larger.
- Once seeded, protect the area from foot and equipment traffic.
- Protect temporary seeding, if seed has not fully developed into 70% of background vegetation, prior to anticipated storm events in order to minimize erosion potential with a concentrated flow of storm water.

Relationship to Other ESC Measures

Seeding should be performed in conjunction with mulching, fertilizing, surface roughening, and grading practices.

Alternate Sediment Control Measures

- Rolled Erosion Control Products
- Rock Drains
- Geotextile Armoring

Other Names

Temporary Seeding

Design

Seed Selection: Annual Ryegrass (Lolium multiflorum)

Seed Application Rate: 1/2 lb/1000 sq.ft. (average rate, site specific conditions may require more or less, steep slopes require more but do not exceed 1 ½ lb/1000 sq.ft.)

Fertilizer Application Rate: 10 lb/1000 sq.ft. 20-20-10 (nitrogen-phosphorous-potassium [average rate, site specific conditions may require more or less])

Materials

Seed, Water, Fertilizer, Mulch

Installation

Prepare the seedbed by using surface roughening. If using hand or mechanical methods, apply fertilizer in order to optimize growing conditions, followed by seed, mulch, and water. If using hydroseeding, mix seed, mulch, fertilizer, and water as per the manufacturer's recommendations. Apply slurry as per the manufacturer's recommendations.

Inspection

Inspect newly seeded areas on a regular basis and after each storm event to check for areas where protective measures (mulch) have failed or where plant growth is not proceeding at the desired rate.

Maintenance

Water seeded areas daily until initial ground cover is established if rainfall does not provide moisture for seed germination. Reseed areas where growth is absent or inadequate. Provide additional fertilizer if needed.

Removal

Removal of temporary vegetation is usually not necessary. Continue inspections and remedial action until the site is stabilized by permanent vegetation

BMP AK-12
Surface Roughening and Terracing

Objectives and Applications

Surface roughening and terracing includes establishing a rough soil surface by creating horizontal grooves, furrows, depressions, steps, or terraces running parallel to the slope contour over the entire face of the slope.

These measures are intended to aid in the establishment of vegetative cover from seed, to reduce runoff velocity and increase infiltration, and to reduce erosion and provide for sediment trapping. By themselves, surface roughening measures are not soil stabilization. They provide simple, inexpensive and immediate short-term erosion control for bare soil where vegetative cover is not yet established. A rough, loose soil surface gives a mulching effect that provides more favorable moisture conditions than hard, smooth surfaces and that aids in seed germination. The measure chosen to achieve these goals depends on the grade of the slope, the type of slope (cut or fill), soil and rock characteristics, future mowing and maintenance requirements, and type of equipment available. The most common measures utilized include:

Tracking – This is done by running machinery (such as bulldozers) up and down slopes to leave horizontal depressions in the soil, and is generally limited to sandy soils in order to avoid undue compaction of the soil surface.

Groove Cutting – This is done by cutting serrations along the contour with a blade attached to a dozer or other equipment.

Contour Furrows – This is done by cutting furrows (a series of ridges and depressions) along the contour of a slope, and is applicable to any area that will safely accommodate disks, tillers, spring harrow, or the teeth of a front end loader.

Stair Step Grading – This is done by cutting "steps" along the contour of a slope, and is applicable to slopes with a gradient greater than 3:1 which have material soft enough to be bulldozed and which will not be mowed.

Gradient Terracing – This is done by constructing earth embankments or ridges and channels along the face of a slope at regular intervals to intercept surface runoff and conduct it to a stable outlet. This measure is applicable to long, steep slopes where water erosion is a problem, and should not be constructed in areas with sandy or rocky soils.

Common Failures - Generally due to faulty installation or maintenance.

- Roughening washed away by heavy rain, necessitating reroughening and reseeding.
- Failure of upslope control measures (diversions), resulting in excessive flows over area and erosion of soil.

Other Considerations

- These measures are of limited effectiveness in anything more than a moderate storm.
- These measures may not be suitable for noncohesive or highly erodible soils.
- All fills should be compacted to reduce erosion, slippage, settlement, subsidence, and other related problems.
- The finished cut and fill slopes to be vegetated should not exceed 2:1.
- Use slope breaks, such as diversions, benches, or contour furrows to reduce the length of cut and fill slopes to limit sheet and rill erosion.

Relationship to Other ESC Measures

Diversions at the upper perimeter of the area function to prevent runoff from causing erosion on the exposed soil. Silt fences and sediment basins at the lower perimeter of the area function to prevent off site sedimentation.

Alternate Sediment Control Measures

Erosion Control Blankets

Other Names

Contour Grading, Serration

Design

Measure Applicability: *Construction slopes greater than 5 vertical feet.*

Measure Selection: *Should be determined by slope grade, soil type, mowing requirements, and slope type (cut or fill).*

Materials

Construction equipment (bulldozer, front end loader, crawler tractor).

Installation

Cut Slope Roughening (Areas Not To Be Mowed)
Stair step grade or groove cut slopes that are steeper than 3:1. Use stair step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair step grading. Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall. Do not make individual vertical cuts more than 2 ft. high in soft materials or more than 3 ft. high in rocky materials. Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening (Areas Not To Be Mowed)
For slopes greater than 3:1, ensure that the face of the slope consists of loose, uncompacted fill 4 in. – 8 in. deep. Use contour furrows or tracking to roughen the face of the slope, if necessary. Do not blade or scrape the final slope face.

Cuts, Fills, And Graded Areas (To Be Mowed)
Make mowed slopes no steeper than 3:1. Roughen these areas with shallow grooves by using tilling, disking, or harrowing implements. Make grooves close together, less than 12 in., and not less than 1 in. deep. Avoid excessive roughness on areas to be mowed.

Roughening With Tracked Machinery
Limit roughening with tracked machinery to sandy soils in order to avoid undue compaction of the soil surface. Operate machinery up and down the slope to leave horizontal depressions in the soil. Do not back blade during the final grading operation.

Inspection

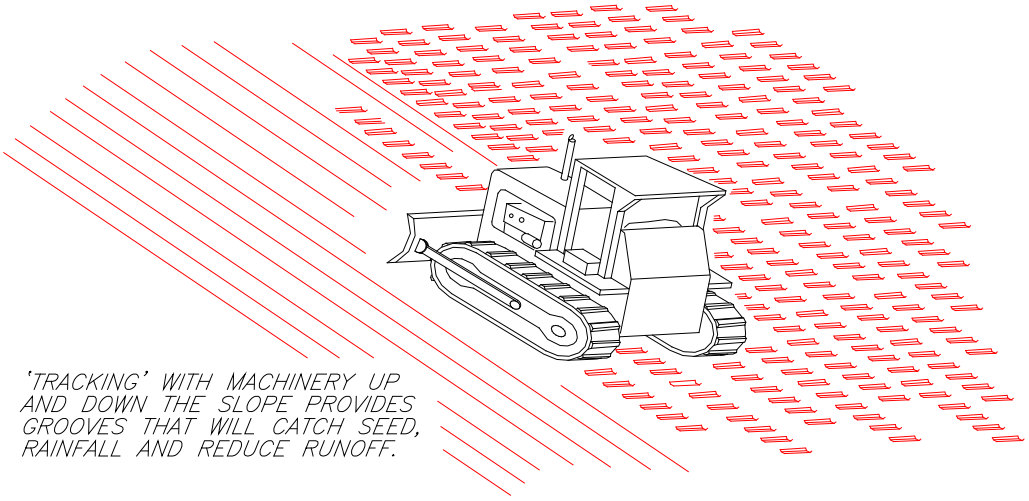
Inspect the areas every week and after each rainfall that produces runoff during construction operations.

Maintenance

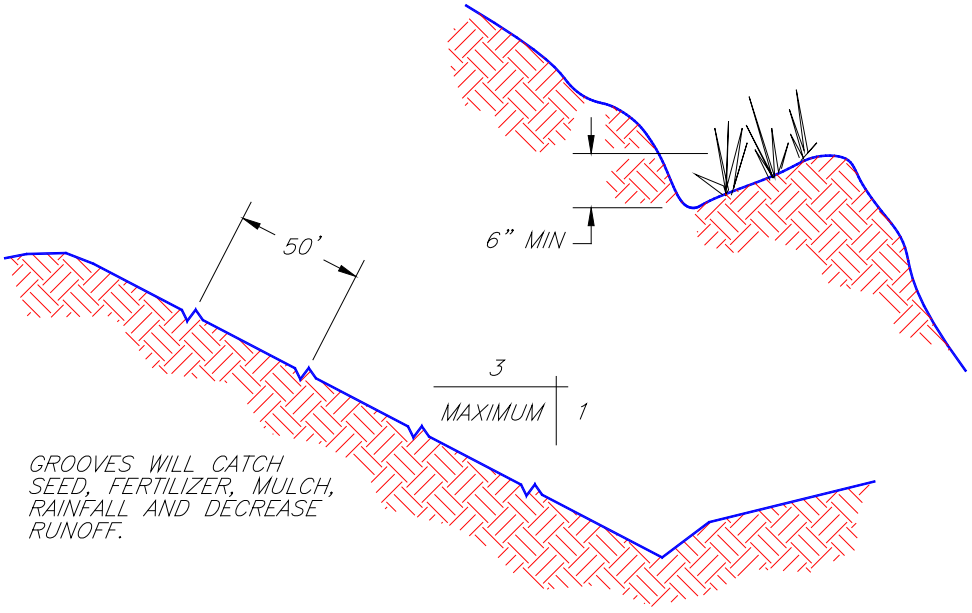
Seed, fertilize, and mulch areas which are graded as quickly as possible. Regrade and reseed immediately if rills appear.

Removal

Surface roughening and gradient terracing will remain an integral part of the slope after final stabilization with vegetation.



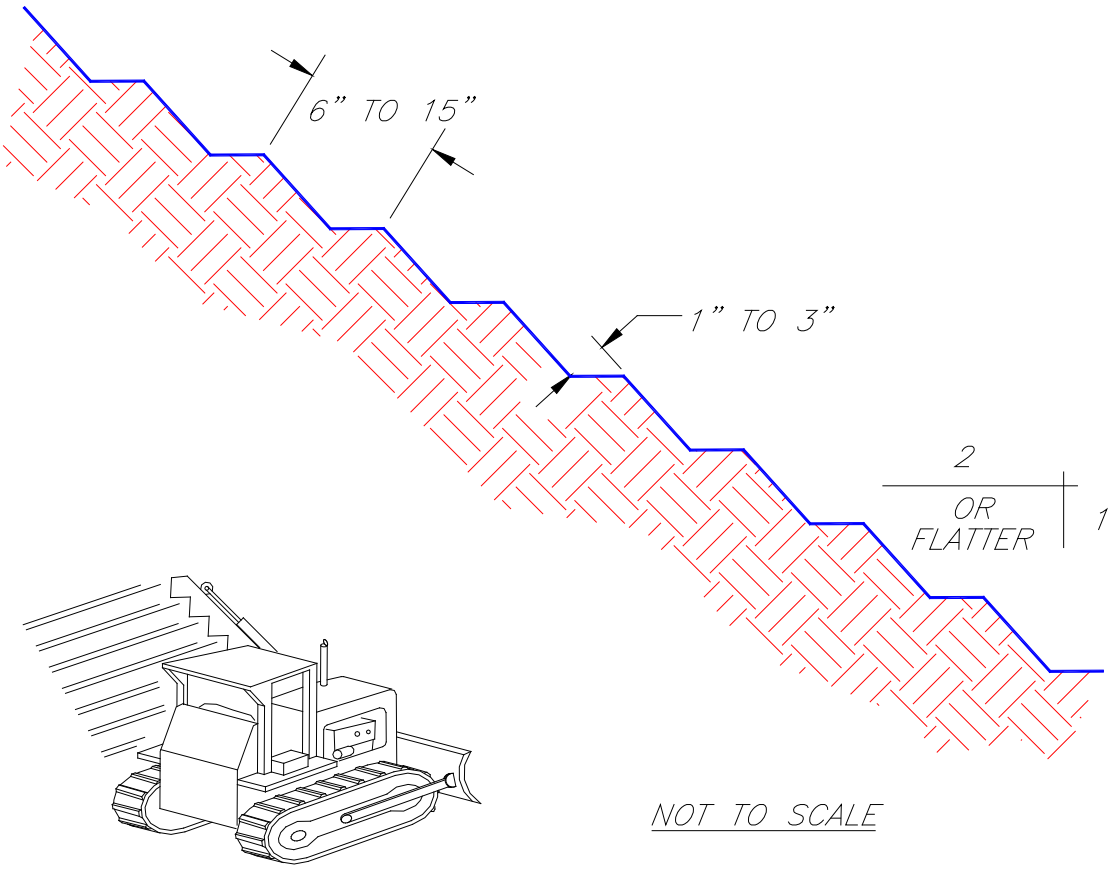
TRACKING



CONTOUR FURROWS

FILE: SRFROUGH

SURFACE ROUGHENING AND TERRACING

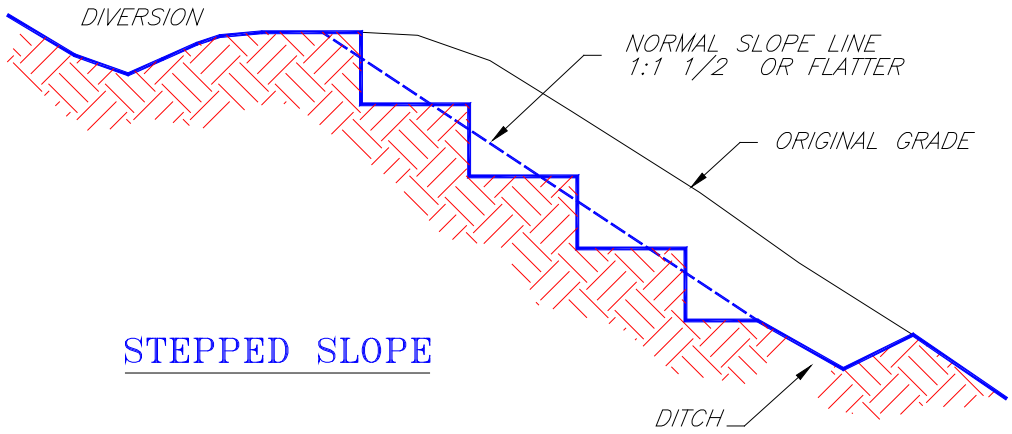


NOTE:

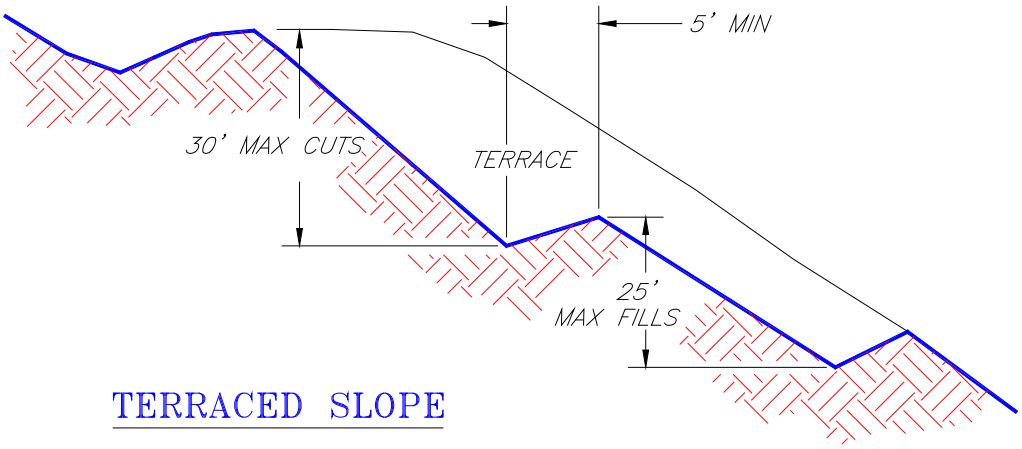
GROOVE BY CUTTING SERRATIONS ALONG THE CONTOUR. IRREGULARITIES IN THE SOIL SURFACE CATCH RAINWATER, SEED, MULCH AND FERTILIZER.

FILE: SERSLOPE

SURFACE ROUGHENING AND TERRACING



STEPPED SLOPE



TERRACED SLOPE

NOT TO SCALE

NOTES:
1. VERTICAL CUT DISTANCE SHALL BE LESS THAN HORIZONTAL DISTANCE.
2. VERTICAL CUT SHALL NOT EXCEED
2 FT IN SOFT MATERIAL AND
3 FT IN ROCKY MATERIAL.

FILE: STPSLOPE

SURFACE ROUGHENING AND TERRACING

BMP AK-13
Compost Blankets

Purpose and Description

- A compost blanket is a layer of compost or composted material applied loosely to the surface of disturbed slopes or other erodible areas.
- It is used to control erosion and retain sediment resulting from sheet flow.[1]
- Can be used in place of mulch, rolled erosion control products, soil binders or other sediment and erosion control tools.[1]
- A compost blanket helps limit erosion by:
    - Promoting growth of vegetation.[1]
    - Filling in rills and ridges to eliminate channelized flow in the slope.[1]
    - Providing a permeable surface for infiltration of sheet flow.[1]
    - Protects slope from destructive and soil compacting forces of rainfall.

Applicability

- Compost blankets can be applied to any soil surface (rocky, frozen, flat, steep, etc…) and are therefore applicable to all regions of Alaska.[1]
- Not applicable in locations of concentrated flow.[1]
- Most effective when applied to slopes between 4:1 and 1:1.[1]
- On slopes greater than 2:1 other BMP's such as RECP's should be considered to be used in conjunction with compost blanket. [1]
- It is also necessary to establish vegetation on slopes greater than 2:1 as soon as possible. [1]
- Pedestrian and vehicular traffic must be eliminated on slopes greater than 2:1.[1]

Design and Installation

- Mature, sanitized compost that meets all local, state and federal regulations must be used.[1]
- Compost must be compatible with pH and nutrient requirements of the vegetation that will be used for stabilization.
- Compost must be applied to the surface in a uniform thickness of 1-4 inches depending on annual rainfall and presence of vegetation on the site (see table 2).[1]
- Compost may be spread using a pneumatic blower, spreader unit (bulldozer, manure spreader, etc), or by hand using a shovel.[1]
- Compost Blanket must extend at least 3 feet over the shoulder of the slope to ensure that storm water does not flow underneath the blanket.[1]
- Seed can be spread over the blanket after it is installed or incorporated into the compost before application (suggested).[1]
- Compost blankets may provide better sediment and erosion control when used in conjunction with other best management practices.

Table 2. Example Compost Blanket Depths for Various Rainfall Rates [1]

Annual Rainfall / Flow Rate	Total Precipitation (Rainfall Erosivity Index)	Compost Blanket Depth (Vegetated Surface)	Compost Blanket Depth (Unvegetated Surface)
Low	1 – 25 in. (20 – 90)	½ – ¾ in. (12.5 – 19 mm)	1 in. – 1½ in. (25 – 37.5 mm)
Average	26 – 50 in. (91 – 200)	¾ – 1 in. (19 – 25 mm)	1½ in – 2 in. (37 – 50 mm)
High	>51 in. (>201)	1 – 2 in. (25 – 50 mm)	2 – 4 in. (50 – 100 mm)

Maintenance and Inspection

- Compost Blanket should be inspected regularly and particularly following heavy rainfall or storm events.[1]
- Compost should be reapplied to areas where the compost has washed out.

References

1. [1]*USEPA (United States Environmental Protection Agency), October 2000, National Menu of Best Management Practices, Compost Blankets,* *http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=118&minmeasure=4*

BMP AK-14
Rolled Erosion Control Products

Objectives and Applications

Rolled erosion control products (RECPs) are manufactured long sheets or coverings that can be unrolled onto unvegetated cut or fill slopes where erosion control or soil stabilization is needed. They are used where temporary seeding and mulching alone are inadequate, or where mulch must be anchored and other methods such as crimping or tackifying are unfeasible. There are many types of RECPs—and an ever-changing array of new products and manufacturers' claims. Applications range from coverings for temporarily inactive construction sites to long term protection of steep slopes.

Common RECP categories include:

Temporary RECP *designed for short term use--e.g. up to 1 year.*

Degradable (generally preferred and more prevalent) *made from naturally decomposing materials*. Different fibers yield different characteristics and breakdown patterns. RECPs are either:
photodegradable—broken down by sunlight exposure or
biodegradable—deteriorated by action of biological organisms.

Erosion control blanket(ECB): matrix of long-fibered mulch held by netting on one or both sides or sewn though the filler. Common ECB mulches are straw, wood shavings (excelsior), flax, coconut fiber (coir) and jute.

Jute matting: woven jute fiber mesh.

Netting: fixative mesh cover to keep mulch in place. Made of cotton, jute, coir or photodegradable plastics. Opening sizes vary by design purpose.

Non-degradable *does not decompose with exposure to the elements*

Plastic sheeting: occasionally used for urgent, short-term protective treatment or for overwintering disturbed slopes.

Semi-permanent RECP *lasts 4-8 years--commonly made from coir products*

Permanent RECP *does not decompose for 10 years or more*

Synthetic Turf Protection Mat: mechanically, structurally or chemically bound continuous mesh of processed or polymeric fibers. Mats are thick, heavy, long lasting. Some are designed to structurally support vegetation.

Common Failures - Generally due to faulty installation or maintenance.

- Seed washout/soil erosion due to water flow beneath poorly secured RECPs.
- Failed/inhibited growth of vegetative cover.
- Unintended RECP destruction by equipment, the elements, wildlife etc.

Other Considerations

- Expensive RECPs aren't necessarily more effective than lower cost RECPs.
- Installation requirements, surface features & preparation, installer experience.
- RECP features; suitability constraints, strength, durability, degradation rate.
- Vegetation viability practices including: soil, temperature, insulation and sunlight requirements for plant species; site suitability including topsoil adequacy; fertilizer/growth-enhancer needs; moisture and timing requirements for germination and plant growth; over-saturation; destructive moisture levels cause seed/plant mold/mildew/rot.
- RECP seasonal durability; e.g. overwintering plastic sheeting tears.
- Ease of RECP puncture (desirable for bio-remedial shoot penetrations).
- Slope length and steepness relative to vegetative support & blanket saturation, weight and durability.
- Runoff velocities, volumes, moisture infiltration rates.
- Compatibility and interaction with other on-site erosion measures. E.g. plastic netting and mattings don't retain moisture or heat useful for germination enhancement; plan means to disperse snow accumulations or high runoff volumes at the toe of plastic covered slopes.
- Visual impact, including public's perception of erosion protection needs and available

levels/sophistication of erosion technologies.
- Compatibility with land use (e.g. urban or well-populated sites).
- Interactions with wildlife: habitat, susceptibility to foraging, grazing, nesting

Relationship To Other ESC Measures

RECPs can complement seeding and revegetation. Byproducts of RECP decomposition add mulch benefits and soil enhancement. RECPs can be used in conjunction with benching or other runoff velocity slowing or redirecting measures. RECPs aid dust control.

Alternate Sediment Control Measures

Stabilization measures for vegetation preservation. Crimped, tracked or tackified mulches. Benching, terracing, diversions or other means to reduce slope steepness, length and runoff velocity and volume.

Other Names

Terms used interchangeably: e.g. matting, blanket, sheet. Specified names e.g. Erosion Control Geotextile, ECB, Straw blanket, Mulch Mat

Design

Consult product distributors for recommendations or use the Product Selection Tool on the Erosion Control Technology Council website (http://www.ectc.org) regarding RECP selection and performance criteria suitable for site-specific parameters. Evaluate:

- *Duration of need--Temporary (e.g. 2 mo., 6 mo., 1 yr.) vs. Permanent (2-10 yrs.)*
- *Slope length*
- *Slope gradient (e.g. less than 1:1, 2:1, 3:1 or steeper)*
- *Soil type & erodibility*
- *Seasonal temperature & weather patterns; regional precipitation distribution*
- *Vegetation needs, especially where germination conditions are not optimal*

Blankets: on grades > 2:1 are subject to high stresses.

Synthetic turf protection mat: distribute loads across (saturated) fill slopes and reinforce root systems. Use where slope protection is needed at least 2 years. Use on highly erodible slopes (>3:1), for steep slide rehabilitation, for heavy/high velocity runoff, landfill or high elevation reclamations, drought areas, long cut/fill slopes, bridge abutments etc.

Plastic sheeting: 6 mil or thicker. Not recommended as cover for seeded slopes.

Wood fiber mat: drawbacks: bulky, difficult to place, 10–20% less effective erosion control than other mat types. May need to replace soil nitrogens leached by degrading wood.

Netting: Plastic netting doesn't hold heat or moisture, may require increased thickness of netted straw mulch 25%. Plastic netting and wood fiber mulches alone should not be used where runoff water flow exceeds 7 ft./sec.

Jute matting: Apply alone for seed germination enhancement or dust control, but not where runoff is significant.

Materials

Matting: Burlap, Jute Mesh Fabric, Woven Paper or Sisal Mesh Netting, Knitted Straw Mat, Woven/ Curled Wood Blanket.

Anchors: U-shaped wire staples, triangular wooden stakes, willow stakes.

Staples: U-shaped steel wire (normally 8 in. long, 1 in. wide, 11 gage or heavier, a 12-in. length, 9 gage or heavier).

Installation

RECPs -Excavate a 6" X 6" check slot trench at a level area well behind the slope crest or slopetop berm. Backfill and tamp over RECP roll end, leaving no gaps to allow under-blanket runoff invasion. Unroll sheeting downslope, parallel to grade and runoff path. Midslope splicings overlap successive sheets in the direction of flow so that upslope ends extend past the trench 16" anchoring the next downslope section. Stagger adjacent splicings. Anchor RECP terminal ends in slope toe key trenches and repeat the entire process until the entire slope has continuous coverage.

Lay RECPs to follow ground contours closely but do not stretch taut across surface depressions. Staple RECPs to maintain firm contact with underlying

surfaces. Staple patterns vary depending upon slope length, grade, soil type and runoff rates. Staple blanket perimeters at no less than 12 in. intervals across the top and 3 ft. spacings along RECP sides and bottom. Staple intervals should be sufficient to prevent runoff flows beneath the blanket. Staple through 5 in. adjacent overlaps strips and staple every 3 ft. down sheet centerlines. Adjacent staple lines should stagger.

Plastic Sheeting - Anchor in slopetop trench (as above) to seal from runoff flow beneath sheeting. Duct tape 18 in. overlap seams to seal against wind and rain. Cover the entire exposed area. Hold sheets close to slope by suspending weights (tires, sandbags etc.) from ropes affixed to uphill anchors set no more than 10 ft. apart. Secure so wind doesn't lift the cover, expose slopes or tear plastic.

Inspection

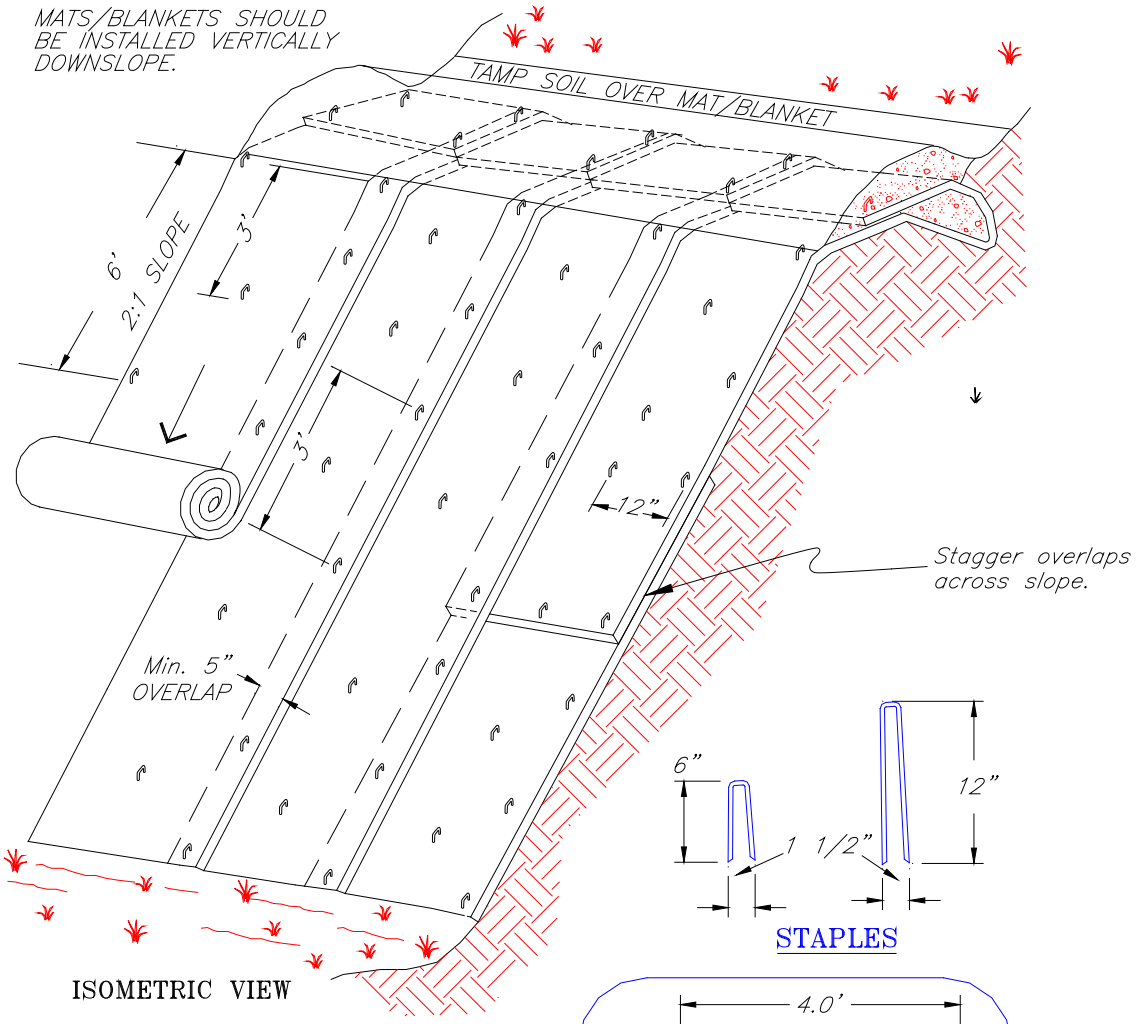
Check that surfaces adhere, fasteners remain secure and covering is in tight contact with soil surface beneath. Look for damaged areas and exposed soil surfaces. Pay special attention to seams and uphill edges.

Maintenance

Repair, re-anchor, reinstall or replace matting. Re-seed where needed. It is especially important to protect overwintering plastic covered slopes, since the saturated soils may be easily erodible upon thaw.

Removal

Non-degradable RECPS must be removed manually when no longer useful and disposed at an offsite landfill or by other approved methods. Degradable RECPs naturally deteriorate over time and can add soil enrichment.



TYPICAL SLOPE SOIL STABLIZATION

NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

NOT TO SCALE

FILE: BLNKTSLP

ROLLED EROSION CONTROL PRODUCTS

BMP AK-16
Vegetative Buffer Strip

Objectives and Applications

A vegetative buffer strip is 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.

Buffer strips act as living sediment filters that intercept and detain storm water runoff. They reduce the flow and velocity of surface runoff, promote infiltration, and reduce pollutant discharge by capturing and holding sediments and other pollutants in the runoff water. They may be natural, undeveloped land, or may be graded and planted with grass or other vegetation; and may be placed at many locations between the source of sediment (road surface, side slopes) and a natural or constructed waterway or other drainage area that could be impacted by deposits of sediment. Buffer strips may be used at any site that can support vegetation, but are best suited where soils are well drained and where the bedrock and water table are well below the surface. Buffer strips are particularly effective on flood plains, along stream banks, and at the top and bottom of a slope. Buffer strips may be either temporary or permanent.

Common Failures - Generally due to faulty installation or maintenance.

- Excessive sediment or oil and grease loads resulting in clogging.
- Introduction of storm water flows onto buffer strip before vegetation is established.

Other Considerations

- Not effective for filtering high velocity flows from large, paved areas, steep slopes, or hilly areas.
- May be more viable than silt fence where silt fence installation and removal will cause more harm than good.
- Avoid flow concentration
- Buffer strips generally only trap coarse sediments. Depending upon vegetative type, clay and fine silt particles will generally pass through a buffer strip during periods of heavy rain.
- Preserve natural vegetation in clumps, blocks or strips where possible, particularly in areas adjacent to waterways.
- Do not use planted or seeded ground as a buffer strip for sediment trapping until the vegetation is established.
- Extensive constructed buffers may increase development costs.

Relationship to Other ESC Measures

Buffer strips are used in conjunction with diversion measures such as earth dikes, diversions, and slope drains for slope protection. Silt fences placed upslope may prevent sediment overloading.

Alternate Sediment Control Measures

Diversion; Slope Drain

Other Names

Buffer Zone, Vegetated Filter Strip.

Design

Location: *Should be determined by considering slope, soil type, anticipated flow, and vegetation type.*

Capacity: *2 year peak runoff storm*

Width: *18 ft. - 60 ft., depending on type of vegetation and length of slope*

Grading: *smooth and uniform*

Permitting: *Wetland use as a vegetative buffer strip requires approval from the Corps of Engineers.*

Flow Distribution: *evenly distributed; avoid flow concentration*

Materials

Natural vegetation, seed or sod; fertilizer, mulch, water; fencing or flagging

Installation

Natural Vegetation

Delineate undisturbed natural areas of vegetation that have been identified on the plans with flagging prior to the start of construction activities. Ensure that other sediment control measures to be used in conjunction with the buffer strip are in place and functioning properly. Minimize construction activities and traffic in the buffer strip and immediate surrounding areas.

New Buffer Strip

Ensure that sediment control measures such as silt fence and diversions are in place to protect waterways or drainage areas until the buffer strip is established. Clear and grade the land according to the plans and specifications. Establish vegetation using specified seeding, mulching, watering, and fertilizer.

Inspection

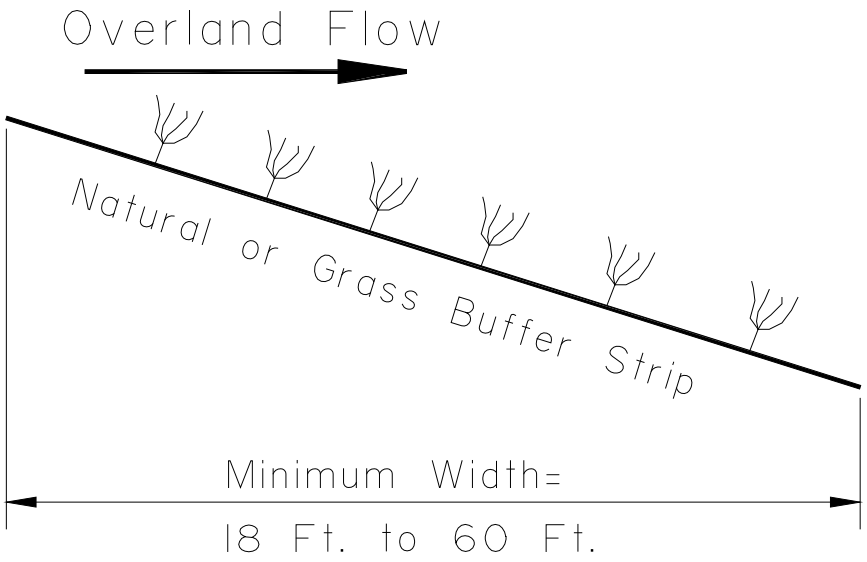
Inspect natural vegetation buffer strip areas at regular intervals to ensure that the fencing or flagging used to delineate non-disturbance areas are in place. Check for damage by equipment and vehicles. Inspect new buffer strip areas for the progress of germination and plant growth. Ensure that water flowing through the area is not forming ponds, rills, or gullies due to erosion within the buffer strip.

Maintenance

Replace or repair fencing or flagging as necessary. Repair any damage by equipment or vehicles. Provide additional seed, fertilizer, and water to ensure adequate establishment of vegetation. Repair and reseed areas damaged by erosion or ponding of water.

Removal

Temporary buffer strips - Provide and compact fill to existing or specified grade. Seed and mulch.



VEGETATIVE BUFFER STRIP

BMP AK-18

Silt Fence

Objectives and Applications

A silt fence is a perimeter control geotextile fence to prevent sediment in silt-laden sheet flow from entering sensitive receiving waters.

Silt fencing downslope from erosion-susceptible terrain traps sheet flow runoff before the drainage exits the project site. Intercepted drainage pools along the uphill side of the fence and standing water promote sediment settling out of suspension. Drainage in contact with the fence is to some degree filtered by the geotextile—the fabric's small pores not only block larger-sized eroded particles but also severely restrict water exfiltration rates.

Barrier locations are informally chosen based on site features and conditions (e.g. soil types, climate, terrain features, sensitive areas, etc.), design plans, existing and anticipated drainage courses, and other available erosion and sediment controls. Typical barrier sites are catchpoints beyond the toe of fill or on sideslopes above waterways or drainage channels. Silt fences are not recommended for wide low-flow, low-velocity drainageways, for concentrated flows, in continuous flow streams, for flow diversion, or as check dams. Use at drop or curb inlets is not appropriate for high volumes of stormwater.

Common Failures - Generally due to faulty installation or maintenance.

- Posts installed on uphill side of trench (instead of downhill side) or fabric attached to downhill side of posts (rather than uphill side).
- Soil is not tamped next to fence after backfilling trench, allowing water to flow underneath.
  - Slope erosion occurs below the fenceline due to drainage that bypasses the barrier end or water build-up that "blows out" a poorly secured fence bottom.
- Fence function impairment due to sediment build-up, maintenance neglect etc.
- Fence topples due to poor installation and/or high levels of impounded back-up water or sediment.
- Inappropriate for intended function (e.g. used for check dam, flow diversion, etc.).
- Uneven distribution of pooled drainage along non-level fenceline ground reduces efficiency.
  - End of fence is not "J-hooked" upslope allowing water to run around the end.
- Poor support system (e.g. soil too rocky to secure posts, fabric stapled to trees, etc.).

Other Considerations

Use of sediment control measures and the level of effort should be commensurate to the potential problem. ***Silt fence is not to be used solely as a project delineator****. (Use barriers, flagging, etc. instead.)*

- Use of a silt fence sediment control measure is usually more complex, expensive and maintenance-prone than other slope stabilization measures.
- Slope stabilization should occur at the earliest possible time.
- Fenceline proximity to sensitive areas needing protection during fence installation, maintenance, removal, etc. (e.g. avoid equipment encroachment on wetlands).
- Undesirable effects of fence placement (e.g. a trench in ground that won't readily "heal" after fence removal; undesirable effects of water back-up, ditch overflow, etc.).
- Equipment access route/space required for fence installation, maintenance and removal.

Relationship to Other ESC Measures

Sediment control measures are secondary to erosion prevention or soil stabilizing measures. Silt fences may be used as part of a sequential system with other temporary or permanent measures such as vegetation, check dams, settling ponds, etc. Occasional flow velocity increases may be offset using corrective measures such as rock berms or other redirecting energy absorbers.

Alternate Sediment Control Measures

Fiber rolls. Brush bundles to filter small amounts of sediment in shallow gullies or ditches. Temporary settlement basin. Gravel berm. Triangular sediment filter dike (stand-alone wire mesh structure covered with filter fabric on uphill side [labor intensive to construct and maintain]).

Other Names

Geotextile for Sediment Control (sect 633 specifications), Filter Fence, Sediment Fence.

Design

Design life: *1 season (6 months) or less*

Contributing sheet flow drainage area: *not to exceed 0.25 acres/ 100 ft. of fence*

Maximum Slope Length for Silt Fence

Slope (%)	18 in. Fence	30 in. Fence
2 (or less)	250 ft.	500 ft.
5	100 ft.	250 ft.
10	50 ft.	150 ft.
15	35 ft.	100 ft.
20	25 ft.	70 ft.
25	20 ft.	55 ft.
30	15 ft.	45 ft.
35	15 ft.	40 ft.
40	15 ft.	35 ft.
45	10 ft.	30 ft.

Undisturbed buffer zone: *At least 3.5 ft. from fence to downstream sensitive area*

Support posts: *at least 18 in. in the ground. Minimum trench size (x-section): 6"x 6"*

Buried fabric: *18 in. (3 sides of trench, if fabric is not pre-attached to posts)*

M**aximum spacing between posts**: *6 ft.*

Maximum fence height: *3 ft. above ground*

Fabric joint overlap: *minimum 6 in. at post not allowed in pooled drainage areas*

Maximum height of ponding water: *18 in.*

Maximum allowable depth of sediment accumulation against fence: *50% of accumulation capacity*

Materials

Geotextile fabric sect 729-2.04 specification (AASHTO M 288 for Temporary Silt Fence except that minimum permittivity is .05/sec)

Support posts wood, steel or synthetic, adequate to support fence under field conditions, available attached to fabric in some products

Staples or other means to attach fabric to posts

Wire-backed (or polymeric backed) silt fence - for use where a longer duration of use is expected or where undermining forces, such as wind, are expected

Installation

Install fences before excavation/ fill work. Erect fenceline downslope along a level contour and perpendicular to anticipated sheet flow drainage path(s). Orient end sections uphill slightly and install sufficient length to keep drainage from spilling around barrier ends. Where ground surfaces are uneven, install shorter fences following contours (rather than install one long, contour-crossing fence that directs drainage to accumulate in low spots). Locate fence 3-10 ft. beyond toe of fill to leave room for a broad, shallow sedimentation pool and for equipment access during fence maintenance and removal. Leave buffers between fencing and sensitive receiving areas. Compacting the soil next to the fence is critical. If using the front wheel of a tractor or roller, it is best to compact the upstream side first, then each side twice (a total of four trips).

Installation can be completed using the trench method or the "slicing" method. The trench method is a manual, labor-intensive method. The "slicing" method is a mechanical method. Both methods are effective when correctly followed.

Trench method: Drive support posts into the ground, excavate a trench on the uphill side along the line of the stakes, attach geotextile, and bury fence bottom. Soil backfill trench and compact to secure fence bottom. (Compacted soil is preferred to gravel fill. Using sandbags or cement blocks to anchor the fence bottom is undesirable because of the tendency for undermining). Keep fence fabric taut. Do not field-sew seams. Overlap joints at support posts but do not place overlapped joints across pooled drainage areas.

Slicing method: This method requires the "Tommy" silt fence machine or equivalent. The machine utilizes a blade that plows or slices the fabric directly into the soil. Though this minimizes soil disturbance, soil crumbs created by the blade can be manually backfilled into the slice and the tractor can then be used to mechanically compact the soil. Check the

installation prior to compaction and use a flat-bladed shovel, if necessary, to tuck fabric deeper into the ground. Support posts are then installed along the length of the fence following similar procedures for the trench method.

For wire-backed silt fence, extend the wire into the trench a minimum of three inches and post spacing may be lengthened to 8'.

Inspection

A properly installed fence intercepts sheet drainage, contains sediment on site and does not permit spillover or bypass. Inspect as needed daily, weekly, or during/ following major rainfall events.

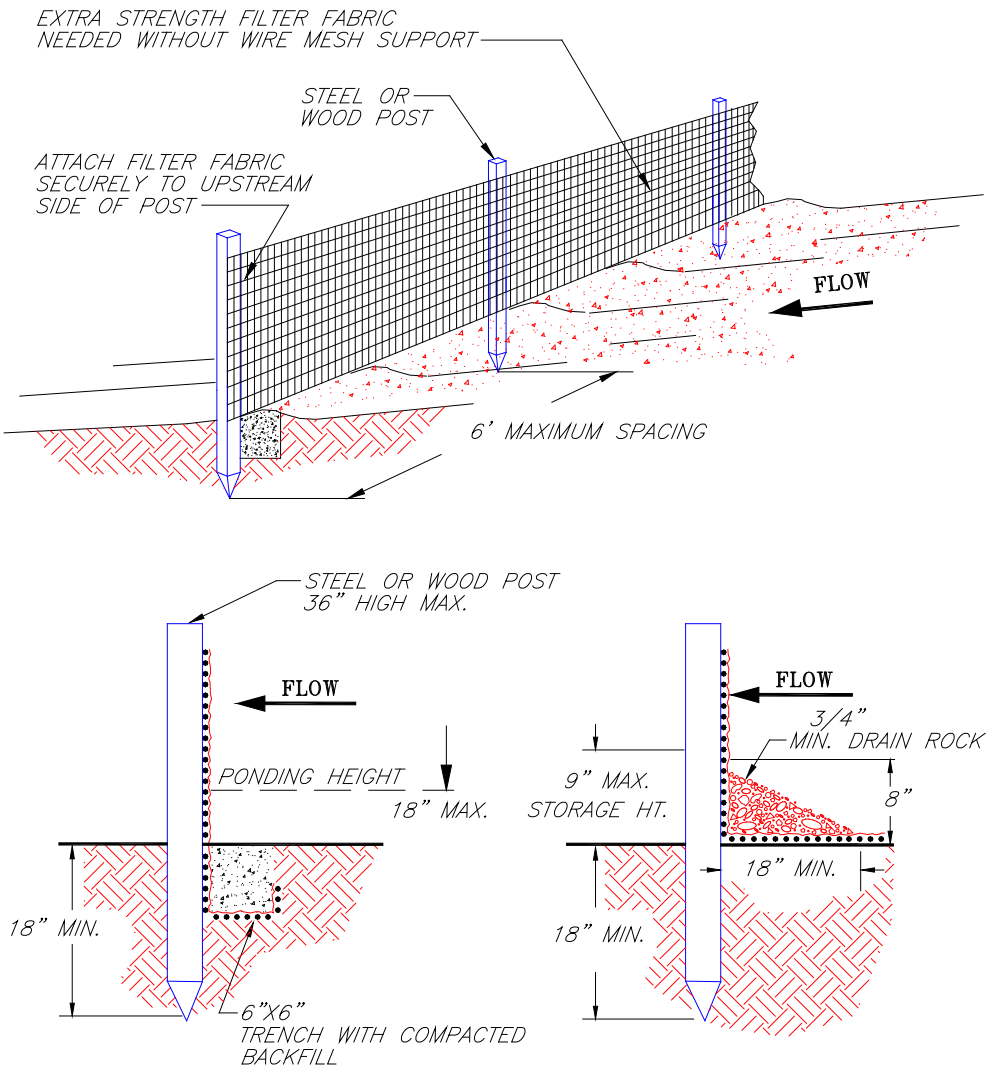
Observe for fenceline continuity. Inspect fences for collapse, damage, undermined areas, compromised integrity, or other installation or functional inadequacies. To ensure the fence is keyed in usually requires close inspection (not looking from a distance upslope). Look for evidence of sediment or erosion flow leading off the downhill edge of the fence. (This may be an indicator of drainage bypass or fence undermine.) Note depth of sediment build up at the fence. Look for signs of inadequate protection of off-site sensitive areas. Observe turbidity levels of protected waterways and determine sources of sediment/siltation.

Maintenance

Repair functional deficiencies immediately. Reinforce fenceline as needed to prevent undesirable sedimentation of sensitive areas. Replace torn or punctured fabric. Remedy fence sags as needed. Periodically remove accumulated sediment and dispose of silt waste in approved manner/location (typically in a non-erosion area).

Removal

Do not remove until the disturbed area is permanently stabilized or sediment protection is no longer needed. Unless directed otherwise, cut fabric at ground level, remove supports and spread sediment. Seed bare ground immediately. Discard filter fence as directed. Avoid damage to sensitive (e.g. wetland or surface water) areas. Stabilize areas.



TRENCH DETAIL

INSTALLATION WITHOUT TRENCHING

NOTES:

1. SILT FENCE FOLLOWS SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM SEDIMENT ACCUMULATION.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT AND CAN BE PERMANENTLY STABILIZED.

NOT TO SCALE

FILE: SILTFENC

SILT FENCE

BMP AK-21
Vehicle Tracking Entrance/Exit

Objectives and Applications

A vehicle tracking entrance/exit provides a stabilized gravel area or pad underlined with a geotextile and located where traffic enters or exits the construction site.

This measure establishes a buffer area for vehicles to deposit their mud and sediment, and minimize the amounts transported onto public roadways. Mud on a road can create a safety hazard as well as a sediment problem. This measure may be used with or without washdown, depending upon severity of problem.

Common Failures - Generally due to faulty installation or maintenance.

- Inadequate depth and length of gravel.
- Failure to periodically "top dress" (provide additional gravel) when sediment accumulates on the surface.
- Failure to repair and/or clean out any structures used to trap sediment.

Other Considerations

- Avoid entrances/exits which have steep grades or which are located where sight distance may be a problem.
- Provide drainage to carry water to sediment trap or other suitable outlet.

Design

Gravel Size*: 2 in.-3 in.*

Pad Thickness*: minimum 6 in.*

Pad Width: *minimum 12 ft.*

Pad Length: *minimum 50 ft.*

Materials

Gravel, geotextile

Installation

Clear the entrance and exit area of all vegetation, roots, and other material and properly grade it. Place geotextile prior to placement of gravel. Place the gravel to the specific grade shown on the plans, and smooth it. Provide drainage to carry water to a sediment trap or other outlet.

Inspection

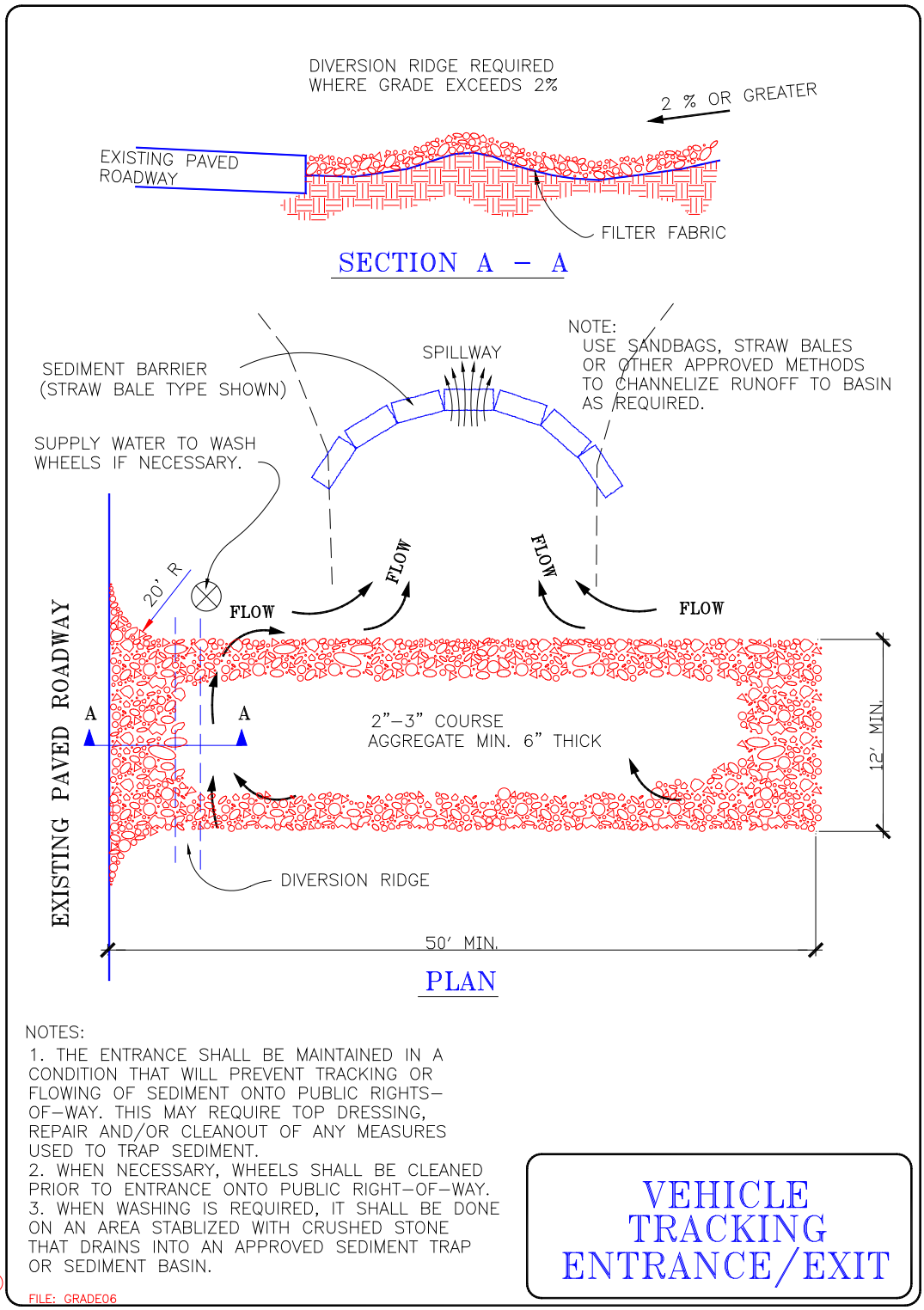
Inspect pads and sediment trapping structures daily for sediment accumulation and material displacement.

Maintenance

Maintain each entrance in a condition that will prevent tracking of mud or sediment onto public rights-of-way. Replace gravel material when surface voids are visible. Top dress with 2 in. gravel when pad becomes laden with sediment. Repair and/or clean out any structures used to trap sediment. Remove all mud and sediment deposited on paved roadways within 24 hours.

Removal

Remove pad and any sediment trapping structures after they are no longer needed, or within 30 days after final site stabilization. Remove and stabilize trapped sediment on site.



Vehicle Tracking Entrance/Exit

BMP AK-22
Tire Wash

Purpose and Description

- A tire wash (located at vehicle tracking entrance/exit) is designed to remove sediment from the tires and undercarriage of construction vehicles and equipment so that it is not tracked on to public roads or highways.

Applicability

- A tire wash must be used when a vehicle tracking entrance/exit is not preventing sediment from being tracked onto public roads or highways.[2]
- Requires a water supply.

Design and Installation

- Incorporated into vehicle tracking entrance/exit BMP.
- Construct on level ground when possible on a pad of coarse gravel that is about 2 to 3 inches in size
- Underline gravel with geotextile.
- Wash rack shall be designed and constructed/manufactured for anticipated traffic loads.[1]
- A drainage ditch must be constructed that will drain the runoff into a sediment trapping device.[1]
- Require all vehicles with mud or sediment on their tires to use tire wash when leaving the site.

Maintenance and Inspection

- Wash rack and sediment trapping device must be inspected routinely.
- Accumulated sediment must be removed to ensure quality performance.
- Repair Damage as needed.

References

[1]Caltrans Storm Water Quality Handbooks, March 2003, Construction Site Best Management Practices Manual, TC-3 Tire Wash, http://www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

[2]Washington State Department of Ecology, February 2005, Storm Water Management Manual for Western Washington, Construction Storm Water Pollution Prevention, BMP C106: Wheel Wash, http://www.ecy.wa.gov/pubs/0510030.pdf

BMP AK-23
Vehicle and Equipment Maintenance

Purpose and Description

- Vehicle and equipment cleaning areas, procedures and practices are designed to minimize or prevent discharge of pollutants and hazardous wastes into water courses and/or storm drain systems.[1]

Applicability

- Procedures and practices are used everywhere that onsite maintenance and washing takes place.

- When practical, maintenance must be done offsite.

Design and Installation

- When vehicle and equipment maintenance cannot be done offsite or within a structure equipped with proper containment and disposal facilities[1] it must be done at an onsite maintenance area with the following characteristics:
    - Located at least 50ft from any downstream drainages or waterbodies.
    - Protected from storm water run-on and run-off by diversion dikes or berms which are configured to contain spills and pollutants.
    - Have drip pans, absorbent pads and spill kits on site.
    - Absorbent pads, contaminated soil, or any other waste product produced by vehicle or equipment maintenance operations must be disposed of properly.
    - Fuels and lubricants must not be dumped on the ground.[1]
    - Tires must not be buried.[1]
    - Batteries must be disposed up properly or recycled.[1]
    - No liquids (oil, fuel, anti-freeze, etc…) will be poured or otherwise go into a storm drain system. They must be disposed of per manufacturer's instructions.[2]
    - Secondary containment is required when storing oil, fuel and chemicals in drums onsite.[1]

Maintenance an Inspection

- Any vessel used to store waste fluids must be inspected regularly and maintained in a leak-proof condition.[1]

- Inspect construction vehicles and equipment daily and immediately fix any leaks or remove problem vehicle(s) and/or equipment from the site.[2]

- Maintenance area and secondary containment must be inspected regularly.

References

[1]Caltrans Storm Water Quality Handbooks, March 2003, Construction Site Best Management Practices Manual, NS-10 Vehicle and Equipment Maintenance, http://www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

[2]USEPA (United States Environmental Protection Agency), October 2000, National Menu of Best Management Practices, Vehicle Maintenance and Washing Areas at Construction Sites, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=34&minmeasure=4

BMP AK-24
Concrete Washout

Objectives and Applications
The purpose of a concrete washout facility is to contain concrete and fluids from the chutes of concrete mixers and hoppers of concrete pumps when they are rinsed out after delivery. Washout facilities allow for easier disposal of consolidated solids and prevent pollution from run-off. Washout facility can consist of a pre-fabricated container or self-installed containment area, which can be above or below ground. Concrete washout facilities can be used on projects where concrete, stucco, mortar, grout, and cement are used as a construction material.

Common Failures - Generally due to faulty installation or maintenance.

- Overflow and discharge of waste when the facility is not covered prior to anticipated rainfall and/or when accumulated liquid wastes have not been removed.
- Leaking resulting from torn or damaged liners going unnoticed or not being replaced.
- Compromised structural integrity due to miscalculated capacity and installation, particularly for self-installed above-ground facilities.

Other Considerations

Operator education: Use of concrete washout areas as a BMP is only successful if concrete truck operators utilize them. Operators need to be made aware of the presence of these facilities. All concrete truck operators, including those of subcontractors, should be educated on the importance of managing concrete waste and washout procedures.

Spill response: Even with washout facilities present, there is still potential for accidental release of concrete materials including wash water and waste. It is important to have items in the spill kit that are capable of capturing, containing, or treating accidental discharge of concrete materials.

Pre-fabricated washout containers: A growing number of companies offer prefabricated containers specifically for concrete washout. However, prefabricated facilities can be any water tight unit that can contain all liquids and solid waste generated by washout operations. When available, prefabricated containers are delivered to the site and minimize installation efforts. They are also resistant to damage and protect against spills and leaks. Some companies will also offer complete service with their product that could include providing maintenance and regular disposal of waste materials. Such full-service options could relieve the superintendent of these responsibilities. However, when selecting a company that provides such an option, ensure that they are properly disposing of materials and give preference to companies that recycle collected materials.

Below-ground facilities: Use of below-ground containment area helps prevent breaches and reduces the likelihood of run-off. This option is recommended for projects expecting extensive concrete work. However, this option is not recommended for areas with high water tables or shallow groundwater such as near natural drainages, springs or wetlands.

Above-ground facilities: Above-ground containment areas must be sized and installed correctly, and diligently maintained in order to be effective. However, this option, particularly if a prefabricated container is unavailable, is better suited in areas with potentially high water tables to prevent leaching of wastewater into groundwater or in areas where excavation is not practical.

Design

Location: Do not place concrete washout facilities within 50 feet of storm drains, open ditches, or waterbodies. Concrete washout facilities should be placed in a location that provides convenient access for concrete trucks, preferably near the area where the concrete is being poured. Larger sites with extensive

concrete work should have concrete washout facilities at multiple locations for ease of use.

Capacity: Concrete washout facilities should be in sufficient quantity and size to handle the expected volume of solids, wash water, and rainfall to prevent overflow. To estimate capacity, Concrete Washout Systems, Inc., (2006) estimates that 7 gallons of wash water are used to wash one truck chute and 50 gallons are used to wash out the hopper of a concrete pump truck.

Containment area: The containment area of the washout facility can consist of a pre-fabricated container or a self-installed containment area. The prefabricated container selected should be of a sufficient size and capacity to contain the expected volume of generated waste from washout operations. Self-installed containment areas can either be installed above- or below-ground, and should be constructed to dimensions that provide sufficient capacity to contain the expected volume of generated waste from washout operations. For larger sites, it is recommended that self-installed containment (both above and below ground) areas be 10 feet wide by 10 feet long, with a depth to provide the sufficient capacity. However, above-ground self-installed containment areas shall not exceed a size and capacity in which the selected outside barrier becomes structurally unsound when filled with waste materials.

Cover: A temporary cover should be used as necessary to prevent rain or other precipitation from filling the facility and causing wash water to discharge into the environment. The cover should be secure, non-collapsing, non-water collecting cover.

Materials

Pre-fabricated washout containers: Prefabricated containers are usually made of sturdy materials such as plastic or metal.

Self-Installed facilities: Self-installed washout facilities can be made of a variety of materials depending on availability and site needs.

Barrier/Sidewalls: The sidewalls of an above-ground containment area can be made from staked straw bales, earthen berms, barrier walls and wood planks to name a few.

Liner: The liner should be an impermeable plastic sheeting of at least 10-mil thickness, and should be free of holes, tears, and other defects that may compromise the impermeability of the material. Because they are more prone to leaks, it is recommended that above-ground facilities use sheeting of at least 30-mil thickness or double or triple line the containment area if using the 10-mil thick sheeting.

Anchors: Anchors are used to secure the liner and certain sidewall materials for self-installed above ground containment areas. Types of anchors that may be used include, but are not limited to, sand bags, 6” wire staples, and wood or metal stakes.

Installation

Site considerations: The number and size of facilities provided should depend on the expected demand for storage capacity. Locate each facility at a location as described above.

Each facility on-site should have highly visible signage to indicate washout locations. It is recommended that signs be at least 48” by 24” and have 6” black letters on white background, and be placed at a height of 3 feet above ground level and within 30 feet of the facility.

If the washout facility is located on undeveloped property or off-pavement, stabilized access should be provided to prevent tracking (see Vehicle Tracking Entrance/Exit BMP).

Prefabricated washout containers: Installation of these containers is minimal. These containers are usually delivered to the site and would only need to be placed in the appropriate location. Some pre-fabricated models may involve assembly of the container and/or its accessories.

Self-Installed facilities:

Above-ground washout:
Construct the sidewalls to the desired size and capacity for the containment area. If not using an earthen berm for this purpose, ensure that the sidewall material is secure and each unit is butted tightly end to end. For use of straw bales in construction of the sidewall, it is required/recommended that the sidewall construction conform to the installation instructions provided below to ensure structural integrity. Line the entire area with the lining material, bringing the sheeting up over the sidewalls and securing the ends with sandbags, staples or other appropriate anchor.

Straw bales:
Excavate a trench the width of the bale and the length of the proposed barrier to a minimum depth of 4 in. Place the bales in a single row, lengthwise, with ends of the adjacent bales tightly abutting one another. Ensure that all bales are wire-bound or string tied. Install bales so that the bindings are oriented around the sides, rather than along the tops and the bottoms of the bales, in order to prevent deterioration of the bindings. Place and anchor each bale with at least two wood stakes, minimum dimensions, 2 in. x 2 in. x 36 in., or with # 4 reinforcing bars, driving the first stake toward the previously placed bale to force the bales together. Drive the stakes or reinforcing bars a minimum of 12 in. into the ground. Fill any gaps between bales with tightly wedged straw.

Below-ground washout:
Excavate a flat, subsurface pit to the desired size and capacity for the containment area. The resulting sidewall should not exceed 3:1 slopes. The base of the pit should be free of rocks and debris that may cause damage to the liner. It is recommended that the excavated material be used to create a berm along three sides of the pit, leaving the side providing access relatively flat. It is recommended that the berm be at least one foot high. Line the entire area with the lining material, bringing the sheeting up over the sidewalls and berm, and securing the ends with sandbags or other appropriate anchor.

Identify the washout pit with lath and flagging on three sides, leaving the approach unflagged.

Inspection
Check all concrete washout facilities frequently to determine if they have been filled to 70 percent capacity, which is when the materials need to be removed.

For any self-installed facility, inspect the plastic liner to ensure it's securely anchored and intact. Inspect the sidewalls for leaks and to ensure they have not been damaged by construction activities. For any prefabricated facility, inspect the unit for leaks and potential damage.

Check to ensure that each facility sign is still secure and visible.

Note whether facilities are being used regularly and whether operators have washed their chutes or hoppers in other locations. This helps to determine if additional facilities need to be placed, perhaps in more convenient locations, if additional signs or new signs need to be installed, or if operator education is needed.

Maintenance
Existing facilities must be cleaned once the washout is two-thirds full.

Concrete washouts are designed to promote evaporation where feasible. However, if stored liquids are not evaporating and are reaching capacity, vacuum and dispose of liquids in an approved manner (check with the local sanitary sewer authority to determine if there are special disposal requirements for concrete wash water).

Remove hardened solids whole or break them up first depending on the type of equipment available. Then re-use the solids on-site or haul them away for recycling or disposal. When removing materials from a self-installed washout, either construct another facility for use during cleaning or, if the existing structure is still intact, it can be re-used.

Before relining the structure, inspect it for signs of weakening or damage and make any necessary repairs. Then line the structure with

new plastic sheeting, checking that it is free of holes, tears and other damage. It is important that new plastic be used after every cleaning as equipment can damage the existing liner.

Any damaged facilities should be repaired promptly. If necessary, a new facility may be required until the existing facility is operational. Contain any spill or discharge of concrete waste materials

Replace or display new signage as needed.

Removal

An operational concrete washout facility should remain in place until all concrete for the project (or phase of the project) is poured. When the concrete facility is no longer needed, the hardened concrete should be removed and properly disposed of. Materials used to construct any above-ground containment area should be removed from the site and properly disposed of.

Holes, depressions or other ground disturbance caused by the creation or removal of the facility should be backfilled and stabilized with an approved stabilization BMP.

Compost Blankets

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Erosion Control

Description

Application of a 2 inch-thick compost blanket to a 1:1 rock slope using a pneumatic blower (Austin, Texas, 2002). Source: McCoy, Texas Commission on Environmental Quality (TECQ), 2005

A compost blanket is a layer of loosely applied compost or composted material that is placed on the soil in disturbed areas to control erosion and retain sediment resulting from sheet-flow runoff. It can be used in place of traditional sediment and erosion control tools such as mulch, netting, or chemical stabilization. When properly applied, the erosion control compost forms a blanket that completely covers the ground surface. This blanket prevents stormwater erosion by (1) presenting a more permeable surface to the oncoming sheet flow, thus facilitating infiltration; (2) filling in small rills and voids to limit channelized flow; and (3) promoting establishment of vegetation on the surface. Composts used in compost blankets are made from a variety of feedstocks, including municipal yard trimmings, food residuals, separated municipal solid waste, biosolids, and manure.

Compost blankets can be placed on any soil surface: rocky, frozen, flat, or steep. The method of application and the depth of the compost applied will vary depending upon slope and site conditions. The compost blanket can be vegetated by incorporating seeds into the compost before it is placed on the disturbed area (recommended method) or the seed can be broadcast onto the surface after installation (Faucette and Risse, 2001).

In general, compost-based erosion and sediment control systems have several advantages over more traditional stormwater best management practices (BMPs) such as geotextile blankets. Advantages provided by compost blankets include the following (Alexander, 2003; Faucette, 2004):

- The compost retains a large volume of water, which helps reduce runoff, prevents or reduces sheet and rill erosion, and aids in establishing vegetation in the blanket.
- The compost blanket acts as a buffer to absorb rainfall energy, which prevents soil compaction and crusting and facilitates rainfall infiltration.

- Compost blankets facilitate plant growth by capturing and retaining moisture and providing a suitable microclimate and nutrients for seed germination.
- The compost stimulates microbial activity, which increases decomposition of organic matter, increases nutrient availability for plants, and improves the soil structure.
- Compost can remove pollutants, such as heavy metals; nitrogen; phosphorus; oil and grease; and fuel, from stormwater, thus improving downstream water quality (W&H Pacific, 1993; USEPA, 1998).

Applicability

Compost blankets are most effective when applied on slopes between 4:1 and 1:1, such as stream banks; road embankments; and construction sites, where stormwater runoff occurs as sheet flow. Compost blankets are not applicable for locations with concentrated flow. Because the compost is applied to the ground surface and not incorporated into the soil, a compost blanket provides excellent erosion and sediment control on difficult terrain—including steep, rocky slopes.

Siting and Design Considerations

Compost Quality: Compost quality is an important consideration when designing a compost blanket. Use of sanitized, mature compost will ensure that the compost blanket performs as designed and has no identifiable feedstock constituents or offensive odors. The compost used in compost blankets should meet all local, state, and Federal quality requirements. Biosolids compost must meet the Standards for Class A biosolids outlined in 40 Code of Federal Regulations (CFR) Part 503. The U.S. Composting Council (USCC) certifies compost products under its Seal of Testing Assurance (STA) Program. Compost producers whose products have been certified through the STA Program provide customers with a standard product label that allows comparison between compost products. The current STA Program requirements and testing methods are posted on the USCC EXIT Disclaimer website.

The nutrient and metal content of some composts are higher than some topsoils. This, however, does not necessarily translate into higher metals and nutrient concentrations or loads in stormwater runoff. A recent study by Glanville, et al. (2003) compared the stormwater runoff water quality from compost- and topsoil-treated plots. They found that although the composts used in the study contained statistically higher metal and nutrient concentrations than the topsoils used, the total masses of nutrients and metals in the runoff from the compost-treated plots were significantly less than plots treated with topsoil. Likewise, Faucette et al. (2005) found that nitrogen and phosphorus loads from hydroseed and silt fence treated plots were significantly greater than plots treated with compost blankets and filter berms. In areas where the receiving waters contain high nutrient levels, the site operator should choose a mature, stable compost that is compatible with the nutrient and pH requirements of the selected vegetation. This will ensure that the nutrients in the composted material are in organic form and are therefore less soluble and less likely to migrate into receiving waters.

The American Association of State Highway Transportation Officials (AASHTO) and many individual state Departments of Transportation (DOTs) have issued specifications for compost blankets (AASHTO, 2003; USCC, 2001). These specifications describe the quality and particle size distribution of compost to be used in compost blankets. The compost blanket media parameters developed for AASHTO specification MP 10-03 are shown in Table 1 as an example (Alexander, 2003). Research on these parameters continues to evolve; therefore, the DOT or Department of Environmental Quality (or similar designation) for the state where the compost blanket will be installed should be contacted to obtain any applicable specifications or compost testing recommendations.

Table 1. Example Compost Blanket Media Parameters

Parameters[1,4]	Units of Measure	Surface to be Vegetated	Surface to be left Unvegetated
pH[2]	pH units	5.0 – 8.5	N/A
Soluble salt concentration (electrical conductivity)[2]	dS/m (mmhos/cm)	Maximum 5	Maximum 5
Moisture content	%, wet weight basis	30 – 60	30 – 60
Organic matter content	%, dry weight basis	25 – 65	25 – 100
Organic matter content	% passing a selected mesh size, dry weight basis	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 – 100% passing - ¾ in. (19 mm), 65 – 100% passing - ¼ in. (6.4 mm), 0 – 75% passing Maximum particle length of 6 in (152 mm)	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 – 100% passing - ¾ in. (19 mm), 65 –100% passing - ¼ in. (6.4 mm), 0 – 75% passing Maximum particle length of 6 in (152 mm)
Stability[3] Carbon dioxide evolution rate	mg CO_2–C per g organic matter per day	<8	N/A
Physical contaminants (manmade inerts)	%, dry weight basis	<1	<1

Source: Alexander, 2003

[1] Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost [USCC EXIT Disclaimer].

[2] Each specific plant species requires a specific pH range. Each plant also has a salinity tolerance rating, and maximum tolerable quantities are known. When specifying the establishment of any plant or turf species, it is important to understand its pH and soluble salt requirements and how they relate to the compost in use.

[3] Stability/maturity rating is an area of compost science that is still evolving; therefore, other test methods could be considered. Also, users should not base compost quality conclusions on the result of a single

stability/maturity test.

[4] Landscape architects and project (field) engineers may modify the allowable compost specification ranges based on specific field conditions and plant requirements.

Siting and Design: Specific site characteristics, such as existing vegetation; climate; structural attributes of the site; annual rainfall; and rainfall erosivity, are considered when determining the appropriate depth for the compost blanket. Erosivity is the term used to describe the potential for soil to erode from disturbed, unvegetated earth into waterways during storms. Example compost blanket depths for various rainfall scenarios developed for AASHTO specification MP 10-03 are shown in Table 2 (Alexander, 2003).

Installation: The compost should be applied to the soil surface in a uniform thickness, usually between 1 and 3 inches thick. A typical application depth is 2 inches (Glanville et al., 2003). The compost can be distributed by hand using a shovel or by mechanical means such as a spreader unit (e.g., bulldozer or manure spreader) or pneumatic blower. The compost blanket should extend at least 3 feet over the shoulder of the slope to ensure that stormwater runoff does not flow under the blanket (Alexander, 2003). The pneumatic blower is best for applying compost to steep, rocky, or difficult to reach locations because the worker can stand below the slope and blow the compost up onto the slope in an even thickness or use a vehicle to reach higher slopes (see photograph on page 1). Very coarse compost should be avoided on slopes that will be landscaped or seeded, as it will make planting and crop establishment more difficult. Thicker and/or coarser compost blankets are recommended for areas with higher annual precipitation or rainfall intensity, and coarser compost is recommended for areas subject to wind erosion (Alexander, 2003).

Table 2. Example Compost Blanket Depths for Various Rainfall Rates

Annual Rainfall/ Flow Rate	Total Precipitation (Rainfall Erosivity Index)	Compost Blanket Depth (Vegetated Surface)	Compost Blanket Depth (Unvegetated Surface)
Low	1 – 25 in. (20 – 90)	½ – ¾ in. (12.5 – 19 mm)	1 in. – 1½ in. (25 – 37.5 mm)
Average	26 – 50 in. (91 – 200)	¾ – 1 in. (19 – 25 mm)	1½ in – 2 in. (37 – 50 mm)
High	>51 in. (>201)	1 – 2 in. (25 – 50 mm)	2 – 4 in. (50 – 100 mm)

Source: Alexander, 2003

Although seed can be broadcast on the compost blanket after installation, it is typically incorporated into the compost before it is applied, to ensure even distribution of the seed throughout the compost and to reduce the risk of the

seed being washed from the surface of the compost blanket by stormwater runoff. In some applications (e.g., on a steep slope), better sediment and erosion control can be achieved by using the compost blanket in conjunction with another BMP, such as lock-down netting, compost filter berms, or compost filter socks. Lock-down netting will help hold the compost in place, while compost filter berms or compost filter socks placed across the slope will slow down the flow of water. Compost filter berms or filter socks can also be placed at the top and bottom of the embankment.

Limitations

Limitations for compost blanket applications are dependent on the site specifications. Compost blankets are not generally used on slopes greater than 2:1 or in areas where concentrated runoff or water flow will occur (Glanville et al., 2003). They can, however, be used on steeper slopes (1:1) if netting or confinement systems are used in conjunction with the compost blanket to further stabilize the compost and the slope or if the compost particle size and compost depth are specially designed for the application.

Maintenance Considerations

The compost blanket should be checked periodically and after each major rainfall. If areas of the compost blanket have washed out, another layer of compost should be applied. In some cases, it may be necessary to add another stormwater BMP, such as a compost filter sock or silt fence. On slopes greater than 2:1, establishing thick, permanent vegetation as soon as possible is the key to successful erosion and sediment control. Restricting or eliminating pedestrian traffic on such areas is essential (Faucette and Ruhlman, 2004).

Effectiveness

Numerous studies conducted by a variety of universities and State DOTs have reported the effectiveness of compost blankets; only a few of the recent studies are cited here. A University of Georgia research trial (Faucette and Risse, 2002) reported that correctly applied compost blankets provide almost 100 percent soil surface coverage, while other methods (e.g., straw mats and mulches) provide only 70 to 75 percent coverage. Uniform soil cover by the compost blanket is a key component to effective erosion and sediment control because it helps maintain sheet flow and prevents stormwater from forming rills under the blanket. Compost blankets also help protect the structural stability of the slope, particularly when vegetated (BioCycle, 2002).

An Iowa State University study (Glanville et al., 2003), sponsored by the Iowa Department of Natural Resources and Iowa DOT, compared compost-treated road embankments to conventionally treated embankments (i.e., topsoil added to surface). The study exposed the test plots to high intensity rainfall (4 inches/hour) lasting at least 30 minutes. The results showed that the 2- and 4-inch thick compost blankets reduced runoff from the embankment by 80 percent. The erosion rate from the compost blanket was less than 1 percent of that from the non-composted areas, and weed growth on compost-treated areas was approximately 25 percent of that on untreated areas.

Cost Considerations

The cost of a compost blanket is comparable to a straw mat and less expensive than a geotextile blanket. Faucette (2004) reports that the cost of a compost blanket in Georgia ranges from $0.83 to $4.32 per cubic yard installed. The actual cost will depend upon the quality of compost required and the thickness of the application. According to the TCEQ (McCoy, 2005), a 1-inch thick unseeded compost blanket costs $0.99 per square yard installed, and a 1-inch thick seeded compost blanket costs $1.08 per square yard in Texas.

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Spill Prevention and Control Plan

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Good Housekeeping/Materials Management

Description

Spill Prevention and Control Plans (SPCP) should clearly state measures to stop the source of a spill, contain the spill, clean up the spill, dispose of contaminated materials, and train personnel to prevent and control future spills.

Absorbent snakes can be used to protect storm drains from spills (Spill911, no date)

Applicability

SPCPs are applicable to construction sites where hazardous wastes are stored or used. Hazardous wastes include pesticides, paints, cleaners, petroleum products, fertilizers, and solvents.

Siting and Design Considerations

When developing an SPCP, a construction site operator should identify potential spill or source areas, such as loading and unloading, storage, and processing areas; places where dust or particulate matter is generated; and areas designated for waste disposal. Also, evaluate spill potential for stationary facilities, including manufacturing areas, warehouses, service stations, parking lots, and access roads. Conduct this evaluation during the project planning phase, and reevaluate it during each phase of construction.

The SPCP should define material handling procedures and storage requirements and outline actions necessary to reduce spill potential and impacts on stormwater quality. This can be achieved by:

- Recycling, reclaiming, or reusing process materials, thereby reducing the amount of process materials that are brought into the facility
- Installing leak detection devices, overflow controls, and diversion berms
- Disconnecting any drains from processing areas that lead to the storm sewer

- Performing preventative maintenance on storm tanks, valves, pumps, pipes, and other equipment
- Using material transfer procedures or filling procedures for tanks and other equipment that minimize spills
- Substituting less or non-toxic materials for toxic materials

The SPCP should document the locations of spill response equipment and procedures to be used and ensure that procedures are clear and concise. The plan should include step-by-step instructions for the response to spills at a facility. In addition, the spill response plan should:

- Identify individuals responsible for implementing the plan
- Define safety measures to be taken with each kind of waste
- Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or municipal sewage treatment facilities for assistance
- State procedures for containing, diverting, isolating, and cleaning up the spill
- Describe spill response equipment to be used, including safety and cleanup equipment

The plan can be a procedural handbook or a poster to be placed in several locations at the site.

Limitations

Training is necessary to ensure that all workers are knowledgeable enough to follow procedures outlined in the SPCP. Make equipment and materials for cleanup readily accessible, and mark them clearly so workers can follow procedures quickly and effectively.

Maintenance Considerations

Update the SPCP regularly to accommodate any changes in the site, procedures, or responsible staff. Conduct regular inspections in areas where spills might occur to ensure that procedures are posted and cleanup equipment is readily available.

Effectiveness

An SPCP can be highly effective at reducing the risk of surface and ground water contamination; however, to ensure that procedures are followed, a construction site operator should provide worker training, appropriate materials and equipment for cleanup, and adequate staff time.

Cost Considerations

Spill prevention and control plans can be inexpensive to implement; however, adequate time and resources are needed to properly handle and dispose of spills.

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Riprap

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Minimum Measure: Construction Site Stormwater Runoff Control

Subcategory: Erosion Control

Description

Riprap is a layer of large stones used to protect soil from erosion in areas of concentrated runoff. Riprap can also be used on slopes that are unstable because of seepage problems.

Riprap can be used to stabilize drainageways and outlets to prevent erosion

Applicability

Use riprap to stabilize cut-and-fill slopes; channel side slopes and bottoms; inlets and outlets for culverts, bridges, slope drains, grade stabilization structures, and storm drains; and streambanks and grades.

Siting and Design Considerations

Riprap can be unstable on very steep slopes, especially when rounded rock is used. For slopes steeper than 2:1, consider using materials other than riprap for erosion protection.

Consider the following design recommendations for riprap installation (Smolen et al., 1988):

- *Gradation*. Use a well-graded mixture of rock sizes instead of one uniform size.
- *Quality of stone*. Use riprap material that is durable so that freeze and thaw cycles do not decompose it in a short time; most igneous stones, such as granite, have suitable durability.
- *Riprap depth*. Make the riprap layer at least two times as thick as the maximum stone diameter.
- *Filter material*. Apply a filter material--usually a synthetic cloth or a layer of gravel--before applying the riprap. This prevents the underlying soil from moving through the riprap.
- *Riprap Limits*. Place riprap so it extends to the maximum flow depth, or to a point where vegetation will be satisfactory to control erosion.

- *Curves*. Ensure that riprap extends to five times the bottom width upstream and downstream of the beginning and ending of the curve and the entire curved section.
- *Riprap Size*. The size of the riprap material depends on the shear stress of the flows the riprap will be subject to, but it ranges from an average size of 2 inches to 24 inches in diameter (Idaho Department of Environmental Quality, no date).
- *Wire Riprap Enclosures*. Consider using chain link fencing or wire mesh to secure riprap installations, especially on steep slopes or in high flow areas.

Limitations

The steepness of the slope limits the applicability of riprap, because slopes greater than 2:1 can cause riprap loss due to erosion and sliding. If used improperly, riprap can actually increase erosion. In addition, riprap can be more expensive than other stabilization options.

Maintenance Considerations

Inspect riprap areas annually and after major storms. If riprap has been damaged, repair it promptly to prevent a progressive failure. If repairs are needed repeatedly at a location, evaluate the site to determine if the original design conditions have changed. Also, you might need to control weed and brush growth in some locations.

Effectiveness

When properly designed and installed, riprap can prevent erosion from the protected area.

Cost Considerations

The cost of riprap varies depending on location and the type of material selected. A cost of $35 to $50 per square yard of nongrouted riprap has been reported, while grouted riprap ranges from $45 to $60 per square yard (1993 dollars; Mayo et al., 1993).

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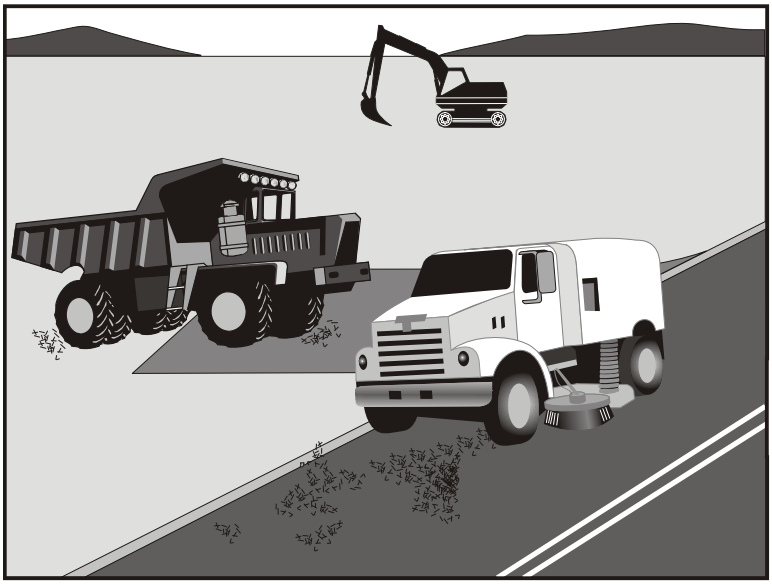
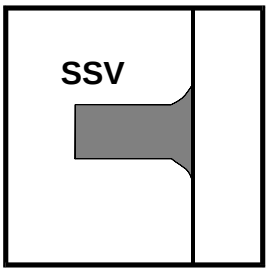
Street Sweeping and Vacuuming

SC-7





Standard Symbol

BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ● Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Practices to remove tracked sediment to prevent the sediment from entering a storm drain or watercourse.

Appropriate Applications

These practices are implemented anywhere sediment is tracked from the project site onto public or private paved roads, typically at points of ingress/egress.

Limitations

Sweeping and vacuuming may not be effective when soil is wet or muddy.

Standards and Specifications

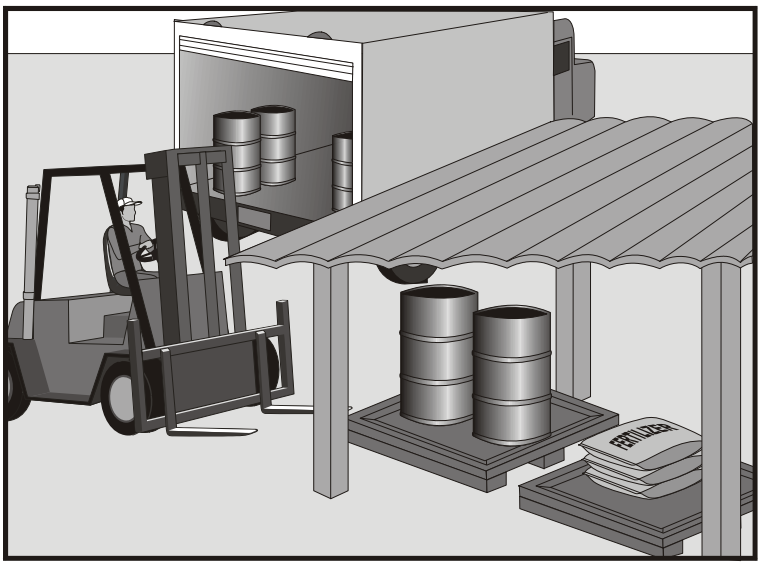
- ■ Kick brooms or sweeper attachments shall not be used.
- ■ Inspect potential sediment tracking locations daily.
- ■ Visible sediment tracking shall be swept and/or vacuumed daily.
- ■ If not mixed with debris or trash, consider incorporating the removed sediment back into the project.

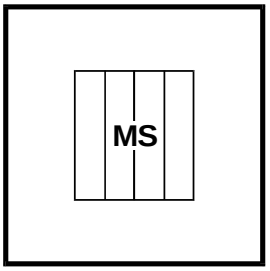
Maintenance and Inspection

- ■ Inspect ingress/egress access points daily and sweep tracked sediment as needed.
- ■ Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- ■ Adjust brooms frequently; maximize efficiency of sweeping operations.
- ■ After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

Material Delivery and Storage

WM-1





Standard Symbol

BMP Objectives

- ○ Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ● Materials and Waste Management

Definition and Purpose

Procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

Appropriate Applications

These procedures are implemented at all construction sites with delivery and storage of the following:

- Hazardous chemicals such as:
  - Acids,
  - lime,
  - glues,
  - adhesives,
  - paints,
  - solvents, and
  - curing compounds.
- Soil stabilizers and binders.
- Fertilizers.
- Detergents.
- Plaster.
- Petroleum products such as fuel, oil, and grease.
- Asphalt and concrete components.
- Pesticides and herbicides.

- Other materials that may be detrimental if released to the environment.

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds must meet building & fire code requirements.

Standards and Specifications

General

- Train employees and subcontractors on the proper material delivery and storage practices.
- Temporary storage area shall be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) shall be supplied for all materials stored.

Material Storage Areas and 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 be placed in temporary containment facilities for storage.
- Throughout the rainy season, each temporary containment facility shall have a permanent cover and side wind protection or be covered during non-working days and prior to and during rain events.
- A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility 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 a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.
- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.
- Bagged and boxed materials shall be stored on pallets and shall not be

allowed to accumulate on the ground. To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during non-working days and prior to rain events.

- Stockpiles shall be protected in accordance with BMP WM-3, "Stockpile Management."
- Minimize the material inventory stored on-site (e.g., only a few days supply).
- Have proper storage instructions posted at all times in an open and conspicuous location.
- Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, under cover in secondary containment.
- Keep hazardous chemicals well labeled and in their original containers.
- Keep ample supply of appropriate spill clean up material near storage areas.
- Also see BMP WM-6, "Hazardous Waste Management", for storing of hazardous materials.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Employees trained in emergency spill clean-up procedures shall be present when dangerous materials or liquid chemicals are unloaded.

Spill Clean-up

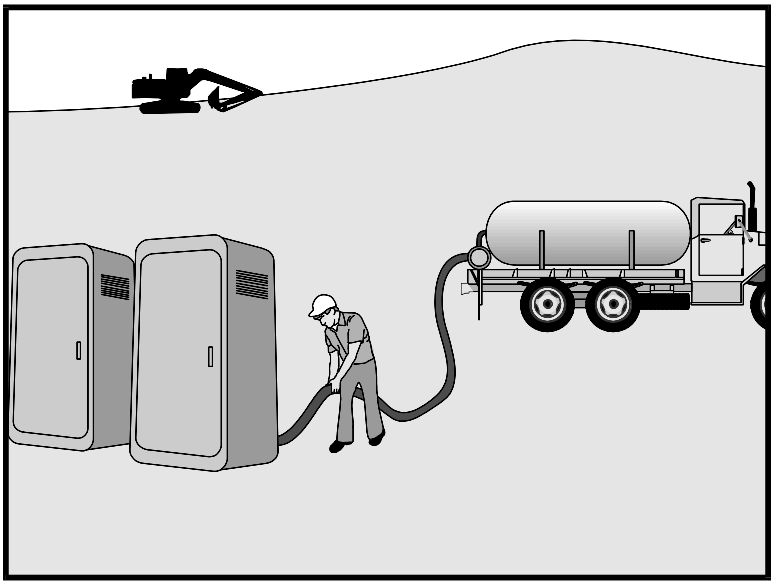
- Contain and clean up any spill immediately.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous materials or contaminated soil.
- See BMP WM-4, "Spill Prevention and Control", for spills of chemicals and/or hazardous materials.

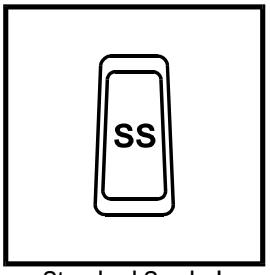
Maintenance and Inspection

- Storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
- Inspect storage areas before and after rainfall events, and at least weekly during other times. Collect and place into drums any spills or accumulated rainwater.

Sanitary/Septic Waste Management

WM-9





Standard Symbol

BMP Objectives

- ○ Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ● Materials and Waste Management

Definition and Purpose

Procedures and practices to minimize or eliminate the discharge of construction site sanitary/septic waste materials to the storm drain system or to watercourses.

Appropriate Applications

Sanitary/septic waste management practices are implemented on all construction sites that use temporary or portable sanitary/septic waste systems.

Limitations

- None identified.

Standards and Specifications

Education

- Educate employees, subcontractors, and suppliers on sanitary/septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary/septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary/septic waste.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Storage and Disposal Procedures

- Temporary sanitary facilities shall be located away from drainage facilities, watercourses, and from traffic circulation. When subjected to high winds or risk.

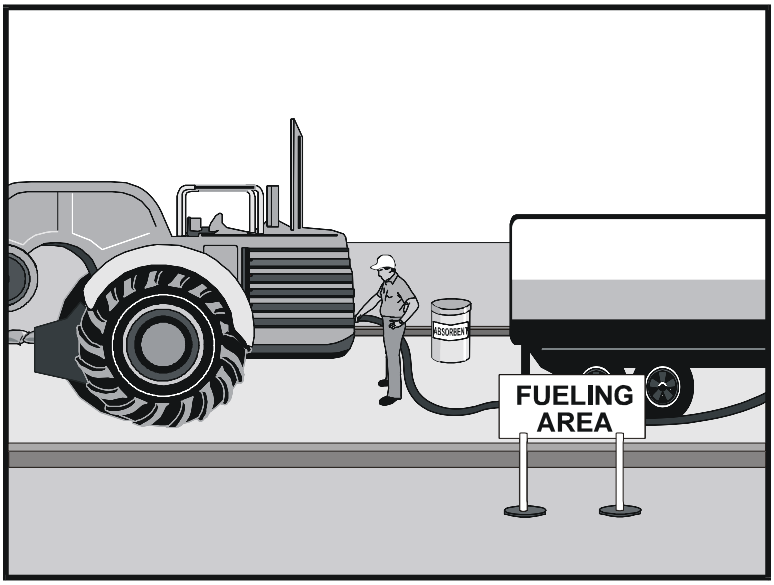
- Wastewater shall not be discharged or buried within the highway right-of-way.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, shall comply with the local health agency, city, county, and sewer district requirements.
- If using an on site disposal system, such as a septic system, comply with local health agency requirements.
- Properly connect temporary sanitary facilities that discharge to the sanitary sewer system to avoid illicit discharges.
- Ensure that sanitary/septic facilities are maintained in good working order by a licensed service.
- Use only reputable, licensed sanitary/septic waste haulers.

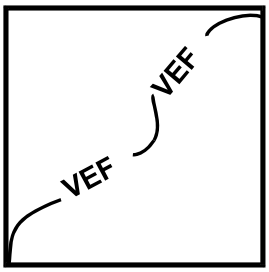
Maintenance and Inspection

- The Contractor shall monitor onsite sanitary/septic waste storage and disposal procedures.

Vehicle and Equipment Fueling

NS-9





Standard Symbol

BMP Objectives

- ○ Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Vehicle and equipment fueling procedures and practices are designed to minimize or eliminate the discharge of fuel spills and leaks into storm drain systems or to watercourses.

Appropriate Applications

These procedures are applied on all construction sites where vehicle and equipment fueling takes place.

Limitations

- Onsite vehicle and equipment fueling shall only be used where it's impractical to send vehicles and equipment off-site for fueling.

Standards and Specifications

- When fueling must occur onsite, the contractor shall select and designate an area to be used.
- Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on fueling trucks and shall be disposed of properly after use.
- Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Dedicated fueling areas shall be protected from storm water run-on and runoff, and shall be located at least 15 m (50 ft) from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut-off to control drips. Fueling operations shall not be left unattended.
- Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills.

- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD). Ensure the nozzle is secured upright when not in use.
- Fuel tanks shall not be "topped-off."
- Vehicles and equipment shall be inspected on each day of use for leaks. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.
- Absorbent spill clean-up materials shall be available in fueling and maintenance areas and used on small spills instead of hosing down or burying techniques. The spent absorbent material shall be removed promptly and disposed of properly.
- Federal, state, and local requirements shall be observed for any stationary above ground storage tanks. Refer to WM-1, "Material Delivery and Storage."
- Mobile fueling of construction equipment throughout the site shall be minimized. Whenever practical, equipment shall be transported to the designated fueling area.

Maintenance and Inspection

- Fueling areas and storage tanks shall be inspected regularly.
- Keep an ample supply of spill cleanup material on the site.
- Immediately cleanup spills and properly dispose of contaminated soil and cleanup materials.