



Master Stormwater Management Plan for Kinder Morgan McElmo Dome-Doe Canyon Field

Prepared for:

Kinder Morgan CO2

Company L.P.

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Durango, CO
Cortez, CO
Pagosa Springs, CO
Farmington, NM

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Figure 1. KM McElmo Dome-Doe Canyon Field Permit Boundary Area. 2

ACRONYMS

BLM	Bureau of Land Management
BMPs	Best Management Practices
CDPHE	Colorado Department of Public Health and Environment
CO ₂	Carbon Dioxide
COGCC	Colorado Oil and Gas Conservation Commission
EPA	U.S. Environmental Protection Agency
KM	Kinder Morgan CO2 Company L.P
MSWMP	Master Stormwater Management Plan
ROWs	Right-of-Ways
SSDS	Site-Specific Data Sheet
SUPO	Surface Use Plan of Operations
WSS	Web Soil Survey

1. INTRODUCTION

This Master Stormwater Management Plan (MSWMP) addresses stormwater management for Kinder Morgan CO₂ Company's L.P. (KM) McElmo Dome and Doe Canyon Carbon Dioxide (CO₂) Fields. KM is permitted under the Colorado Department of Public Health and Environment (CDPHE) General Permit COR034610: *Stormwater Discharges Associated with Construction Activity*. KM's Stormwater Construction Permit for the McElmo Dome-Doe Canyon Field (No. COR034610) was issued on September 20, 2002. A copy of the Permit is included in Appendix A.

This 2012 MSWMP updates and replaces KM's 2007 McElmo Dome-Doe Canyon Regional Stormwater Management Plan. This MSWMP includes "field permit coverage," as recommended and described in CDPHE's July 2007 *Stormwater Fact Sheet—Construction at Oil and Gas Facilities*. Due to the nature of oil and gas construction activities, CDPHE allows coverage to be obtained under the Stormwater Construction Permit for multiple construction activities in an oil and gas field (Field Permit Coverage), instead of obtaining permits for each separate site. A Field Permit covers all construction activities disturbing over 1 acre, or that are part of a common plan of development exceeding 1 acre, within the applied-for oil and gas field. The KM McElmo Dome CO₂ Field encompasses 204,452 acres and the Doe Canyon CO₂ Field encompasses 53,705 acres miles. The McElmo Dome field is located in western Montezuma County, Colorado and the Doe Canyon field is located in southern Dolores County, Colorado (see Figure 1).

The main objective of this MSWMP is to comply with State of Colorado stormwater regulations for stormwater discharges from construction activities for oil and gas sites, such as construction of well pads, roads, pipelines, pumping stations, etc. Permit coverage is required until the site is "finally stabilized"—as defined by CDPHE and the Colorado Oil and Gas Conservation Commission (COGCC). This document identifies Best Management Practices (BMPs), which when implemented will meet the terms and conditions of the CDPHE Stormwater Construction Permit and provide for effective erosion control throughout the construction process in the McElmo Dome-Doe Canyon CO₂ Field. This MSWMP has been developed in accordance with good engineering, hydrologic, and pollution control practices. The MSWMP addresses all potential sources of pollution and associated BMPs to reduce pollutants in stormwater. This MSWMP will be continuously modified to reflect changes in the field.

This MSWMP has been designed for a field coverage management approach and, therefore, will include general field information about the oil and gas field, as well as note and document site-specific information. The appendices of this MSWMP detail specific stormwater management at each site in the McElmo Dome-Doe Canyon CO₂ Field. Included in the appendices are KM's Stormwater Construction Permit, BMP installation diagrams, and the Site-Specific Data Sheets (SSDS) and Inspection Reports that will be prepared for every construction site within the McElmo Dome-Doe Canyon CO₂ Field. Each SSDS describes specific site conditions, recommends BMPs, and guides BMP implementation and stormwater inspections.

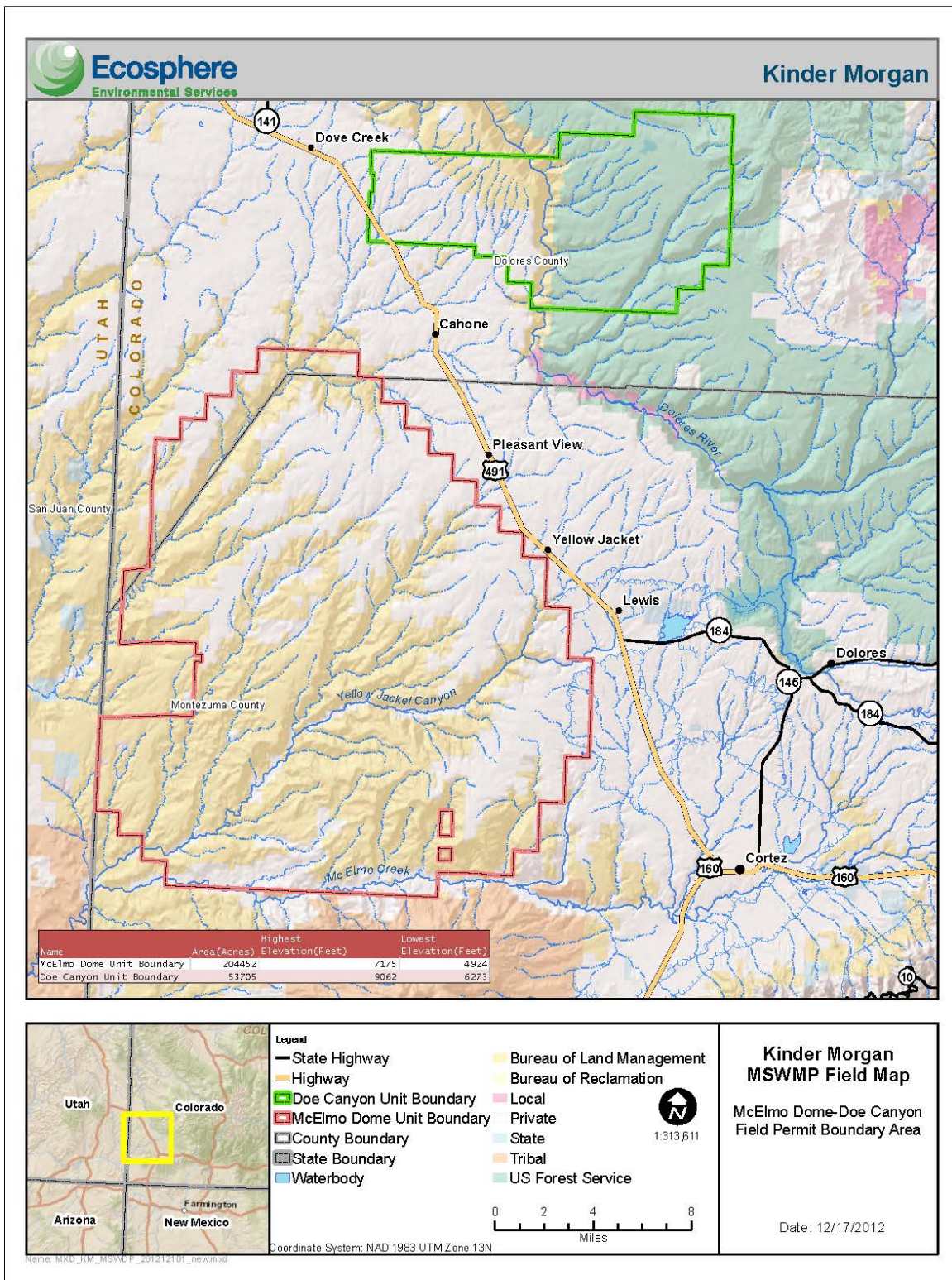


Figure 1. KM McElmo Dome-Doe Canyon Field Permit Boundary Area.

2. McELMO DOME-DOE CANYON CARBON DIOXIDE FIELD

The McElmo Dome field is located in western Montezuma County, Colorado and the Doe Canyon field is located in southern Dolores County, Colorado (see Figure 1). The elevation of the McElmo Dome Field ranges from 4,924 to 7,175 feet in elevation and the Doe Canyon Field ranges from 6,273 to 9,062 feet in elevation. The land ownership in the CO₂ fields consists of private and federal, including portions of the Canyons of the Ancients National Monument managed by the BLM. Land use consists of agriculture, cattle grazing, rural residential, and energy development.

Site-specific information/site description details are included in the SSDS created for each individual site. These SSDS are actively managed for stormwater compliance and are included in Appendix C.

2.1 General Nature and Sequence of Construction Activity

All KM construction activities within the McElmo Dome-Doe Canyon CO₂ Field are associated with CO₂ gas exploration, production, gathering, maintenance, and transportation. The general nature of construction activity at each well pad site includes constructing a new well pad, blading a new access road(s), drilling and completing the CO₂ well, installing equipment on the well pad for extracting CO₂, and constructing a pipeline to transport the CO₂ to a processing facility. KM uses a variety of heavy equipment throughout the construction process including but not limited to trenchers, backhoes, bulldozers, side booms, drill rigs, and graders.

Each site generally follows a sequence of activities (see below) during the construction process; any deviations from this sequence at a specific site will be noted in the SSDS:

- Surveying of land and project right-of-way (ROW).
- Installing stabilized construction entrances as necessary.
- Clearing vegetation and establishing perimeter stormwater controls as necessary.
- Removing and stockpiling topsoil in accordance with requirements of the BLM or landowner request.
- Grade, re-contour, and compact the work areas.
- Excavating for installation/repair/maintenance/replacement of oil and gas facilities.
- Setting of production equipment.
- Well drilling, completion, and production testing.
- Removing all temporary equipment and restoring final grade.
- Performing clean up and restoration including but not limited to final grading, restoration of geomorphic features (banks, terraces, slopes), and installing erosion/sediment control and vegetation or gravel ground cover as appropriate.
- Seeding in accordance with the Conditions of Approval or landowner request.

- Reseeding/reclaiming the remaining disturbed area with uniform vegetative cover to at least 70 percent of pre-disturbance levels.
- Employing other permanent physical erosion reduction methods as an alternative to revegetation or if revegetation is not successful.
- Removing all temporary erosion control measures when construction activities are complete and the site is stabilized, as well as reseeding any areas disturbed by their removal.

2.2 Disturbance Estimates

The construction of each new well pad generally disturbs approximately 5 acres of soil. The length and width of access roads and associated pipelines varies by project. Each SSDS defines the exact amount of ground disturbance associated with each new construction project.

2.3 Soil Types

There are a variety of soil types found within the McElmo Dome-Doe Canyon CO₂ Field. Each SSDS includes detailed information that includes erosion potential for the specific soil type at each location. Soil information can be found online from the Web Soil Survey (WSS): <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>. The WSS is operated by the United States Department of Agriculture Natural Resources Conservation Service.

2.4 Vegetation Description and Cover

The dominant vegetation types within the McElmo Dome-Doe Canyon CO₂ Field include piñon and juniper woodlands, agricultural fields, irrigated pastures, desert shrub communities, and Gambel oak shrublands. Vegetation type and ground cover percentage is documented with photographs prior to construction for each site and then recorded in the SSDS.

2.5 Potential Pollution Sources

Potential pollution sources at construction sites within the McElmo Dome-Doe Canyon CO₂ Field include stockpiled soil, cut and fill slopes, drill cutting stockpiles, solid waste, drilling production fluids, construction and drill rig related fluids (grease, oil, etc.), and drilling-related chemicals. KM has protocols for the management of construction and drilling-related waste and fluids including how they are transported, utilized, and managed, and spill cleaned up. These protocols are outlined in KM's Surface Use Plan of Operations (SUPO) for each well pad.

2.6 Non-Stormwater Discharge

Non-stormwater discharges at any construction site within the McElmo Dome-Doe Canyon CO₂ Field are not anticipated; however, if there is the potential for a non-stormwater discharge at a site, it will be addressed in the SSDS.

2.7 Receiving Waters and Outfall Locations

Stormwater from the McElmo Dome-Doe Canyon CO₂ Field flows into small, unnamed ephemeral washes that drain into Yellowjacket Creek and Cross Canyon (Figure 1). These creeks flow southwest, and eventually flow into the San Juan River near Mexican Hat, Utah. The San Juan River is a major tributary to the Colorado River. Each SSDS names the specific receiving waters and outflow locations, per project, as well as their locations on an associated figure within the SSDS.

3. SITE SPECIFIC DATA SHEETS

The following list includes the type of details to be included in the SSDS for all construction activities covered under the MSWMP. All planned construction activities disturbing over 1 acre of land is covered under KM's McElmo Dome-Doe Canyon CO₂ Field Permit and will have an SSDS. As each project reaches final stabilization, the applicable SSDS is removed from the MSWMP and maintained in KM's office files for a period of at least 3 years. The SSDS for each site within the McElmo Dome-Doe Canyon CO₂ Field will include:

- The name of the project.
- The location of the project.
- Estimates of the total area of the site and the area of the site that is expected to undergo clearing, excavation, or grading.
- A summary of any existing data used in the development of the site construction plans or SSDS that describe the soil or existing potential for soil erosion.
- A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover prior to ground disturbance.
- The location and description of any anticipated non-stormwater components of the discharge such as springs and landscape irrigation return flow.
- The name of the receiving water(s) and the size, type, and location of any outfall; if the discharge is to a municipal separate storm sewer, the name of that system, location of the storm sewer discharge, and ultimate receiving water(s) will be included.
- List of individual BMPs, including identifying where and when they will be used on site.
- A site map showing topography and drainage patterns, as well as locations of structural BMPs (more details on features to be included on site maps are noted below).
- Identify stabilization methods for various site areas as needed.
- Any uncommon BMP maintenance or inspection scheduling information.
- Land jurisdiction and corresponding authority regulating stormwater—CDPHE.

Each SSDS has a site map identifying the following elements:

- Construction site boundaries.
- All areas of ground surface disturbance.
- Areas of cut and fill.
- Areas used for storage of building materials, equipment, soil, or waste.
- Locations of dedicated asphalt or concrete batch plants.
- Locations of all structural BMPs.
- Locations of non-structural BMPs as applicable.
- Locations of springs, streams, wetlands, and other surface waters.

While both the stormwater construction permit and the CDPHE July 2007 construction at oil and gas facilities fact sheet indicate that the location of dedicated asphalt or concrete batch plants must be noted on any stormwater figures, those types of facilities are not part of the operations expected at any of the oil and gas construction projects for KM in the McElmo Dome-Doe Canyon CO₂ Field.

4. STORMWATER MANAGEMENT CONTROLS

4.1 MSWMP Administrator

The MSWMP Administrator is:

Bob Clayton
Kinder Morgan
17801 Highway 491
Cortez, CO 81321
(970) 882-5507 office; (970) 799-1103 cell
bob_clayton@kindermorgan.com

The MSWMP Administrator is responsible for developing, implementing, maintaining, and revising the MSWMP. The MSWMP Administrator is the contact for all MSWMP-related issues and is the person responsible for its accuracy, completeness, and implementation.

4.2 Identification of Potential Pollutant Sources

All KM construction activities within the McElmo Dome-Doe Canyon CO₂ Field will be evaluated for their potential to cause pollution.

The stormwater construction permit (Part I, C, 3, b) requires that the following potential sources are evaluated for contributing pollutants to stormwater discharge:

- All disturbed and stored soils.
- Vehicle tracking of sediments.
- Management of contaminated soils.
- Loading and unloading operations.
- Outdoor storage activities (building materials, fertilizers, chemicals, etc.).
- Vehicle and equipment maintenance and fueling.
- Significant dust or particulate generating processes.
- Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.
- On-site waste management practices (waste piles, liquid wastes, dumpsters, etc.).
- Concrete truck/equipment washing including the concrete truck chute and associated fixtures and equipment.
- Dedicated asphalt and concrete batch plants.
- Non-industrial waste sources such as worker trash and portable toilets.
- Other areas or procedures where potential spills can occur.

All of these activities and any potential pollution sources will be identified and evaluated for each construction project; however, KM does not currently use or anticipate the use of dedicated asphalt or concrete batch plants.

4.3 Best Management Practices

This MSWMP identifies and describes the different types of BMPs—both structural and nonstructural—that will be recommended at each project site to reduce the potential for erosion and off-site sediment transport.

4.3.1 Structural BMPs

Structural BMPs refer to physical structures designed to remove pollutants from stormwater runoff, reduce downstream erosion, provide flood control, and promote groundwater recharge. Structural BMPs require engineering design and engineered construction.

The most common structural BMPs used at oil and gas construction sites and a description of each is included in Table 1 and the most common non-structural BMPs are included in Table 2. The installation diagram and required maintenance specifications for each BMP identified in this MSWMP is included in Appendix B. Each BMP will be installed according to the proper specifications provided in these diagrams and maintained according to the maintenance schedules included with the installation diagrams. All stormwater inspections will check for proper BMP installation and maintenance.

These recommended BMPs are based on CDPHE and United States Environmental Protection Agency (EPA) guidance documents, and other engineering practice sources. General BMPs to be implemented are described in the following sections and recommended site-specific BMPs are presented in the individual SSDs.

Table 1. Structural BMPs that may be recommended in the McElmo Dome-Doe Canyon CO2 Field

BMP	Description
Culverts	Metal culverts are used to channel water under access roads and commonly designed by engineers.
Berms and Diversions	A gravel, stone, or soil berm or diversion is a temporary ridge that slows and filters flow and diverts stormwater from an open traffic area or slope.
Erosion Control Blankets	Erosion control blankets that completely cover the ground surface are placed on disturbed areas to prevent erosion from sheet flow and protect newly seeded areas.
Bonded Fiber Matrix and Soil Stabilizers	Bonded fiber matrix and soil stabilizers are used on steep slopes where blankets will not work to promote vegetation growth and reduce erosion.
Culvert Outlet Protection	Culvert outlet protection is usually a layer of angular rocks installed on the downhill side of a culvert or sediment trap. The rocks slow stormwater flow, thereby reducing erosion and settling out sediment.

BMP	Description
Erosion Control Logs	Erosion control logs are made of fibrous material and work by trapping sediment. Erosion control logs must be trenched into the ground to be effective.
Erosion Control Bales	Erosion control bales work by trapping sediment in areas with high water flows.
Rock Check Dams	Rock check dams are constructed across a ditch to catch sediment.
Sediment Traps	Sediment traps can be a variety of sizes and shapes, depending on the intended use. Sediment traps pool stormwater, allowing sediment to settle out and have an armored outlet.
Silt Fences	Silt fences consist of a length of filter fabric stretched between anchoring posts, spaced at regular intervals, and are trenched into the ground. Silt fences filter stormwater and can also be used as perimeter control. In the McElmo Dome-Doe Canyon CO ₂ Field, silt fences are only used on rare occasions, due to their high maintenance needs.
Water bars	Water bars will be constructed of soil or cobble materials and slows flow down steep slopes. Recommended water spacing is based on the slope of the area with spacing between water bars decreasing with an increasing slope.

Table 2. Non-structural BMPs that may be recommended in the McElmo Dome-Doe Canyon CO₂ Field

BMP	Description
Management Actions	Management actions include contractor education, planning and scheduling site activities, scheduling rapid revegetation and BMP implementation, and coordination with the MSWMP inspector.
Mulching	Mulching crimps certified weed-free straw into bare soil for temporary slope stabilization and facilitates successful revegetation.
Revegetation	Revegetation includes grading, soil preparation, seeding, and occasionally mulching. Revegetation stabilizes slopes and creates a vegetative buffer strip.
Preserving Natural Vegetation	At every site, preserving natural vegetation prevents any unnecessary erosion.
Preventative Maintenance	Preventative maintenance ensures BMPs are functioning properly.
Slope Roughening	Surface roughening creates small ridges in exposed soil, which follow the slope contour. Surface roughening is a temporary BMP that slows surface runoff, helps prepare the seedbed, and is a commonly used BMP in the McElmo Dome-Doe Canyon CO ₂ Field.
Spill Response Procedures	KM maintains a SUPO for each well pad that outlines how spills are to be managed, contained, and cleaned up.
Site Grading	Minimize grading of level and gently sloping terrain on site and immediately off site except where reasonable for construction equipment and fire safety to reduce size of ground disturbance.

4.3.2 Phased BMP Implementation

Pre-Construction Stabilization

Pre-construction stabilization practices include both structural and non-structural BMPs. These BMPs will be installed/implemented prior to ground disturbance and maintained until the ground surface is stabilized. BMPs include:

- Not grading level and gently sloping terrain outside the project area except where reasonable for construction equipment stability and fire safety. This minimizes disturbance associated with the project.
- Erosion control barriers (silt fence, erosion control log or bale, or earthen berm) at the edge of the disturbance area.

During Construction Stabilization

The following structural and non-structural BMPs will be installed and/or implemented during construction activities:

- Existing cover and trees will be removed or trimmed only where necessary to facilitate clearing, grading, equipment operation, and safe installation of facilities. In general, vegetation will be cut near ground level, leaving the root system intact except where permanent facilities, roads, or ROWs require complete vegetation removal. Cuttings may be stacked into a brush dam, distributed along the contour across reclaimed areas, or disposed as directed by the landowner or agency representative.
- Any vegetation that is not cleared from the site will be protected from damage during construction by avoidance.
- Excavated materials will be stored in an isolated area to protect the material from vehicular and equipment traffic.
- Excavation in especially sensitive areas may be conducted according to special techniques, as specified by the landowner or agency representative.
- Materials excavated will be utilized as backfill when practicable. An exception may be rock excavated by blasting. Excess rock may be used for culvert outlet protection, rock check dams, distributed over a portion of the project area, or disposed off site.
- All cuts made in steep rolling terrain during construction will be re-graded and contoured to blend into the adjoining landscape and reestablish the natural drainage patterns where possible.
- Materials that are unsuitable for use as backfill or excess backfill material will be disposed at approved locations.
- Applicable conditions for Clean Water Act Section 404 permits and 401 Water Quality Certifications will be implemented for crossing perennial waterways, ephemeral washes, or wetlands. The locations of these water features will be identified in the SSDS.

Post-Construction Stabilization

The following post-construction structural and non-structural BMPs will be installed and/or implemented immediately after construction:

- Perimeter control BMPs will be used at the edge of disturbance areas. These BMPs will be inspected and maintained until soil surfaces are stabilized and revegetated.
- Permanent water bars will be installed along steep slopes of pipeline ROWs after pipeline construction is completed. The water bars will reduce runoff velocity, prevent erosion, and promote vegetative regrowth. The water bars will be constructed of soil or cobble materials. Recommended water spacing is based on the slope of the area, with spacing between water bars decreasing with increasing slopes.
- Disturbed areas will be reseeded according to landowner or land management agency specifications.
- Steeper slopes along the pipeline ROW will be stabilized with tackifier, erosion control mats, bonded fiber matrix, soil stabilizers, or other means to reduce soil erosion and promote re-growth of vegetation.

4.3.3 Materials Handling and Spill Prevention

4.3.3.1 Hazardous Materials

KM's SUPO for each well pad clearly states the measures to stop the source of a spill, contain a spill, clean up a spill, dispose of contaminated materials, and train personnel to prevent and control a future spill. KM's SUPO for each well pad is available by calling the MSWMP Administrator at (970) 882-5507.

Table 3 lists the possible chemicals that may be on site at any time during the construction activities. These chemicals have the potential to contribute pollutants to runoff. Proper chemical handling and storage procedures at the site will include the following:

- The contractors working with these chemicals will store them in a truck or trailer (serving as secondary containment) and will cover all containers when not in use.
- No chemical containers will be placed on the ground within 200 feet of a water source.
- No chemicals will be stored overnight on the ground at the site; they will be stored within secondary containment if they remain on site.

Table 3. Potential chemical materials present at the project site

Chemicals On Site	Hazardous or Non-Hazardous ¹	BMPs to Minimize Impacts
Hydraulic Fluids	Non-Hazardous	Vehicle maintenance will be performed off site. Proper chemical handling and storage.
Paints	Hazardous	Proper chemical handling and storage.

Chemicals On Site	Hazardous or Non-Hazardous ¹	BMPs to Minimize Impacts
Solvents	Hazardous	Proper chemical handling and storage.
Grease	Non-Hazardous	Proper chemical handling and storage.
Glues	Hazardous	Proper chemical handling and storage.
Gas	Hazardous	Vehicle fueling will be performed off site. Proper chemical handling and storage.
Oil	Non-Hazardous	Vehicle maintenance will be performed off site, unless an emergency occurs. Proper chemical handling and storage.
Form Oils	Hazardous	Limit use to forms only, do not use more than necessary. Proper chemical handling and storage.

¹ As defined by the EPA (<http://www.epa.gov/wastes/index.htm>).

Any accidental spill will be cleaned up immediately and contaminated soils will be sent to a land farm or landfill in accordance with state and federal requirements. Depending on the nature of the spill and the material involved, the CDPHE (24-hour spill reporting line is [877] 518-5608), downstream water users, or other agencies may also need to be notified.

Where a release of hazardous substance or oil exceeds the reportable quantity established under 40 CFR 110, 40 CFR 117, or 40 CFR 302 during a 24-hour period, the following will occur:

- The operator will notify the National Response Center at (800) 424-8802 or (202) 426-2675.
- The spill will be cleaned up according to the appropriate protocol, per government regulations and SUPO guidance.
- The MSWMP Administrator will update the MSWMP within 14 days to address occurrences of such releases.

4.3.4 Dedicated Concrete or Asphalt Batch Plants

No concrete or asphalt batch plants are expected in the construction areas.

4.3.5 Vehicle Tracking Control

Most of the project sites within the McElmo Dome-Doe Canyon CO₂ Field are located several miles in the action areas via dirt or gravel roads. This usually prevents vehicles tracking sediment and/or mud onto paved roads. If vehicle tracking BMPs are required at a site, the information will be included in the SSDS.

4.3.6 Waste Management and Disposal, Including Concrete Washout

During drilling operations, garbage and trash will be contained in portable skid-mounted refuse containers that will be periodically emptied and the contents properly disposed. No other construction or drilling generated wastes (except authorized wastes in drilling reserve pits or storage tanks/closed

loop systems) will routinely be stored on site. While drilling and construction operations are in progress, portable toilets will be maintained on site and the contents will be periodically emptied and disposed in accordance with applicable requirements. KM's SUPO will be followed during construction activities. The program specifies the following waste management procedures:

- Produced Water—Produced water will be placed in a Class I non-hazardous disposal well or reused at another nearby drill site.
- Produced Water with Oil—Oil separation will occur for sale or disposed at state licensed facility.
- Solid Waste—All garbage will be stored on site in a portable refuse container and hauled away by KM to an approved landfill. Any brush, small trees, or limbs will be used as a component of erosion control throughout the project area.
- Sewage—Chemical toilets will be provided and maintained during drilling operations and construction activities, and then hauled under existing permit to the licensed sewage treatment plant in Dolores, Colorado.
- Drilling fluids for existing locations with drilling reserve pits—The following will be conducted to accomplish the task of handling the drilling fluids and drill cuttings waste materials:
 - The free liquids from the reserve pit will be removed via vacuum truck. The liquids will be hauled for reuse to another drilling location in connection with this project or disposed in the appropriate Kinder Morgan disposal well (MWD-1, HWD-1, and YWD-1).
 - For locations with a drilling reserve pit, pit design keeps fresh water cuttings separated from the salt formation and brine water cuttings. The fresh water cutting contents of each pit will be tested using the COGCC rule 910-1 procedures:
 - a. The liners from each containment pit will then be removed and disposed at an approved solid waste disposal site such as the Montezuma County landfill located south of Cortez, Colorado.
 - b. Salt cuttings will go automatically without testing to a land farm because they are likely to exceed salt limits for re-use. Site of preference will be 'Contract Environmental Services Inc. (CES)' located 1/4 mile west of the Hovenweep National Monument, off Road 10 in Utah. The CES main office is located at 410 N Auburn Ave., Farmington, New Mexico, 87401.
 - c. If regulatory limits are met for fresh-water cuttings, they will be dried and buried on site in their original containment pit and mixed with the native soil recovered from the original pit construction.
- Drilling fluids for closed loop drilling—In November 2012, Kinder Morgan implemented closed loop drilling systems to handle drilling fluids and drilling cuttings waste material. The closed loop system utilizes on site storage containers (storage tanks and roll-offs) to store fluids and waste material. An on-site centrifuge reduces the liquid content in the drill cutting material. Drill cutting storage areas and all tanks, roll-offs, and material handling equipment are located in

lined and bermed areas to contain spills or releases. Salt cuttings and fresh water are segregated and disposed as described above.

- Maintenance—Maintenance of erosion and sediment control BMPs will be conducted as defined in Section 4.3 to ensure that the BMPs are functioning properly.
- Concrete wash out areas will be designated at locations where concrete is required for construction activities. Concrete washouts will be excavated and lined pits will contain all washout material from concrete trucks.

4.3.7 Groundwater and Stormwater Dewatering

Encountering groundwater during oil and gas construction activities in the McElmo Dome-Doe Canyon CO₂ Field is unlikely; therefore, dewatering during the construction process is not expected. In the event that groundwater is encountered, the contractor will notify the stormwater inspector and MSWMP Administrator immediately.

A permit is required from the CDPHE to dewater a construction site unless the following conditions are met:

- The discharge and associated BMPs are included in the SSDS.
- Adequate BMPs are included to control stormwater pollution.
- The discharge does not leave the site as surface runoff or to surface waters/storm sewer systems.
- The groundwater being pumped is not contaminated to exceed State groundwater standards.

Because construction dewatering is unlikely, this MSWMP does not include the detailed information needed to cover this type of discharge. If groundwater is encountered, construction work will be stopped until a separate construction dewatering general permit is issued to KM or the above conditions are met and the activity is covered under the contractor's stormwater permit.

4.4 Final Stabilization and Long-Term Stormwater Management

The process of achieving "final" stabilization per the CDPHE means that all ground surface disturbing activities at the site have been completed with an individual plant density of at least 70 percent or pre-disturbance levels. The following reclamation activities will be completed to achieve final stabilization:

- Contouring and re-establishing previous slopes where feasible.
- Seeding the disturbed areas not utilized by the project with the appropriate designated seed mixes and seeding techniques.
- Seeding when seasonal or weather conditions are most favorable for the area. Whenever possible, seeding will be timed to take advantage of moisture. This generally means seeding will be scheduled during the working season and before the succeeding winter. Re-vegetation

treatments will be accomplished as soon as practicable following completion of the construction process.

- Planting the seed mixes in the rate specified by the appropriate owner or land manager, and specified by the application methodology, in pounds of pure live seed per acre. The seed mix will be certified weed-free and not contain primary or secondary noxious weed seeds.
- On terrain where drill seeding is appropriate, seed may be planted using a drill equipped with a depth regulator to ensure proper depth of planting. The seed mix will be evenly and uniformly planted over the disturbed area. Broadcast seeding will occur on steep terrain and on areas where the cut vegetation and rocks were redistributed over the ROW.
- In general, the applicable portions of the project area will not be mulched during reclamation and re-vegetation. Mulch will only be applied at the request of the landowner or jurisdictional authority.
- The need for fertilizers will be determined in conjunction with the landowner or jurisdictional authority. If fertilization is necessary, the rates of application will be based on site-specific requirements of the soil.

In addition to requirements in the CDPHE Stormwater Construction Permit, oil and gas sites must also consider COGCC Interim Stabilization requirements (COGCC 1000 series rule, including 1003.e) CDPHE defines “final stabilization” to include the following components:

- All soil-disturbing activities at the site have been completed.
- All soils have been stabilized or uniform vegetation cover has been established with a density of at least 70 percent of pre-disturbance levels or equivalent, permanent physical erosion control BMPs have been employed.

The COGCC (1003.e) considers “interim” reclamation of the portions of well locations not needed for production (COGCC uses “interim” at this stage in the reclamation process and reserves the use of “final reclamation” for the reclamation required following plugging and abandoning well sites and associated production facilities):

Interim reclamation is considered complete when all disturbed areas have been either built on, compacted, covered, paved or otherwise stabilized to the extent practicable; or a uniform vegetative cover has been established that reflects pre-disturbance or reference area forbs, shrubs, and grasses with total plant cover of at least 80 percent—excluding noxious weeds. Re-seeding alone is not sufficient.

In addition to these requirements, the COGCC also includes two other considerations:

- All croplands have been restored and revegetated in accordance with COGCC Rule 1003.e.1 and returned to the surface owner for agriculture use.
- All non-cropland areas requiring restoration and revegetation in accordance with COGCC Rule 1003.e(2) have established a uniform vegetative cover with an individual density of at least 70 percent of pre-disturbance levels.

5. INSPECTION AND MAINTENANCE

5.1 Inspection Schedules

The stormwater inspections in the McElmo Dome-Doe Canyon CO₂ Field will follow inspection schedules below, as outlined in the CDPHE Stormwater Permit.

5.1.1 Minimum Inspection Schedule

The minimum inspection schedule applies to those sites under active construction, which includes the period from when the ground is initially disturbed to when construction activity is completed and includes the preparation of areas that will be revegetated for interim reclamation. During this period, a thorough inspection of the site stormwater management system and associated BMPs must be conducted at least once every 14-calendar days. In addition, post-storm event inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion.

5.1.2 Exceptions to the Minimum Inspection Schedule

Post-Storm Event Inspections at Temporarily Idle Sites

Temporarily Idle Sites are those where there are no construction activities occurring following a storm event. At such sites, post-storm event inspections must be conducted prior to restarting construction activities at the site, but no later than 72 hours following the storm event and the delay noted in the inspection report. Routine inspections still must be conducted at least every 14-calendar days.

Completed Sites

Once construction is completed and the site has been prepared for final stabilization (including completion of appropriate soil preparation, amendments, and stabilization practices), the site (or portion of a site) is considered a “Completed Site” for purposes of the stormwater permit. A Completed Site qualifies for a reduced inspection schedule, as the potential for pollution is reduced if the site has been adequately prepared and/or seeded. However, because slopes and other disturbed areas are not vegetated, erosion in these areas still occurs, which requires maintenance activities such as re-grading and seeding of problem areas. As such, inspections must continue in order to address these situations.

For a Completed Site, a thorough inspection of the site stormwater management system is required at least once every month, and post-storm event inspections are not required. The SSDS for the site must be amended to indicate those areas that will be inspected at the reduced frequency.

Winter Conditions Inspections Exclusion

Inspections are not required at sites where construction activities are temporarily halted, snow cover exists over the entire site for an extended period, and melting conditions do not exist. This temporary exclusion is applicable only during the period where melting conditions do not exist and applies to the routine 14-day and monthly inspections, as well as the post-storm-event inspections. Note: it is typical

that when snow cover exists, even at a Completed Site, significant potential for erosion and BMP failure exists when melting does finally occur; therefore, KM will prepare the site prior to snow cover to ensure it is stabilized and be prepared to perform site maintenance when melt-off occurs. Inspection records must document the following information when this exclusion is used: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began.

5.2 Inspection Procedures

Each stormwater inspection in the McElmo Dome-Doe Canyon CO₂ Field will be documented on a Field Inspection Report, which will include at least the minimum requirements outlined by the CDPHE (Appendix A) and be included with the appropriate SSDS in Appendix C. The inspection will include observations of the following areas for evidence of and/or potential for pollutants leaving the site boundaries, entering the stormwater drainage system, or discharging to state waters:

- The construction site perimeter.
- All disturbed areas.
- Areas used for material or waste storage that are exposed to precipitation.
- Discharge locations.
- Locations where vehicles enter and exit the site.
- Erosion and sediment control measures identified in the MSWMP to ensure they are maintained and operating correctly.

BMPs should be inspected to determine if they still meet the design and operational criteria in the MSWMP and if they continue to adequately control pollutants at the site. Any BMPs not operating in accordance with the MSWMP must be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants. Documentation of BMP status and any changes required will be made in the SSDS.

5.3 BMP Maintenance or Replacement and Failed BMPs

The Stormwater Construction Permit requires that all erosion and sediment control BMPs identified in the MSWMP and specified in the SSDS be maintained in effective operating condition and in accordance with good engineering, hydrologic, and pollution control practices; therefore, site inspection procedures must address maintenance of BMPs that are found to no longer function as needed and designed, as well as preventive maintenance to proactively ensure continued effective operation. BMPs that have failed or have the potential to fail without maintenance or modifications must be addressed as soon as possible, immediately in most cases, to prevent the discharge of pollutants. Documentation of these activities will be included in the Field Inspection Report.

5.4 Record Keeping

Keeping accurate and complete records serves several functions. First, keeping records of spills, leaks, inspections, etc. is a requirement of the Stormwater Construction Permit. Second, by keeping accurate

and detailed records, KM will have documentation of events that could prove invaluable should complications arise concerning the permit. Lastly, KM will document inspection results and maintain a record of the results for a period of 3 years following expiration or inactivation of permit coverage.

A Field Inspection Report will be completed during each site inspection. The completed inspection reports will be maintained in Appendix C of this MSWMP, along with the corresponding SSDSs. At a minimum, the following items will be documented as part of the site inspection report:

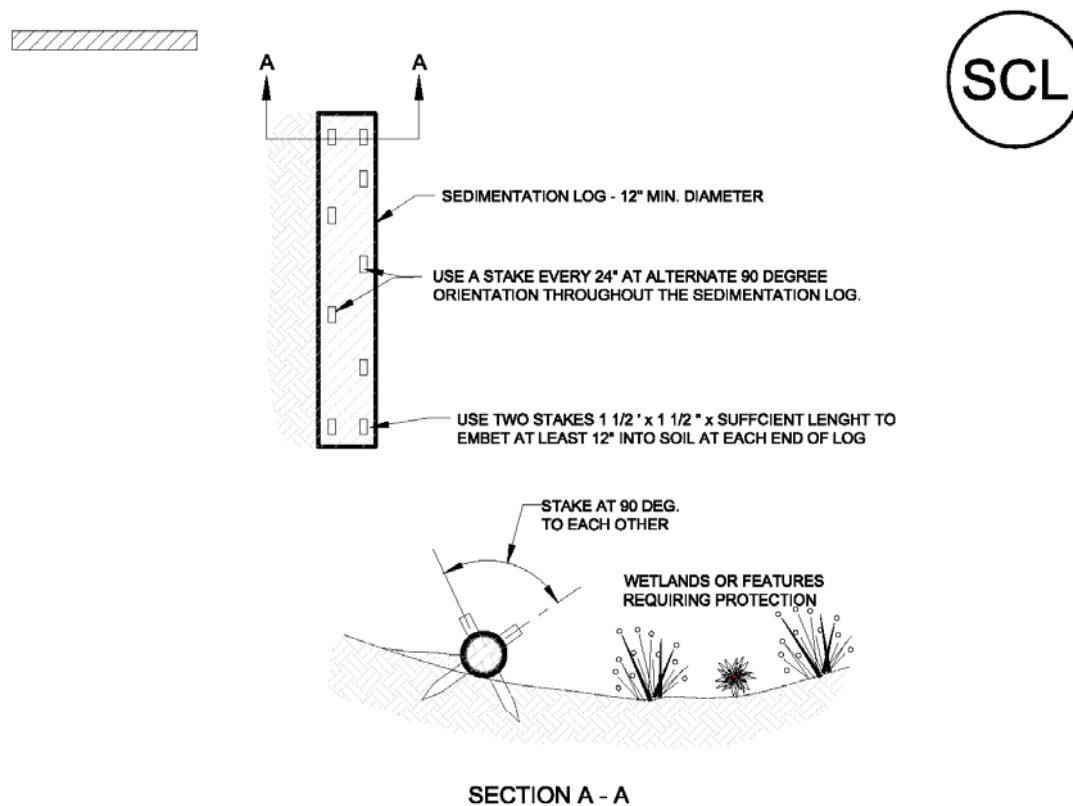
1. The inspection date.
2. Name(s) and title(s) of personnel making the inspection.
3. Location(s) of discharges of sediment or other pollutants from the site.
4. Location(s) of BMPs that need to be maintained.
5. Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location.
6. Location(s) where additional BMPs are needed, but not in place at the time of inspection.
7. Deviations from the minimum inspection schedule.
8. Description of corrective action for items 3, 4, 5, and 6 above; dates the corrective action(s) was taken; and measures taken to prevent future violations including requisite changes to the MSWMP, if necessary.
9. After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report will contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

A copy of this MSWMP will be provided to the appropriate construction staff and stormwater inspectors as a reference to be kept in their vehicle in the McElmo Dome-Doe Canyon CO₂ Field. The KM office will also maintain a complete and updated copy of the MSWMP.

When changes are made to site conditions, the MSWMP and the appropriate SSDS must be revised immediately, except for some BMP description changes that conditionally may occur within 72 hours. This requirement ensures that the MSWMP and SSDS are kept accurate and up-to-date

**Appendix A—KM's Stormwater Construction Permit
for the McElmo Dome-Doe Canyon CO2 Field**

Appendix B—BMP Installation Diagrams

**SEDIMENT CONTROL LOG INSTALLATION NOTES**

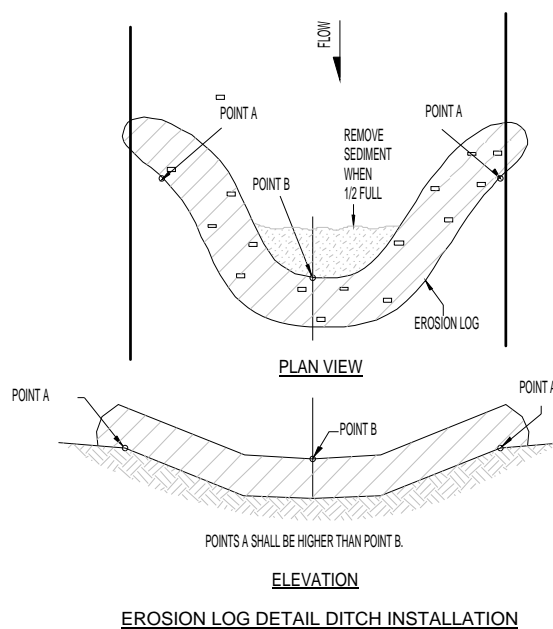
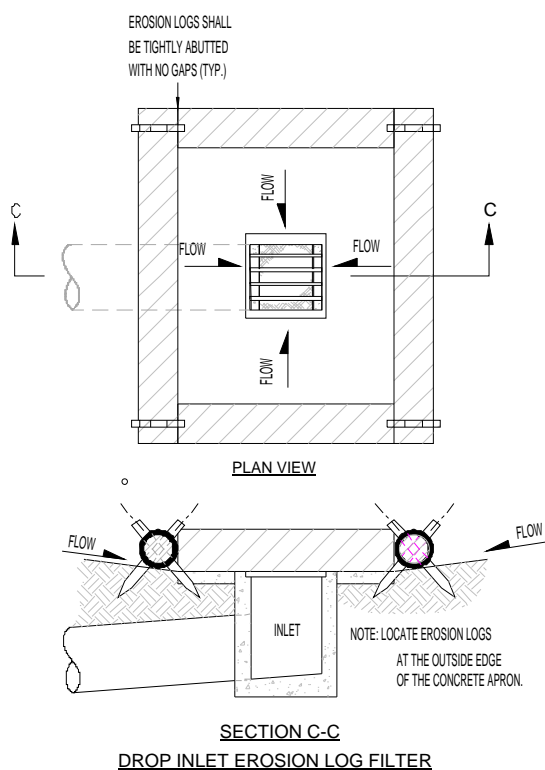
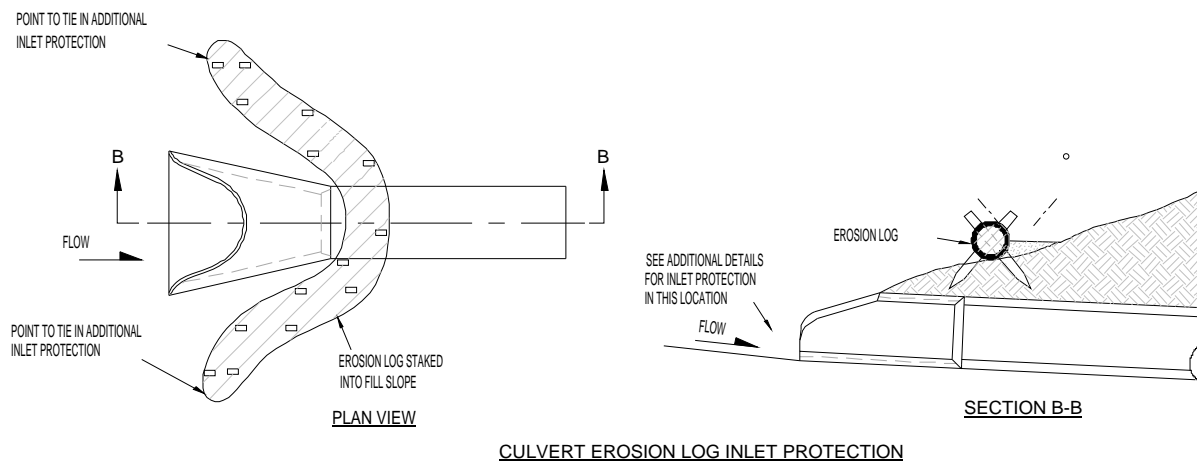
1. SEE PLAN VIEW FOR:
-LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL SWMP PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2" AND ADJACENT LOGS SHALL BE FIRMLY PACKED AGAINST EACH OTHER TO ELIMINATE ALL GAPS.

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OF CLEANOUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH REACHES $\frac{1}{2}$ THE HEIGHT OF THE CREST OF THE LOG.
3. SEDIMENT CONTROL LOGS SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE COVERED WITH TOPSOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

DETAIL BASED ON DETAILS PROVIDED BY DOUGLAS COUNTY AND CDOT

Figure C5-8—Sediment Control Log



NOTE: EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.

Adapted From Colorado Department of Transportation (2007)

Figure C5-9—Sediment Control Log Application Examples

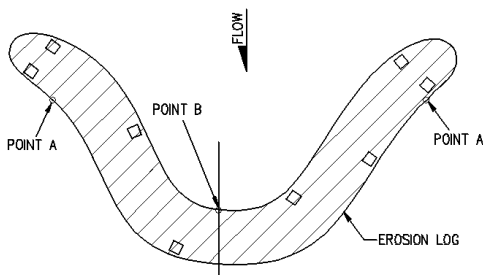
Erosion Log Check Dam

Tips

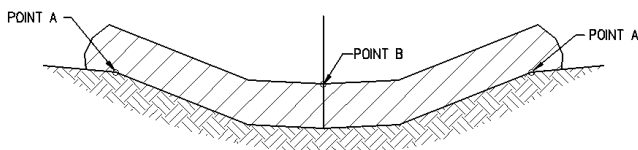
- Embed erosion log 2 inches into soil and ensure contact with the ground for its entire length.
- Erosion logs can be placed on top of soil retention blankets to help reduce water velocity.
- Proper staking is essential for erosion log function.
- Diameter of the erosion log is specified in the Stormwater Management Plan.

NOTES

1. EROSION LOGS SHALL BE EMBEDDED 2 INCHES INTO THE SOIL.
2. STAKES SHALL BE EMBEDDED TO A MINIMUM DEPTH OF 12 INCHES.
3. EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.



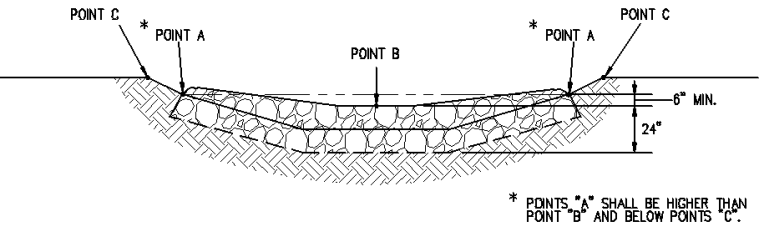
PLAN VIEW



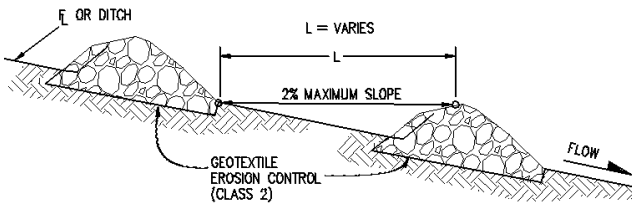
POINTS A SHALL BE HIGHER THAN POINT B.

ELEVATION

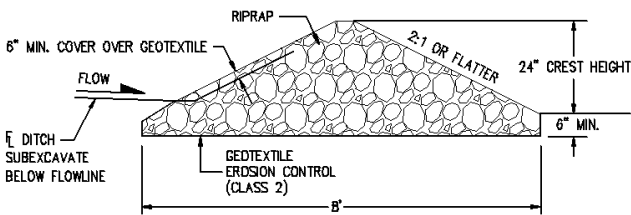
EROSION LOG DITCH INSTALLATION



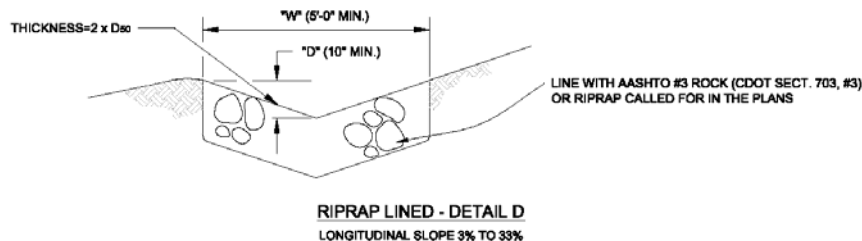
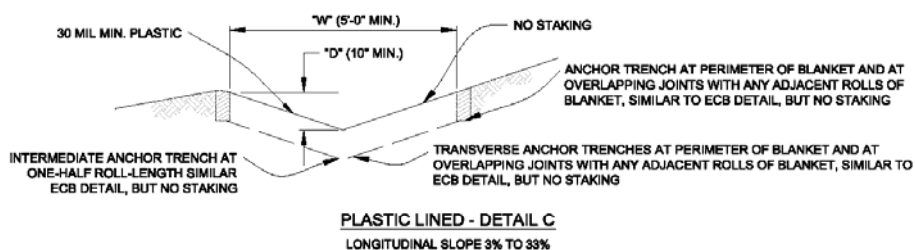
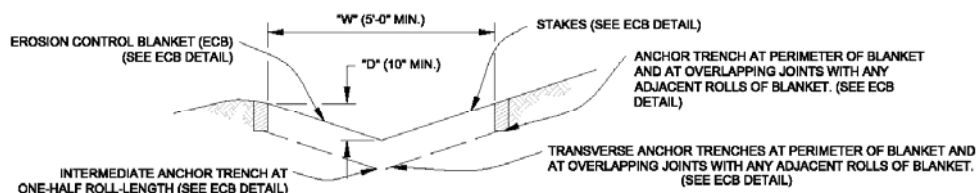
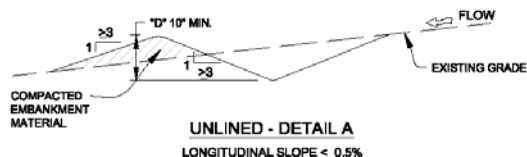
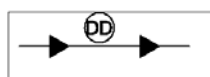
TYPICAL SECTION VIEW



SECTION VIEW ALONG DITCH FLOWLINE



SECTION DETAIL

**DIVERSION DITCH INSTALLATION NOTES**

- SEE PLAN VIEW FOR:
 - LOCATION OF DIVERSION DITCH.
 - TYPE OF DITCH (UNLINED, ECB LINED, PLASTIC LINED OR RIPRAP LINED).
 - LENGTH OF EACH TYPE OF DITCH.
 - DEPTH, "D", AND WIDTH, "W" DIMENSIONS.
 - FOR ECB LINED DITCH, EROSION CONTROL BLANKET TYPE (SEE ECB DETAIL).
 - FOR RIPRAP LINED DITCH, SIZE OF RIPRAP, "D₅₀".
- SEE DRAINAGE PLANS FOR DETAILS OF ANY PERMANENT CONVEYANCE FACILITIES OR DIVERSION DITCHES EXCEEDING A 2-YEAR FLOW RATE OF 10 CFS.
- DIVERSION DITCHES INDICATED ON INITIAL SWMP PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
- FOR ECB LINED DITCHES, INSTALLATION OF EROSION CONTROL BLANKET SHALL CONFORM TO THE REQUIREMENTS OF THE ECB DETAIL.
- IN LOCATIONS WHERE CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION DITCH, THE PERMITTEES SHALL INSTALL A TEMPORARY CULVERT WITH A MINIMUM DIAMETER OF 12 INCHES.

DIVERSION DITCH MAINTENANCE NOTES

- THE SWMP MANAGER SHALL INSPECT DIVERSION DITCHES WEEKLY AND DURING AND AFTER ANY STORM. MAKE REPAIRS AS NECESSARY.
- DIVERSION DITCHES ARE TO REMAIN IN PLACE UNTIL THE END OF CONSTRUCTION, OR IF APPROVED BY LOCAL JURISDICTION MAY BE LEFT IN PLACE.
- IF DIVERSION DITCHES ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, DRILL SEED, HAY CRIMPED, MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

DETAIL BASED ON DETAILS PROVIDED BY DOUGLAS COUNTY, COLORADO

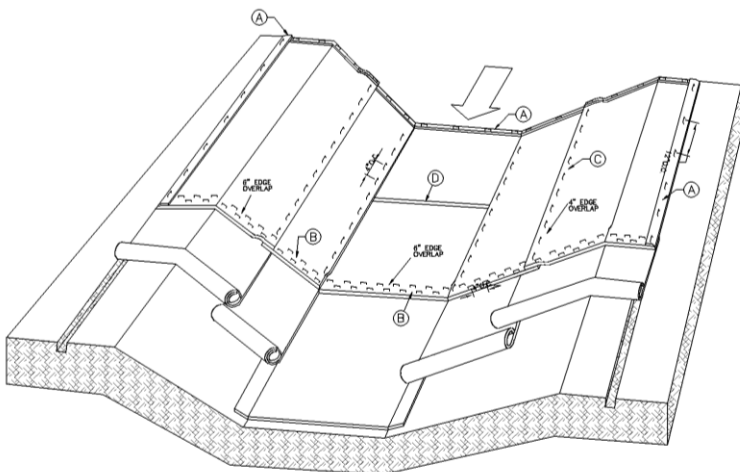
Figure C5-3—Temporary Diversion Dike & Ditch

Soil Retention Blankets for Ditch Use

Drainage ditches convey stormwater runoff through a stable conduit. Vegetation lining the ditch slows down concentrated runoff. Because grassed channels are not usually designed to control peak runoff loads by themselves, they are often used with additional BMPs, such as check dams or silt dikes. If the drainage ditch is over 2 percent grade, contact a CDOT Landscape Architect for recommendations on blanket type. Refer to Soil Retention Blankets in the Slopes chapter for more details on installation and use.

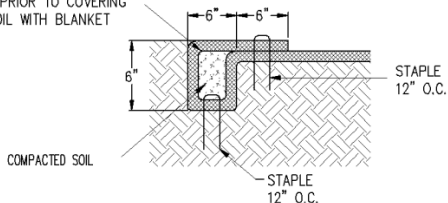
Tips

- Lay in blankets similar to roof shingles; start at the lowest part of the ditch, then work your way up. Uphill pieces lap over downhill sections. Staple through both layers around edges at the overlap.
- Trench, tuck, and tamp down ends at the top of the slope. Do not stretch blankets or mats.
- Avoid creating “v” shaped ditches. Construct “u” or trapezoidal shape.



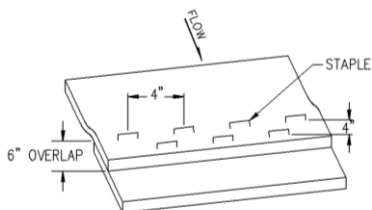
SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM)
CHANNEL APPLICATION
IN ACCORDANCE WITH SECTION 216.

APPLY SEED AND ANY REQUIRED SOIL
CONDITIONERS PRIOR TO COVERING
COMPACTED SOIL WITH BLANKET



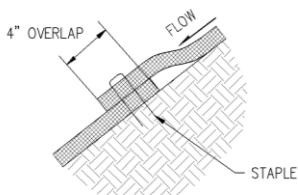
ANCHOR TRENCH SECTION A

TO BE USED AT THE BEGINNING AND END
OF THE CHANNEL ACROSS IT'S ENTIRE WIDTH.



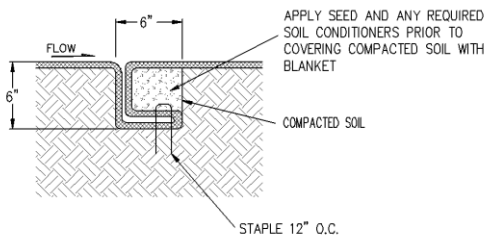
CONSECUTIVE ROLL OVERLAP SECTION B

TO BE USED WHEREVER ONE ROLL
OF BLANKET ENDS AND ANOTHER
BEGINS WITH UPSTREAM BLANKET
PLACED ON TOP OF THE BLANKET
ON THE DOWNSTREAM SIDE.



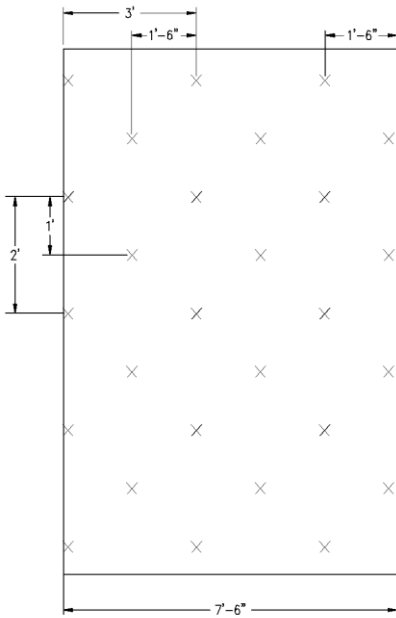
SIDE SEAM OVERLAP SECTION C

TO BE USED FOR OVERLAP WHEN
2 WIDTHS OF BLANKET ARE APPLIED
SIDE BY SIDE WITH THE UPHILL
BLANKET PLACED ON TOP OF
THE BLANKET ON THE DOWNHILL SIDE.



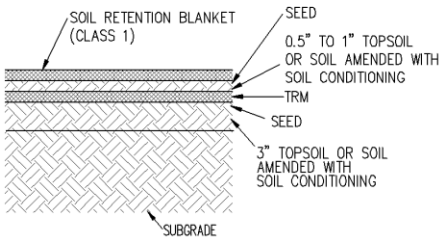
CHANNEL CHECK SLOT SECTION D

TO BE USED AT 30' INTERVALS IN CHANNEL FLOWLINE.



TYPICAL STAPLE PATTERN
FOR CHANNEL APPLICATION

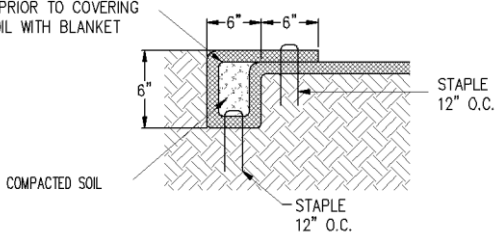
SEE SUBSECTION 216.05.



SOIL FILLED TRM APPLICATION

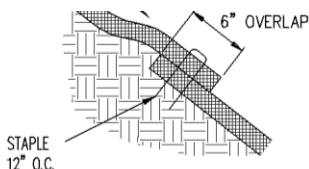
1. PLACE 3" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
2. APPLY SEED AND RAKE INTO SOIL.
3. INSTALL TRM.
4. PLACE 0.5" TO 1" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
5. APPLY SEED AND RAKE INTO SOIL.
6. INSTALL SOIL RETENTION BLANKET (CLASS 1).

APPLY SEED AND ANY REQUIRED SOIL
CONDITIONERS PRIOR TO COVERING
COMPACTED SOIL WITH BLANKET



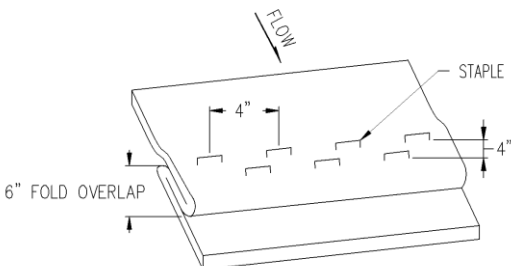
ANCHOR TRENCH SECTION A

TO BE USED AT THE BEGINNING AND END
OF THE CHANNEL ACROSS IT'S ENTIRE WIDTH.



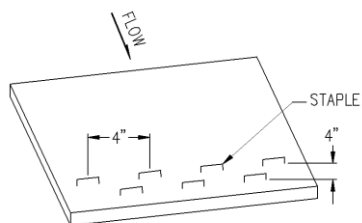
CONSECUTIVE ROLL OVERLAP SECTION B

TO BE USED WHEREVER ONE ROLL OF BLANKET ENDS
AND ANOTHER BEGINS WITH THE UPHILL BLANKET
PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.



STAPLE CHECK SECTION C

TO BE USED ON SLOPE EVERY 35 FEET.

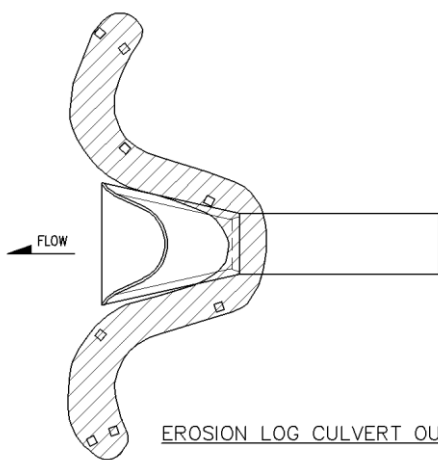


DOWNSLOPE END STAPLE CHECK

TO BE USED WHEN SLOPE RUNS INTO A RECEIVING WATER
AND CANNOT BE EXTENDED 3 FEET BEYOND SLOPE.

Outlet Protection

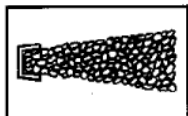
Outlet protection prevents scour and erosion at the outlet of a channel or conduit by reducing the speed of stormwater. Outlet protection is comprised of geotextile fabric and riprap placed at the outlet.



EROSION LOG CULVERT OUTLET PROTECTION



Good use of rock as outlet protection. The erosion log above the culvert helps prevent debris and dirt from falling into the outlet.



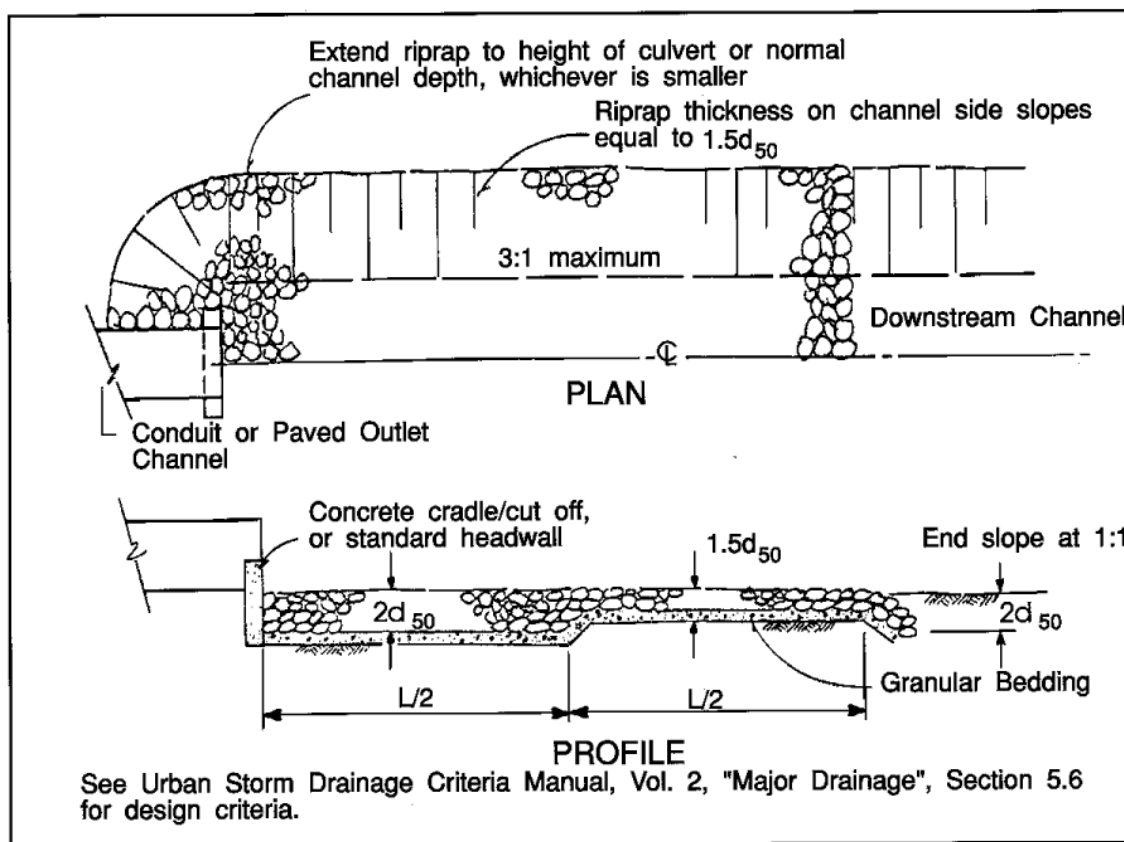
OUTLET PROTECTION

Definition

Structurally lined aprons or other acceptable energy dissipating devices placed at the outlets of pipes or paved channel sections.

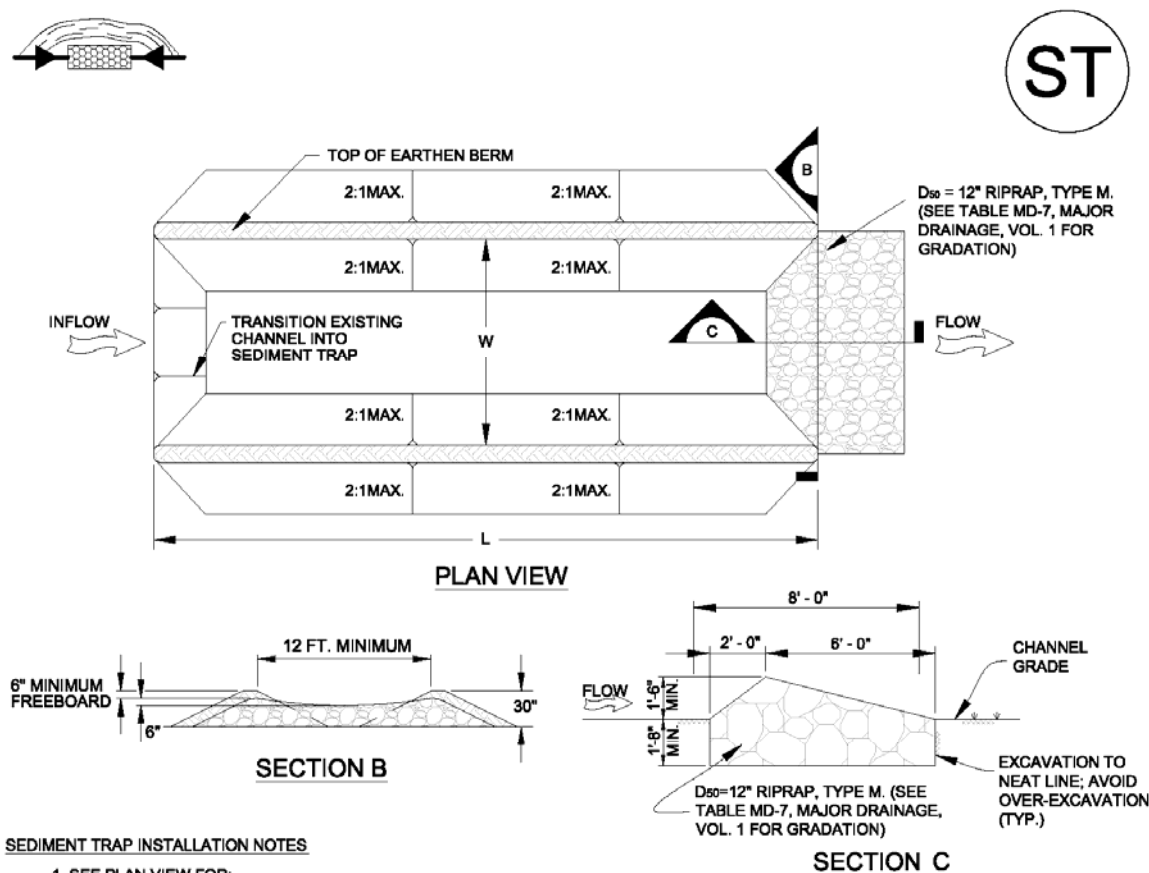
Purposes

To prevent scour at stormwater outlets and to minimize the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.



From: Major Drainage, Volume 2, Urban Storm Drainage Criteria Manual

Figure C5-16—Outlet Protection for a Culvert in a Channel

**SEDIMENT TRAP MAINTENANCE NOTES**

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT TRAPS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF RIPRAP SHALL BE REMOVED WHEN THE UPSTREAM DEPTH IS WITHIN $\frac{1}{2}$ THE HEIGHT OF THE RIPRAP OUTLET STRUCTURE.
3. SEDIMENT TRAPS SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVERAGE IS APPROVED BY THE LOCAL JURISDICTION.
4. WHEN SEDIMENT TRAPS ARE REMOVED THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILLED SEEDING AND CRIMP MULCHED OR STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

DETAIL BASED ON DETAILS PROVIDED BY DOUGLAS COUNTY, COLORADO

Figure C5-13—Standardized Temporary Sediment Trap

Seeding

Seeding is used to control runoff and erosion on disturbed areas by establishing vegetative cover. It reduces erosion and sediment loss and provides permanent stabilization.

Tips

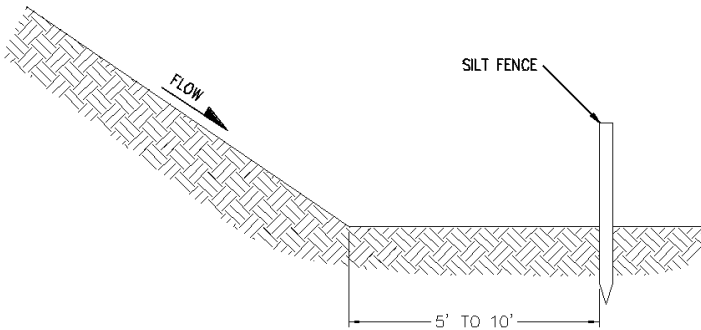
- Prepare seed bed by loosening surface to a minimum depth of 4 inches.
- Perform all drill seeding operations along the slope's contour.
- Provide seed tags to inspector.
- Inspect seed drill to ensure proper operation and placement of seed.
- Mulch and mulch tackifier or blankets should be applied immediately, but no more than 4 hours after seeding.
- An area should be re-seeded if the seeded area fails to establish, provide adequate ground coverage, or becomes disturbed.
- Seeding should occur throughout the duration of the project as construction is completed.
- Seeding should only take place during the seeding seasons listed in the Seeding table. Seeding outside the seasonal constraints may cause seeding failures.

Prepare soil and, if required, incorporate topsoil or soil conditioning. Drill seed rows must be parallel to contours (along grade).



Seeding

Zone	Spring Seeding	Fall Seeding
<i>Areas other than the Western Slope</i>		
Below 6,000'	Spring thaw to June 1 st	September 15 th until consistent ground freeze
6,000' to 7,000'	Spring thaw to June 1 st	September 1 st until consistent ground freeze
7,000' to 8,000'	Spring thaw to July 15 th	August 1 st until consistent ground freeze
Above 8,000'	Spring thaw to consistent ground freeze	
<i>Western Slope</i>		
Below 6,000'	Spring thaw to May 1 st	August 1 st until consistent ground freeze
6,000' to 7,000'	Spring thaw to June 1 st	September 1 st until consistent ground freeze
Above 7,000'	Spring thaw to consistent ground freeze	

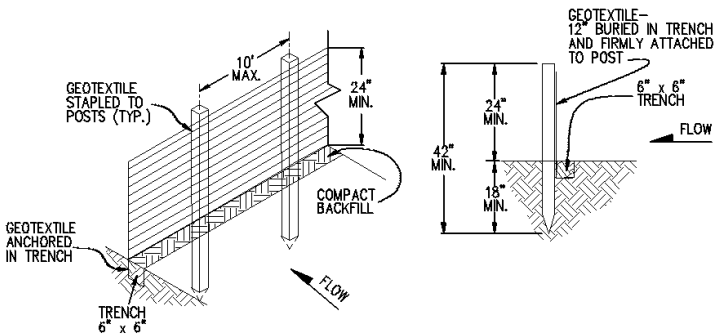


SECTION A-A

TOE OF SLOPE PROTECTION

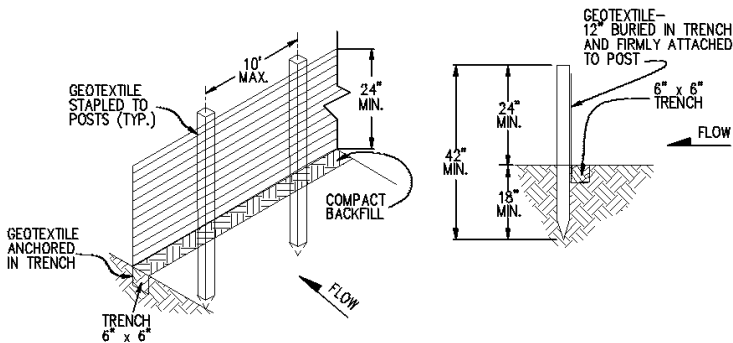
NOTES

1. SILT FENCE SHALL HAVE A MAXIMUM DRAINAGE AREA OF ONE-QUARTER ACRE PER 100 FEET OF SILT FENCE LENGTH; MAXIMUM SLOPE LENGTH BEHIND BARRIER IS 100 FEET; MAXIMUM GRADIENT BEHIND THE BARRIER IS 2:1.
2. SILT FENCE USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
3. SILT FENCE SHALL BE PLACED ON THE CONTOUR, WITH ENDS FLARED UP SLOPE.



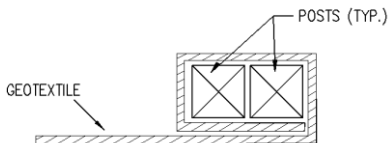
SILT FENCE

GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST. STAPLES SHALL BE 1/2"
WOOD POST SHALL BE 1 1/2" X 1 1/2" NOMINAL.



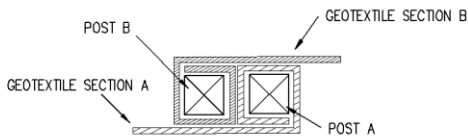
SILT FENCE

GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST.
STAPLES SHALL BE 1/2"
WOOD POST SHALL BE 1 1/2" x 1 1/2" NOMINAL



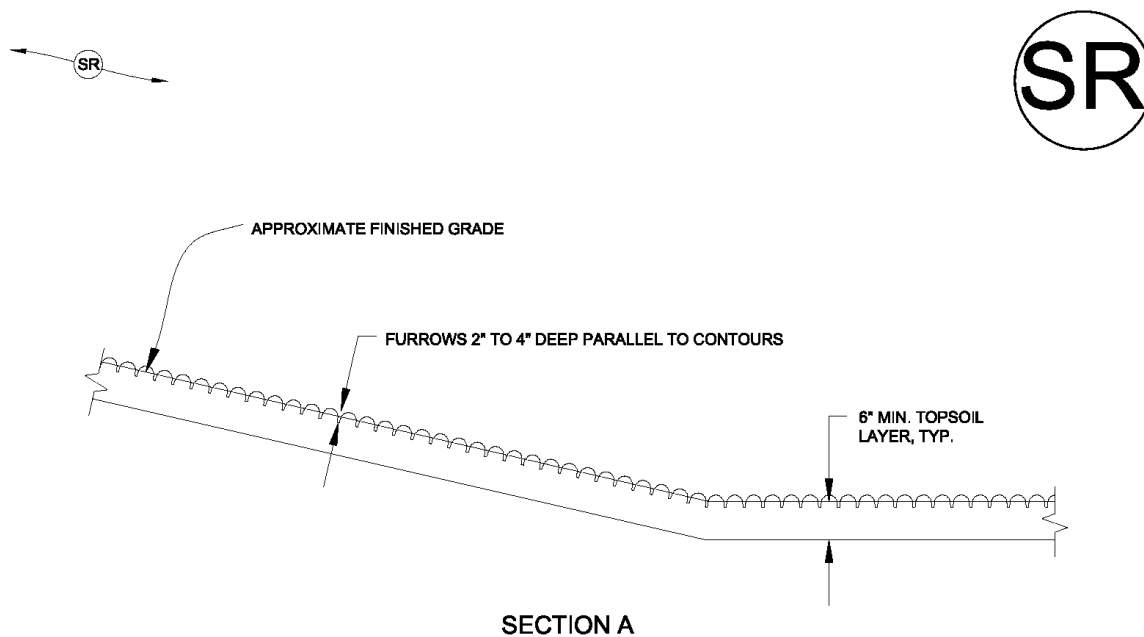
END SECTION DETAIL (PLAN VIEW)

GEOTEXTILE SHALL BE FOLDED AROUND TWO POSTS
ONE FULL TURN. SECURE GEOTEXTILE TO POST WITH THREE
STAPLES MINIMUM.



JOINING SECTION DETAIL (PLAN VIEW)

FOLD GEOTEXTILE AROUND EACH POST ONE FULL
TURN. SECURE GEOTEXTILE TO POST WITH THREE STAPLES
MINIMUM. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS
TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.

**SURFACE ROUGHENING INSTALLATION NOTES**

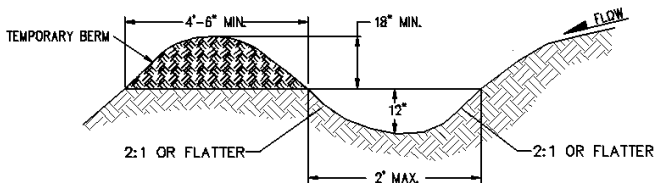
1. SURFACE ROUGHENING SHALL BE PROVIDED ON ALL FINISHED GRADES (SLOPES AND "FLAT" AREAS) WITHIN 2 DAYS OF COMPLETION OF FINISHED GRADE (FOR AREAS NOT RECEIVING TOPSOIL) OR WITHIN 2 DAYS OF TOPSOIL PLACEMENT.
2. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD ARE TO BE PLACED WITHIN 7-DAYS OF FINISHED GRADING DO NOT NEED TO BE SURFACE ROUGHENED.
3. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

SURFACE ROUGHENING MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT THE SURFACE ROUGHENING WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. VEHICLES AND EQUIPMENT SHALL GENERALLY BE CONFINED TO ACCESS DRIVES AND SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.
3. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.
4. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER ANY RILL EROSION.

DETAIL BASED ON DETAILS PROVIDED BY DOUGLAS COUNTY, COLORADO

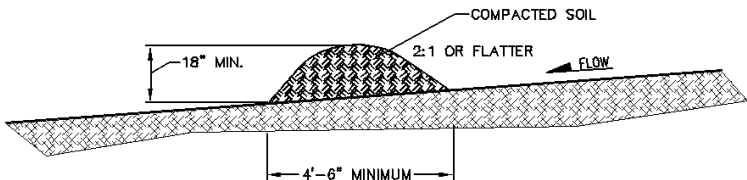
Figure C4-1—Surface Roughening



TEMPORARY DIVERSION

NOTES:

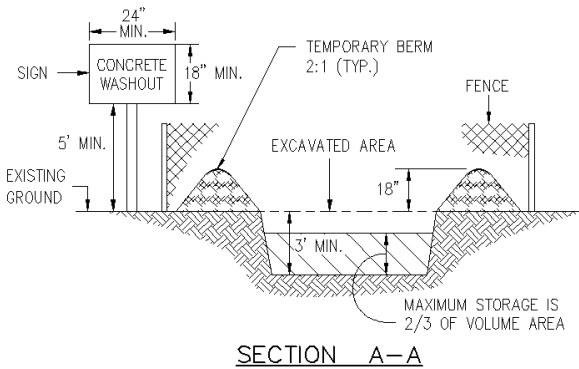
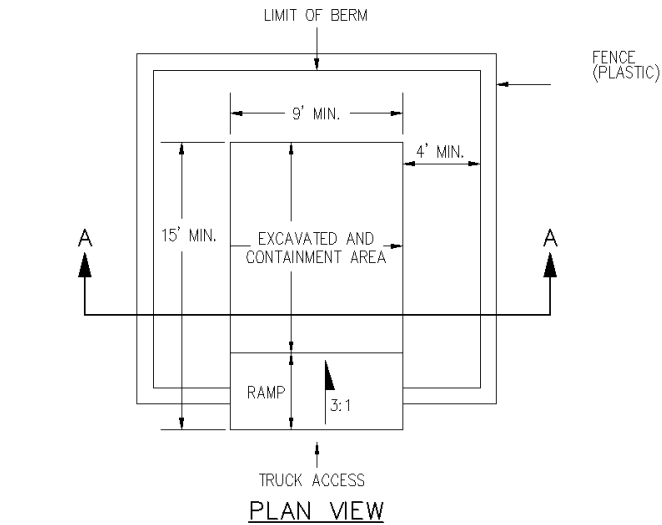
1. TEMPORARY DIVERSION DITCH SHALL BE CONSTRUCTED ACROSS THE SLOPE TO INTERCEPT RUNOFF AND DIRECT IT TO A STABLE OUTLET OR SEDIMENT TRAP.
2. USE IMMEDIATELY ABOVE A NEW CUT OR FILL SLOPE OR AROUND THE PERIMETER OF A DISTURBED AREA.
3. GRADIENT ALONG THE FLOW PATH SHALL HAVE A POSITIVE GRADE TO ASSURE DRAINAGE, BUT SHALL NOT BE SO STEEP AS TO RESULT IN EROSION DUE TO HIGH VELOCITY.



TEMPORARY BERM

NOTES:

1. BERMS SHALL HAVE A HEIGHT OF 18 INCHES, SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM BASE WIDTH OF 4.5 FEET.
2. BERMS SHALL BE USED TO INTERCEPT AND DIVERT DRAINAGE TO A DESIGNATED OUTLET.
3. BERMS SHALL NOT BE USED WHERE DRAINAGE AREA EXCEEDS 10 ACRES.



NOTES:

1. EROSION BALES MAY BE USED AS AN ALTERNATIVE FOR THE BERM.
2. A FENCE (PLASTIC) CONFORMING TO SUBSECTION 607.02 SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.
3. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS AT LEAST 3 INCHES HIGH AND CONFORM TO SUBSECTION 630.02.

Appendix C—Site Specific Data Sheets