STORMWATER MANAGEMENT PLAN (SWMP)

For Colorado Construction Activities at:

Crosspoint Substation

Prepared for:

TRI-STATE G&T

A Touchstone Energy® Cooperative

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DMC # 23148

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1.0 INTRODUCTION

1.1 The National Pollutant Discharge Elimination System (NPDES) Process and Construction Stormwater Management Plan (SWMP)

This document establishes a plan to manage the quality of stormwater runoff from construction activities associated with the Crosspoint Substation, El Paso County, CO. This project will disturb at least 1 acre or is part of a larger common plan of development, which will disturb more than 1 acre. For construction projects that require the disturbance of more than 1 acre, the U.S. Environmental Protection Agency (USEPA) requires that the project owner or contractor apply for a stormwater permit under the NPDES program. For the purposes of the NPDES program, construction activities are defined as clearing, grubbing, excavating, grading, import and placement of road material, improvements to existing or new drainage, installation of permanent drainage structures, installing landscaping improvements, paving (asphalt or concrete), construction of permanent structures, or any similar activity that causes native / undisturbed areas to be disturbed.

This NPDES permit program is administered in Colorado by the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (Division) under the Colorado Discharge Permit System (CDPS). CDPHE has a general permit for stormwater discharges from construction activities. The Construction Stormwater Permit (COR400000) was renewed and issued on January 31, 2024, and effective on March 31, 2029.

This document, including its attachments and appendices comprises the Stormwater Management Plan (SWMP) required by CDPHE's general permit for Stormwater Discharges from Construction Activities. This plan was written in accordance with the guidelines in the Division's Construction Guidance Document: "COR400000 Stormwater Management Plan Guidance". Reference material was used from the Urban Drainage and Flood Control District's Urban Storm Drainage Criteria Manual (V. 3) (updated 11/2010), the EPA "Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites" (May 2007), and the Colorado Department of Transportation (C.D.O.T.) Drainage Design Manual.

A permit application for Stormwater Discharges Associated with Construction Activity must be submitted to CDPHE at least 10 days prior to the start of construction, and the applicant must receive written notification that the Division granted permit coverage prior to conducting construction activities. The plan and permit will be available on-site while construction activities are taking place.

The USEPA and the State of Colorado have substantial penalties for non-compliance with the permit. Any permit non-compliance constitutes a violation of the Clean Water Act and is grounds for enforcement action including: permit termination; revocation, reissuance, or modifications; or denial of permit renewal application. Individuals responsible for such violations are subject to criminal, civil and administrative penalties.

The Construction Stormwater Permit only authorizes the discharges of the stormwater and those non-stormwater sources listed in Part 1.A.1. of the Construction Stormwater Permit. The permit does not cover discharges currently covered under an individual permit or a Division Low Risk Discharge Guidance developed in accordance with the Low Risk Discharge Policy (WQCD Policy 27).

1.2 Project Owner/Operator and Key Personnel

Owner/Operator:

Tri-State Generation and Transmission Association
1100 W. 116th Ave
Westminster, CO 80234

Contact for Owner/Operator:

Selina Koler
Tri-State Generation and Transmission Association
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The owner is the party that has overall control of the activities and that has funded the implementation of the construction plans and specifications. This is the party with ownership of, a long term lease of, or easements on the property on which the construction activity is occurring. The operator is the party that has operational control over day-to-day activities at the project site which are necessary to ensure compliance with the permit. This party is authorized to direct individuals at a site to carry out activities required by the permit. Tri-State owns/leases the Crosspoint Substation property and has operational control over the activities at the project site.

SWMP Administrator/Qualified Stormwater Manager (QSM):

Selina Koler
Tri-State Generation and Transmission Association
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Qualified Stormwater Manager:
An individual knowledgeable in the principles and practices of erosion and sediment control and pollution prevention, and with the skills to assess conditions at construction sites that could impact stormwater quality and to assess the effectiveness of stormwater controls implemented to meet the requirements of this permit. Tri-State's Stormwater Administrator, Developer, and Inspector are all identified as Qualified Stormwater Managers (QSM).

The SWMP Administrator is responsible for developing, implementing, maintaining, and revising the SWMP. This individual serves as the comprehensive point of contact for all aspects of this SWMP.

SWMP Administrator/QSM Signature: _____

Name: _____

Title: _____

Date: _____

SWMP Developer/QSM:

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The SWMP Developer is responsible for developing the SWMP in accordance with the requirements of the General Permit. Critically important in developing the SWMP is to identify all potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges associated with construction activity, to describe the practices to be used to reduce these pollutants, and to ensure that pollution prevention practices are based on good engineering practices (includes installation, implementation and maintenance requirements). The SWMP Developer is also available to adjust or update the plan as needed during construction, to make field visits and provide recommendations on appropriate Control Measures (CMs) for specific areas of concern or to determine if final stabilization has been achieved, and can help with administration of the plan or with Inactivation, Transfer, or Reassignment of the Permit.

SWMP Developer/QSM Signature: _____

SWMP Inspector/QSM Signature: _____

Name: _____

Title: _____

Date: _____

The SWMP Inspector is responsible for conducting and documenting required site inspections in accordance with the Permit. The SWMP Inspector must notify the Construction Contractor and the SWMP Administrator immediately if any additional or different CMs are required on the site, if

any CMs require maintenance, or if any CM has failed. During construction, the SWMP Inspector will assist the Construction Contractor with implementing and maintaining stormwater controls at the site and the SWMP Administrator with revising the SWMP as needed.

Construction Contractor:
Name:_____
Company: _____
Address:_____
Email: _____
Phone: _____

The Construction Contractor is responsible for installing and maintaining CMs as defined in the SWMP and is responsible for notifying the SWMP Administrator immediately if any CMs fail, require maintenance, or if additional CMs are required. The Construction Contractor will work closely with both the SWMP Inspector and the SWMP Administrator throughout the duration of the project.

2.0 CONSTRUCTION ACTIVITY AND SITE DESCRIPTION

2.1 Project Location

The proposed substation yard is located on a 81.67-acre parcel owned by TSGT, situated in the SE ¼ of Section 8, Township 14 South, Range 61 West, 6th Principal Meridian in El Paso County, Colorado. The substation site is accessed from N Lauppe Road.

2.2 Nature and Description of Construction Activities

The scope of this project is to build a new high voltage substation. The construction will include clearing/grubbing substation pad area, yard construction, grading drainage swales and detention pond, and installation of high voltage electrical equipment.

2.3 Proposed Sequence of Activities

Construction Task	Planned Start Month/Year
Install initial CMs	July 2026
Construct Substation	July 2026
Remove CMs no longer required	Winter 2026
Reclaim and stabilize all disturbed areas	Winter 2026/Spring 2027
Remove all temporary CMs	Spring 2027
Site stabilization	Summer 2027
Close Construction Stormwater Permit	Fall 2027

2.4 Estimation of the Total Area of Disturbance

The total area of the site is 81.67 acres. The estimated area of the site to be disturbed by all construction-related activities is approximately 13.24 acres.

2.5 Existing Soil Conditions

Consistent with other similar sites in the El Paso County area, the Crosspoint Substation site has the sandy soil with varying amounts of gravel, silt, and clay. A NRCS Soils Report (see Appendix G) confirms this typical soil and was used to develop and apply appropriate CMs. Use of appropriate CMs and the small contributing drainage basin minimize the soil erosion potential. Engineering judgment and construction experience with local drainage patterns were relied on to develop appropriate CMs to prevent soil erosion and migration.

2.6 Existing Vegetation and Runoff Characteristics

The site naturally drains to the south. The natural vegetation consists of native grasses and weeds. The site is estimated to have 30-60% ground cover prior to construction. The percent density was determined by examining a representative 10'x10' square and determining the plant density within the area. At final stabilization, ground cover should be greater than 70% of the pre-construction cover, 0.70 x 0.30-0.60, or approximately 20-40% vegetation coverage.

2.7 Potential Pollutants

The following chart identifies the potential pollutants that need to be addressed per the CDPS General Permit and their applicability to this project.

Potential Pollutant Source/Activity	Potential Pollutant	Potential with this Project?	Description of Activities	CMs Selected to Control Source
All disturbed and stored soils	Sediment	X	Construction of access road	Controlled Parking Controlled Site Entrance Designated Staging Area Detention Basins Drainage Swales/Check Dams Dust Control Good Housekeeping Practices Inlet Protection Natural Vegetative Barrier Seeding Silt Fence Straw Bales Straw Wattles (fiber rolls) Surface Roughening Vehicle Tracking Control
Vehicle Tracking of Sediments	Sediment	X	Delivery of construction materials; installation of sub-base materials; clearing and grubbing; daily construction traffic; construction of new access roads, excavation and removal of excess materials	Controlled Site Entrance Controlled Parking Designated Staging Area Dust Control Vehicle Tracking Control

Potential Pollutant Source/Activity	Potential Pollutant	Potential with this Project?	Description of Activities	CMs Selected to Control Source
Management of Contaminated soils	Fuel spill, runoff from contaminated area	X	On-Site vehicle maintenance & refueling	Spill Prevention Plan
Loading & Unloading Operations	Sediment, runoff from contaminated area	X	Equipment/material drop off and pick up; portable sanitary delivery & routine cleaning	Controlled Site Entrance Designated Staging Area
Outdoor storage activities	Sediment, Fuel spill, runoff from contaminated area	X	Construction material storage on-site for the duration of project	Controlled Site Entrance Designated Staging Area Spill Prevention Plan
Vehicle & equipment maintenance and refueling	Fuel spill, runoff from contaminated area	X	Vehicles & equipment which will remain at the site until work is completed will be maintained and refueled on site; fuels will not be stored on site	Controlled Parking Designated Vehicle Fueling and Maintenance Area Spill Prevention Plan
Significant dust or particulate generating processes	Dust	X	Construction of new pad area, grading pad, installation of structures	Dust Control
Routine Maintenance activities involving fertilizers, pesticides, detergents, etc.	Nitrogen, phosphorous		None	Project does not require use of these materials.
On site waste management practices	Debris, trash	X	Construction debris; portable sanitary facilities; personal trash	Designated Staging Area Solid Waste Management
Concrete truck & equipment washing	Concrete waste, concrete wash water	X	Equipment foundations	Concrete Washout(s)
Dedicated asphalt or concrete batch plants	Waste products, runoff from contaminated areas		None	Project will not require use of dedicated asphalt or concrete batch plants.
Non-industrial waste sources	Bacteria, parasites, viruses	X	Portable sanitary facilities; Personal trash and construction debris	Designated Staging Area Solid Waste Management

Potential Pollutant Source/Activity	Potential Pollutant	Potential with this Project?	Description of Activities	CMs Selected to Control Source
Other areas where spills could potentially occur	Runoff from contaminated areas		None	No other potential sources of pollutant were identified.
Irrigation Return Flows	Erosion/sediment from construction activities		None	No irrigation return flows expected on this project

2.8 Allowable Sources of Non-Stormwater Discharges

Irrigation return flows are not anticipated on this site. When construction activity involving concrete is required, a concrete washout will be installed in a designated area. Discharges to the ground of concrete or masonry washout water associated with the washing of concrete or masonry tools and concrete or masonry mixer chutes, and water used to wash vehicles, equipment and external buildings. Discharges of concrete or masonry washout water will not leave the site as surface run-off. The addition of soaps, solvents and detergents will not be used. No other allowable sources of discharge exist on the site.

2.9 Receiving Waters

Receiving waters include any classified or unclassified surface water segment (including tributaries) in the State of Colorado into which stormwater associated with construction activities discharges. This includes all water courses, even if they are usually dry, such as borrow ditches, arroyos, and other unnamed waterways. Runoff from the project site flows southeast, flowing overland through various drainages into Pond creek, ultimately running to the Arkansas River. Runoff from the substation will flow to the on-site detention pond to provide water quality treatment prior to discharge following historical drainage patterns. There are no stream crossings located within the construction site. There are no discharges to Outstanding Waters.

2.10 Site Map

The site map (see Appendix A) will show the following per the CDPS Permit:

- Construction site boundaries
- Flow arrows that depict stormwater flow directions on-site and runoff direction
- Entrances and exits (if applicable)
- All areas of ground disturbance including areas of cut and fill
- Areas used for vehicle parking, storage of building materials, equipment, soil or waste
- Locations of concrete washouts
- Locations of all structural CMs (including existing CMs)
- Locations of all non-structural CMs (including areas that will be subject to re-seeding)
- Locations of springs, streams, wetlands, and other surface waters (including areas that require pre-existing vegetation be maintained within 50 feet of a receiving water)
- Locations of all stream crossings located within the construction site boundary
- Any other factors that are important to the site and/or the SWMP

- **3.0 CONTROL MEASURES**

3.1 Structural Measures for Erosion and Sediment Control

Structural measures are those physical structures implemented at the site to minimize erosion and sediment transport. The CMs specified for use on the project are described below. Specific locations for CM implementation at the site are indicated on the site map in Appendix A. The installation details for these CMs are provided in Appendix B. This SWMP anticipates that not all of these CMs are going to be used and additional CMs may be added as site conditions change or climatic conditions warrant. If additional CMs are added, description and construction details will be added to Appendix B or to a revision of the Site Map prior to installation.

Concrete Washout

A concrete washout is used to capture waste water and waste products resulting from the cleaning of concrete equipment. The wash water is alkaline and can contaminate groundwater, increase the pH of receiving waters, clog storm drains, and harm wildlife. Examples of concrete washouts include, but is not limited to, a bermed excavation, a mobile disposal unit, small excavations located near the point of concrete placement, water tight vessels (such as a rigid pre-fabricated impermeable plastic wading pool, stock tanks, small dumpsters, buckets, etc.), and geotextile bags.

Control measures designed for concrete washout waste shall be implemented at the project site, and Tri-State will ensure that washing activities do not contribute pollutants to stormwater runoff or receiving waters. Discharges that may reach groundwater will flow through soil that has a buffering capacity prior to reaching groundwater. The concrete washout area shall not be located in an area where shallow groundwater may be present and would result in the soil buffering capacity not being adequate. Hardened concrete wastes on the ground will be picked up daily and disposed of properly

Concrete pours will be scheduled so that no pours occur when a storm event is anticipated. No concrete pours will be conducted during storm events. A concrete washout will not be necessary if all washout operations are performed off-site (at the vendor mixing plant for example).

Concrete washout will only be allowed in the designated area. For project phases with large amounts of concrete work, concrete washout will be conducted at a dedicated concrete washout pit installed and maintained on the site. For project phases with small amounts of concrete work, the driver will be directed to return to the mixing facility to washout the truck drum or a rigid pre-fabricated impermeable plastic wading pool can be used to contain the washout. If the concrete contractor is able to provide a prefabricated washout container, this will be used in place of constructing one onsite.

A concrete washout will be installed or provided prior to any construction activities that include the handling of materials containing cement (e.g. concrete, masonry, etc.). Concrete washouts will

be installed per the attached detail ("Concrete Washout Area" CWA-1 through CWA-4 from Urban Drainage and Flood Control District Drainage Criteria Manual Volume 3).

The concrete washout will be inspected daily during periods of concrete construction to make sure appropriate access control, tracking and containment is in place. Additionally, the project manager/superintendent will ensure that concrete washing is being conducted only at this designated area and that no damage is present at the washout. For lined washouts, the liner will be inspected for rips, tears, etc. Concrete operations will be suspended until any needed repairs are completed.

Maintenance will include the removal of excess material, cleaning, and general structural integrity of the installation as needed. The concrete washout will be cleaned of excess water and solids on a regular basis to maintain its proper function. The washout will be cleaned out when at 75% of capacity (50% if rigid containment is used). The concrete waste will be properly disposed by a qualified contractor.

If a water-tight vessel is used to contain concrete washout water, the following management practices will be followed:

(1) The CM will be inspected for waterproof integrity prior to each use;
(2) The CM will not be filled to more than 50% of capacity with either liquid or solid waste;
(3) Immediately after concrete washing is complete, the CM will be covered with a waterproof barrier;
(4) Upon termination of use of the washout site or when waste reaches 50% capacity, the accumulated waste will be removed from the site and properly disposed.

If unlined pits are used to contain concrete washout, the following management practices will be followed:

(1) The use of the washout site must be temporary (less than 1 year);
(2) The washout site will not be located in an area where groundwater may be present, such as near natural drainages, springs, or wetlands, or down slope of construction activity where runoff could flow into the washout;
(3) Upon termination of use of the washout site, accumulated solid waste, including concrete waste and any contaminated soils, will be removed from the site to prevent on-site disposal of solid waste.

The washout will be removed when it is no longer needed.

Drainage Swales/Check Dams

Drainage swales and check dams may be constructed during the initial stages of new construction to ensure run-on and run-off are managed correctly. Check dams may also be constructed where existing drainage patterns cross onto the site and bring neighboring property run-on into the construction area. Check dams are generally constructed from rock, straw wattles, or straw bales. They are designed to slow water velocity allowing some sediment to settle. Check dams will be used in areas of concentrated flows along drainage swales. The check dam will be installed

across the entire width of the drainage swale in order to function properly. The center of the check dam should be lower than the sides. Drainage swales will be installed per the construction drawings and from Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010. Check dams will be inspected for proper installation and sediment accumulation on the up-gradient side. Accumulated sediment and debris will be removed when the sediment level reaches one-half the height of the CM or at any time that sediment or debris adversely impacts the functioning of the CM. The removed sediment shall be placed with the topsoil stockpile and debris shall be hauled from site and disposed of. Check dam materials will be cleaned and replaced as needed to maintain function and integrity.

Inlet/culvert protection

Inlet protection consists of a barrier placed in front, around, or immediately up-gradient from the inlet or culvert. The most common forms of inlet protection are straw wattles or straw bales. Inlet protection is designed to slow stormwater flow into the inlet or culvert, allowing sediment time to settle and accumulate on the up-gradient side to the structure, without constricting the inlet throat. As permanent stormwater system inlets are constructed in areas with potential disturbed area run-off or when existing inlets are potentially impacted by construction activity, inlet protection will be installed. Any structure with a potential to receive run-off from non-stabilized surfaces will be treated with an inlet protection CM. Inlet protection will remain in place until all up-gradient areas are stabilized. See attached detail for further description and applications (excerpt from Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010. Inlet protection will be inspected for damage, structural integrity, and proper installation in relationship to the culvert, and accumulated sediment/debris. Maintenance includes repairing or replacing as needed, repositioning the inlet protection and/or removing accumulated sediment.

Riprap

Rip rap is a layer of rock used to reduce the velocity of stormwater and to trap sediment. It is a permanent CM that is used to line channels, ditches, drainage swales, and at culvert inlets/outlets. The depth of the rip rap should be a minimum of twice the maximum rock diameter. A geotextile fabric can be used to extend the effectiveness of rip rap. See construction drawings regarding specifications of riprap.

Sediment Trap

Sediment traps are small impoundments which allow sediment to settle out which are generally installed in a drainage way or other point of discharge from a disturbed area. They are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. Typically, a spillway or outlet is constructed to allow the slow release of stormwater runoff. Sediment traps are commonly used at the outlets of diversion structures, slope drains or any other runoff that discharges waters containing sediment. If detailed engineering drawings specifically are not designed for this project, see attached installation detail and notes (“Sediment Trap” ST-1 through ST-3 from Urban Drainage and Flood Control District Drainage Criteria Manual Volume

3). Sediment Traps will be inspected for accumulated sediment, erosion and to ensure effective operation.

Silt Fence

Silt fence consists of geotextile fabric installed with at least six inches of the fabric entrenched into the soil attached to wooden stakes on the down-gradient side. Wire-backed fence may be used or additional stakes or lathe may be added on the down-gradient side for strengthening the fence around corners or in high wind conditions. Silt fence provides sediment control by reducing water velocity and ponding water to facilitate the deposition of sediment on the up-gradient side of the fence. Silt fence applications include, but are not limited to: project perimeter control, secondary containment, back of curb protection, containment for any disturbed or staging area, or around temporary material stockpiles (outer boundary). Silt fence is an optional CM to be used at the discretion of either the construction foreman and/or the SWMP Administrator. When silt fence is used, it will primarily be installed prior to clearing and grubbing operations in a new phase of construction where a sediment control measure is appropriate. Usually other CMs, such as natural vegetative barriers, straw wattles, and rock sediment traps, will be employed before use of silt fence. The primary application for silt fence will be in steeper sections of the project to protect the site from neighboring run-on or to direct project run-off toward a large sediment trap. Silt fence will be installed per the attached detail ("Silt Fence" SF-1 through Sf-4 from Urban Drainage and Flood Control District Drainage Criteria Manual Volume 3). Silt fence will be inspected regularly for sediment accumulation one-half the height of the fence, tears or holes in the fabric, broken stakes, and gaps in the fabric or areas where the fabric needs to be re-attached to the wooden stakes.

Straw Bales

A straw bale should be a minimum of 14" X 18" X 36" and have a minimum mass of 50 pounds. It should be composed of only vegetative matter, except for the binding. The straw bales should be bound by steel wire (minimum 14-gauge), nylon or polypropylene. Applications include, but are not limited to, check dams in swales, inlet protection, outlet protection, perimeter control, disturbed areas with significant potential for off-site drainage, protection from neighboring site run-on, or during the construction of drainage swales and ditches. Straw bales may also be used as "final discharge check dams" for drainage swales and ditches to slow run-off and collect sediment. Straw bales will be keyed into the soil perpendicular to the run-off flow. Straw bales will be installed per the attached detail (Excerpt from Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010).

Straw Wattles (fiber rolls)

A straw wattle consists of a net or geotextile fabric filled with straw, excelsior, wood mulch or other fillers. Straw wattles reduce water velocity allowing sediment to accumulate on the up-gradient side of the straw wattle. Applications include, but are not limited to, disturbed areas with significant potential for off-site drainage, protection from neighboring site run-on, during the construction of drainage swales and ditches, slope stabilization, check dams in swales, back of curb protection, or temporary secondary containment for stock piles and materials storage. Straw

wattles will be keyed into the soil in a trench a minimum of two inches deep perpendicular to the run-off flow, secured in the trench using stakes, and backfilled on the up-gradient side. When necessary they will be stacked two courses high with joints off-set or overlapped. Straw wattles will be installed per the attached detail (Excerpt from Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010). Straw wattles should be inspected for proper installation, structural integrity and sediment accumulation. A straw wattle that has been flattened out of round may not need to be replaced if they remain sufficiently sound to function appropriately on the up-gradient side of the straw wattle.

Topsoil Berm

A topsoil berm is a ridge of compacted soil which is used to prevent run-off and sheet flow of stormwater. The minimum height of the berm is 18 inches with side slopes less than 2:1. Topsoil berms shall be used to intercept and divert drainage to a designated outlet point. Topsoil berms will be installed per the attached detail (Excerpt from Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010).

Vehicle Tracking Control

Vehicle tracking control will consist of an area with a geotextile liner and gravel, metal grate, medium-sized (6” to 12”) rough-cut rocks, or asphalt/concrete “rumble strip”. Tracking control is designed to cause soil to vibrate off equipment and vehicles as they transition from disturbed soils to paved areas. The vehicle tracking control will remain in place until access to the areas used by the control are stabilized or no longer needed. All appropriate points of ingress and egress, where traffic transitions from a stabilized road surface (e.g. gravel or pavement) to disturbed soil, will have vehicle tracking control installed. Tracking control will be moved or eliminated as on-site conditions and activities change. Tracking control will be inspected for depth of gravel/rock, presence of excess soil, proper usage and the overall general condition. Strict site access will be maintained throughout the project. Once the section is stabilized and surface drainage features are built, tracking pads will be removed in favor of controlled site access. See attached detail for further description and applications (Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010.

Diversions For Clean Water

Diversions for clean water will be implemented to minimize soil transportation and erosion. Contractor may used lined or piped structures that result in no erosion for anticipated flow conditions. Diversion channels, berms, and coffer dams must be lined or composed of a material that minimizes potential for soil loss in the entire wetted perimeter during anticipated flow conditions (e.g. vegetated swale, non-erosive soil substrate). The entire length of the diversion channel must be designated such that the maximum flow velocity for the type of material(s) exposed to the anticipated flows ensures the calculated maximum shear stress of flows in the channel is not expected to result in physical damage to the channel or liner nor result in discharge of pollutants. Additionally, the conditions relied on to minimize soil loss must be maintained for the

projected life of the diversion (e.g. use of a vegetated swale must be limited to a period of time that ensures vegetative growth, minimizes erosion and maintains stable conditions).

3.2 Non-Structural CMs for Erosion and Sediment Control

Non-structural practices are those practices which when implemented will minimize erosion and sediment transport. Practices implemented at this site include interim stabilization practices, permanent stabilization practices (see Section 4), site-specific scheduling for implementation of the practices, and site management practices and personnel training. The CMs specified for the project are described below. Specific locations for CM implementation at the site are indicated on the site map in Appendix A. The installation details for these CMs are provided in Appendix B. Additional CMs may be added as site conditions change and will be identified in the "New CMs Added to the Site" form (Appendix C) prior to installation.

Controlled Parking

During construction activity, controlled parking areas will be established to allow workers to commute to/from the job site. Limited and designated parking areas will be established for all new phases of construction. This CM is an administrative measure to control access to/from the site.

Controlled Site Entrance

During construction activity or when construction activity is temporarily left in an intermediate state awaiting final treatment (concrete, finished gravel surface, etc.), controlled access will be established to direct traffic in/out and across/through the areas under construction. Limited access points will be established for all new phases of construction. This CM is an administrative measure to control access to/from the site and to ensure the general public is directed through the construction site via a safe and stabilized route.

Designated Staging Area

A designated staging area is a specific location on-site for stockpiling/staging materials or staging equipment for use on-site. A stabilized staging area allows for a central location for deliveries and storage of equipment when not in use, and to prevent disturbance of areas not scheduled for construction activities. Stabilized staging areas will be implemented as needed on site and will be located out of areas of active construction activity. If possible, the designated area will be located so it can be utilized during the entire construction period. Stabilized staging areas will be inspected for adequate vehicle tracking control and perimeter control. The staging area will be repaired or modified as needed. No hazardous material will be stored on site. This CM is an administrative measure to control access to/from the site.

Designated Vehicle Fueling and Maintenance Area

During all active construction phases, vehicle fueling and maintenance will only be conducted in a designated area. Any waste (oil, antifreeze, solvents, etc.) will be disposed according to manufacturer's instructions or Material Safety Data Sheets (MSDS). Vehicles and equipment will be inspected for leaks. Leaks will be repaired on site immediately or the vehicle/equipment will be removed from the site. Spill kits will be readily available. Any spills will be immediately cleaned

up and properly dispose as described in Section 6.4, Spill Control and Cleanup. No fuel will be stored on-site.

Dust Control

Dust control reduces dust generated from disturbed surfaces and wind. To control dust that may be generated at the project site during construction, water will be applied from water trucks as needed. Care will be taken to apply water per industry standard in small volumes and at a low rate to prevent surface runoff. Correct application is just enough water to moisten the surface and calm dust, but not so much as to create standing water and mud.

Erosion Control Blankets (ECBs) and Turf Reinforcement Mats (TRMs)

ECBs and TRMs are sheets of straw, excelsior, coconut, manmade fiber, or combination thereof, usually contained between layers of netting to provide structural integrity. ECBs and TRMs provide a ground cover that reduces erosive action. TRMs are able to handle higher levels of concentrated flows and are used mainly in channel applications. ECBs and TRMs may be used in conjunction with other velocity reducing CMs. ECB and TRM applications include, but are not limited to, slope and swale protection. See attached detail for further description and applications (Standard Plan No. M-208-1, Temporary Erosion Control, from the Colorado Department of Transportation (CDOT) 2006 M-Standard (Miscellaneous Standard) Plans, rev 8-2010). ECB and TRMs will be inspected for erosion underneath and at the sides, sediment accumulation, rips, tears and other structural problems. Maintenance will include removing sediment (to be placed with topsoil stockpile), re-securing material to ground, and re-trenching at up-gradient portions and sides as needed.

Good Housekeeping Practices

Good housekeeping will be used to keep potential areas where pollutants exist clean and orderly. Any containers, drums, and bags will be stored away from direct traffic routes to reduce the risk of accidental spills, stacked according to manufacturer's instructions, and stored on pallets or similar items. Materials which require spill containment practices (described in Section 6) shall be stored in close proximity to an appropriately stocked spill response kit. Hazardous materials will not be stored on this site. The site will be managed to keep materials, equipment, and portable sanitary facilities (these will additionally be staked to prevent/inhibit tipping) only in designated areas and promptly directing the thorough clean-up of any debris resulting from these operations. Stockpiles will be protected from run-on and run-off with berms, natural vegetative barriers, or structural CMs (straw wattles, straw bales, silt fence, etc.).

Mulching

Mulching uses materials such as grass, wood chips or fibers, hay, straw or native mowed vegetation to stabilize exposed or recently seeded soil and to reduce stormwater velocity and improve infiltration. It is most effective when used in conjunction with vegetation. Mulching can additionally aid vegetation growth by preventing birds from eating the seeds, retaining moisture, etc. Natural mulches will be used whenever possible. For steep slopes and critical areas, mulch matting with anchoring or matting will be utilized. The SWMP administrator will determine the appropriateness of utilizing mulching throughout the project. See attached detail for further

description and applications (Figure C4-2, Mulching, from the Urban Drainage and Flood Control District Drainage Criteria Manual (V.3)). Since subject to erosion, mulched areas will be inspected frequently for effectiveness.

Natural Vegetative Barrier

A natural vegetative barrier is a preexisting vegetated area that is retained during construction to reduce water velocity and prevent erosion. Natural vegetative barrier provides a barrier zone where sediment is trapped, which reduces sediment discharge off-site, and are encouraged for any perimeter or environmentally sensitive areas. Whenever possible, a natural vegetative barrier will be maintained between the construction area and stormwater drainage areas. For best efficiency, buffer strips should be a minimum of 20' in length along the direction of flow; shorter distances should be supplemented with additional CMs.

Perimeter control

Perimeter control will control access during construction activity. Perimeter control will consist of various CMs, including, but not limited to controlled parking, controlled site entrances, vehicle tracking control, wire boundary fencing, etc. This CM is an administrative measure to control access to/from the site and to ensure the general public safety.

Seeding

Seeding involves the mechanical or hand application of specific seed mixes appropriate for the site location and soil type. Seeding provides plant growth to stabilize the soil reducing the likelihood of erosion or sediment transport and provides permanent stabilization. Drilling is the preferred method of seeding.

As soon as practical, but no more than 14 days after the completion of final grading, disturbed surfaces as well as all areas which will not be hard surfaced or graveled, shall be properly prepared and seeded per the recommended seed mix below. To maximize seed germination and to utilize natural precipitation, seeding will normally occur from March to May or September to October. The SWMP Administrator will determine the appropriateness of seeding throughout the project. Seeding may be accompanied by an additional CM, such as mulching or straw mats, to protect the seed and soil from erosion during the germination and growth process. Straw mats will be stapled to the slopes and overlapped.

Stockpiled topsoil will be redistributed over areas to be seeded. At the discretion of the SWMP administrator, a soil conditioner (3CY per 1,000 SF) may be rototilled into the top 6" of the topsoil soil before fine grading. The topsoil shall be graded to a reasonably even and smooth surface. Seed shall be uniformly distributed over the area. Drilled seed shall be applied .25 to .5 inches deep in rows spaced no more than 7 inches apart. On slopes steeper than 3:1, seed shall be applied by a mechanical broadcaster or hand broadcast at double the rate required for drill seeding. All seed sown by mechanical broadcasters shall be raked or dragged into the soil to a depth of ½".

Seed mix to be provided by Contractor to be approved by the owner and El Paso County.

All seed must comply with Colorado weed seed guidelines. There should be no prohibited/noxious weed species seeds in the mix. Use certified Pure Live Seed (PLS). Deliver in original unopened containers with seed tags dealers warranty analysis attached.

Seeded areas will be inspected every 14 days and after an erosion causing storm event to ensure that the soil stabilization method (e.g. surface roughening, erosion control blankets, etc.) was applied correctly and has not been compromised. The area will also be inspected for erosion and/or sediment deposition. If vegetation does not begin to grow in a seeded area after 4 to 6 weeks, the area will be reseeded, fertilized, and mulched. Maintenance items would include re-grading and seeding bare or areas of thin vegetative growth and/or adding additional CMs as appropriate. Seeded area will be inspected and monitored until the area obtains final stabilization.

Solid Waste Management

To reduce the risk of pollution at the project site, construction wastes require proper management and disposal. This includes location of refuse piles, materials that may be displaced by stormwater, trash disposal and spill prevention. Waste collection will be scheduled to prevent containers from overflowing. Debris stockpiles will be continuously monitored and dispose of properly throughout the construction period. Additionally, waste will be monitored around the site perimeter. The onsite portable sanitary facilities will be staked to prevent tipping and will be monitored and cleaned weekly. Trays can be used to contain spills. Any spills of sewage chemicals will be cleaned up according to Section 6.4.

Surface Roughening

Surface roughening consists of grooves or tracks installed in the soil surface, perpendicular to the slope. This is a temporary soil stabilization technique that works well in areas that will remain inactive for a short time. It reduces water velocity and promotes infiltration, thus decreasing the potential for erosion to occur. As areas are cleared, surfaces will be left rough to inhibit run-off sheeting from disturbed areas. Where practical, surfaces will be left in a roughened state and slopes will be graded (or “tracked”) parallel to the contour to further inhibit sheet flow drainage. Any disturbed areas with no construction activity planned for more than 14 days or longer will be surfaced roughened. See attached detail for further guidance and potential applications (“Surface Roughening” SR-1 through SR-4 from Urban Drainage and Flood Control District Drainage Criteria Manual Volume 3). In areas where it is impractical to apply surface roughening using tracked equipment the surface may be manually raked to create the desired texture.

3.3 Phased CM Installation

Phased CMs will be used in conjunction with the installation of permanent structural CMs (rip-rapped outfalls, culvert installations, etc.). Temporary additional sediment control and/or erosion control CMs will be added to the upstream side of the permanent CM. As an example, if new culverts are installed, rip-rapped scour protection will generally be installed at the outlet end. A temporary (phased) sediment control CM (usually straw bales or straw wattles) will be installed on

the inlet side to prevent the culvert and the outlet rip-rap from silting in before the upstream ditch/drainage can be stabilized (usually with natural vegetation). Phased CMs can be a combination of both Structural and Non-Structural CMs. Refer to Appendix C for phased CM Installation.

3.4 Dedicated Concrete or Asphalt Batch Plants

No onsite concrete or asphalt production will be used for this project unless approved by the owner. All concrete and asphalt will be imported and placed the same day.

3.5 Vehicle Tracking Control

Vehicle tracking controls are used to prevent sediment transport from the construction site to paved or permanently graveled roads. These controls are:

- Controlled Parking
- Controlled Site Entrance
- Designated Staging Area
- Dust Control
- Vehicle Tracking Control, including management of general public traffic

3.6 Waste Management and Disposal (Including Concrete Washouts)

On-site waste disposal including personnel trash, construction debris, sanitary wastes, etc. is prohibited. The following practices shall be implemented as directed.

Concrete Washout

Designated concrete washout(s) will be installed on site during construction phases involving concrete. The location of these washout(s) will be added to the site map. No concrete waste will be discharged directly into the ground without a containment feature. The concrete waste and/or excess wash water will be properly disposed as needed. Additionally, signs will clearly indicate the concrete washout location. Concrete washout water will not be discharged to receiving waters, storm sewer systems or the ground.

Portable Sanitary Facilities

Portable sanitary facilities will be provided (if necessary) in a convenient, level location away from traffic areas at least three feet from curb flow lines and paved/driving surfaces, storm drains, or retention areas. A qualified contractor will maintain and clean the units, inspect for any deficiencies, and keep the units in good working order. Portable sanitary facilities will be adequately anchored to prevent tipping. The construction contractor will be responsible for ensuring that the units are properly used and maintained.

Solid Waste

Large amounts of solid waste are not anticipated to be generated during this project. The majority of solid waste will be collected, removed from site, and properly disposed on a daily basis. If dumpsters are needed, they will be installed in a convenient, level location away from traffic areas, storm drains, drainage areas, or retention areas. The dumpsters will be kept off of paved surfaces (to avoid damages to the asphalt) and a qualified contractor will empty the dumpsters, as needed. The site perimeter will be monitored to ensure that all site personnel utilize the proper waste disposal practices and facilities.

Hazardous Wastes

Fuel and hazardous materials will not be stored at the site.

3.7 Product Specific Practices

Due to the chemical makeup of specific products, certain handling and storage procedures are required to promote the safety of personnel and prevent the possibility of pollution. Site personnel will be instructed to follow all directions and warnings for products used on the site. All pertinent information can be found on the Material Safety Data Sheets (MSDS) for each product. The appropriate MSDS will be located with each product container or in a readily accessible central location.

3.8 Groundwater and Stormwater Dewatering

Based on the shallow nature of construction, dewatering of groundwater or stormwater is not anticipated on this project. The Division's Low Risk Discharge Guidance for Discharges of Uncontaminated Groundwater to Land allows the discharge of construction dewatering to the ground, under specific conditions, when appropriate control measures are implemented. It does not allow discharge of construction dewatering of non-stormwater to be discharged to the surface waters or to storm sewer systems without separate permit coverage. Although the Construction Stormwater permit does not authorize the conditional discharge of construction dewatering to the ground, discharge of uncontaminated groundwater to land may be covered under the Low Risk Discharge Guidance when all the provisions in the guidance document are adhered to. In all cases when groundwater is encountered, a geotechnical and/or a professional engineer will be consulted before proceeding with the project.

4.0 FINAL STABILIZATION AND LONG-TERM STORMWATER MANAGEMENT

4.1 Temporary Stabilization

Temporary stabilization must be implemented for earth disturbing activities on any portion of the site where ground disturbing construction activity has permanently ceased, or temporarily ceased for more than 14 calendar days. Temporary stabilization methods may include, but are not limited to, tarps, soil tackifier, and hydroseed. The 14-day schedule may be exceeded when either the function of the specific area of the site requires it to remain disturbed, or, physical characteristics of the terrain and climate prevent stabilization. The constraints necessitating the alternative schedule must be documented, an alternate stabilization schedule provided, and all locations where the alternative schedule is applicable on the site map need to be identified.

Detention pond may be used as temporary sediment basin prior to installing outlet structure and converting to Extended Detention Basin. All pond slopes must comply with temporary stabilization requirements.

4.2 Description of Final Stabilization Practices

Final stabilization for disturbed areas of the site will be to return to their original condition or to the improved design (native re-vegetated areas, access roads, gravel yards, drainage basins, etc.). For disturbed areas, temporary CMs will be maintained until the final surface cover is constructed or established.

4.3 Final Stabilization Methods

Final stabilization includes those measures taken to control pollutants in stormwater after soil disturbing activities are complete. Practices implemented to achieve final stabilization include:

- Preparation of the soil prior to seed application;
- Seed mix appropriate for the area will be broadcasted per recommended instructions;
- Maintaining appropriate erosion and sediment control CMs until final stabilization is achieved; and
- Removal of temporary CMs once work is completed and final stabilization achieved.

4.4 Final Stabilization Achievement

Final stabilization of road surface areas and graveled areas will be achieved when the final surface (improved gravel surface, landscaping, etc.) is accepted by the Owner. Final stabilization will be reached when all ground surface disturbing activities at the site have been completed, and for all areas of ground surface disturbing activities where a uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. Coverage

under the Stormwater Construction Permit may be terminated by the permittee when the entire site has attained final stabilization, the El Paso County Stormwater inspector has completed a final inspection, all temporary erosion and sediment control measures have been removed, and all components of the SWMP are complete. Vegetative ground cover shall be greater than 70% of the pre-construction cover, 0.70 x 0.3-0.60, or approximately 20-40% vegetation coverage depending on the location, for areas of disturbance that are not hard surfaced, graveled, or landscaped. When the site has attained final stabilization and all temporary erosion and sediment control measures have been removed, the permittee will submit an Inactivation Notice form.

4.5 Permanent Control Measure

This site will have an extended detention basin (EDB-1) that will serve as a permanent control structure. EDB-1 is located on the south side of the Crosspoint Substation. Drainage from the substation is collected in subsurface drains, released into a pond, and then detained via a concrete outlet structure before being released through an outlet into riprap, and then into a basin controlled by a level spreader.

-Note: No control measures used on project will be owned nor operated by another entity.

5.0 INSPECTION AND MAINTENANCE

5.1 Minimum Inspection Schedule

A thorough inspection will be conducted within 7 calendar days of the commencement of construction activities, and in accordance with one of the following minimum frequencies:

- At least one inspection every 7 calendar days
- At least one inspection every 14 calendar days, PLUS post-storm even inspections conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion.
    - Post-storm inspections may be used to fulfill the 14-day routine inspection requirement.

Inspections will be conducted on either the 7 day or 14 day schedule, and may switch between these schedules as appropriate for the site. The inspection frequency will be noted on the inspection reports. There are no discharges to Outstanding Waters; therefore inspections will not be required at least once every 7 days.

5.1.1 Post-storm inspections

Post-storm inspections will be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion. If no construction activities will occur following a storm event, post-storm event inspections will be conducted prior to re-commencing construction activities, but no later than 72 hours following the storm event. The delayed inspection will be documented in the inspection record.

5.1.2 Inspections at Completed Sites/Areas

For completed construction sites, an inspection of the site will be made at least once every month until final stabilization is reached. The following must be met in order for the site to be inspected on a monthly basis instead of every 14 days:

- All construction activities that will result in surface ground disturbance are completed;

- All activities required for final stabilization have been completed, with the exception of the application of sod or seed that has not occurred due to seasonal conditions or the necessity for additional seed application to augment previous efforts; and

- The SWMP has been amended to indicate those areas that will be inspected in accordance with the reduced schedule.

The reduced frequency schedule also applies to the site or portions of the site where continuing construction activities can be conducted without disturbance of the ground surface.

5.1.3 Winter Conditions Inspections Exclusion

Inspections will not be conducted where construction activities are temporarily halted, snow cover exists over the entire site for an extended period, and melting conditions posing a risk of surface erosion do not exist. The following information will be documented in the inspection record for use of this exclusion:

- Dates when snow cover occurred,
- Date when construction activities ceased, and
- Date melting conditions began.

5.2 Inspection Requirements

Inspections should include a visual verification of whether all implemented control measures are in effective operational condition and are working as designed to minimize pollutant discharges. It should be determined if there are new potential sources of pollutants. The adequacy of control measures should be assessed to identify areas requiring new or modified control measures. All areas of non-compliance should be identified and corrective actions implemented.

5.2.1 Inspection Scope

The following items will be examined for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters during the inspection and reported on the inspection reports:

- Construction site perimeter;
- All disturbed areas;
- Designated haul routes;
- Material and/or waste storage areas that are exposed to precipitation;
- Discharge locations;
- Locations where vehicles access the site; and
- All CMs implemented will be evaluated to ensure that they are maintained and operating correctly

5.2.2 Inspection Reports

The inspection report form is located in Appendix D. Inspection reports must identify any incidents of non-compliance with the terms and conditions of the general permit. The inspection records will be retained for three years from the expiration or inactivation of permit coverage.

The inspection record will note evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters.

The inspection report will include:

- The inspection date;
- Name(s) and title(s) of personnel making the inspection;
- Weather conditions at the time of inspection;
- Phase of construction at the time of inspection;
- Estimated acreage of disturbance at the time of inspection;
- Location(s) of discharges of sediment or other pollutants from the site;
- Location(s) of CMs that need to be maintained;
- Location(s) and identification of inadequate control measures
- Location(s) and identification of additional control measures needed that were not in place at the time of inspection
- Description of the minimum inspection frequency, and any deviations from the minimum inspection schedule;
- Identification of control measures observed that require routine maintenance (any control measure that is still operating in accordance with its design and the requirements of the permit, but requires maintenance to prevent a breach of the control measure).
- After adequate corrective action(s) have been taken, or where a report does not identify any incidents requiring corrective action, the report will contain a signed statement indicating “all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit.”

5.3 Required Actions Following Site Inspections

CMs will be maintained or replaced in accordance with Sections 5.4 and 5.5 of this SWMP. The SWMP will be updated in accordance with Section 5.6.3. Where site inspections note the need for CM maintenance activities, CMs must be maintained such that the conditions in those sections are met.

5.4 CM Maintenance

All erosion and sediment control practices and other protective measures identified in the SWMP will be maintained in effective operating condition in accordance with Section 3.0 and Appendix B. CMs that are not adequately maintained in accordance with good engineering, hydrologic and pollution control practices are considered to be no longer operating effectively and will be modified or replaced. CMs implemented at the site must be adequately designed and maintained to provide control for all potential pollutant sources associated with the construction activity to prevent pollution or degradation of State waters. Where site inspections note the need for CM maintenance activities, CMs will be maintained such as these conditions are met. Maintenance

items include, but are not limited to: removal of accumulated sediment, repair or replacement of worn or damaged sections, repositioning to correct placement; and reinstallation of CMs displaced. Accumulated sediment and debris will be removed from a CM when the sediment level reaches one-half the height of the CM (unless otherwise noted in the design drawings or CM detail) or at any time that sediment or debris adversely impacts the functioning of the CM.

5.5 Corrective Actions

Adequate site assessment will be performed as part of the comprehensive inspection and maintenance procedures, to assess the adequacy of CMs at the site, and the necessity of changes to those CMs to ensure continued effective performance. When an inadequate control measure is identified, the following corrective action requirements apply:

All necessary steps must be taken to minimize or prevent the discharge of pollutants, until a control measure is implemented and made operational and/or an inadequate control measure is replaced or corrected and returned to effective operating condition.

- If it is infeasible to install or repair a control measure immediately after discovering the deficiency, the following information must be documented and kept on record:
  - Describe why it is infeasible to initiate the installation or repair immediately, and
  - Provide a schedule for installing or repairing the control measure and returning it to an effective operating condition as soon as possible.

If applicable, any unauthorized release or discharge must be removed and properly disposed of. Contaminated surfaces must be cleaned up to minimize discharges of the material in subsequent storm events.

5.6 SWMP Requirements

5.6.1 SWMP Availability

The SWMP will be implemented prior to commencement of construction activities. The SWMP will be kept accurate and up-to-date, and will reflect the actual on site ground conditions. Only changes in site conditions that require new or modified CMs need to be addressed in the SWMP. A hard copy of this SWMP will be maintained on the project site at all times and will be made available upon request to members of the public or local, state, and federal agencies. An electronic copy may be used if it can be read in a similar manner as a paper record and be immediately accessible to the inspector during an inspection to the same extend as a paper copy stored at the site would be.

5.6.2 SWMP Retention

A copy of the SWMP must be retained on site unless another location, specified by the permittee, is approved by the Division.

5.6.3 SWMP Amendment

The SWMP will be amended:

- When there is a change in design, construction, operation, or maintenance of the site, which would require the implementation of new or revised CMs; or
- If the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity; or
- When CMs are no longer necessary and are removed.

SWMP changes will be made prior to changes in the site conditions, except as noted below under “Responsive SWMP Changes.” SWMP revisions may include, but are not limited to: potential pollutant source identification; selection of appropriate CMs for site conditions; CM maintenance procedures; and interim and final stabilization practices.

The SWMP changes may include a schedule for further CM design and implementation, provided that, if any interim CMs are needed to comply with the permit, they are also included in the SWMP and implemented during the interim period.

For SWMP revisions made prior to or following a change(s) onsite, including revisions to sections addressing site conditions and control measures, a notation must be included in the plan that identifies; the date of the site change; the control measure removed or modified; the location(s) of those control measures; and any changes to the control measure(s).

5.6.4 Responsive SWMP Changes

The majority of SWMP revisions to address changing site conditions can be made immediately with simple field revisions to the SWMP. In the less common scenario where more complex development of materials to modify the SWMP are necessary, SWMP revisions will be made in accordance with the following requirements:

- The SWMP will be revised as soon as practicable, but in no case more than 72 hours after the change(s) in CM installation and/or implementation occur at the site, and

- A notation must be included in the site map prior to the site change(s) that includes the date of the change(s) in the field, an identification of the CM(s) removed or added, and the location(s) of those CM(s).

5.7 RECORD KEEPING

Copies of the SWMP, amendments to or changes to the SWMP, inspection records and all other data must be retained by the owner (permittee) for three (3) years after the expiration or inactivation of the permit.

6.0 SPILL PREVENTION AND RESPONSE

6.1 Introduction

This section describes measures to prevent, control, and minimize impacts from a spill of chemical products (hazardous, toxic, or petroleum substances) during construction of this project. This plan identifies the handling, transportation, storage, and disposal procedures for these chemical products and outlines procedures to be followed in the event of a spill.

6.2 Material Management Practices

Properly managing these materials on the site will greatly reduce the potential for stormwater pollution. Good housekeeping along with proper use and storage of these construction materials form the basis for proper management of chemical products.

6.2.1 Good Housekeeping

The proper use of materials and equipment along with the use of general common sense greatly reduce the potential for contaminating stormwater runoff. The following is a list of good housekeeping practices to be used during the construction project:

- Provide secondary containment (or equivalent protection) for any container containing 55 gallons or greater.
- Fueling of construction equipment will not be performed within 150 feet of definitive stormwater drainages.
- An effort will be made to store only enough product required to do the job.
- Materials will be stored in a neat, orderly manner, in appropriate closed containers, in secondary containment and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Whenever possible, all of the product will be used up before properly disposing of the container.
- Manufacturer's recommendations for proper use of a product will be followed.
- If surplus product must be disposed of, local and state recommended methods for proper disposal will be followed.

6.3 Product-Specific Practices

Due to the chemical makeup of specific products, certain handling and storage procedures are required to promote the safety of personnel and prevent the possibility of pollution. Care will be taken to follow all directions and warnings for products used on the site. All pertinent information can be found on the Material Safety Data Sheets (MSDS) for each product. The MSDSs will be located with each product container it represents or in a readily accessible central location. Several product-specific practices are listed in the following sections.

6.3.1 Flammable and Combustible Liquids and Hazardous Materials

All products will be stored in tightly sealed containers that are clearly labeled. The containers will be stored in secondary containment, which will be of sufficient size to contain the entire contents of the primary container plus a sufficient quantity for precipitation (a total of approximately 110 percent of the volume of the primary container). The secondary containment will be an impermeable containment basin to prevent any spills or leaks from reaching the ground. The containment may be one of the following or other means that meets the definition of impermeable: 1) a temporary earthen berm lined with 20-ml plastic, 2) a portable tank or basin, or 3) a galvanized steel trough.

After each storm event, all secondary containment areas will be inspected. If there is no visible sheen on the collected water, it can be pumped or drained to the ground in a manner that does not cause scouring. If a sheen is present, it must be cleaned up using absorbent materials prior to discharging or disposing of the water. The absorbent material will be disposed of properly.

6.3.2 Petroleum Products

In addition to the requirements above in Section 6.2.1, petroleum products are required to have some additional procedures for handling and storage to prevent the possibility of pollution. On-site vehicles will be monitored for leaks and receive regular maintenance to reduce the potential for leakage.

Bulk fuel or lubricating oil dispensers will have a valve that must be manually held open to allow the flow of fuel. When not in use, the fuel dispensing nozzles and/or associated hoses will be kept inside the containment basin. During fueling operations, personnel will be present at all times to detect and contain spills. If any spills or leaks occur, the activity will be stopped immediately, and the containment and cleanup will begin immediately. In addition, the contractor will follow the procedure listed in Section 6.4.

6.4 Spill Control and Cleanup

In addition to the material management practices discussed in Section 6.2, the following spill control and cleanup practices will be followed to prevent stormwater pollution in the event of a spill:

- Spills will be contained and cleaned up immediately after discovery.

- Manufacturer's methods for spill cleanup of a material will be followed as described on the material's MSDS.

- Materials and equipment needed for cleanup procedures ("spill kits") will be kept readily available on the site, either at an equipment storage area or on contractor's trucks. Equipment to be kept on the site may include but is not be limited to brooms, dust pans, shovels, granular absorbents, sand, sawdust, absorbent pads and socks, plastic and metal trash containers, gloves, and goggles.

- Drums containing used clean up materials will be labeled with the contents and date.

- Personnel on the site will be made aware of cleanup procedures and the location of spill cleanup equipment. In general, every vehicle with bulk fuel or petroleum lubrication supplies will be outfitted with a spill containment and clean-up kit.

- The contractor will be responsible for all cleanup activities in accordance with applicable local, state, and federal regulations.

6.5 Spill Reporting

If a spill occurs, the contractor is responsible for immediately (within 5 to 10 minutes) reporting the spill to the Owners Authorized Technical Representative/Project Manager the Tri-State Environmental Services at (303) 349-7711. Tri-State Environmental Services is responsible for calling all agencies in the event of a spill.

If there is a spill of antifreeze, gasoline or oils from personal vehicles, it does not need to be reported to Tri-State's Environmental Services or the SWMP Administrator, but should be documented and kept with the master SWMP. All spills should be documented using the "Spill Report" form provided in Appendix E and a record kept with the master SWMP. Copies of the forms can be found in Appendix E.

6.6 SWMP Modification Procedures Related to Reportable Releases

If a reportable release occurs, a modification to the SWMP must be made within 14 days. The modification will include: a description of the release, the date of the release, an explanation of why the spill happened, a description of procedures to prevent future spills and/or releases from happening, and a description of response procedures should a spill or release occur again and within 14 days of the release. A written description of the release must be submitted to the permitting authority that includes: a description of the release, including the type of material and an estimated amount of spill, the date of the release; an explanation of why the spill happened; and a description of the steps taken to prevent and control future releases. The SWMP Administrator will submit spill reports to the appropriate agencies. Modifications to the SWMP will be made by the SWMP Administrator, or his designee, and will be documented on the "New CMs Added to the Site" form in Appendix C.

APPENDIX A: Site Maps

LEGEND

- PROPERTY BOUNDARY
- LIMITS OF CONSTRUCTION / DISTURBANCE
- TOE OF FILL SLOPE
- TOP OF CUT SLOPE
- STAGING AREA
- (DD) DIVERSION DITCH (INITIAL)
- (TB) TOPSOIL BERM (INITIAL)
- (ST) SEDIMENT TRAP (INITIAL/INTERIM)
- (SW) STRAW WATTLE (INITIAL/INTERIM)
- (CP) CULVERT PROTECTION (INITIAL/INTERIM)
- (VEG) SEEDING (FINAL) – SEE NOTES
- (GRV) GRAVEL (FINAL)
- (T/P) TRACKING PAD (INITIAL/INTERIM)
- CONC. WASH-OUT — CONCRETE WASHOUT (WITH LOCATION SIGN)
- W/C — PORTABLE TOILET

- ohe — EXISTING OVERHEAD POWER LINE
- x — x — EXISTING FENCE
- EXISTING CULVERT
- EXISTING UTILITY POLE
- EXISTING GUY ANCHOR
- 5800 — EXISTING INDEX CONTOUR
- 5796 — EXISTING INTERMEDIATE CONTOUR
- EXISTING DRAINAGE FLOWLINE
- SD — PROPOSED SUBDRAIN LINE
- x — x — PROPOSED FENCE
- PROPOSED CULVERT
- 5800 — PROPOSED INDEX CONTOUR
- 5796 — PROPOSED INTERMEDIATE CONTOUR
- PROPOSED DRAINAGE FLOWLINE
- PROPOSED DRAINAGE FLOW ARROW
- EXISTING DRAINAGE FLOW ARROW

NOTES:

1. EXISTING VEGETATION CONSISTS OF NATIVE GRASSES AND WEEDS AT 30–60% GROUND COVER.
2. NO BATCH PLANTS WILL BE UTILIZED ON SITE.
3. NO PART OF THE SITE LIES WITHIN THE FEMA 100 YEAR FLOODPLAIN.
4. CONCRETE OUTLET STRUCTURE MUST BE INSTALLED IN ORDER TO USE DETENTION POND AS A TEMPORARY SEDIMENT POND DURING CONSTRUCTION.
5. SEEDING SHALL BE WEED–FREE HAY MULCH AT 5,000 LBS PER ACRE WHEN DISTRIBUTED UNIFORMLY. CONTRACTOR SHALL UTILIZE EL PASO COUNTY CONSERVATION DISTRICTS NATIVE SHOTGUN MIX.

1" = 100'

Scale in feet

100' 0 100' 200'

PARCEL NO. 1400000490
JAMES R. BLACK

PARCEL NO. 1400000491
JAMES H. MCMASTER

PARCEL NO. 1409000005
COLORADO INVESTMENT CO

PARCEL NO. 1409000006
JAMES P. SONNLEITNER

PARCEL NO. 1409000007
NICOLE BALDOCK

PARCEL NO. 1400000592
TRI–STATE GENERATION & TRANSMISSION INC.

PARCEL NO. 1400000593
CHARLES F. REED

PROPERTY LINE

100' TRANSMISSION LINE EASEMENT
RECEPTION NO. 000038808

CROSSPOINT
SUBSTATION

915'

440'

547.77'

CP1 CP2 CP3 CP4 CP5

SEE SHEET S1174–A–01–008
FOR SUBDRAIN PLAN

SEE SHEET S1174–A–01–014
FOR FOREBAY DETAILS

DETENTION POND, EDB–1
SEE NOTE 4

SEE SHEET S1174–A–01–007
FOR DETENTION POND GRADING

SEE SHEET S1174–A–01–013
FOR OUTLET STRUCTURE DETAILS

SEE SHEET S1174–A–01–012
FOR LEVEL SPREADER DETAILS

SEE DRAINAGE REPORT APPENDIX A
FOR RIPRAP SIZING CALCULATIONS

STAGING & STORAGE AREA

REFUELING AREA

DUMPSTER

ACCESS ROAD

NORTH LAUPPE ROAD

No.	Date	Dwn.	Appd.	DWS	REVISED PER EPC COMMENTS	WL	03/10/26
1	03/10/26	WL	DWS				
2							
3							
4							
5							
6							
7							

Revision

Drawing Title: CROSSPOINT SUBSTATION
230 KV
EROSION CONTROL PLAN

Mfgr.: TRI–STATE GENERATION & TRANSMISSION ASSOCIATION, INCORPORATED

Dwg. No.: Reference Drawings

M.F.

UPDATED BY: WLUDGATE 3/10/2026 4:06 PM

Contract: –

PATH: \\DMS1\Projects\Active Projects\2023\23148–TSGT Crosspoint Substation\Facility\Civil\Sheets\S1174–A–01–SHEETS.dwg

TRI-STATE
Generation and Transmission Association, Inc.
A Touchstone Energy Cooperative
1100 W. 116th Ave.
P.O. Box 33695
Denver, Colorado 80233
303–452–6111

Dwn:	Date:
TMC	11/17/25
Appd:	Date:
.	.

S1174–A–01–015

APPENDIX B: Soil erosion and Sediment Control Measures (CMs) Details

Check Dams (CD) EC-12

Description

Check dams are temporary grade control structures placed in drainage channels to limit the erosivity of stormwater by reducing flow velocity. Check dams are typically constructed from rock, gravel bags, sand bags, or sometimes, proprietary devices. Reinforced check dams are typically constructed from rock and wire gabion. Although the primary function of check dams is to reduce the velocity of concentrated flows, a secondary benefit is sediment trapping upstream of the structure.

Photograph CD-1. Rock check dams in a roadside ditch. Photo courtesy of WWE.

Appropriate Uses

Use as a grade control for temporary drainage ditches or swales until final soil stabilization measures are established upstream and downstream. Check dams can be used on mild or moderately steep slopes. Check dams may be used under the following conditions:

- As temporary grade control facilities along waterways until final stabilization is established.
- Along permanent swales that need protection prior to installation of a non-erodible lining.
- Along temporary channels, ditches or swales that need protection where construction of a non-erodible lining is not practicable.
- Reinforced check dams should be used in areas subject to high flow velocities.

Design and Installation

Place check dams at regularly spaced intervals along the drainage swale or ditch. Check dams heights should allow for pools to develop upstream of each check dam, extending to the downstream toe of the check dam immediately upstream.

When rock is used for the check dam, place rock mechanically or by hand. Do not dump rocks into the drainage channel. Where multiple check dams are used, the top of the lower dam should be at the same elevation as the toe of the upper dam.

When reinforced check dams are used, install erosion control fabric under and around the check dam to prevent erosion on the upstream and downstream sides. Each section of the dam should be keyed in to reduce the potential for washout or undermining. A rock apron upstream and downstream of the dam may be necessary to further control erosion.

Check Dams	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No

Design details with notes are provided for the following types of check dams:

- Rock Check Dams (CD-1)
- Reinforced Check Dams (CD-2)

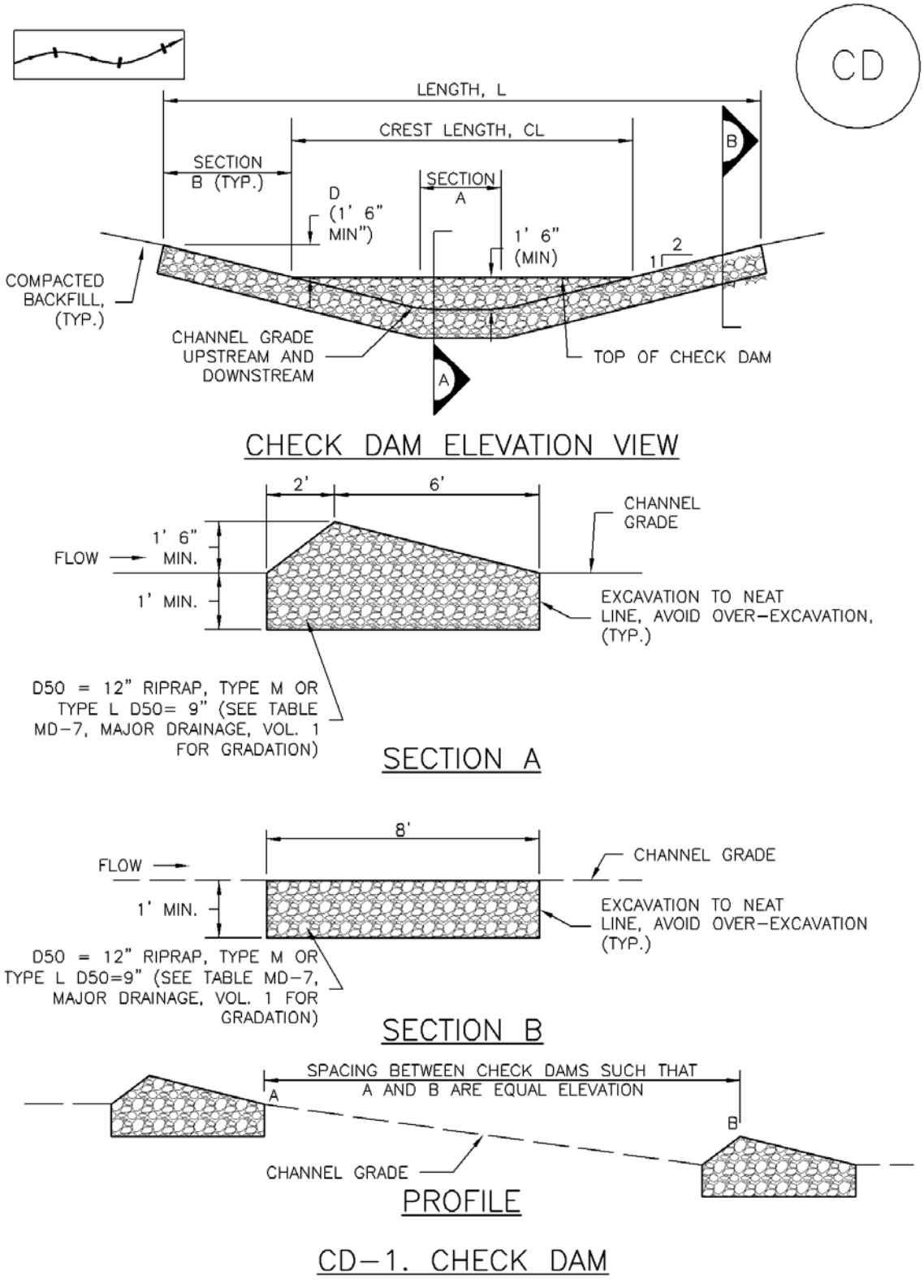
Sediment control logs may also be used as check dams; however, silt fence is not appropriate for use as a check dam. Many jurisdictions also prohibit or discourage use of straw bales for this purpose.

Maintenance and Removal

Replace missing rocks causing voids in the check dam. If gravel bags or sandbags are used, replace or repair torn or displaced bags.

Remove accumulated sediment, as needed to maintain BMP effectiveness, typically before the sediment depth upstream of the check dam is within ½ of the crest height. Remove accumulated sediment prior to mulching, seeding, or chemical soil stabilization. Removed sediment can be incorporated into the earthwork with approval from the Project Engineer, or disposed of at an alternate location in accordance with the standard specifications.

Check dams constructed in permanent swales should be removed when perennial grasses have become established, or immediately prior to installation of a non-erodible lining. All of the rock and accumulated sediment should be removed, and the area seeded and mulched, or otherwise stabilized.


CD
LENGTH, L
CREST LENGTH, CL
SECTION B (TYP.)
SECTION A
D (1' 6" MIN")
1' 6" (MIN)
2
1
B
A
COMPACTED BACKFILL, (TYP.)
CHANNEL GRADE UPSTREAM AND DOWNSTREAM
TOP OF CHECK DAM
CHECK DAM ELEVATION VIEW
2'
6'
CHANNEL GRADE
FLOW
1' 6" MIN.
1' MIN.
EXCAVATION TO NEAT LINE, AVOID OVER-EXCAVATION, (TYP.)
D50 = 12" RIPRAP, TYPE M OR TYPE L D50= 9" (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 FOR GRADATION)
SECTION A
8'
FLOW
CHANNEL GRADE
1' MIN.
EXCAVATION TO NEAT LINE, AVOID OVER-EXCAVATION (TYP.)
D50 = 12" RIPRAP, TYPE M OR TYPE L D50=9" (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 FOR GRADATION)
SECTION B
SPACING BETWEEN CHECK DAMS SUCH THAT A AND B ARE EQUAL ELEVATION
A
B
CHANNEL GRADE
PROFILE
CD-1. CHECK DAM

CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF CHECK DAMS.
   –CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   –LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON INITIAL SWMP SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND DISTURBING ACTIVITIES.

3. RIPRAP UTILIZED FOR CHECK DAMS SHOULD BE OF APPROPRIATE SIZE FOR THE APPLICATION. TYPICAL TYPES OF RIPRAP USED FOR CHECK DAMS ARE TYPE M (D50 12") OR TYPE L (D50 9").

4. RIPRAP PAD SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'.

5. THE ENDS OF THE CHECK DAM SHALL BE A MINIMUM OF 1' 6" HIGHER THAN THE CENTER OF THE CHECK DAM.

CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

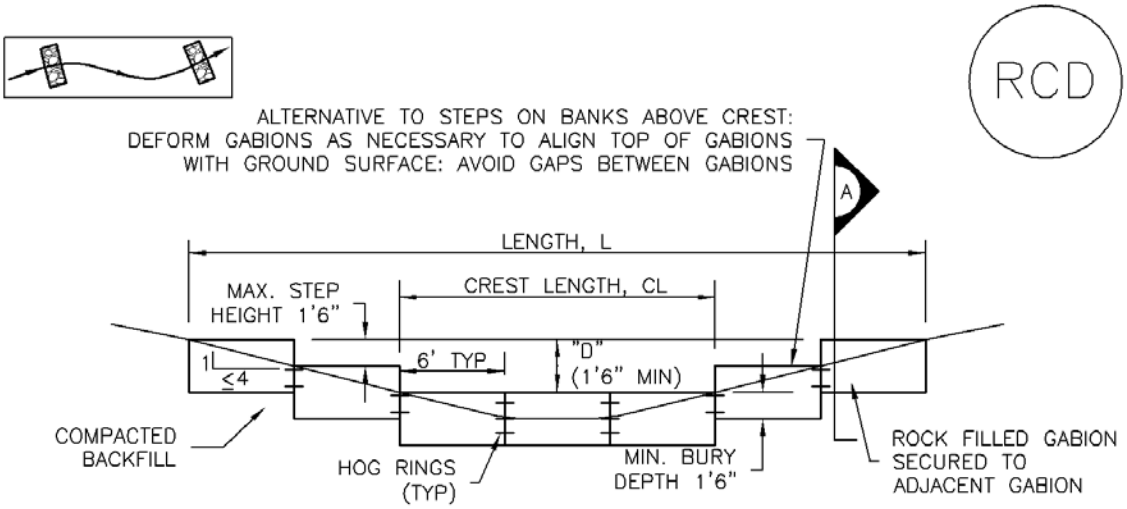
4. SEDIMENT ACCUMULATED UPSTREAM OF THE CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS WITHIN ½ OF THE HEIGHT OF THE CREST.

5. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

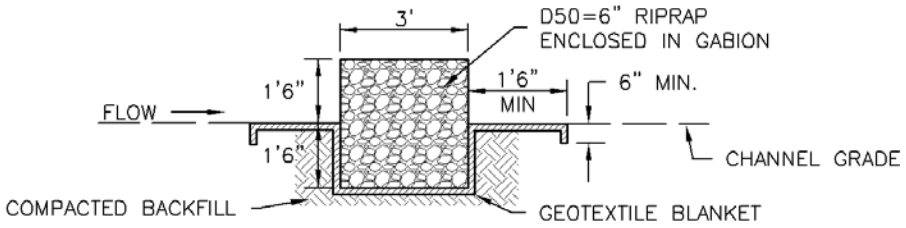
6. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACKFILL. DISTURBED AREA SHALL BE SEEDED AND MULCHED AND COVERED WITH GEOTEXTILE OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



REINFORCED CHECK DAM ELEVATION VIEW



SECTION A

REINFORCED CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATIONS OF CHECK DAMS.
   - –CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   - –LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON THE SWMP SHALL BE INSTALLED PRIOR TO AN UPSTREAM LAND–DISTURBING ACTIVITIES.

3. REINFORCED CHECK DAMS, GABIONS SHALL HAVE GALVANIZED TWISTED WIRE NETTING WITH A MAXIMUM OPENING DIMENSION OF 4½" AND A MINIMUM WIRE THICKNESS OF 0.10". WIRE "HOG RINGS" AT 4" SPACING OR OTHER APPROVED MEANS SHALL BE USED AT ALL GABION SEAMS AND TO SECURE THE GABION TO THE ADJACENT SECTION.

4. THE CHECK DAM SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1' 6".

5. GEOTEXTILE BLANKET SHALL BE PLACED IN THE REINFORCED CHECK DAM TRENCH EXTENDING A MINIMUM OF 1' 6" ON BOTH THE UPSTREAM AND DOWNSTREAM SIDES OF THE REINFORCED CHECK DAM.

CD–2. REINFORCED CHECK DAM

REINFORCED CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF REINFORCED CHECK DAMS SHALL BE REMOVED AS NEEDED TO MAINTAIN THE EFFECTIVENESS OF BMP, TYPICALLY WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST.

5. REPAIR OR REPLACE REINFORCED CHECK DAMS WHEN THERE ARE SIGNS OF DAMAGE SUCH AS HOLES IN THE GABION OR UNDERCUTTING.

6. REINFORCED CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN REINFORCED CHECK DAMS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, AND COVERED WITH A GEOTEXTILE BLANKET, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Concrete Washout Area (CWA) MM-1

Description

Concrete waste management involves designating and properly managing a specific area of the construction site as a concrete washout area. A concrete washout area can be created using one of several approaches designed to receive wash water from washing of tools and concrete mixer chutes, liquid concrete waste from dump trucks, mobile batch mixers, or pump trucks. Three basic approaches are available: excavation of a pit in the ground, use of an above ground storage area, or use of prefabricated haul-away concrete washout containers. Surface discharges of concrete washout water from construction sites are prohibited.

Photograph CWA-1. Example of concrete washout area. Note gravel tracking pad for access and sign.

Appropriate Uses

Concrete washout areas must be designated on all sites that will generate concrete wash water or liquid concrete waste from onsite concrete mixing or concrete delivery.

Because pH is a pollutant of concern for washout activities, when unlined pits are used for concrete washout, the soil must have adequate buffering capacity to result in protection of state groundwater standards; otherwise, a liner/containment must be used. The following management practices are recommended to prevent an impact from unlined pits to groundwater:

- The use of the washout site should be temporary (less than 1 year), and
- The washout site should be not be located in an area where shallow groundwater may be present, such as near natural drainages, springs, or wetlands.

Design and Installation

Concrete washout activities must be conducted in a manner that does not contribute pollutants to surface waters or stormwater runoff. Concrete washout areas may be lined or unlined excavated pits in the ground, commercially manufactured prefabricated washout containers, or aboveground holding areas constructed of berms, sandbags or straw bales with a plastic liner.

Although unlined washout areas may be used, lined pits may be required to protect groundwater under certain conditions.

Do not locate an unlined washout area within 400 feet of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources. Even for lined concrete washouts, it is advisable to locate the facility away from waterbodies and drainage paths. If site constraints make these

Concrete Washout Area	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

setbacks infeasible or if highly permeable soils exist in the area, then the pit must be installed with an impermeable liner (16 mil minimum thickness) or surface storage alternatives using prefabricated concrete washout devices or a lined aboveground storage area should be used.

Design details with notes are provided in Detail CWA-1 for pits and CWA-2 for aboveground storage areas. Pre-fabricated concrete washout container information can be obtained from vendors.

Maintenance and Removal

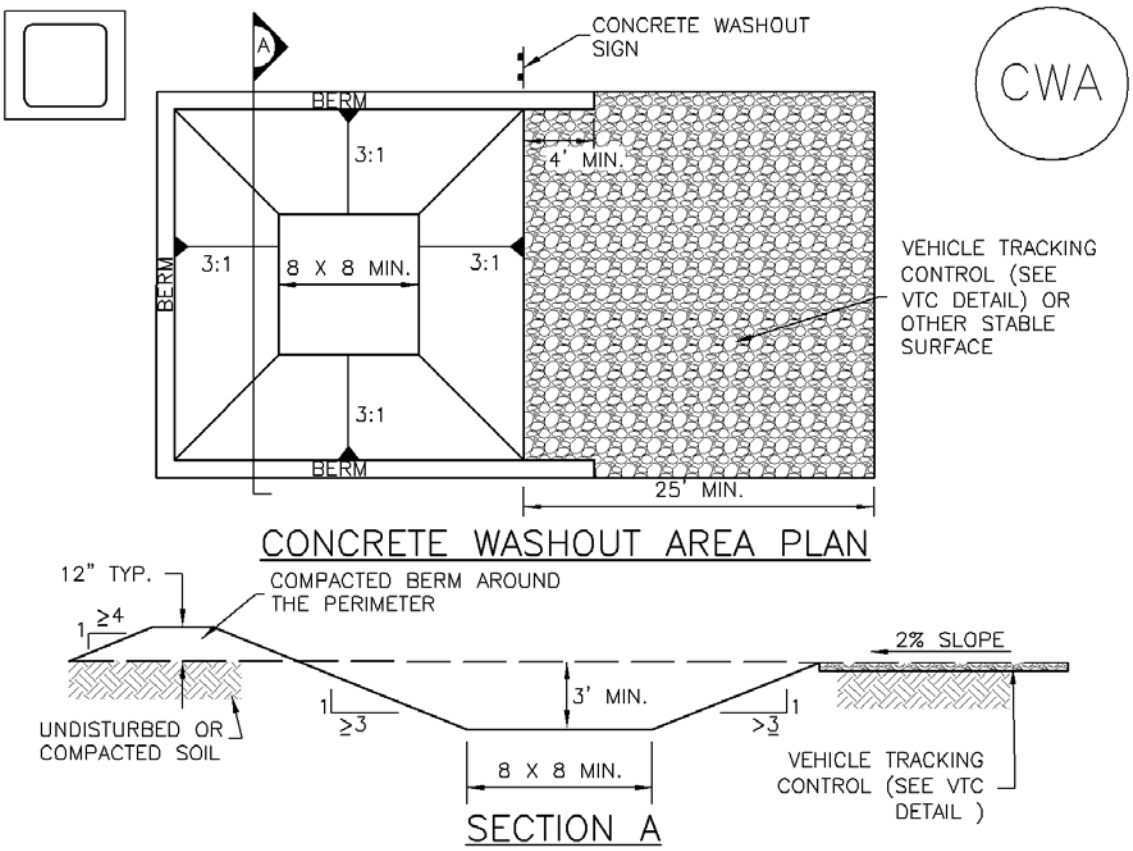
A key consideration for concrete washout areas is to ensure that adequate signage is in place identifying the location of the washout area. Part of inspecting and maintaining washout areas is ensuring that adequate signage is provided and in good repair and that the washout area is being used, as opposed to washout in non-designated areas of the site.

Remove concrete waste in the washout area, as needed to maintain BMP function (typically when filled to about two-thirds of its capacity). Collect concrete waste and deliver offsite to a designated disposal location.

Upon termination of use of the washout site, accumulated solid waste, including concrete waste and any contaminated soils, must be removed from the site to prevent on-site disposal of solid waste. If the wash water is allowed to evaporate and the concrete hardens, it may be recycled.

Photograph CWA-2. Prefabricated concrete washout. Photo courtesy of CDOT.

Photograph CWA-3. Earthen concrete washout. Photo courtesy of CDOT.



CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

CWA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER–TIGHT CONTAINER AND DISPOSED OF PROPERLY.

6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

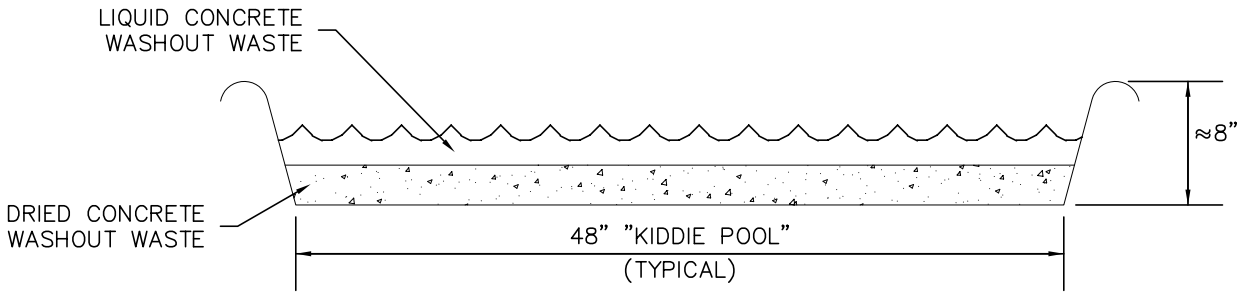
7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD).

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

CONCRETE WASHOUT "KIDDIE" POOL

N.T.S



NOTES:

1. Use only rigid, prefabricated impermeable plastic wading pool.
2. Inspect Containment for waterproof integrity prior to each use.
3. Do not fill Containment more than 50% of capacity with either liquid or solid concrete waste.
4. Immediately after each use, cover the Containment with a waterproof barrier to prevent collection of rain water or snow.
5. Properly dispose of dried concrete waste at a landfill when the project is complete or when waste reaches a 50% capacity.

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www.del-mont.com ▼ service@del-mont.com

DESIGNED BY:	SCALE:
N/A	N.T.S.
CHECKED BY:	FILE NAME:
SNS	CONCRETE WASHOUT - KIDDIE POOL

BMP DETAIL

CONCRETE WASHOUT - "KIDDIE" POOL

D.M. JOB NO.:	N/A
DATE ISSUED:	5-13-2011
SHEET:	1 of 1

Inlet Protection (IP) SC-6

Description

Inlet protection consists of permeable barriers installed around an inlet to filter runoff and remove sediment prior to entering a storm drain inlet. Inlet protection can be constructed from rock socks, sediment control logs, silt fence, block and rock socks, or other materials approved by the local jurisdiction. Area inlets can also be protected by over-excavating around the inlet to form a sediment trap.

Photograph IP-1. Inlet protection for a curb opening inlet.

Appropriate Uses

Install protection at storm sewer inlets that are operable during construction. Consider the potential for tracked-out sediment or temporary stockpile areas to contribute sediment to inlets when determining which inlets must be protected. This may include inlets in the general proximity of the construction area, not limited to downgradient inlets. Inlet protection is not a stand-alone BMP and should be used in conjunction with other upgradient BMPs.

Design and Installation

To function effectively, inlet protection measures must be installed to ensure that flows do not bypass the inlet protection and enter the storm drain without treatment. However, designs must also enable the inlet to function without completely blocking flows into the inlet in a manner that causes localized flooding. When selecting the type of inlet protection, consider factors such as type of inlet (e.g., curb or area, sump or on-grade conditions), traffic, anticipated flows, ability to secure the BMP properly, safety and other site-specific conditions. For example, block and rock socks will be better suited to a curb and gutter along a roadway, as opposed to silt fence or sediment control logs, which cannot be properly secured in a curb and gutter setting, but are effective area inlet protection measures.

Several inlet protection designs are provided in the Design Details. Additionally, a variety of proprietary products are available for inlet protection that may be approved for use by local governments. If proprietary products are used, design details and installation procedures from the manufacturer must be followed. Regardless of the type of inlet protection selected, inlet protection is most effective when combined with other BMPs such as curb socks and check dams. Inlet protection is often the last barrier before runoff enters the storm sewer or receiving water.

Design details with notes are provided for these forms of inlet protection:

IP-1. Block and Rock Sock Inlet Protection for Sump or On-grade Inlets

IP-2. Curb (Rock) Socks Upstream of Inlet Protection, On-grade Inlets

Inlet Protection (various forms)	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

IP-3. Rock Sock Inlet Protection for Sump/Area Inlet

IP-4. Silt Fence Inlet Protection for Sump/Area Inlet

IP-5. Over-excavation Inlet Protection

IP-6. Straw Bale Inlet Protection for Sump/Area Inlet

CIP-1. Culvert Inlet Protection

Propriety inlet protection devices should be installed in accordance with manufacturer specifications.

More information is provided below on selecting inlet protection for sump and on-grade locations.

Inlets Located in a Sump

When applying inlet protection in sump conditions, it is important that the inlet continue to function during larger runoff events. For curb inlets, the maximum height of the protective barrier should be lower than the top of the curb opening to allow overflow into the inlet during larger storms without excessive localized flooding. If the inlet protection height is greater than the curb elevation, particularly if the filter becomes clogged with sediment, runoff will not enter the inlet and may bypass it, possibly causing localized flooding, public safety issues, and downstream erosion and damage from bypassed flows.

Area inlets located in a sump setting can be protected through the use of silt fence, concrete block and rock socks (on paved surfaces), sediment control logs/straw wattles embedded in the adjacent soil and stacked around the area inlet (on pervious surfaces), over-excavation around the inlet, and proprietary products providing equivalent functions.

Inlets Located on a Slope

For curb and gutter inlets on paved sloping streets, block and rock sock inlet protection is recommended in conjunction with curb socks in the gutter leading to the inlet. For inlets located along unpaved roads, also see the Check Dam Fact Sheet.

Maintenance and Removal

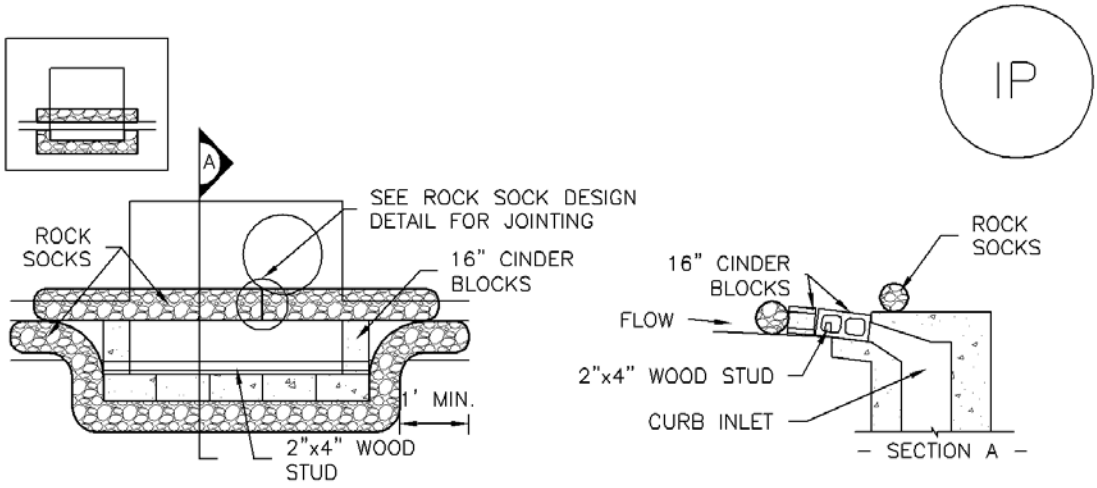
Inspect inlet protection frequently. Inspection and maintenance guidance includes:

- Inspect for tears that can result in sediment directly entering the inlet, as well as result in the contents of the BMP (e.g., gravel) washing into the inlet.
- Check for improper installation resulting in untreated flows bypassing the BMP and directly entering the inlet or bypassing to an unprotected downstream inlet. For example, silt fence that has not been properly trenched around the inlet can result in flows under the silt fence and directly into the inlet.
- Look for displaced BMPs that are no longer protecting the inlet. Displacement may occur following larger storm events that wash away or reposition the inlet protection. Traffic or equipment may also crush or displace the BMP.
- Monitor sediment accumulation upgradient of the inlet protection.

- Remove sediment accumulation from the area upstream of the inlet protection, as needed to maintain BMP effectiveness, typically when it reaches no more than half the storage capacity of the inlet protection. For silt fence, remove sediment when it accumulates to a depth of no more than 6 inches. Remove sediment accumulation from the area upstream of the inlet protection as needed to maintain the functionality of the BMP.

- Propriety inlet protection devices should be inspected and maintained in accordance with manufacturer specifications. If proprietary inlet insert devices are used, sediment should be removed in a timely manner to prevent devices from breaking and spilling sediment into the storm drain.

Inlet protection must be removed and properly disposed of when the drainage area for the inlet has reached final stabilization.



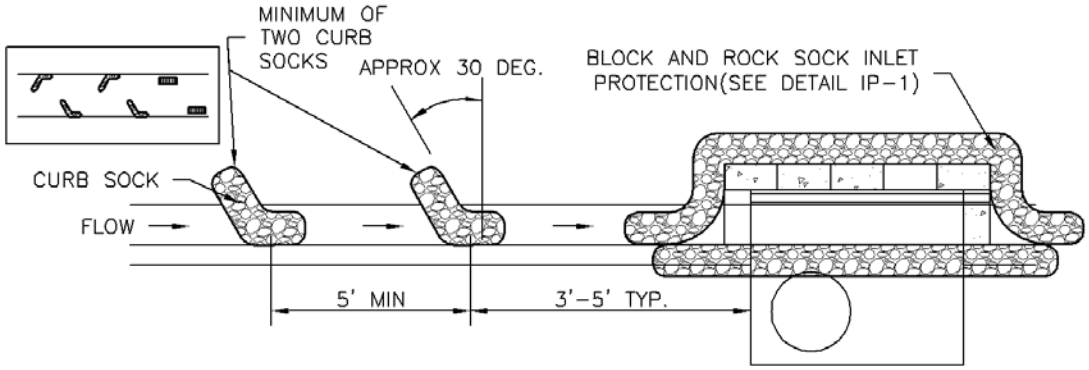
IP–1. BLOCK AND ROCK SOCK SUMP OR ON GRADE INLET PROTECTION

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.

3. GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINTED TOGETHER IN ACCORDANCE WITH ROCK SOCK DESIGN DETAIL.



IP–2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

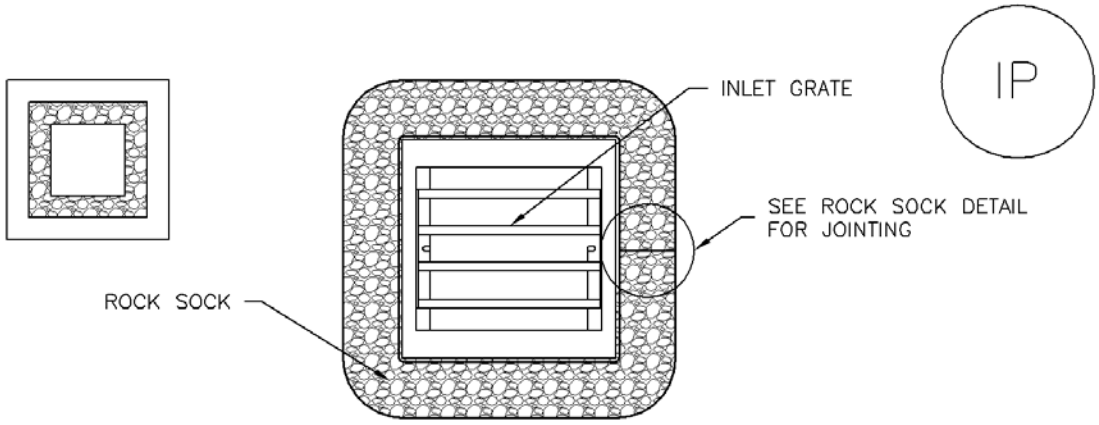
CURB ROCK SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.

2. PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.

3. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.

4. AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON–GRADE INLETS.

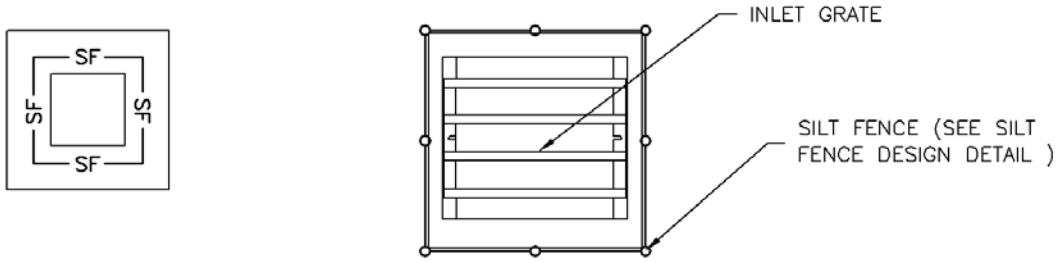


IP–3. ROCK SOCK SUMP/AREA INLET PROTECTION

ROCK SOCK SUMP/AREA INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



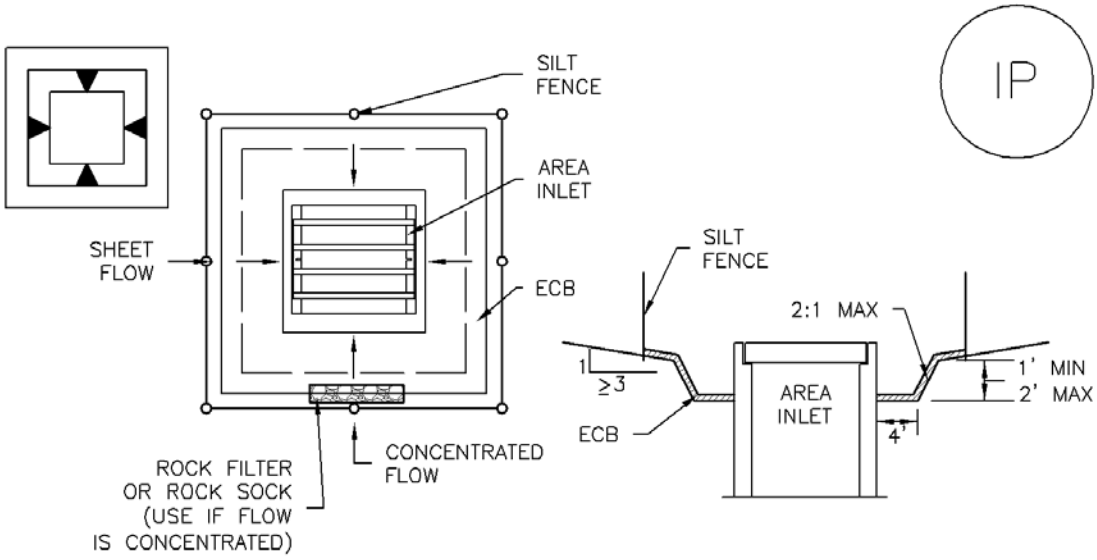
IP–4. SILT FENCE FOR SUMP INLET PROTECTION

SILT FENCE INLET PROTECTION INSTALLATION NOTES

1. SEE SILT FENCE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. POSTS SHALL BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.

3. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF SILT FENCE FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



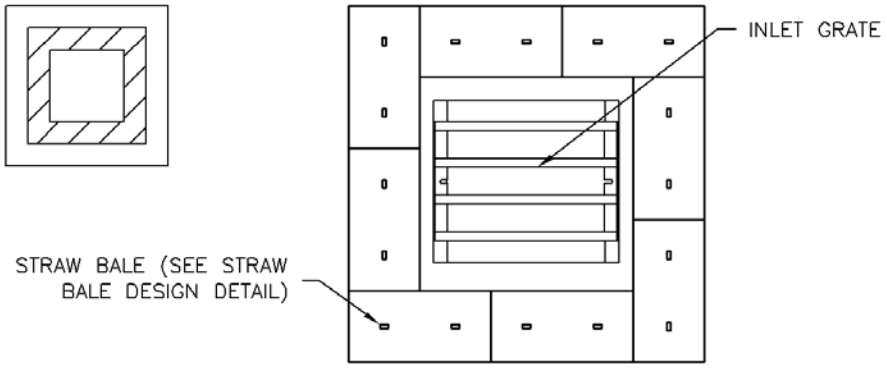
IP–5. OVEREXCAVATION INLET PROTECTION

OVEREXCAVATION INLET PROTECTION INSTALLATION NOTES

1. THIS FORM OF INLET PROTECTION IS PRIMARILY APPLICABLE FOR SITES THAT HAVE NOT YET REACHED FINAL GRADE AND SHOULD BE USED ONLY FOR INLETS WITH A RELATIVELY SMALL CONTRIBUTING DRAINAGE AREA.

2. WHEN USING FOR CONCENTRATED FLOWS, SHAPE BASIN IN 2:1 RATIO WITH LENGTH ORIENTED TOWARDS DIRECTION OF FLOW.

3. SEDIMENT MUST BE PERIODICALLY REMOVED FROM THE OVEREXCAVATED AREA.

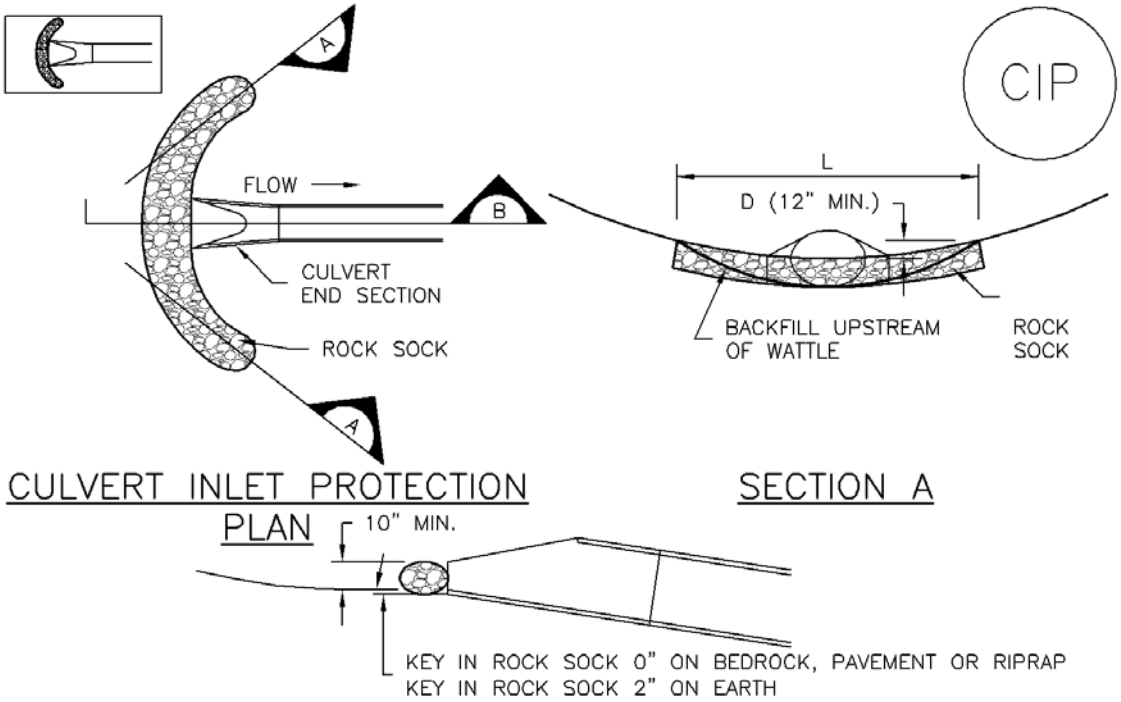


IP–6. STRAW BALE FOR SUMP INLET PROTECTION

STRAW BALE BARRIER INLET PROTECTION INSTALLATION NOTES

1. SEE STRAW BALE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. BALES SHALL BE PLACED IN A SINGLE ROW AROUND THE INLET WITH ENDS OF BALES TIGHTLY ABUTTING ONE ANOTHER.



CIP–1. CULVERT INLET PROTECTION

CULVERT INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF CULVERT INLET PROTECTION.

2. SEE ROCK SOCK DESIGN DETAIL FOR ROCK GRADATION REQUIREMENTS AND JOINTING DETAIL.

CULVERT INLET PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE CULVERT SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS ½ THE HEIGHT OF THE ROCK SOCK.

5. CULVERT INLET PROTECTION SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

GENERAL INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF INLET PROTECTION.
   –TYPE OF INLET PROTECTION (IP.1, IP.2, IP.3, IP.4, IP.5, IP.6)

2. INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.

3. MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

INLET PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR ¼ OF THE HEIGHT FOR STRAW BALES.

5. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.

6. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTION TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.

Straw Bale Barrier (SBB) SC-3

Description

A straw bale barrier is a linear wall of straw bales designed to intercept sheet flow and trap sediment before runoff exits a disturbed area.

Photograph SBB-1. Straw bale barrier used for perimeter control. Photo courtesy of Tom Gore.

Appropriate Uses

Appropriate uses of properly installed straw bale barriers may include:

- As a perimeter control for a site or soil stockpile.
- As a sediment control at the toe of an erodible slope.
- Along the edge of a stream or drainage pathway to reduce sediment laden runoff from entering the waterway.
- As part of an inlet protection design in sump conditions (See Inlet Protection BMP).

Do not use straw bale barriers in areas of concentrated flow or in areas where ponding is not desirable. Straw bales tend to degrade quickly, so they should generally not be used in areas where longer term disturbance is expected.

Due to a history of inappropriate placement, poor installation, and short effective lifespan, the use of straw bales is discouraged or prohibited by some communities.

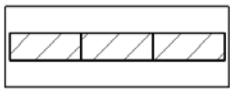
Design and Installation

The maximum recommended tributary drainage area per 100 lineal feet of straw bale barrier is 0.25 acres with a disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1; longer and steeper slopes require additional measures. Design details with notes are provided in Detail SBB-1. To be effective, bales must be installed in accordance with the design details with proper trenching, staking, and binding. Jute and cotton string must not be used to bind the straw bale. The bales should be certified weed-free prior to use.

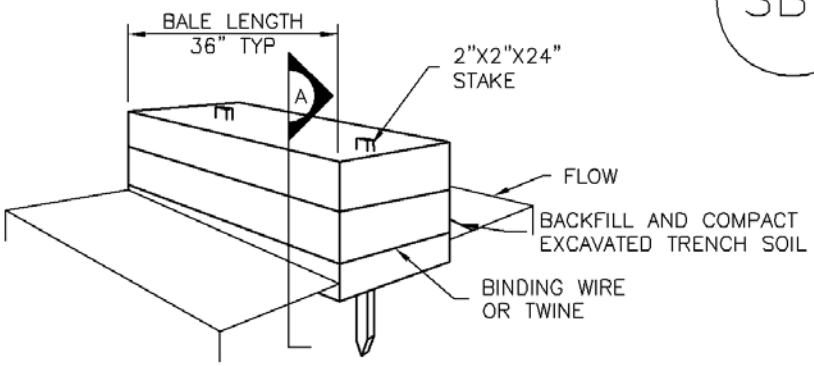
Maintenance and Removal

Check bales for rotting and replace as necessary. Straw bales degrade, and rotting bales require replacement on a regular basis (as often as every three months) depending on environmental conditions. Check for undercutting, bypassed flows, and displacement. Repair by properly re-installing the straw bale barrier and repairing washouts around the bales. Remove sediment accumulated behind the bale when it reaches one-quarter of the bale height. Remove and properly dispose of the straw bale once the upstream area has been stabilized. Areas of disturbance beneath the bale should be seeded and mulched when the bale is removed.

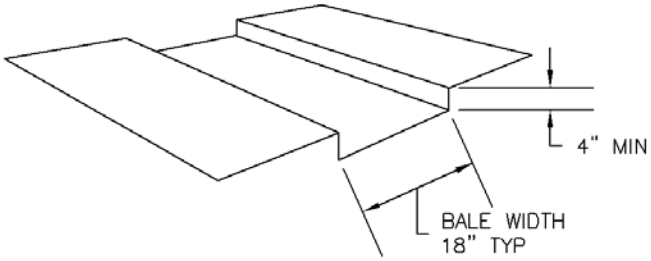
Straw Bale Barrier	
Functions	
Erosion Control	No
Sediment Control	Moderate
Site/Material Management	No



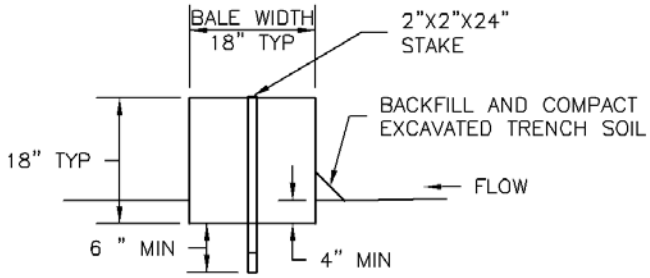
SBB



STRAW BALE



TRENCH FOR STRAW BALE



SECTION A

SBB–1. STRAW BALE

STRAW BALE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF STRAW BALES.

2. STRAW BALES SHALL CONSIST OF CERTIFIED WEED FREE STRAW OR HAY. LOCAL JURISDICTIONS MAY REQUIRE PROOF THAT BALES ARE WEED FREE.

3. STRAW BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF STRAW OR HAY AND WEIGH NOT LESS THAN 35 POUNDS.

4. WHEN STRAW BALES ARE USED IN SERIES AS A BARRIER, THE END OF EACH BALE SHALL BE TIGHTLY ABUTTING ONE ANOTHER.

5. STRAW BALE DIMENSIONS SHALL BE APPROXIMATELY 36"X18"X18".

6. A UNIFORM ANCHOR TRENCH SHALL BE EXCAVATED TO A DEPTH OF 4". STRAW BALES SHALL BE PLACED SO THAT BINDING TWINE IS ENCOMPASSING THE VERTICAL SIDES OF THE BALE(S). ALL EXCAVATED SOIL SHALL BE PLACED ON THE UPHILL SIDE OF THE STRAW BALE(S) AND COMPACTED.

7. TWO (2) WOODEN STAKES SHALL BE USED TO HOLD EACH BALE IN PLACE. WOODEN STAKES SHALL BE 2"X2"X24". WOODEN STAKES SHALL BE DRIVEN 6" INTO THE GROUND.

STRAW BALE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. STRAW BALES SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, ROTTEN, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF STRAW BALE BARRIER SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ¼ OF THE HEIGHT OF THE STRAW BALE BARRIER.

6. STRAW BALES ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN STRAW BALES ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Sediment Control Log (SCL) SC-2

Description

A sediment control log is a linear roll made of natural materials such as straw, coconut fiber, or other fibrous material trenched into the ground and held with a wooden stake. Sediment control logs are also often referred to as "straw wattles." They are used as a sediment barrier to intercept sheet flow runoff from disturbed areas.

Photographs SCL-1 and SCL-2. Sediment control logs used as 1) a perimeter control around a soil stockpile; and, 2) as a "J-hook" perimeter control at the corner of a construction site.

Appropriate Uses

Sediment control logs can be used in the following applications to trap sediment:

- As perimeter control for stockpiles and the site.
- As part of inlet protection designs.
- As check dams in small drainage ditches. (Sediment control logs are not intended for use in channels with high flow velocities.)
- On disturbed slopes to shorten flow lengths (as an erosion control).
- As part of multi-layered perimeter control along a receiving water such as a stream, pond or wetland.

Sediment control logs work well in combination with other layers of erosion and sediment controls.

Design and Installation

Sediment control logs should be installed along the contour to avoid concentrating flows. The maximum allowable tributary drainage area per 100 lineal feet of sediment control log, installed along the contour, is approximately 0.25 acres with a disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. Longer and steeper slopes require additional measures. This recommendation only applies to sediment control logs installed along the contour. When installed for other uses, such as perimeter control, it should be installed in a way that will not produce concentrated flows. For example, a "J-hook" installation may be appropriate to force runoff to pond and evaporate or infiltrate in multiple areas rather than concentrate and cause erosive conditions parallel to the BMP.

Sediment Control Log	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	No

Although sediment control logs initially allow runoff to flow through the BMP, they can quickly become a barrier and should be installed is if they are impermeable.

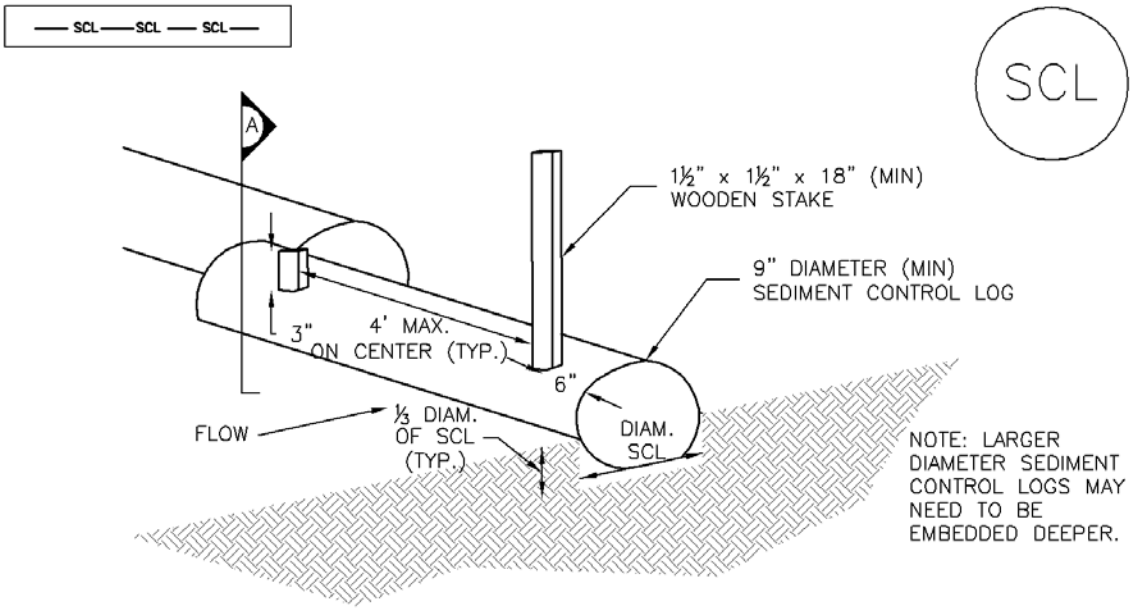
Design details and notes for sediment control logs are provided in Detail SCL-1. Sediment logs must be properly trenched and staked into the ground to prevent undercutting, bypassing and displacement. When installed on slopes, sediment control logs should be installed along the contours (i.e., perpendicular to flow).

Improper installation can lead to poor performance. Be sure that sediment control logs are properly trenched, anchored and tightly jointed.

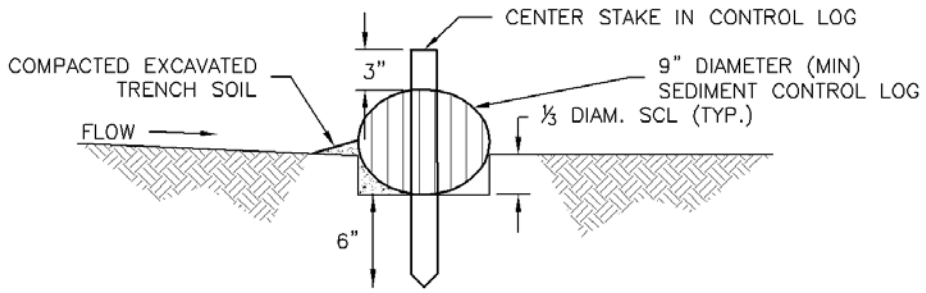
Maintenance and Removal

Be aware that sediment control logs will eventually degrade. Remove accumulated sediment before the depth is one-half the height of the sediment log and repair damage to the sediment log, typically by replacing the damaged section.

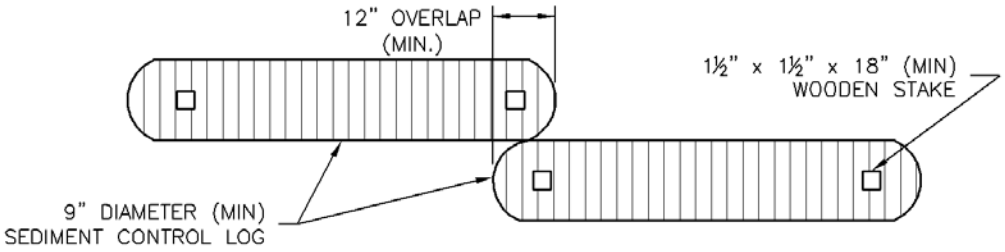
Once the upstream area is stabilized, remove and properly dispose of the logs. Areas disturbed beneath the logs may need to be seeded and mulched. Sediment control logs that are biodegradable may occasionally be left in place (e.g., when logs are used in conjunction with erosion control blankets as permanent slope breaks). However, removal of sediment control logs after final stabilization is typically recommended when used in perimeter control, inlet protection and check dam applications.



SEDIMENT CONTROL LOG

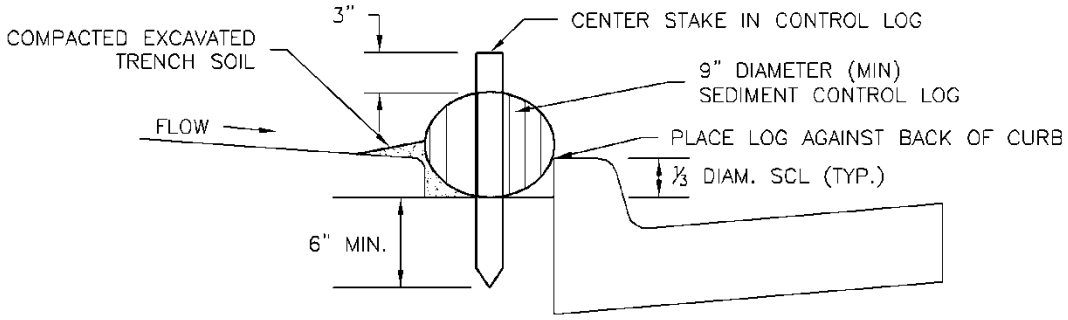


SECTION A

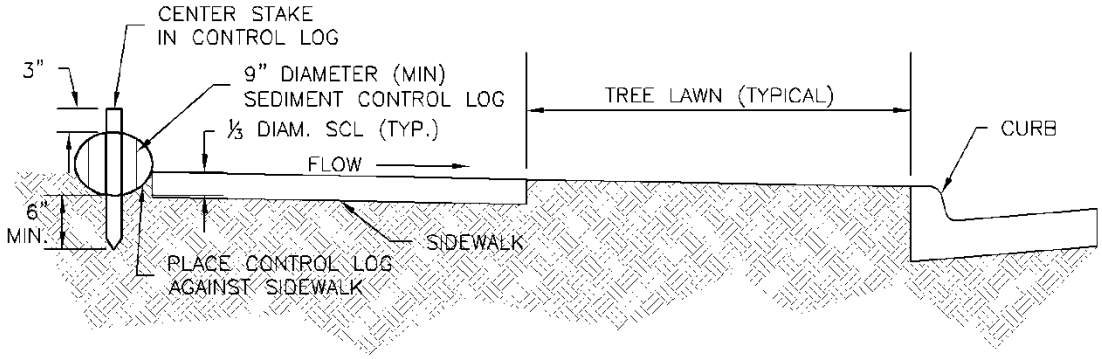


SEDIMENT CONTROL LOG JOINTS

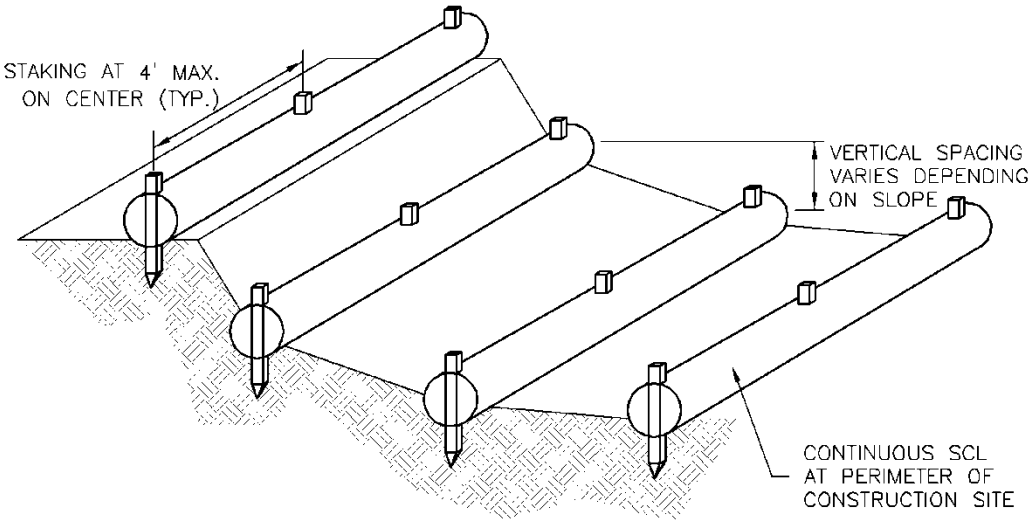
SCL–1. SEDIMENT CONTROL LOG



SCL–2. SEDIMENT CONTROL LOG AT BACK OF CURB



SCL–3. SEDIMENT CONTROL LOG AT SIDEWALK WITH TREE LAWN



SCL–4. SEDIMENT CONTROL LOGS TO CONTROL SLOPE LENGTH

SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOGS.

2. SEDIMENT CONTROL LOGS THAT ACT AS A PERIMETER CONTROL SHALL BE INSTALLED PRIOR TO ANY UPGRADIENT LAND-DISTURBING ACTIVITIES.

3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER, AND SHALL BE FREE OF ANY NOXIOUS WEED SEEDS OR DEFECTS INCLUDING RIPS, HOLES AND OBVIOUS WEAR.

4. SEDIMENT CONTROL LOGS MAY BE USED AS SMALL CHECK DAMS IN DITCHES AND SWALES. HOWEVER, THEY SHOULD NOT BE USED IN PERENNIAL STREAMS OR HIGH VELOCITY DRAINAGE WAYS.

5. IT IS RECOMMENDED THAT SEDIMENT CONTROL LOGS BE TRENCHED INTO THE GROUND TO A DEPTH OF APPROXIMATELY ⅓ OF THE DIAMETER OF THE LOG. IF TRENCHING TO THIS DEPTH IS NOT FEASIBLE AND/OR DESIRABLE (SHORT TERM INSTALLATION WITH DESIRE NOT TO DAMAGE LANDSCAPE) A LESSER TRENCHING DEPTH MAY BE ACCEPTABLE WITH MORE ROBUST STAKING

6. THE UPHILL SIDE OF THE SEDIMENT CONTROL LOG SHALL BE BACKFILLED WITH SOIL THAT IS FREE OF ROCKS AND DEBRIS. THE SOIL SHALL BE TIGHTLY COMPACTED INTO THE SHAPE OF A RIGHT TRIANGLE USING A SHOVEL OR WEIGHTED LAWN ROLLER.

7. FOLLOW MANUFACTURERS' GUIDANCE FOR STAKING. IF MANUFACTURERS' INSTRUCTIONS DO NOT SPECIFY SPACING, STAKES SHALL BE PLACED ON 4' CENTERS AND EMBEDDED A MINIMUM OF 6" INTO THE GROUND. 3" OF THE STAKE SHALL PROTRUDE FROM THE TOP OF THE LOG. STAKES THAT ARE BROKEN PRIOR TO INSTALLATION SHALL BE REPLACED.

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOG SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE SEDIMENT CONTROL LOG.

5. SEDIMENT CONTROL LOG SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF DISTURBED AREAS EXIST AFTER REMOVAL, THEY SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, JEFFERSON COUNTY, COLORADO, DOUGLAS COUNTY, COLORADO, AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Sediment Trap (ST) SC-8

Description

Sediment traps are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. Sediment traps are designed to capture drainage from disturbed areas less than one acre and allow settling of sediment.

Photograph ST-1. Sediment traps are used to collect sediment-laden runoff from disturbed area. Photo courtesy of EPA Menu of BMPs.

Appropriate Uses

Sediment traps can be used in combination with other layers of erosion and sediment controls to trap sediment from small drainage areas (less than one acre) or areas with localized high sediment loading. For example, sediment traps are often provided in conjunction with vehicle tracking controls and wheel wash facilities.

Design and Installation

A sediment trap consists of a small excavated basin with an earthen berm and a riprap outlet. The berm of the sediment trap may be constructed from the excavated material and must be compacted to 95 percent of the maximum density in accordance with ASTM D698. An overflow outlet must be provided at an elevation at least 6 inches below the top of the berm. See Detail ST-1 for additional design and installation information.

Maintenance and Removal

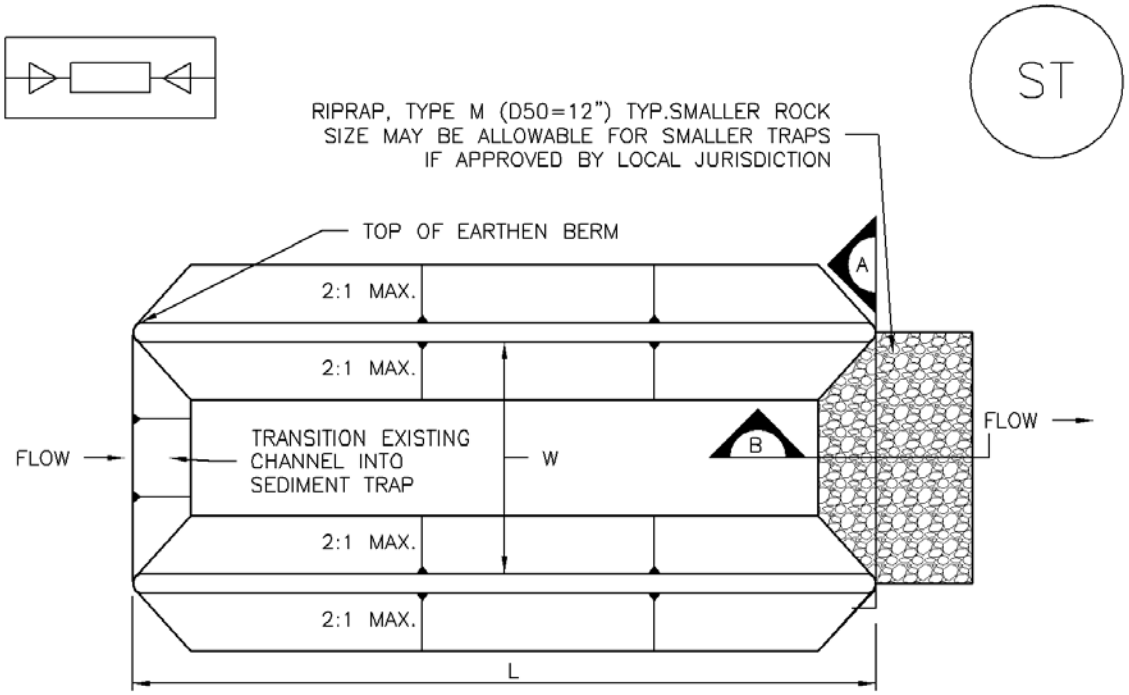
Inspect the sediment trap embankments for stability and seepage.

Remove accumulated sediment as needed to maintain the effectiveness of the sediment trap, typically when the sediment depth is approximately one-half the height of the outflow embankment.

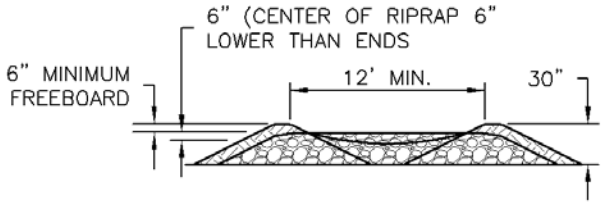
Inspect the outlet for debris and damage. Repair damage to the outlet, and remove all obstructions.

A sediment trap should not be removed until the upstream area is sufficiently stabilized. Upon removal of the trap, the disturbed area should be covered with topsoil and stabilized.

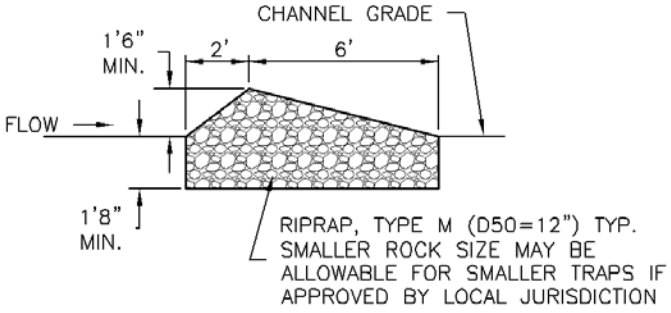
Sediment Trap	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No



SEDIMENT TRAP PLAN



SECTION A



SECTION B

ST–1. SEDIMENT TRAP

SEDIMENT TRAP INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION, LENGTH AND WIDTH OF SEDIMENT TRAP.

2. ONLY USE FOR DRAINAGE AREAS LESS THAN 1 ACRE.

3. SEDIMENT TRAPS SHALL BE INSTALLED PRIOR TO ANY UPGRADIENT LAND–DISTURBING ACTIVITIES.

4. SEDIMENT TRAP BERM SHALL BE CONSTRUCTED FROM MATERIAL FROM EXCAVATION. THE BERM SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

5. SEDIMENT TRAP OUTLET TO BE CONSTRUCTED OF RIPRAP, TYPE M (D50=12") TYP.SMALLER ROCK SIZE MAY BE ALLOWABLE FOR SMALLER TRAPS IF APPROVED BY LOCAL JURISDICTION.

6. THE TOP OF THE EARTHEN BERM SHALL BE A MINIMUM OF 6" HIGHER THAN THE TOP OF THE RIPRAP OUTLET STRUCTURE.

7. THE ENDS OF THE RIPRAP OUTLET STRUCTURE SHALL BE A MINIMUM OF 6" HIGHER THAN THE CENTER OF THE OUTLET STRUCTURE.

SEDIMENT TRAP MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. REMOVE SEDIMENT ACCUMULATED IN TRAP AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN THE SEDIMENT DEPTH REACHES ½ THE HEIGHT OF THE RIPRAP OUTLET.

5. SEDIMENT TRAPS SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT TRAPS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Silt Fence (SF) SC-1

Description

A silt fence is a woven geotextile fabric attached to wooden posts and trenched into the ground. It is designed as a sediment barrier to intercept sheet flow runoff from disturbed areas.

Photograph SF-1. Silt fence creates a sediment barrier, forcing sheet flow runoff to evaporate or infiltrate.

Appropriate Uses

A silt fence can be used where runoff is conveyed from a disturbed area as sheet flow. Silt fence is not designed to receive concentrated flow or to be used as a filter fabric. Typical uses include:

- Down slope of a disturbed area to accept sheet flow.
- Along the perimeter of a receiving water such as a stream, pond or wetland.
- At the perimeter of a construction site.

Design and Installation

Silt fence should be installed along the contour of slopes so that it intercepts sheet flow. The maximum recommended tributary drainage area per 100 lineal feet of silt fence, installed along the contour, is approximately 0.25 acres with a disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. Longer and steeper slopes require additional measures. This recommendation only applies to silt fence installed along the contour. Silt fence installed for other uses, such as perimeter control, should be installed in a way that will not produce concentrated flows. For example, a "J-hook" installation may be appropriate to force runoff to pond and evaporate or infiltrate in multiple areas rather than concentrate and cause erosive conditions parallel to the silt fence.

See Detail SF-1 for proper silt fence installation, which involves proper trenching, staking, securing the fabric to the stakes, and backfilling the silt fence. Properly installed silt fence should not be easily pulled out by hand and there should be no gaps between the ground and the fabric.

Silt fence must meet the minimum allowable strength requirements, depth of installation requirement, and other specifications in the design details. Improper installation of silt fence is a common reason for silt fence failure; however, when properly installed and used for the appropriate purposes, it can be highly effective.

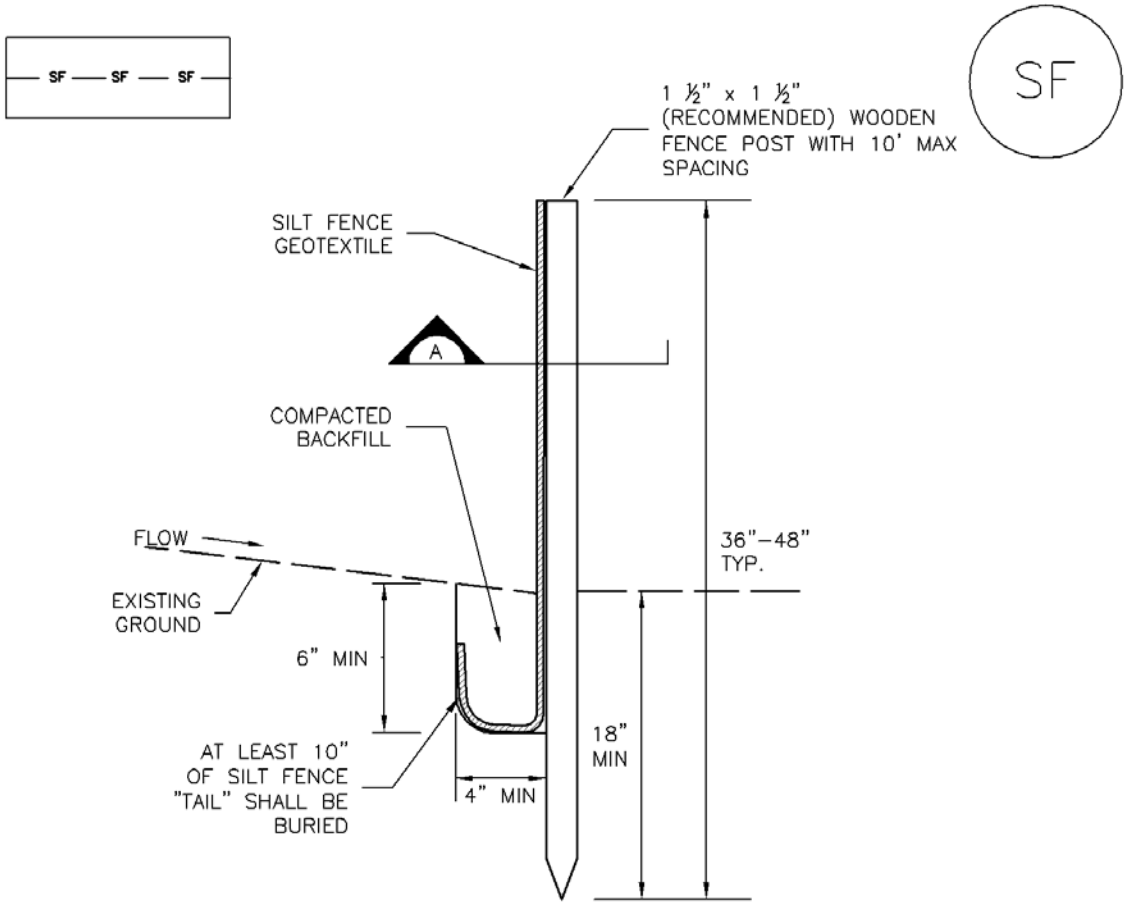
Silt Fence	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

Maintenance and Removal

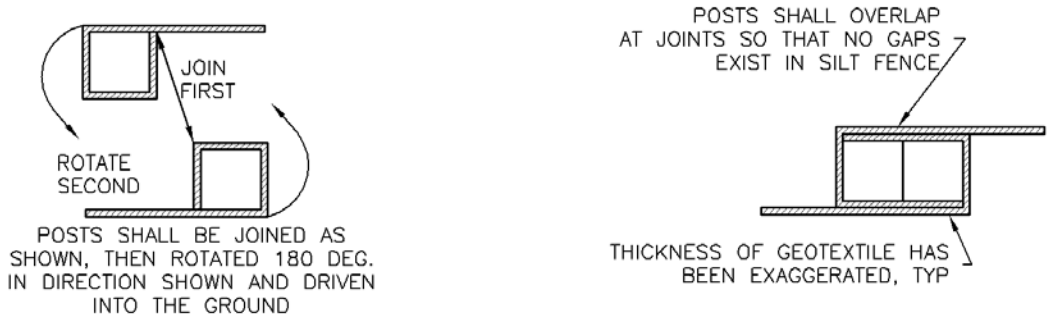
Inspection of silt fence includes observing the material for tears or holes and checking for slumping fence and undercut areas bypassing flows. Repair of silt fence typically involves replacing the damaged section with a new section. Sediment accumulated behind silt fence should be removed, as needed to maintain BMP effectiveness, typically before it reaches a depth of 6 inches.

Silt fence may be removed when the upstream area has reached final stabilization.

Photograph SF-2. When silt fence is not installed along the contour, a "J-hook" installation may be appropriate to ensure that the BMP does not create concentrated flow parallel to the silt fence. Photo courtesy of Tom Gore.



SILT FENCE



SECTION A

SF–1. SILT FENCE

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2–5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.

2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.

3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.

4. SILT FENCE SHALL BE PULLED TIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.

5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.

6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J–HOOK." THE "J–HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10' – 20').

7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".

5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.

6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.

7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Surface Roughening (SR) EC-1

Description

Surface roughening is an erosion control practice that involves tracking, scarifying, imprinting, or tilling a disturbed area to provide temporary stabilization of disturbed areas. Surface roughening creates variations in the soil surface that help to minimize wind and water erosion. Depending on the technique used, surface roughening may also help establish conditions favorable to establishment of vegetation.

Photograph SR-1. Surface roughening via imprinting for temporary stabilization.

Appropriate Uses

Surface roughening can be used to provide temporary stabilization of disturbed areas, such as when revegetation cannot be immediately established due to seasonal planting limitations. Surface roughening is not a stand-alone BMP, and should be used in conjunction with other erosion and sediment controls.

Surface roughening is often implemented in conjunction with grading and is typically performed using heavy construction equipment to track the surface. Be aware that tracking with heavy equipment will also compact soils, which is not desirable in areas that will be revegetated. Scarifying, tilling, or ripping are better surface roughening techniques in locations where revegetation is planned. Roughening is not effective in very sandy soils and cannot be effectively performed in rocky soil.

Design and Installation

Typical design details for surfacing roughening on steep and mild slopes are provided in Details SR-1 and SR-2, respectively.

Surface roughening should be performed either after final grading or to temporarily stabilize an area during active construction that may be inactive for a short time period. Surface roughening should create depressions 2 to 6 inches deep and approximately 6 inches apart. The surface of exposed soil can be roughened by a number of techniques and equipment. Horizontal grooves (running parallel to the contours of the land) can be made using tracks from equipment treads, stair-step grading, ripping, or tilling.

Fill slopes can be constructed with a roughened surface. Cut slopes that have been smooth graded can be roughened as a subsequent operation. Roughening should follow along the contours of the slope. The tracks left by truck mounted equipment working perpendicular to the contour can leave acceptable horizontal depressions; however, the equipment will also compact the soil.

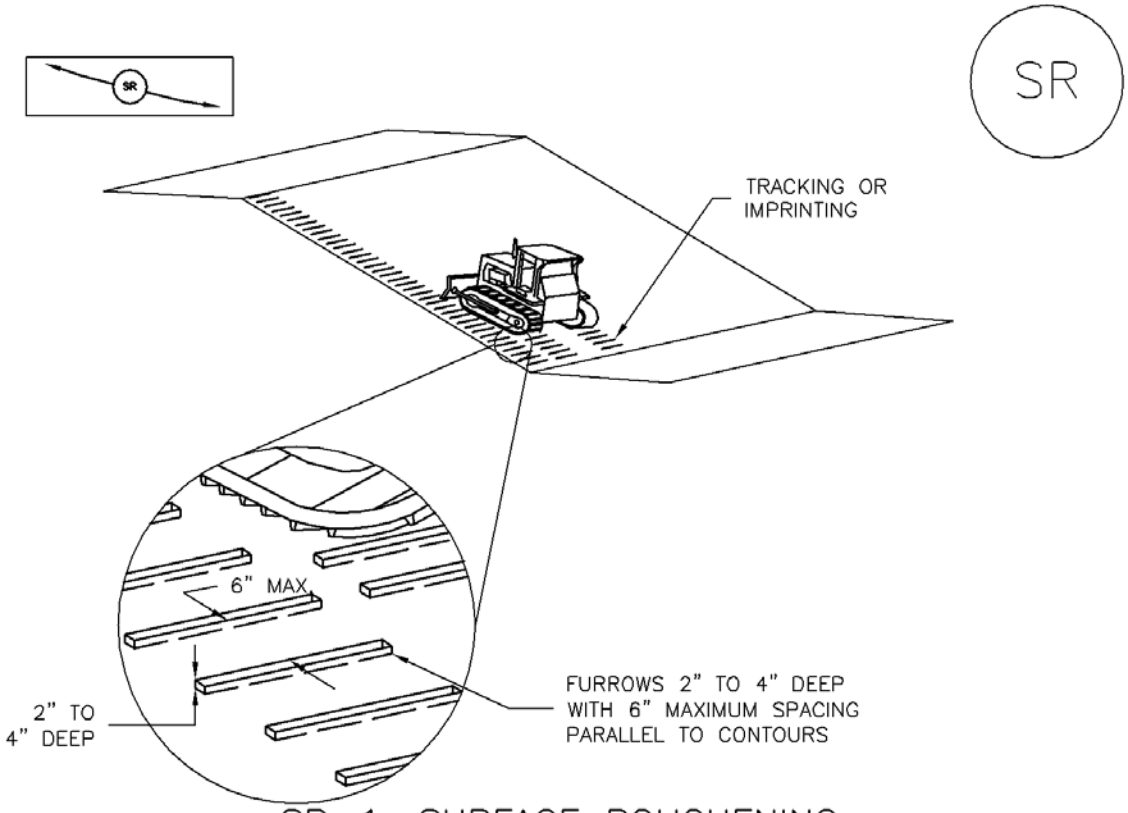
Surface Roughening	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

Maintenance and Removal

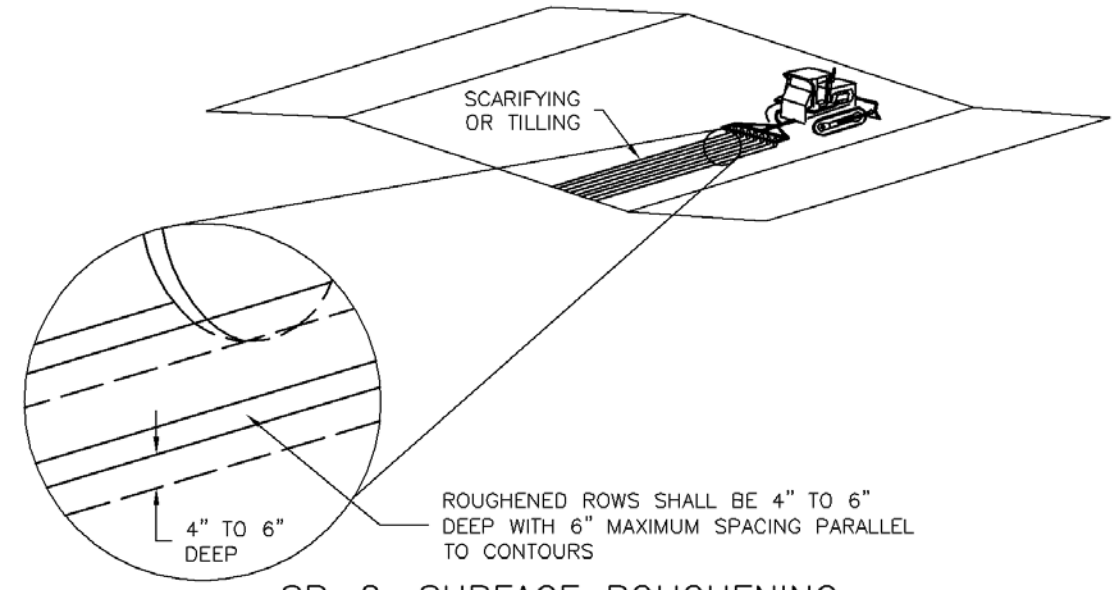
Care should be taken not to drive vehicles or equipment over areas that have been surface roughened. Tire tracks will smooth the roughened surface and may cause runoff to collect into rills and gullies.

Because surface roughening is only a temporary control, additional treatments may be necessary to maintain the soil surface in a roughened condition.

Areas should be inspected for signs of erosion. Surface roughening is a temporary measure, and will not provide long-term erosion control.



SR–1. SURFACE ROUGHENING
FOR STEEP SLOPES (3:1 OR STEEPER)



SR–2. SURFACE ROUGHENING
FOR LOW SLOPES (LESS THAN 3:1)

SURFACE ROUGHENING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATION(S) OF SURFACE ROUGHENING.

2. SURFACE ROUGHENING SHALL BE PROVIDED PROMPTLY AFTER COMPLETION OF FINISHED GRADING (FOR AREAS NOT RECEIVING TOPSOIL) OR PRIOR TO TOPSOIL PLACEMENT OR ANY FORECASTED RAIN EVENT.

3. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD WILL BE PLACED WITHOUT DELAY IN THE CONSTRUCTION SEQUENCE, SURFACE ROUGHENING IS NOT REQUIRED.

4. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

5. A FARMING DISK SHALL NOT BE USED FOR SURFACE ROUGHENING.

SURFACE ROUGHENING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACE UPON DISCOVERY OF THE FAILURE.

4. VEHICLES AND EQUIPMENT SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.

5. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.

6. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER RILL EROSION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Vehicle Tracking Control (VTC) SM-4

Description

Vehicle tracking controls provide stabilized construction site access where vehicles exit the site onto paved public roads. An effective vehicle tracking control helps remove sediment (mud or dirt) from vehicles, reducing tracking onto the paved surface.

Photograph VTC-1. A vehicle tracking control pad constructed with properly sized rock reduces off-site sediment tracking.

Appropriate Uses

Implement a stabilized construction entrance or vehicle tracking control where frequent heavy vehicle traffic exits the construction site onto a paved roadway. An effective vehicle tracking control is particularly important during the following conditions:

- Wet weather periods when mud is easily tracked off site.
- During dry weather periods where dust is a concern.
- When poorly drained, clayey soils are present on site.

Although wheel washes are not required in designs of vehicle tracking controls, they may be needed at particularly muddy sites.

Design and Installation

Construct the vehicle tracking control on a level surface. Where feasible, grade the tracking control towards the construction site to reduce off-site runoff. Place signage, as needed, to direct construction vehicles to the designated exit through the vehicle tracking control. There are several different types of stabilized construction entrances including:

VTC-1. Aggregate Vehicle Tracking Control. This is a coarse-aggregate surfaced pad underlain by a geotextile. This is the most common vehicle tracking control, and when properly maintained can be effective at removing sediment from vehicle tires.

VTC-2. Vehicle Tracking Control with Construction Mat or Turf Reinforcement Mat. This type of control may be appropriate for site access at very small construction sites with low traffic volume over vegetated areas. Although this application does not typically remove sediment from vehicles, it helps protect existing vegetation and provides a stabilized entrance.

Vehicle Tracking Control	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	Yes

VTC-3. Stabilized Construction Entrance/Exit with Wheel Wash. This is an aggregate pad, similar to VTC-1, but includes equipment for tire washing. The wheel wash equipment may be as simple as hand-held power washing equipment to more advance proprietary systems. When a wheel wash is provided, it is important to direct wash water to a sediment trap prior to discharge from the site.

Vehicle tracking controls are sometimes installed in combination with a sediment trap to treat runoff.

Maintenance and Removal

Inspect the area for degradation and replace aggregate or material used for a stabilized entrance/exit as needed. If the area becomes clogged and ponds water, remove and dispose of excess sediment or replace material with a fresh layer of aggregate as necessary.

With aggregate vehicle tracking controls, ensure rock and debris from this area do not enter the public right-of-way.

Remove sediment that is tracked onto the public right of way daily or more frequently as needed. Excess sediment in the roadway indicates that the stabilized construction entrance needs maintenance.

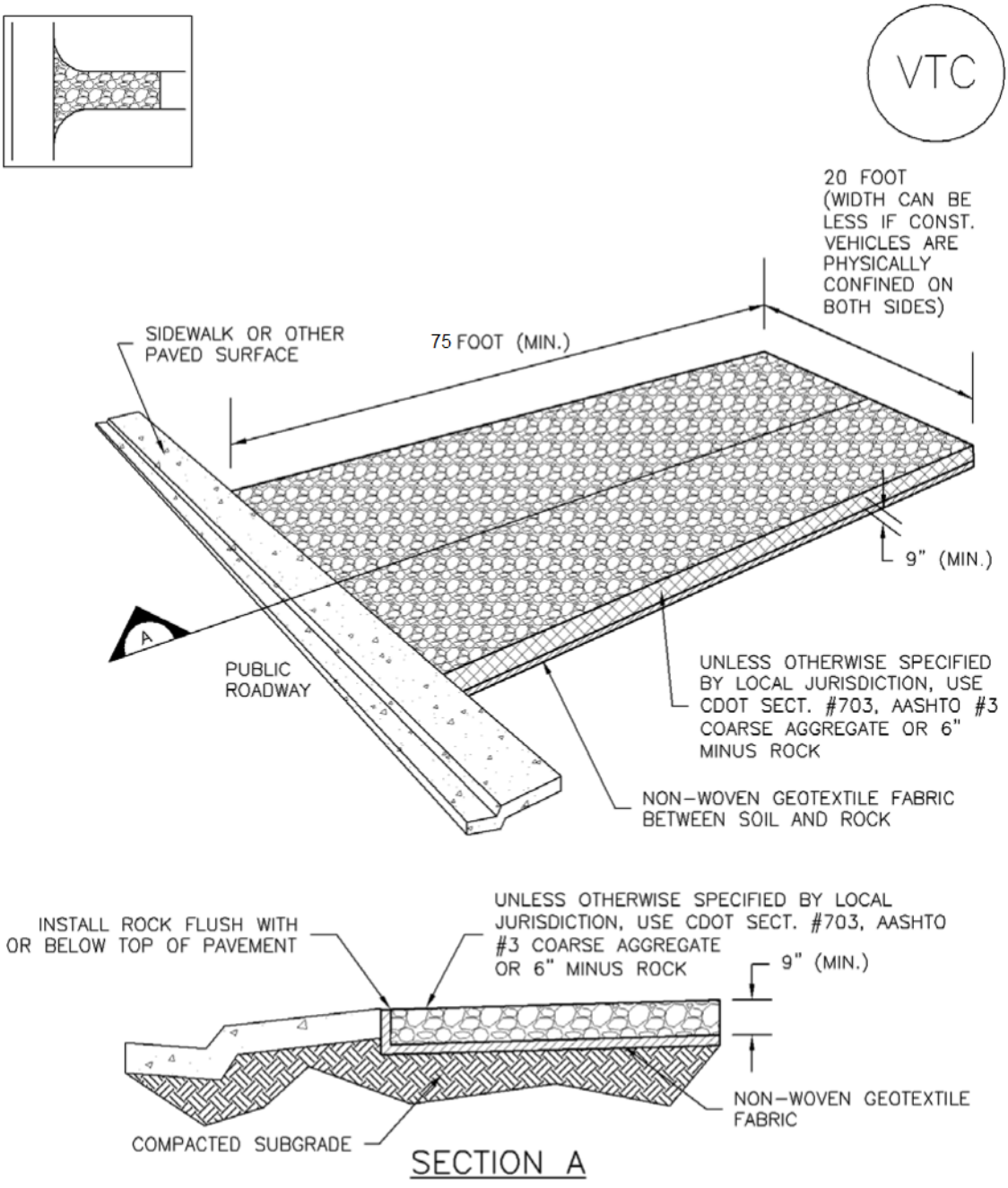
Ensure that drainage ditches at the entrance/exit area remain clear.

Photograph VTC-2. A vehicle tracking control pad with wheel wash facility. Photo courtesy of Tom Gore.

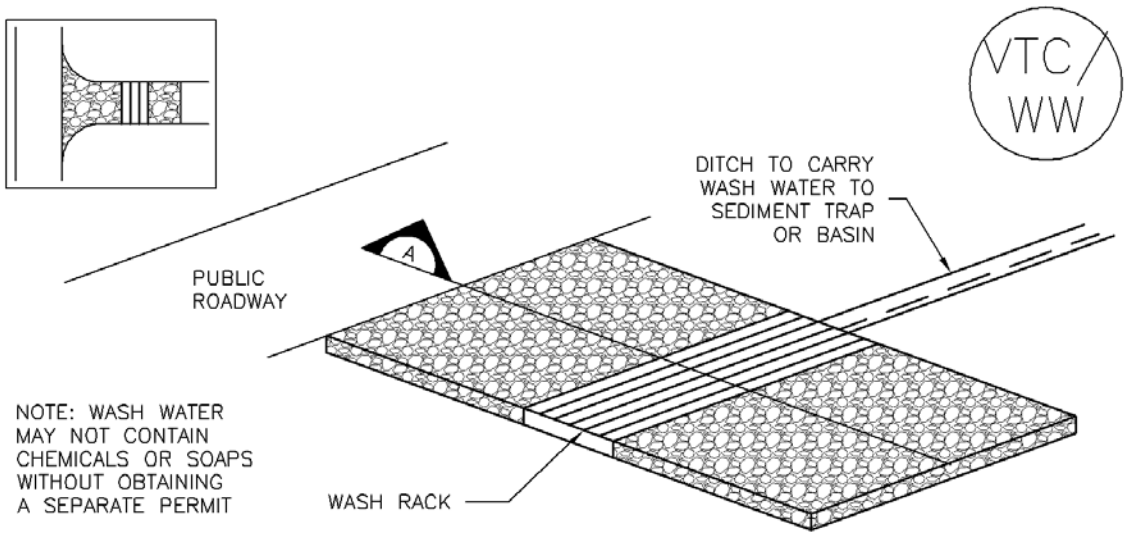
A stabilized entrance should be removed only when there is no longer the potential for vehicle tracking to occur. This is typically after the site has been stabilized.

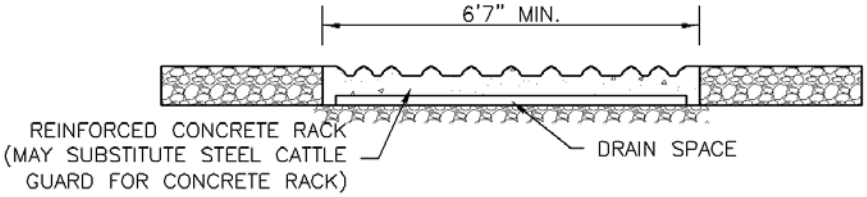
When wheel wash equipment is used, be sure that the wash water is discharged to a sediment trap prior to discharge. Also inspect channels conveying the water from the wash area to the sediment trap and stabilize areas that may be eroding.

When a construction entrance/exit is removed, excess sediment from the aggregate should be removed and disposed of appropriately. The entrance should be promptly stabilized with a permanent surface following removal, typically by paving.



VTC-1. AGGREGATE VEHICLE TRACKING CONTROL





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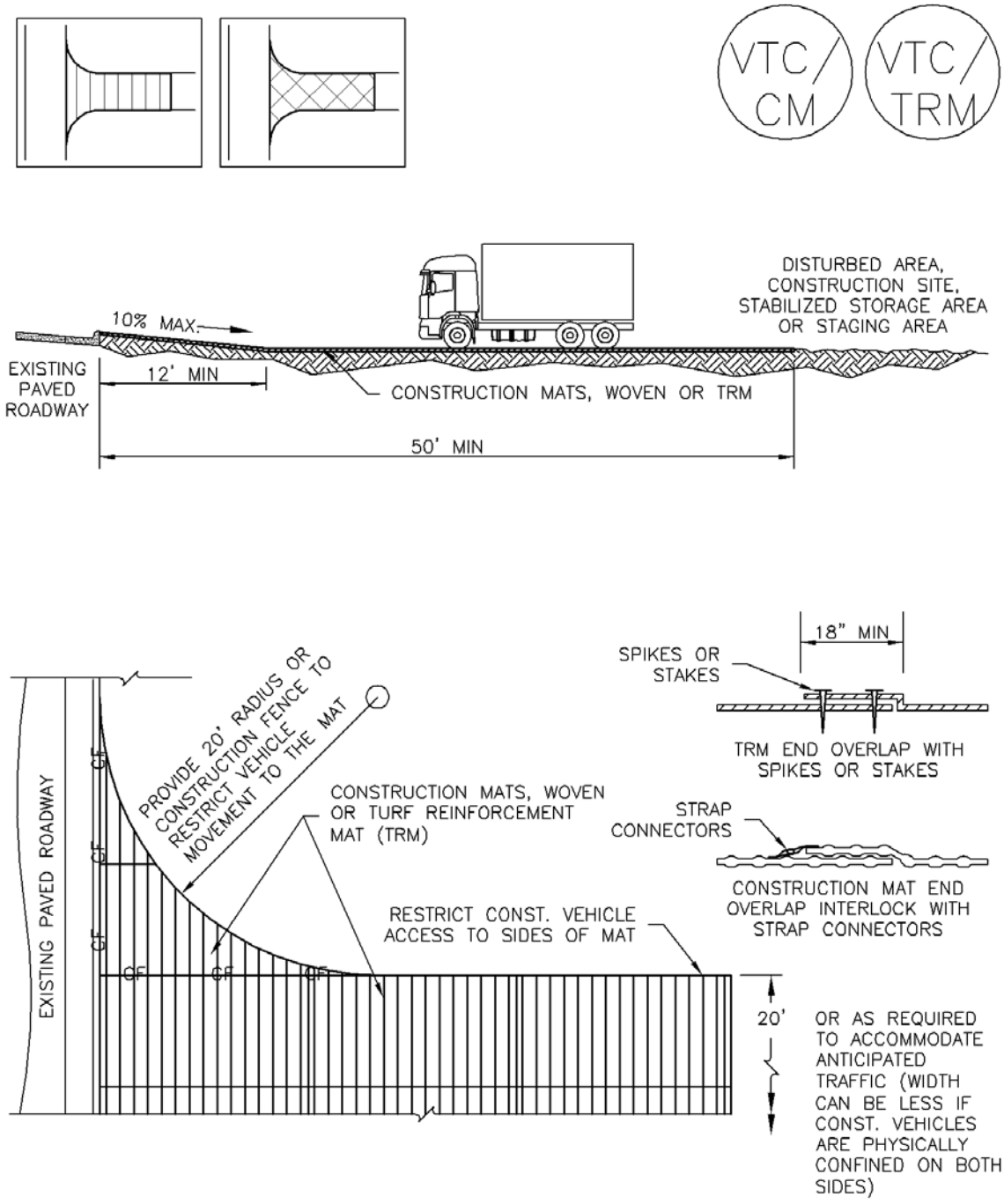
VTC–2. AGGREGATE VEHICLE TRACKING CONTROL WITH WASH RACK



VTC–3. VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT OR TURF REINFORCEMENT MAT (TRM)

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S).
   -TYPE OF CONSTRUCTION ENTRANCE(S)/EXITS(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).

2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.

3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS.

4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK.

6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

STABILIZED CONSTRUCTION ENTRANCE/EXIT MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.

5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM CITY OF BROOMFIELD, COLORADO, NOT AVAILABLE IN AUTOCAD)

Rolled Erosion Control Products (RECP) EC-6

Description

Photograph RECP-1. Erosion control blanket protecting the slope from erosion and providing favorable conditions for revegetation.

Rolled Erosion Control Products (RECPs) include a variety of temporary or permanently installed manufactured products designed to control erosion and enhance vegetation establishment and survivability, particularly on slopes and in channels. For applications where natural vegetation alone will provide sufficient permanent erosion protection, temporary products such as netting, open weave textiles and a variety of erosion control blankets (ECBs) made of biodegradable natural materials (e.g., straw, coconut fiber) can be used. For applications where natural vegetation alone will not be sustainable under expected flow conditions, permanent rolled erosion control products such as turf reinforcement mats (TRMs) can be used. In particular, turf reinforcement mats are designed for discharges that exert velocities and sheer stresses that exceed the typical limits of mature natural vegetation.

Appropriate Uses

RECPs can be used to control erosion in conjunction with revegetation efforts, providing seedbed protection from wind and water erosion. These products are often used on disturbed areas on steep slopes, in areas with highly erosive soils, or as part of drainageway stabilization. In order to select the appropriate RECP for site conditions, it is important to have a general understanding of the general types of these products, their expected longevity, and general characteristics.

The Erosion Control Technology Council (ECTC 2005) characterizes rolled erosion control products according to these categories:

- **Mulch control netting**: A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable rolled erosion control product to anchor loose fiber mulches.
- **Open weave textile**: A temporary degradable rolled erosion control product composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.
- **Erosion control blanket (ECB)**: A temporary degradable rolled erosion control product composed of processed natural or polymer fibers which are mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment. ECBs can be further differentiated into rapidly degrading single-net and double-net types or slowly degrading types.

Rolled Erosion Control Products	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

- **Turf Reinforcement Mat (TRM)**: A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh, and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. Note: TRMs are typically used in hydraulic applications, such as high flow ditches and channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.

Tables RECP-1 and RECP-2 provide guidelines for selecting rolled erosion control products appropriate to site conditions and desired longevity. Table RECP-1 is for conditions where natural vegetation alone will provide permanent erosion control, whereas Table RECP-2 is for conditions where vegetation alone will not be adequately stable to provide long-term erosion protection due to flow or other conditions.

Table RECP-1. ECTC Standard Specification for Temporary Rolled Erosion Control Products
(Adapted from Erosion Control Technology Council 2005)

Product Description	Slope Applications*		Channel Applications*	Minimum Tensile Strength[1]	Expected Longevity
	Maximum Gradient	C Factor[2,5]	Max. Shear Stress[3,4,6]		
Mulch Control Nets	5:1 (H:V)	≤0.10 @ 5:1	0.25 lbs/ft^2 (12 Pa)	5 lbs/ft (0.073 kN/m)	Up to 12 months
Netless Rolled Erosion Control Blankets	4:1 (H:V)	≤0.10 @ 4:1	0.5 lbs/ft^2 (24 Pa)	5 lbs/ft (0.073 kN/m)	
Single-net Erosion Control Blankets & Open Weave Textiles	3:1 (H:V)	≤0.15 @ 3:1	1.5 lbs/ft^2 (72 Pa)	50 lbs/ft (0.73 kN/m)	
Double-net Erosion Control Blankets	2:1 (H:V)	≤0.20 @ 2:1	1.75 lbs/ft^2 (84 Pa)	75 lbs/ft (1.09 kN/m)	
Mulch Control Nets	5:1 (H:V)	≤0.10 @ 5:1	0.25 lbs/ft^2 (12 Pa)	25 lbs/ft (0.36 kN/m)	24 months
Erosion Control Blankets & Open Weave Textiles (slowly degrading)	1.5:1 (H:V)	≤0.25 @ 1.5:1	2.00 lbs/ft^2 (96 Pa)	100 lbs/ft (1.45 kN/m)	24 months
Erosion Control Blankets & Open Weave Textiles	1:1 (H:V)	≤0.25 @ 1:1	2.25 lbs/ft^2 (108 Pa)	125 lbs/ft (1.82 kN/m)	36 months

* C Factor and shear stress for mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material. (*See Section 5.3 of Chapter 7 Construction BMPs for more information on the C Factor*.)

[1] Minimum Average Roll Values, Machine direction using ECTC Mod. ASTM D 5035.

[2] C Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, H:V) to ratio of soil loss from unprotected (control) plot in large-scale testing.

[3] Required minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in) soil loss) during a 30-minute flow event in large-scale testing.

[4] The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

[5] Acceptable large-scale test methods may include ASTM D 6459, or other independent testing deemed acceptable by the engineer.

[6] Per the engineer's discretion. Recommended acceptable large-scale testing protocol may include ASTM D 6460, or other independent testing deemed acceptable by the engineer.

Table RECP-2. ECTC Standard Specification for Permanent[1] Rolled Erosion Control Products
(Adapted from: Erosion Control Technology Council 2005)

Product Type	Slope Applications	Channel Applications	
TRMs with a minimum thickness of 0.25 inches (6.35 mm) per ASTM D 6525 and UV stability of 80% per ASTM D 4355 (500 hours exposure).	Maximum Gradient	Maximum Shear Stress[4,5]	Minimum Tensile Strength[2,3]
	0.5:1 (H:V)	6.0 lbs/ft^2 (288 Pa)	125 lbs/ft (1.82 kN/m)
	0.5:1 (H:V)	8.0 lbs/ft^2 (384 Pa)	150 lbs/ft (2.19 kN/m)
	0.5:1 (H:V)	10.0 lbs/ft^2 (480 Pa)	175 lbs/ft (2.55 kN/m)

[1] For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.

[2] Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D 6818 (Supersedes Mod. ASTM D 5035 for RECPs)

[3] Field conditions with high loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 44 kN/m (3,000 lb/ft) or greater.

[4] Required minimum shear stress TRM (fully vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during a 30-minute flow event in large scale testing.

[5] Acceptable large-scale testing protocols may include ASTM D 6460, or other independent testing deemed acceptable by the engineer.

Design and Installation

RECPs should be installed according to manufacturer's specifications and guidelines. Regardless of the type of product used, it is important to ensure no gaps or voids exist under the material and that all corners of the material are secured using stakes and trenching. Continuous contact between the product and the soil is necessary to avoid failure. Never use metal stakes to secure temporary erosion control products. Often wooden stakes are used to anchor RECPs; however, wood stakes may present installation and maintenance challenges and generally take a long time to biodegrade. Some local jurisdictions have had favorable experiences using biodegradable stakes.

This BMP Fact Sheet provides design details for several commonly used ECB applications, including:

ECB-1 Pipe Outlet to Drainageway

ECB-2 Small Ditch or Drainageway

ECB-3 Outside of Drainageway

Staking patterns are also provided in the design details according to these factors:

- ECB type
- Slope or channel type

For other types of RECPs including TRMs, these design details are intended to serve as general guidelines for design and installation; however, engineers should adhere to manufacturer's installation recommendations.

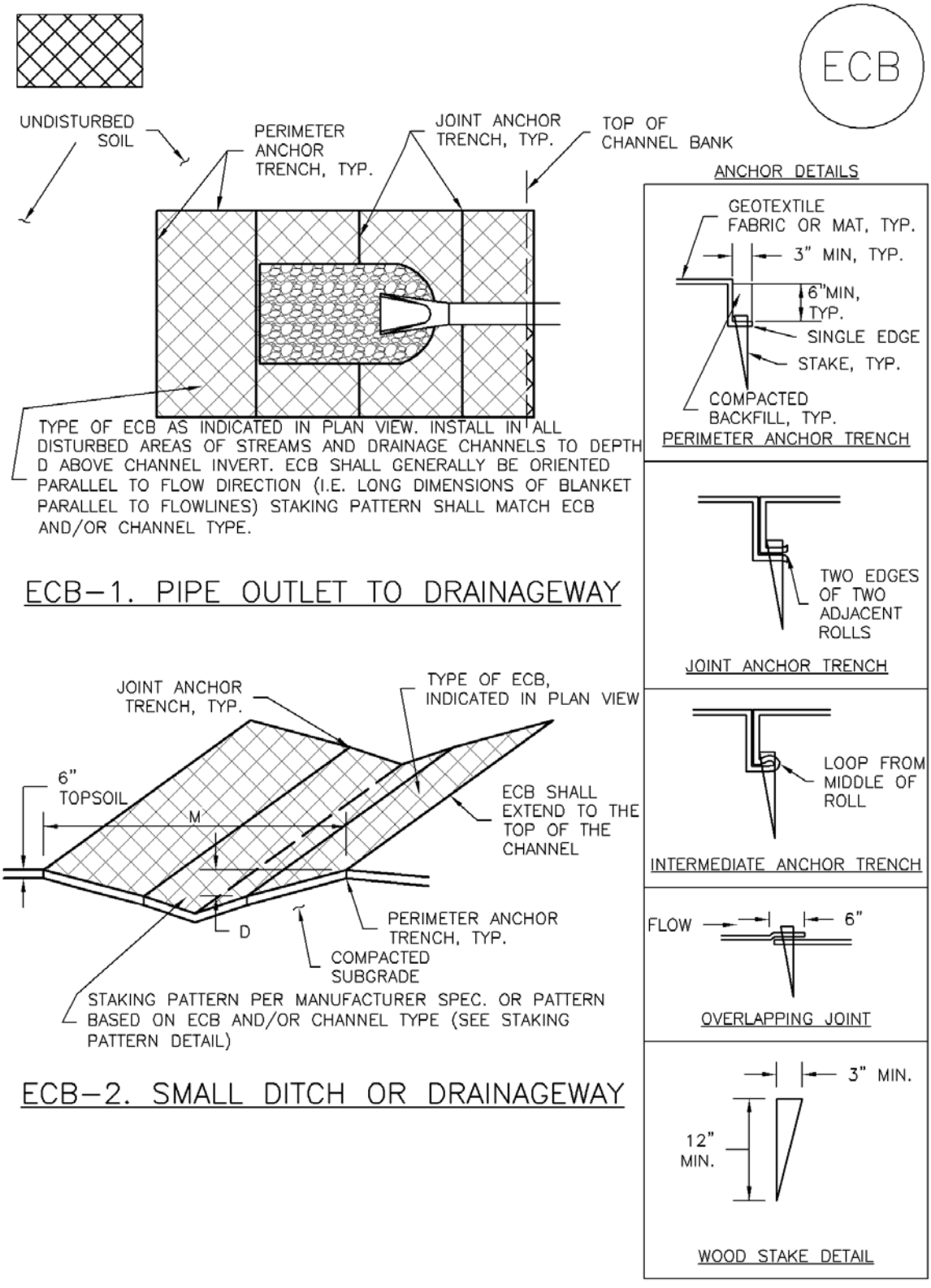
Maintenance and Removal

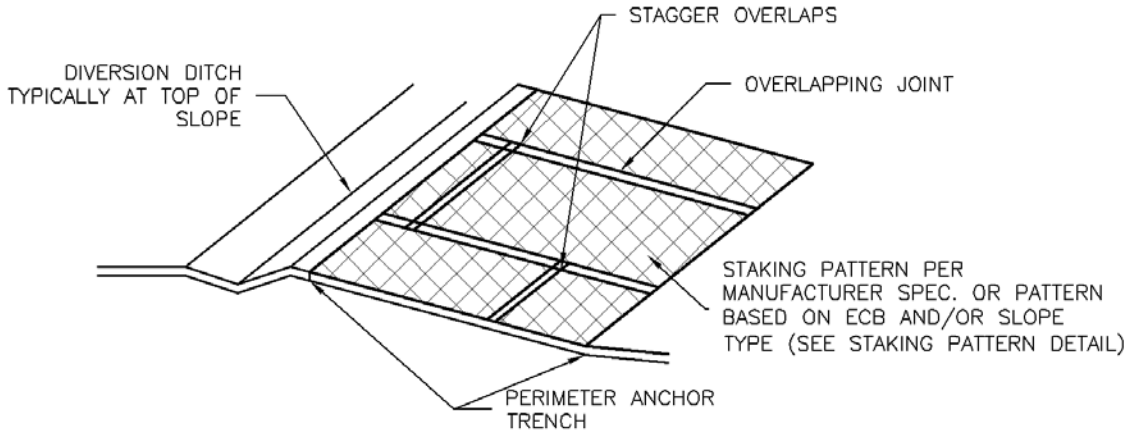
Inspection of erosion control blankets and other RECPs includes:

- Check for general signs of erosion, including voids beneath the mat. If voids are apparent, fill the void with suitable soil and replace the erosion control blanket, following the appropriate staking pattern.
- Check for damaged or loose stakes and secure loose portions of the blanket.

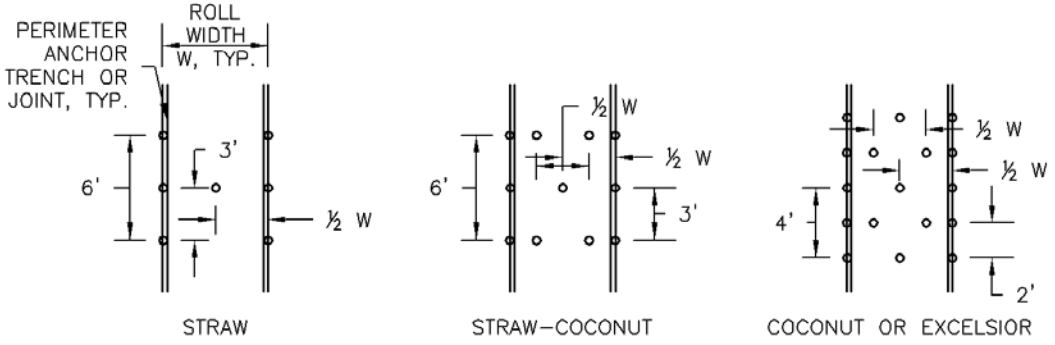
Erosion control blankets and other RECPs that are biodegradable typically do not need to be removed after construction. If they must be removed, then an alternate soil stabilization method should be installed promptly following removal.

Turf reinforcement mats, although generally resistant to biodegradation, are typically left in place as a dense vegetated cover grows in through the mat matrix. The turf reinforcement mat provides long-term stability and helps the established vegetation resist erosive forces.

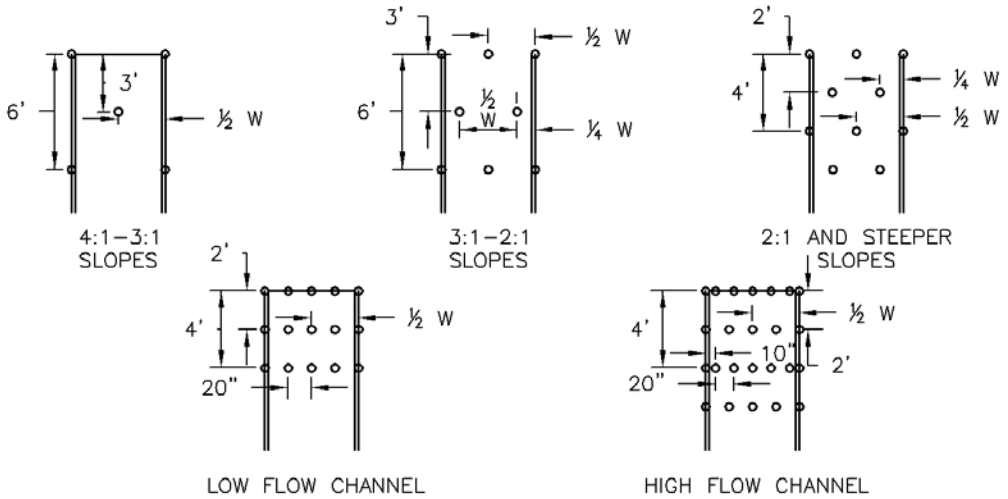

ECB
UNDISTURBED SOIL
PERIMETER ANCHOR TRENCH, TYP.
JOINT ANCHOR TRENCH, TYP.
TOP OF CHANNEL BANK
TYPE OF ECB AS INDICATED IN PLAN VIEW. INSTALL IN ALL DISTURBED AREAS OF STREAMS AND DRAINAGE CHANNELS TO DEPTH D ABOVE CHANNEL INVERT. ECB SHALL GENERALLY BE ORIENTED PARALLEL TO FLOW DIRECTION (I.E. LONG DIMENSIONS OF BLANKET PARALLEL TO FLOWLINES) STAKING PATTERN SHALL MATCH ECB AND/OR CHANNEL TYPE.
ECB–1. PIPE OUTLET TO DRAINAGEWAY
JOINT ANCHOR TRENCH, TYP.
TYPE OF ECB, INDICATED IN PLAN VIEW
6" TOPSOIL
M
ECB SHALL EXTEND TO THE TOP OF THE CHANNEL
D
PERIMETER ANCHOR TRENCH, TYP.
COMPACTED SUBGRADE
STAKING PATTERN PER MANUFACTURER SPEC. OR PATTERN BASED ON ECB AND/OR CHANNEL TYPE (SEE STAKING PATTERN DETAIL)
ECB–2. SMALL DITCH OR DRAINAGEWAY
ANCHOR DETAILS
GEOTEXTILE FABRIC OR MAT, TYP.
3" MIN, TYP.
6" MIN, TYP.
SINGLE EDGE STAKE, TYP.
COMPACTED BACKFILL, TYP.
PERIMETER ANCHOR TRENCH
TWO EDGES OF TWO ADJACENT ROLLS
JOINT ANCHOR TRENCH
LOOP FROM MIDDLE OF ROLL
INTERMEDIATE ANCHOR TRENCH
FLOW
6"
OVERLAPPING JOINT
3" MIN.
12" MIN.
WOOD STAKE DETAIL



ECB–3. OUTSIDE OF DRAINAGEWAY



STAKING PATTERNS BY ECB TYPE



STAKING PATTERNS BY SLOPE OR CHANNEL TYPE

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF ECB.
   - –TYPE OF ECB (STRAW, STRAW–COCONUT, COCONUT, OR EXCELSIOR).
   - –AREA, A, IN SQUARE YARDS OF EACH TYPE OF ECB.

2. 100% NATURAL AND BIODEGRADABLE MATERIALS ARE PREFERRED FOR RECPs, ALTHOUGH SOME JURISDICTIONS MAY ALLOW OTHER MATERIALS IN SOME APPLICATIONS.

3. IN AREAS WHERE ECBs ARE SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO ECB INSTALLATION AND THE ECB SHALL BE IN FULL CONTACT WITH SUBGRADE. NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.

4. PERIMETER ANCHOR TRENCH SHALL BE USED ALONG THE OUTSIDE PERIMETER OF ALL BLANKET AREAS.

5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL ECBs EXCEPT STRAW WHICH MAY USE AN OVERLAPPING JOINT.

6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE–HALF ROLL LENGTH FOR COCONUT AND EXCELSIOR ECBs.

7. OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER FOR ECBs ON SLOPES.

8. MATERIAL SPECIFICATIONS OF ECBs SHALL CONFORM TO TABLE ECB–1.

9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING ECBS SHALL BE RESEEDED AND MULCHED.

10. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM THOSE SHOWN HERE.

TABLE ECB–1. ECB MATERIAL SPECIFICATIONS

TYPE	COCONUT CONTENT	STRAW CONTENT	EXCELSIOR CONTENT	RECOMMENDED NETTING**
STRAW*	–	100%	–	DOUBLE/ NATURAL
STRAW–COCONUT	30% MIN	70% MAX	–	DOUBLE/ NATURAL
COCONUT	100%	–	–	DOUBLE/ NATURAL
EXCELSIOR	–	–	100%	DOUBLE/ NATURAL

*STRAW ECBs MAY ONLY BE USED OUTSIDE OF STREAMS AND DRAINAGE CHANNEL.
**ALTERNATE NETTING MAY BE ACCEPTABLE IN SOME JURISDICTIONS

EROSION CONTROL BLANKET MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ECBs SHALL BE LEFT IN PLACE TO EVENTUALLY BIODEGRADE, UNLESS REQUESTED TO BE REMOVED BY THE LOCAL JURISDICTION.

5. ANY ECB PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE REPAIRED OR REINSTALLED. ANY SUBGRADE AREAS BELOW THE GEOTEXTILE THAT HAVE ERODED TO CREATED A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE ECB REINSTALLED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO AND TOWN OF PARKER COLORADO, NOT AVAILABLE IN AUTOCAD)

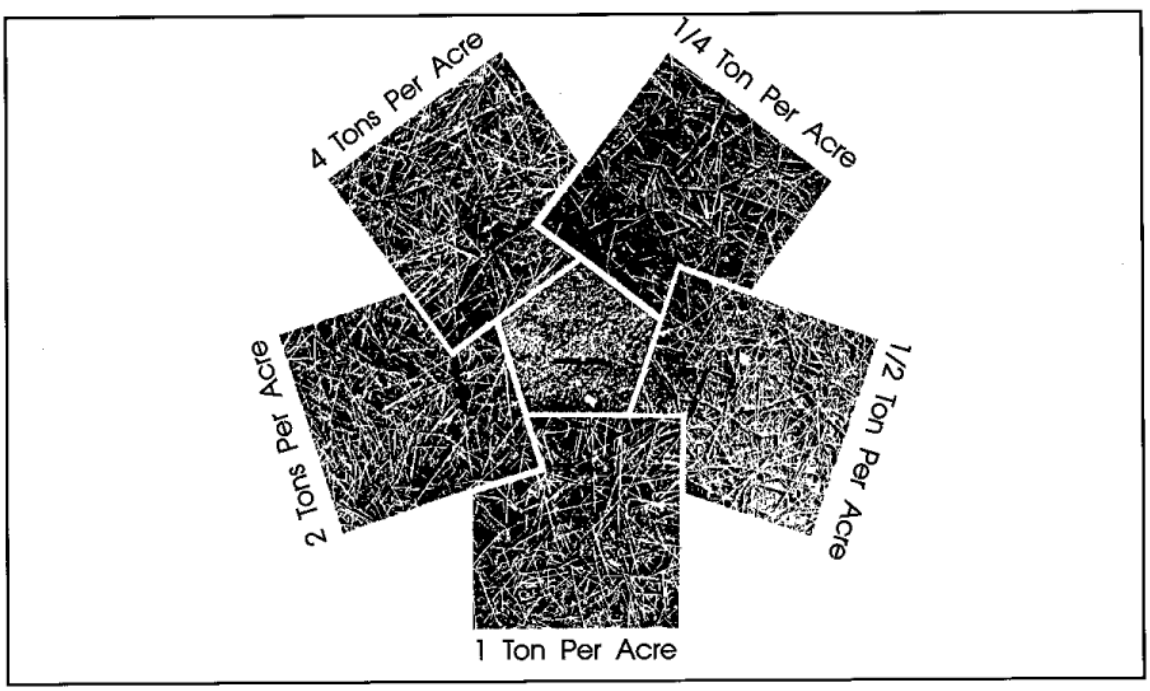
MULCHING

Definition

Application of plant residues or other suitable materials to the soil surface.

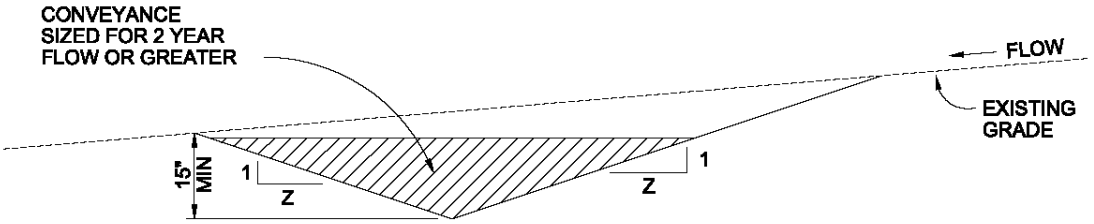
Purposes

1. To prevent erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow.
2. To foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

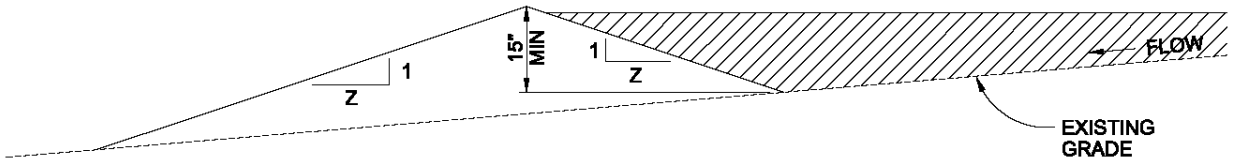


From: Environmental Protection Agency, 1976

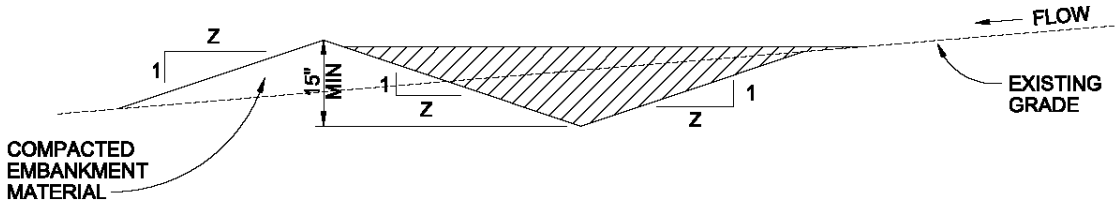
Figure C4-2—Mulching



A. EXCAVATED SWALE



B. SWALE FORMED BY BERM



C. SWALE FORMED BY CUT AND FILL

TEMPORARY SWALE

NTS

TEMPORARY SWALE NOTES

INSTALLATION REQUIREMENTS

1. TEMPORARY SWALES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

2. THE AREA UNDER WHICH THE EMBANKMENT IS TO BE INSTALLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ALL VEGETATION AND ROOT MAT.

3. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL WITH A MINIMUM OF 15% PASSING A #200 SIEVE. EXCAVATED SOIL CAN BE USED IF IT MEETS THIS REQUIREMENT.

4. EMBANKMENT IS TO BE COMPACTED TO AT LEAST 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D 698.

5. SWALES WITH SLOPE > 2% SHALL BE LINED, SEE FIGURE TSW-3.

6. SWALES ARE TO DRAIN INTO A SEDIMENT BASIN OR OTHER STABILIZED OUTLET.

7. Z SHALL BE 3 OR GREATER.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SWALES AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS OF NO RAINFALL.

2. SWALES SHALL BE ROUTINELY CLEARED OF ANY DEBRIS OR ACCUMULATION OF SEDIMENT.

3. ERODED SLOPES OR DAMAGED LININGS SHALL IMMEDIATELY BE REPAIRED.

4. TEMPORARY SWALES SHALL REMAIN OPERATIONAL AND PROPERLY MAINTAINED UNTIL THE SITE AREA IS PERMANENTLY STABILIZED WITH ADEQUATE VEGETATIVE COVER AND/OR OTHER PERMANENT STRUCTURE AS APPROVED BY THE CITY.

APPENDIX C: Phased CM Implementation

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
Install initial CMs	Perimeter control	Perimeter control serves as erosion and sediment control and, when appropriate, access control during construction activity. At down gradient locations on the perimeter, controls will be installed where overland sheet flow has the potential to leave the site. In up-gradient areas perimeter control may be added to define project boundaries, limit on-site flows or protect off-site features.	Perimeter control may consist of any number of CMs, including, but not limited to diversion ditch & dike, earthen berms, straw wattles, silt fence, construction fencing, controlled parking, controlled site entrance, vehicle tracking control, etc. See the plan for approximate locations and type proposed for installation. Perimeter control will remain in place until areas up-gradient of controls are stabilized.	See CM specific discussions for inspection and maintenance issues.
Install initial CMs	Vehicle tracking control	Vehicle tracking control will consist of an area with a geotextile liner and gravel, metal grate, medium-sized (6” to 12”) rough-cut rocks, or asphalt/concrete “rumble strip”. Tracking control is designed to cause soil to vibrate off equipment and vehicles as they transition from disturbed soils to paved areas.	All appropriate points of ingress and egress, from where traffic transitions from a stabilized road surface (e.g. gravel or pavement) to disturbed soil, will have a vehicle tracking control installed. Tracking control may be moved or eliminated as on-site conditions and activities change.	Tracking control should be inspected for depth of gravel/rock, presence of excess soil, proper usage and the overall general condition. The most common maintenance items include the removal of accumulated soil and addition of gravel/rock.

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
Install initial CMs	Designated Staging Area	A stabilized staging area is a specific location on-site to stockpile/stage materials and equipment for use on-site. A stabilized staging area allows a central location for deliveries and storage of equipment when not in use, and to reduce disturbance of areas of the site not scheduled for disturbance through construction activities.	Stabilized staging areas generally consist of a cleared area of the site with vehicle tracking control and perimeter controls. Stabilized staging areas will be implemented as needed on site and will be located out of areas of active construction activity. If possible, the designated area will be located so it can be utilized during the entire construction period.	Stabilized staging areas should be inspected for adequate vehicle tracking control and perimeter control. Stabilized staging areas should function as designed or repaired or modified as needed.
Initial stages of construction	Sediment Trap	Sediment traps are small impoundments which allow sediment to settle out which are generally installed in a drainage way or other point of discharge from a disturbed area. They are formed by excavating an area or by placing an earthen embankment across a low area or drainage swale. Typically, a spillway or outlet is constructed to allow the slow release of stormwater runoff. Sediment traps are commonly used at the outlets of diversion structures, slope drains or any other runoff that discharges waters containing sediment.	Sediment traps will be installed prior to earth disturbing activities in areas where it's determined to be needed.	Sediment Trap will be inspected for accumulated sediment, erosion and to ensure effective operation

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
Initial stages of construction	Diversion Ditch	Diversion ditches are excavated channels, generally 6”-18” in depth which provide channelization of stormwater runoff for the purpose of directing sediment-laden flows to treatment facilities or interception of potential run-on flows to convey it around the disturbed area. All diversion ditches shall be of the ‘unlined’ type unless specifically noted on the plan.	Diversion ditches will be installed prior to earth disturbing activities in areas indicated on the site map.	Diversion ditches will be inspected for effectiveness and repaired or modified as necessary.
Clearing, Grubbing & Pad Grading	Natural Vegetative Barrier	A natural vegetative barrier is a preexisting vegetated, landscaped or sod/seed area that is retained to reduce water flow and prevent erosion over disturbed soil. Additionally, natural vegetative barriers provide a barrier zone where overland sheet flow velocity is dissipated and sediment trapped, reducing sediment discharge off-site.	Natural vegetative barriers are encouraged for any perimeter or environmentally sensitive areas. Whenever possible, a natural vegetative barrier will be maintained between the construction area and stormwater drainage areas.	Inspections include observation for sediment accumulation or erosion to the area. Should damage occur to a vegetative buffer strip a new or additional CM should be considered.
Construction of temporary material storage areas, improvement or construction of drainage features if needed	Straw Bales	A straw bale should be a minimum of 14” X 18” X 36” with a minimum mass of 50 pounds. It should be composed of only vegetative matter, except for the binding. The straw bales should be bound by steel wire (minimum 14-gauge), nylon or polypropylene. Applications include check dams in swales, inlet protection, outlet protection, perimeter control, disturbed areas with significant potential for off-site drainage, protection from neighboring site run-on, or during the construction of drainage swales and ditches.	The basic installation for a straw bale is to prepare a trench approximately four inches deep, secure the bale in the trench using stakes, and backfilled.	Straw bales will be inspected for proper installation, structural integrity and sediment accumulation. Straw bales degrade and need to be replaced on a regular basis.

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
Installation of new culvert if needed	Inlet protection	Inlet protection consists of a barrier material place in front, around, or immediately up-gradient from the inlet. The most common forms of inlet protection are wire or fabric socks filled with rock or straw wattles. Inlet protection is designed to slow stormwater flow into the inlet, allowing sediment time to settle and accumulate on the up-gradient side of the structure, without constricting the inlet throat.	Inlet protection will be installed prior to earth disturbing activity. As permanent stormwater system inlets are constructed in areas with potential disturbed area run-off or when existing inlets are potentially impacted by construction activity, inlet protection will be installed. If conditions warrant, protection will be provided to prevent sediment from entering the inlet from above or behind the opening. Any structure with a potential to receive run-off from non-stabilized surfaces will be treated with an inlet protection CM. Inlet protection will remain in place until all up-gradient areas are stabilized.	Inlet protection will be inspected for damage, structural integrity and need for sediment removal. Maintenance includes repairing or replacing as needed, repositioning the inlet protection and/or removing accumulated sediment.
Foundation construction	Concrete Wash-Out	A concrete wash-out is designed to capture waste water and waste products resulting from the cleaning of concrete equipment. A concrete wash-out may not be necessary if all wash-out operations are performed off-site.	A concrete wash-out will be installed or provided prior to any construction activities that include the handling of materials containing cement (e.g. concrete, masonry, etc.). Examples of permanent installations include a bermed excavation, a mobile disposal unit, small excavations located near the point of concrete placement, water tight vessels such as rigid pre-fabricated impermeable plastic pools, stock tanks, small dumpsters, buckets, etc. and geotextile bags.	A concrete wash-out should be inspected to make sure appropriate access control, tracking and containment is in place. Maintenance would include the removal of excess material, and general structural integrity of the installation. Concrete wash-outs should be cleaned of excess water and solids when the capacity of the wash-out reaches no more than 50% (5” for rigid “kiddie” pools).

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
Throughout construction period	Dust Control	Dust control reduces dust generated from disturbed surfaces and wind.	Water will be applied from water trucks as needed. Correct application is just enough water to moisten the surface and calm dust, but not so much as to create standing water and mud.	Disturbed areas should be inspected for obvious signs of wind erosion and dust. This CM is implemented as needed.
As appropriate during all phases of construction which cause soil disturbances on sloped surfaces.	Surface Roughening	Surface roughening consists of grooves or tracks installed in the soil surface, perpendicular to the slope. This is a temporary soil stabilization technique that works well in areas that will remain inactive for a short time. Surface roughening works by reducing water velocity and promoting infiltration, thus decreasing the potential for erosion to occur.	Any disturbed areas with no construction activity planned for longer than 14 days may be surfaced roughened. Surface roughening may be applied by creating a continuous furrow perpendicular to the slope. This can be done with the teeth on a loader bucket, ripping, disking or plowing equipment. Surface roughening can also be created by running tracked equipment up and down the slope.	Inspection of surface roughened areas would include proper implementation, structural integrity and areas of erosion or sediment accumulation. Maintenance for surface roughening would include re-applying the technique or installation of new or additional CMs.
All Phases where appropriate to the water volume and velocity	Straw Wattles (fiber rolls)	Straw wattles consist of a net or geotextile fabric filled with straw, excelsior, wood mulch or other man made fillers. They reduce water velocity allowing sediment to accumulate on the up-gradient side of the wattle. Applications include, but are not limited to, slope stabilization, check dams in swales, back of curb protection and temporary secondary containment for stock piles and materials storage.	The basic installation for a net wrapped wattle is to prepare a trench approximately three inches deep, secure the wattle in the trench using a stake or landscape pin, and backfill approximately 1/3 of the wattle on the up-gradient side. Wattles should be installed based on manufacturer's directions. Typical wattle installation details are provided.	Straw wattles should be inspected for proper installation, structural integrity and sediment accumulation. Note: A wattle that has been flattened out of round may not need to be replaced if they remain sufficient to function appropriately on the up-gradient side of the wattle.

CMs – Phasing, Implementation and Maintenance

Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance
All Phases where appropriate to the water volume and velocity	Check Dams	Rock check dams will be used in areas of concentrated flows along the swales to slow water velocity to allow sediment to settle and to prevent erosion. Additionally, this may be used in areas where existing drainage patterns cross onto the site and bring neighboring property run-on into the construction area.	The check dam will be installed across the entire width of the swale, with the center of the check dam lower than the sides.	Check dams should be inspected for proper installation, structural integrity and accumulated sediment. Maintenance would include repairing or replacing damaged rock berms and removing accumulated sediment.
After completion of construction activities	Erosion Control Mats & Seeding	Seeding involves the mechanical or hand application of a specific seed mixes appropriate for the site location and soil type. Seeding can be used as a permanent or temporary CM. Seeding provides plant growth to stabilize the soil reducing the likelihood of erosion or sediment transport.	As soon as practicable, after the completing of construction activities, soil should be properly prepared and seeded. The choice of seed mix will dictate application rates and methods. Seeding should always be accompanied by an additional CM, such as mulching or straw mat to protect the seed and soil from erosion during the germination and growth process.	Seed areas should be inspected to ensure that the straw mat was applied correctly and has not been compromised. The area should also be inspected for erosion and sediment deposition. Maintenance items would include re-grading and seeding bare or areas of thin vegetative growth and/or adding additional CMs as appropriate.

New CMs Added to the Site

Use the following space to provide information regarding new CMs added to site.				
Phase	CM	Description/Function	Installation/Implementation	Inspection/Maintenance

APPENDIX D: Inspection Forms

StormWater Inspection Report

Facility Name		Permittee	
Date of Inspection		Weather Conditions	
Permit Certification #		Current Acres Disturbed	
Phase of Construction		Inspector Title	
Inspector Name		Location of SWMP	
Is the above inspector a qualified stormwater manager?			
(permittee is responsible for ensuring that the inspector is a qualified stormwater manager)			

GENERAL NOTES

INSPECTION FREQUENCY

Check the box that describes the minimum inspection frequency utilized when conducting each inspection		
At least one inspection every 7 calendar days		
At least one inspection every 14 calendar days PLUS post-storm event inspections		
•This is a post-storm event inspection within 24 hours after storm. Event Date:		
Reduced inspection frequency - Include site conditions that warrant reduced inspection frequency		
• Post-storm inspections at temporarily idle sites (prior to construction/within 72 hours after storm)		
• Inspections at completed sites/area (at least once every 30 days)		
• Winter conditions exclusion		
Have there been any deviations from the minimum inspection schedule?		
If yes, describe:		

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StormWater Inspection Report

INSPECTION REQUIREMENTS	RESULT	COMMENT
Are control measures in effective operational condition and working as designed in the specifications?		
Are there any new potential sources of pollutants? If answer is yes, list new pollutants in comments.		
Does the site require any new or modified control measures to minimize pollutant discharges?		
Are there any areas that require temporary or permanent stabilization? (e.g. slopes, inactive disturbed areas, stockpiles, etc.).		
Are there any Bulk storage (55 gal. or greater) of petroleum products and other liquid chemicals on site that require secondary containment?		
Are there any areas of non-compliance with the permit requirements? If answer is yes, implement corrective actions in section below.		

AREAS TO INSPECT		
Is there evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system or discharging to state waters at the following locations?		
If "YES" describe discharge or potential for discharge below. Then document related maintenance, inadequate control measures and corrective actions on the approriate subseqent forms.		
Location	Result	Description
Construction site perimeter		
All disturbed areas		
Designated haul routes		
Material and waste storage areas exposed to precipitation		
Locations where stormwater has the potential to discharge offsite		
Locations where vehicles exit the site		
Other:		

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StormWater Inspection Report

CONTROL MEASURES REQUIRING ROUTINE MAINTENANCE				
Definition: Any control measure that is still operating in accordance with its design and the requirements of the permit, but requires maintenance to prevent a breach of the control measure. These items are not subject to the corrective action requirements as specified in Part I.B.1.c of the permit.				
Are there control measures requiring maintenance? If YES, Document below				
Location	Control Measure	Maintenance Required	Date Observed	Date Completed & Initials

Summit SERVICES GROUP

StormWater Inspection Report

CONTROL MEASURES REQUIRING ROUTINE MAINTENANCE				
Location	Control Measure	Maintenance Required	Date Observed	Date Completed & Initials

Summit SERVICES GROUP

StormWater Inspection Report

INADEQUATE CONTROL MEASURES REQUIRING CORRECTIVE ACTION

Definition: Any control measure that is not designed or implemented in accordance with the requirements of the permit and/or any control measure that is not implemented to operate in accordance with its design. This includes control measures that have not been implemented for pollutant sources. If it is infeasible to install or repair the control measure immediately after discovering the deficiency the reason must be documented and a schedule included to return the control measure to effective operating condition as possible.

Are there control measures requiring corrective action? If YES, Document below.	
Are there additional control measures needed that were not in place at the time of inspection? If YES, Document below.	

Location	Description of Inadequate Control Measure	Description of Corrective Action	Was deficiency corrected when discovered? YES/NO. If "NO" provide reason and schedule to correct.	Date Observed	Date Completed & Initials

Summit SERVICES GROUP

StormWater Inspection Report

INADEQUATE CONTROL MEASURES REQUIRING CORRECTIVE ACTION					
Location	Description of Inadequate Control Measure	Description of Corrective Action	Was deficiency corrected when discovered? YES/NO. If "NO" provide reason and schedule to correct.	Date Observed	Date Completed & Initials

StormWater Inspection Report

Has there been an incident of noncompliance requiring 24-hour notification? If YES, Document Below:	

INSPECTION CERTIFICATION

I certify this inspection is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information.

Qualified Stormwater Manager/Inspector (Name, Title, Company & Signature) Date:

COMPLIANCE CERTIFICATON

I verify that, to the best of my knowledge and belief, all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit.

Qualified Stormwater Manager/Designee (Name, Title, Company & Signature) Date:

APPENDIX E: Spill Reports

TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.

Construction Stormwater Pollution Prevention
Spill Report Form

Spill Reported By: _____ Phone Number: _____

Details

Date Reported: _____ Time: _____

Date of Spill: _____ Time: _____

Name of the Facility: Crosspoint Substation, El Paso County, CO

Describe Spill Location and Events Leading to Spill: _____

_____

_____

_____

_____

Material Spilled: _____

Source of Spill: _____

AMOUNT OF THE SPILL (GALLONS OR POUNDS): ____

Containment and Cleanup

Containment or Cleanup Action: _____

_____

Date and Time Cleanup Completed or Terminated: _____

Description of Materials Contaminated: _____

_____

Label on the Drum of Cleanup Materials: _____

_____

Signed: _____
Contractor Superintendent or
Environmental Inspector

APPENDIX F: All Permits For Construction Site

APPENDIX G: NRCS Soils Report

United States Department of Agriculture

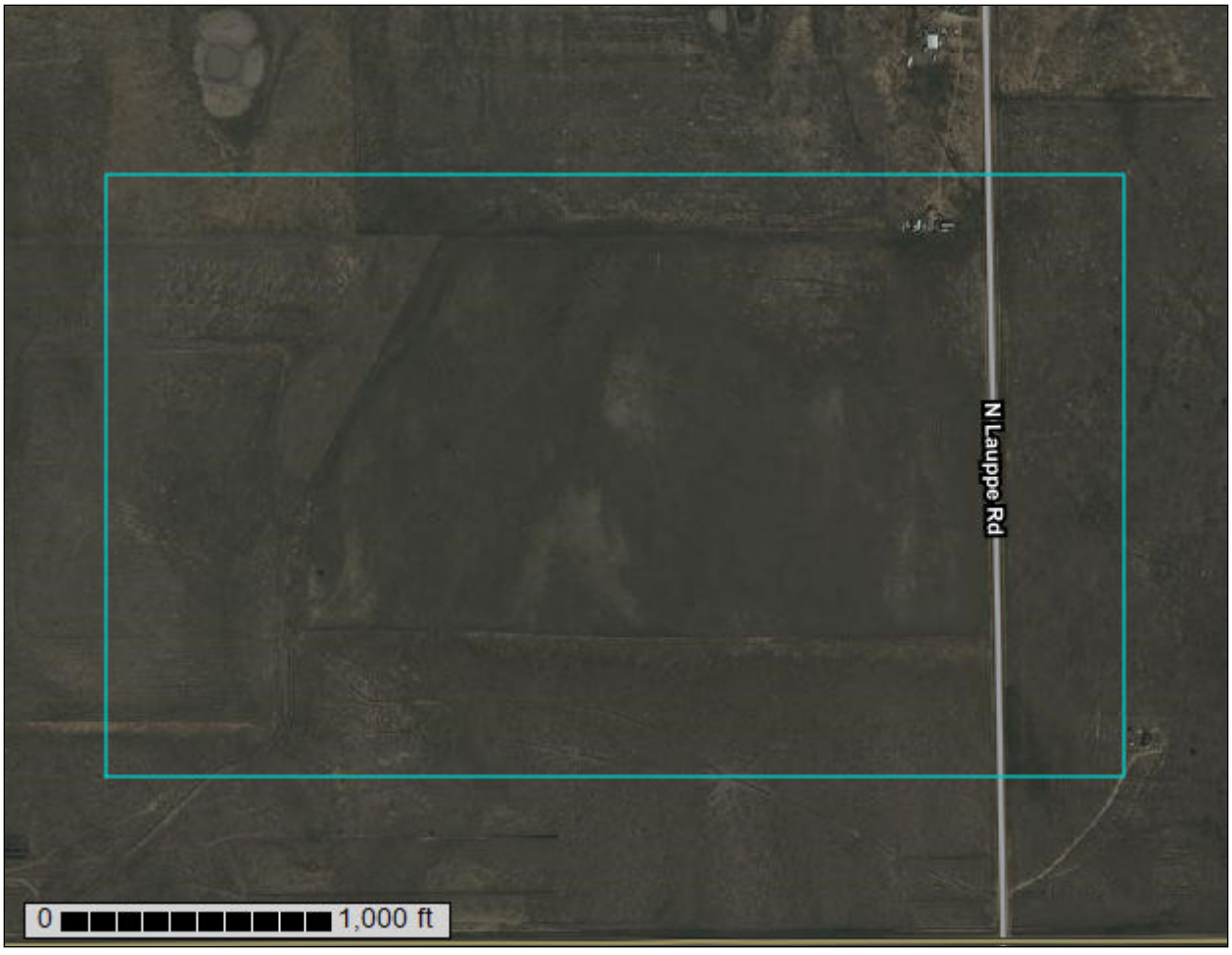
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado

Crosspoint Substation



January 22, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

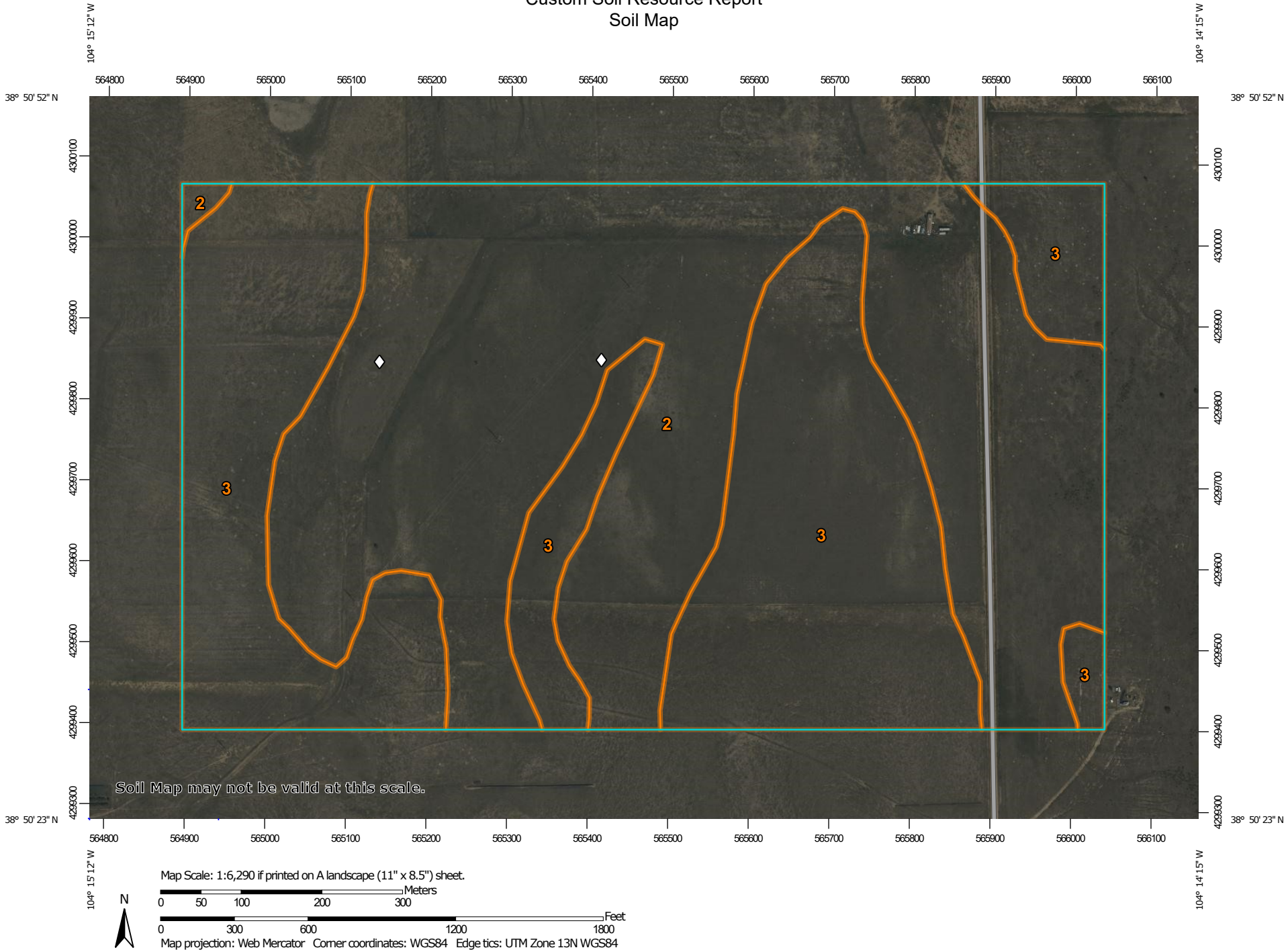
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:6,290 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	106.3	55.5%
3	Ascalon sandy loam, 3 to 9 percent slopes	85.3	44.5%
Totals for Area of Interest		**191.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

2—Ascalon sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367q
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian deposits

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 21 inches: sandy clay loam
BC - 21 to 27 inches: sandy loam
Ck1 - 27 to 48 inches: sandy loam
Ck2 - 48 to 60 inches: loamy sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: SANDY PLAINS (069BY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlny
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 95 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk1 - 19 to 35 inches: fine sandy loam
Bk2 - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

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APPENDIX H: Grading & Erosion Control Plan

APPENDIX I: Erosion and Stormwater Quality Control Permit