CONSTRUCTION STORMWATER MANAGEMENT PLAN (SWMP)

Xcel Tline: Pathway Segment 5 El Paso County Build

Start: 3.01 miles east of the intersection Edison Road and N County Line Road

End: 1.06 miles southeast of the intersection U.S. Highway 24 and Chelton Road

El Paso County, Colorado, 80832

(38.524361, -104.109778 to 39.127176, -104.106881)

Owner, Operator, Contractor:

Xcel Energy℠

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Tab 1 – Introduction and Site Description

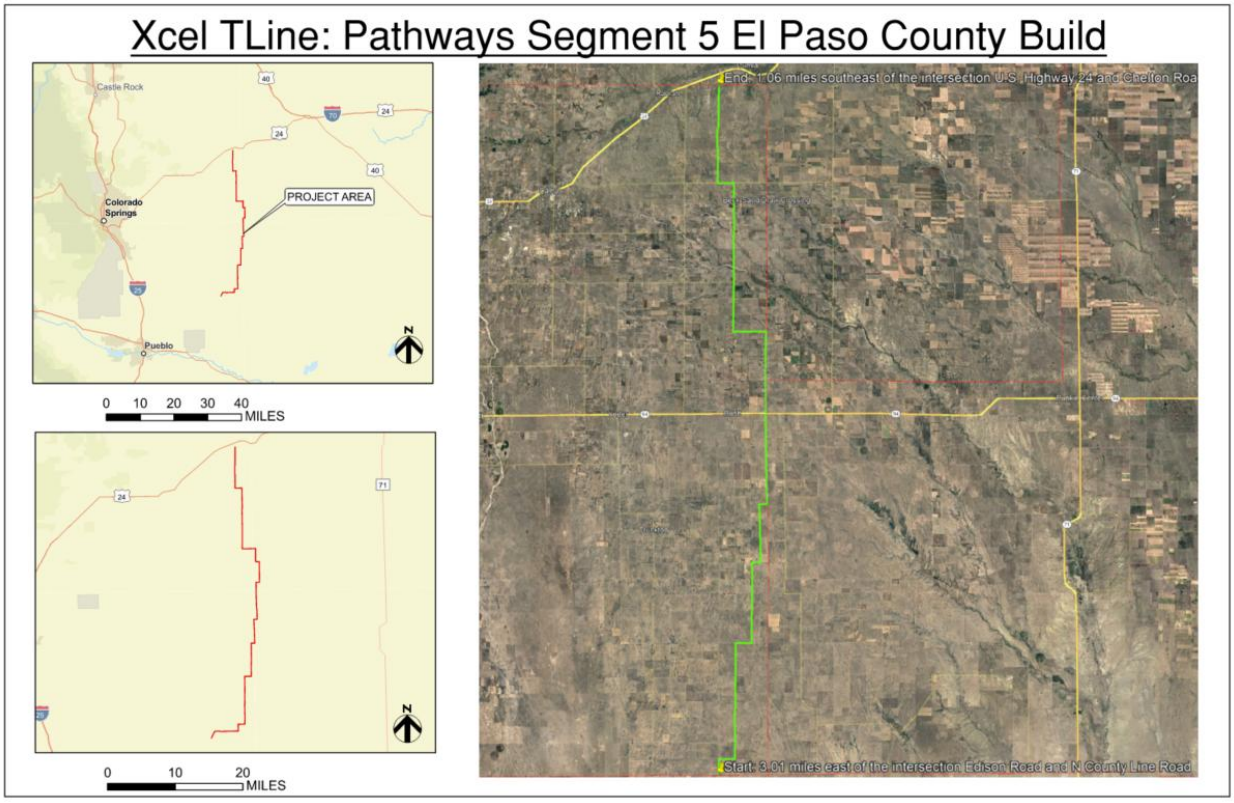
INTRODUCTION

This is a Stormwater Management Plan (SWMP) for the Xcel Tline: Pathways Segment 5 El Paso County Build Project being conducted by Public Service Company of Colorado (PSCo), a Colorado corporation and an Xcel Energy Company. This document has been developed as defined in the Colorado Discharge Permit System (CDPS) *General Permit for Stormwater Discharges Associated with Construction Activity* (Permit No. COR400000, effective April 1, 2024.) authorizing stormwater discharges from construction activities that result in a total land disturbance of one acre or greater or if a project is less than an acre but part of a larger common plan of development. This SWMP was also developed to meet El Paso County requirements. El Paso County regulates stormwater through their Erosion and Stormwater Quality Control Permit (ESQCP).

This SWMP was prepared in accordance with good engineering, hydrologic and pollution control practices. Changes or additions to the SWMP may be required to reflect changes in conditions at the project, such as when new control measures (CMs) are installed at the site. If such changes are made, this SWMP will be updated accordingly, and revisions documented in the SWMP.

SITE DESCRIPTION (PART I.C.2.C)

a) Nature of the Construction Activity at the Site



This SWMP covers linear construction activities associated with the installation of approximately 43 linear miles of a new double circuit 345kV overhead electrical transmission line. This SWMP covers the portion of Segment 5 of the transmission line that spans El Paso County; starting 3.01 miles east of the intersection Edison Road and N County Line Road and terminating 1.06 miles southeast of the intersection U.S. Highway 24 and Chelton Road. The Segment 5 transmission line build is part of the larger Xcel Pathways project.

The construction scope includes the installation of 227 total new utility poles; all of which will have concrete foundations. Concrete foundation diameters will range from 5.5 feet to 10.5 feet, depending on geologic conditions and the structural loading. Access will be from existing county roads, dirt packed roads, drive and crush access within the transmission line right-of-way, and improved access within the transmission line right-of-way. Permanent 18" CMP culverts will be installed along access points. Depending on if the access point will remain as permanent access for Xcel, the culverts may remain in place or be removed following completion of construction. Additional improvements and grading will include excavation around the structure locations, grading to construct work pads around structures on sloped terrain, and grading for access improvements. All grading is anticipated to be temporary and will be restored to pre-existing grade to the extent practicable unless otherwise identified in the Site Maps.

Construction activities will begin with vegetation clearing using pickup and flatbed trucks, skid steers with mulchers, utility task vehicles (UTVs), and other light weight vehicles and machinery. Vegetation clearing will be above-grade and should not result in ground disturbance which would warrant installation of Control Measures (CMs).

Grading work will follow and includes access improvements using excavators, dozers, graders, rollers, and water trucks. CM installation crews will work alongside site grading crews and install CMs down-gradient of disturbed areas. CM details attached to this report will be used as a reference for placement in the field along newly constructed, or existing and improved upon, access routes. CM placement at structure work areas should generally follow what is indicated on the Site Map but will be field fit to properly function at the work area.

If the construction team determines a level work area (pad) is needed for equipment setup, the topsoil of the pad area will be stripped and stockpiled. Topsoil will generally be stored at the uphill side of the work area. Stockpiles will be inspected for signs of erosion and additional temporary stabilization (mulch, tarping, etc.) implemented as required. Down-gradient CMs will be placed at the toe of the topsoil stockpile. Additional grading to prepare a level and flat work area may be required, with subsoils stockpiled separately from the topsoil and equipped with down-gradient CM.

Foundation crews will follow site grading work and begin with excavating at structure locations; size of excavation will depend upon designed foundation size. Subsoils from excavations will be stockpiled and provided with down-gradient protection. Excavations will be backfilled and compacted to engineering standards. Excess spoils, if in small amounts, will be spread across the work area.

When conductor stringing crosses county roads or sensitive areas, wooden guard structures are installed to limit the amount of sag in the conductor line during pulling/tensioning. Alternatively, trucks designed for the task may be placed at these areas to support the conductor. These activities involve limited disturbance and CMs are not typically warranted. Once the conductor is installed, final tensioning is achieved through sagging and clipping with aerial and on the ground crews.

Materials will be stored at staging areas permitted separately from the transmission line. The staging areas will be the primary location for overnight storage of equipment, materials, etc.

Final stabilization will begin after the conductor is installed and will generally include replacement of topsoil followed by seed and mulch application. Interim CMs, such as those installed down-gradient of stockpiles, will be removed. Final phase CMs must remain in place until stabilization is achieved at each disturbance area. Reclamation success is achieved when there is an evenly distributed, perennial cover of equal to 70% of pre-disturbance values. Agricultural areas used as cropland will be surface roughened prior to being returned to the land manager for cultivation in the following growing season.

Appropriate CMs will be used to minimize the impact of earth-disturbing activities as shown on the Site Maps in Tab 2.

b) Proposed Sequence for Major Activities

Estimated Construction Start Date: 07/2026
Estimated Construction End Date: 02/2028
Estimated Final Stabilization Date: 06/2030

The project will be phased to the extent practical to limit the amount of disturbed area that is exposed at any given time. CM phasing is critical to stormwater management. CM implementation will be coordinated with the various stages of construction. Controls that manage erosion and sediment transport from initial site activities will be installed prior to earth-disturbing activities. As work progresses and additional areas are disturbed, controls targeted for erosion and sediment transport will be implemented prior to the start of earth-disturbing activities in those areas. As portions of the site are completed and previously disturbed areas are stabilized or the CM(s) are no longer needed, they will be removed. Construction of the utility line will take place linearly, with differing phases of work being completed at different locations along the project. The actual schedule for installation of each of these phases is documented by the installation and removal dates for associated CMs on the Site Maps.

Permanent or temporary soil erosion CMs for any disturbed land areas and soil stockpiles will be implemented as soon as practicable after the final earth disturbance has been completed. When it is not possible to permanently stabilize a disturbed area after an earth disturbance has been completed or where significant earth disturbance activity ceases for more than 14 days, temporary erosion CMs will be implemented as soon as practicable, and no more than 14 days after construction activity has temporarily or permanently ceased.

Specific locations of the CMs are indicated on the Site Maps provided in Tab 2. Installation, implementation, and maintenance specifications for each control are included in Tab 6 or are shown on the Site Maps. Tab 4 describes the potential pollutants for the project for which these controls were selected, and Tab 5 provides descriptions of the CMs.

Project Phase	Controls to be Implemented During Phase
Pre-disturbance and Site Preparation	• Develop SWMP based on site visit and anticipated disturbance. • Establish disturbance area with perimeter controls (as needed), spoil pile areas, and vehicle tracking control (VTC). • Determine haul routes/areas that will undergo repeated disturbance. • Limit access to areas that are not to be disturbed, protecting existing vegetation. • Mobilize control measures to work area.
Construction	• Unless infeasible, strip and segregate topsoil (where present) for use in final restoration efforts. • Install culverts for access where identified in Site Maps. • Grade for access improvements and work pads. • Excavate for pole foundations, locate stockpiles in areas with perimeter control or install down-gradient protection. • Pour concrete foundations. Utilize concrete washout as required for concrete foundations. • Pile excess spoils in a conical manner around the base of foundation to allow for settling over time and to ensure water sheds from the pole outward. • Install new poles. • Install conductor wire. Tension line.

	• Monitor pull sites for disturbances and install CMs as necessary. CMs not likely required at pull sites given limited use. • Protect and repair CMs as necessary. • Perform street sweeping as needed.
Backfill and Compaction	• Leave disturbed areas in surface roughened condition once work in an area is complete. Surface roughen, or otherwise stabilize, within 14 days of area becoming inactive. • Restore grade to match pre-existing conditions to the extent practicable. • Remove temporary control measures where appropriate. • Remove limited stored material and equipment from areas. • Replace topsoil layer, if revegetation is the final form of stabilization, prior to implementing final stabilization.
Final Stabilization	• Perform seeding and mulching per seed mix and application rates defined in Tab 14 of this report. • Monitor regrowth of vegetation, irrigate and re-seed if necessary. • If area is to be returned to landowner for agricultural management, surface roughen. • Remove all non-biodegradable temporary controls once required vegetative cover is reached. • Close permits as applicable.

c) Disturbed Area

- Total Area of Construction Site: ~1,025 Acres
- Total Area of Disturbance: ~217 Acres

d) Existing Soil Data

Primary soils present are Wolney sandy loam, Bresser sandy loam, Ascalon sandy loam, and Olney-Vonid soils. A breakdown is shown below.

Soil Type	Olney sandy loam	Bresser sandy loam	Ascalon sandy loam	Olney-Vonid soils	Misc. (under 9% of Project Area)
% of Project Area Soils	17.9%	12.9%	9.3%	9.0%	50.9%

Hydrologic properties, wind erodibility, and sheet/rill erosion potential are broken down and discussed below. Control measures were prescribed based on information made available by the NRCS.

Hydrologic soil groups describe runoff potential and infiltration properties of soils and range from A to D. Group A soils have high infiltration rates and low runoff potential, group D have slow infiltration and high runoff potential. On-site soils are primarily categorized by the NRCS with a hydrologic soul group of B and C indicating a moderate rate of infiltration and moderate runoff potential.

Hydrologic Soils Group	A	B	C	D
% of Project Area Soils	33.8%	63.7%	0.5%	2.0%

Susceptibility of soils to sheet and rill erosion by water is rated by a K factor. K factors range from 0.02 to 0.69; with all other factors being equal, higher K values indicate higher susceptibility to sheet and rill erosion.

Most soils within the limits of disturbance at the site are rated with a K factor of 0.02-0.28 indicating a low susceptibility to sheet/rill erosion.

K Factor Rating Range	0.01 – 0.15	0.16-0.30	0.31-0.43	> 0.43
% of Project Area Soils	30.7%	67.4%	0%	0%

Wind erodibility ratings range from 1 to 8 with 1 being the most susceptible to wind erosion. Most soils within the disturbance limits are rated between 3 and 4, indicating a relatively moderate susceptibility to wind erosion.

Wind Erodibility Rating	1-2	3-4	5-6	7-8
% of Project Area Soils	9.8%	83.8%	4.5%	0%

Soil properties throughout the Project area are highly variable. Control measures will be used to minimize erosion.

Preconstruction photos of the project area are documented in Tab 11 and include each of the evaluated Existing Vegetation

Vegetation type along the project alignment includes native and introduced grasses and forbs, sagebrush, and shrubs. Due to agricultural activity in the area, the project areas have highly variable levels of disturbance and existing vegetative cover. Vegetation density observed during site visits ranged from 25% to 95% and was evaluated during site assessment conducted on October 22, 2024 and October 23, 2024.

Pre-construction photos of the project area are documented in Tab 11.

Observed Vegetation Density

Photo Number	Structure	~% Vegetative Cover	~70% Regrowth
1	079	60	42
2	106	50	35
8	139	70	49
12	143	75	52.5
13	157	60	42
15	158	45	31.5
17	166	90	63
19	167	80	56
21	179	40	28
25	197	85	59.5
28	226	25	17.5
30	229	85	59.5
33	261	50	35
34	261	25	17.5
37	262	50	35
39	274	50	35
41	281	95	66.5
42	283	85	59.5
44	287	85	59.5
48	296	85	59.5

50	313	90	63
52	314	90	63
55	323	95	66.5

Due to the site's current and ongoing agricultural use, pre-construction vegetative cover may not accurately reflect pre-disturbance vegetation densities. Therefore, vegetative coverage required for final stabilization should be based on the highest densities per area observed at the site and adjacent areas will be used to evaluate reclamation success, as they are most likely to be representative of vegetative cover in an undisturbed ecosystem. The above table represents high-end density observations for respective work areas. Revegetation of disturbed areas on private or agricultural land may be modified based on land operator wishes.

Wetlands observed in the field during pre-construction site visits conducted by TetraTech are depicted on the Site Map in Tab 2. Construction will work to minimize impacts to wetlands by avoiding the areas or using control measures when avoidance is not feasible.

e) Allowable Non-stormwater Discharges and Separately Authorized Discharges

CDPS permit COR400000 allows for several non-stormwater discharges in addition to stormwater discharges associated with construction sites, provided that the non-stormwater discharge is identified in the SWMP and appropriate control measures are implemented, in accordance with Part I.B.1 of COR400000.

The following table lists these allowable non-stormwater discharges and notes whether each discharge is expected to occur at this site. Discharges other than stormwater or the below allowable non-stormwater discharges will obtain separate authorizations/permits as needed.

Discharge Type and Limitations	Expected Discharge?
Discharges from uncontaminated natural springs that do not originate from an area of land disturbance.	No
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 are allowed under this SWMP, provided that: the washout water is confined in a concrete or masonry washout area and does not leave the site as surface runoff or reach receiving waters, and does not contaminate groundwater. Controls for concrete and masonry washout water from washing tools and chutes if applicable to the project are illustrated in Site Maps (Tab 2). Concrete or masonry on-site waste disposal is not authorized by this permit except in accordance with Part I.B.1.a.ii(c) of COR400000. See Tab 7, Section d for additional information on concrete and masonry washout requirements.	Yes
Discharges to the ground of water used to wash vehicles, equipment, and building exteriors. These discharges may not leave the site as surface runoff or reach receiving waters as defined by COR400000. The addition of soaps, solvents, and detergents is prohibited. If vehicle, equipment, or external building washing are to occur, the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division's (WQCD's) Low Risk Discharge Guidance Document *Discharges from Surface Cosmetic Power Washing Operations to Land* will be followed and a copy of the guidance will be added to Tab 12.	No
Emergency fire-fighting discharges that occur during the active emergency response.	Yes, *potential always exists.*

Discharges of landscape irrigation return flow.	Yes
Discharges from diversions of state waters within the permitted site.	No

Low Risk Discharges of groundwater that has come into contact with construction activities may be authorized under the WQCD's Low Risk Guidance Document *Discharges of Uncontaminated Groundwater to Land* which requires that these discharges are applied to land and that the following conditions are met:

- The water source must be uncontaminated groundwater or uncontaminated groundwater mixed with stormwater, no chemicals can be added, and there cannot be a visible sheen.
- The groundwater cannot leave the operational control of the site and the landowner must authorize the discharge of the groundwater to the ground.
- The discharge **cannot** enter waters of the State or other water conveyance systems.
- Control measures must be used to prevent erosion, ponding, or runoff.

Discharges of material other than stormwater must either be addressed in a separate Colorado Discharge Permit System (CDPS) permit issued for that discharge or by a Water Quality Control Division Low Risk Discharge Guidance document. If there are any additional CDPS or USACE Section 404 permits associated with this project, or any low-risk discharge guidance documents used to support non-stormwater discharges associated with this project, copies are retained in Tab 12

f) Receiving Waters

Describe the general manner and direction in which discharges leave the site. Provide the name(s) of immediate receiving water(s) and the ultimate receiving water(s). If the stormwater discharge is to a municipal separate storm sewer system, provide the name of the entity owning that system as well. If construction activities will permanently alter the existing drainage patterns, describe the new drainage patterns that will exist upon completion of construction. This section should clearly describe how discharges from the site are conveyed from within the limits of construction to the ultimately receiving water:

During minor to moderate storm events drainage tributaries i.e. ditches, canals, creeks etc. will intercept flow. During large rainfall events the will be to the Arkansas River. The named streams within the project limits of construction are the Big Sandy Creek, Mustang Creek, North Fork Horse Creek, Horse Creek, Little Horse Creek, East Branch Steels Fork, Steels Fork, West Branch Steels Fork Horse Creek, Pond Creek, and Tributaries to the Arkansas River. The named creeks, ditches, canals, and tributaries are the immediate receiving waters which will discharge into ultimate receiving water, the Arkansas River.

Is a receiving water within or immediately adjacent to the limits of construction?

Yes, there are multiple immediate receiving waterbodies within the limits of construction. A 50-ft pre-existing vegetation buffer will be maintained in areas where feasible. Additional CMs such as SCL, VT, CF, etc. will also be used to prevent pollutants from entering waterbodies.

Is the immediate receiving water (classified stream segment or ultimate receiving water) listed as impaired? If yes, does it have an approved TMDL?

The Mustang Creek, North Fork Horse Creek, East Branch Steels Fork, West Branch Steels Fork Horse Creek, Steels Fork, and Pond Creek are immediate receiving waters and 303(d) listed waterbodies impaired with Manganese (Dissolved), Selenium (Dissolved), and Sulfate. The Big Sandy Creek is a 303(d) listed waterbody impaired with Arsenic (Total), Manganese (Dissolved), Selenium (Dissolved), and Uranium (Total). The Horse Creek is a 303(d) listed waterbody impaired with Arsenic (Total), Iron (Total), Manganese (Dissolved), and Selenium (Dissolved). The Little Horse Creek is a 303(d) listed waterbody impaired with Iron (Total) and Selenium (Dissolved). The East Branch Steels Fork is a 303(d) listed waterbody impaired with Manganese (Dissolved), Selenium (Dissolved), and Sulfate. These segments do not have any approved TMDLs.

If yes and the WQCD has issued additional restrictions on the permit certification as a result of an applicable Waste Load Allocation, discuss the restrictions and planned measures used to meet the restrictions here:

N/A

Is the immediate receiving water (classified stream segment or ultimate receiving water) listed as an Outstanding Water (website https://www.colorado.gov/pacific/cdphe/clean-water-gis-maps?

N/A

If yes, describe the long-term ecological or water quality benefit, or public interest served by the Project:

N/A

Does the receiving water have any known additional monitoring or sampling requirements?

No

g) Stream Crossings

Are there any stream crossings proposed as part of this project?

There are multiple stream crossings within the limits of construction, contractor to utilize CMs when ground is saturated or when water is present in channel (SCL, matting, TSC, etc.) Contractor to maintain buffer where feasible.

Tab 2 – Site Map

SITE MAP (PART I.C.2.D.)

The SWMP must include a legible site map(s) showing the entire site and identifying:

a) Construction site boundaries.
b) Flow arrows that depict stormwater flow directions on- and off-site and runoff direction.
c) All areas of ground disturbance, including areas of borrow and fill.
d) Areas used for the storage of soil.
e) Locations of all waste accumulation areas, including areas for liquid, concrete, masonry, and asphalt.
f) Locations of dedicated asphalt, concrete batch plants, and masonry mixing stations.
g) Locations of other potential sources of pollution not listed in c-f above.
h) Locations of all structural CMs.
i) Locations of all non-structural CMs, as applicable.
j) Locations and names of springs, streams, wetlands, diversions, and other state waters within or bordering the site, including areas that require preservation of pre-existing vegetation within 50-feet of a receiving water, where determined feasible in accordance with Part I.B.1.a.i(e).
k) Locations of all stream crossings within the construction site.
l) Locations where alternative temporary stabilization schedules apply.

Many of these items will be illustrated on the Site Map prior to starting construction; however, some items such as stockpile locations, waste locations, parking, and staging may be added or modified during construction. Any modifications associated with CMs will also be redlined in the field. Site Maps are intended to be living documents modified in the field as needed.

Tab 3 – Contact Information and Qualified Stormwater Manager

QUALIFIED STORMWATER MANAGER (PART I.C.2.A)

The PSCo Qualified Stormwater Manager is responsible for overseeing and working with the PSCo Construction Project Manager/Construction Supervisor assigning PSCo personnel, consultants, and/or contractors to aid in the development, implementation, maintenance, and revisions to the SWMP. PSCo's Qualified Stormwater Manager, who oversees stormwater compliance for the company, works with the PSCo Construction Program Manager/Construction Supervisor to designate a site-specific Qualified Stormwater Manager for each project who is responsible for day-to-day SWMP compliance at the site and is often the SWMP inspector. Additional team members include: the SWMP Designer and CM Installer all of whom are qualified stormwater professionals.

CONTACT INFORMATION

PSCo is typically the Project Owner and Operator. PSCo may also have construction contractor(s) and/or subcontractors; however, PSCo is in charge of overseeing and directing work related to stormwater compliance. Contractors and subcontractors are also given trainings by PSCo Environmental Services on stormwater compliance even though third-party specialist are typically hired to perform inspections and install CMs. Contact information for Qualified Stormwater Managers and other responsible parties are provided below.

PSCo Environmental Services Qualified Stormwater Manager Title: Environmental Analyst Name: Tensy Thatcher Address: 1800 Larimer Street Suite 1300 Denver, CO 80202 Phone: 970-903-0595 Email: Tensy.C.Thatcher@xcelenergy.com	**Project Foreman** Title: Name: Address: Phone: Email:
PSCo Project Manager (Part of the Stormwater Management Team) Title: Project Manager Name: Sasha Archie Address: 1800 Larimer Street Suite 1300 Denver, CO 80202 Phone: 718-896-4118 Email: Sascha.w.archie@xcelenergy.com	**SWMP Inspector (Site-specific Qualified Stormwater Manager)** Title: Name: Address: Phone: Email:
SWMP Preparer (Part of the Stormwater Management Team) Name: Brian Brown, P.E. Company: HDR, Inc. Address: 1670 Broadway Street, Suite 3400 Denver, CO 80202 Phone: 970-416-4404 Email: Brian.Brown@hdrinc.com	**Control Measure Implementation and Maintenance (Part of the Stormwater Management Team)** Title: Name: Address: Phone: Email:

This document will be redlined in the field if personnel change during the course of the Project. Add an additional page if needed.

Tab 4 – Potential Sources of Pollution

IDENTIFICATION OF POTENTIAL SOURCES OF POLLUTION (PART I.C.2.E)

The following potential sources of pollutants and activities have been evaluated for their ability to impact stormwater discharges. If the potential source exists at the site, the CMs used to manage that source are listed in this section and are illustrated in the Site Maps in Tab 2.

Potential Source of Pollutant	Will the pollutant be on-site?	Activities associated with the pollutant and control measures selected to manage the source
All disturbed and stored soils including stockpiled soils, exposed areas, staging areas, parking areas, etc.	Yes	Activities associated with this pollution source are the earth-disturbing activities during all phases of construction activities, including but not limited to excavating, grading, cutting, filling, backfilling, stockpiling, etc. Control Measures: Sediment control and stockpile containment may include usage of sediment control logs, silt fence, sweeping, temporary berms, rock socks, check dams, landforms, vehicle tracking control (VTC), inlet and culvert protection, and other proprietary CMs (i.e., Big Red Bag, Dandy Recyclers, etc.). Erosion control may include surface roughening, mulch/mulch tackifier application, erosion control blankets, seeding and mulching. Additionally, temporary stabilization will be implemented for earth-disturbing activities that have permanently or temporarily ceased for more than 14 calendar days. Temporary stabilization methods may include, but are not limited to, tarps, soil tackifier, and hydroseed or mulch and/or surface roughening. Administrative controls may include phased construction to reduce the amount of open area at any given time and limiting the number of stockpiles.
Vehicle tracking of sediment	Yes	The activity associated with this pollution source is the movement of vehicles from disturbed areas to paved streets during all phases of construction activities. Control Measures: Sediment control may include VTCs (rock, geotextiles, mud mats, and/or other proprietary products), street sweeping, and inlet and culvert protection. If necessary, use construction fencing to limit entry and exit points and establish perimeter control. Access may also be limited during muddy conditions if feasible with the construction activities and schedule.

Potential Source of Pollutant	Will the pollutant be on-site?	Activities associated with the pollutant and control measures selected to manage the source
On-site waste management practices such as waste piles, liquid waste, dumpsters, etc.	Yes	Activities associated with this pollution source are generation of waste materials during all phases of construction activities that include but are not limited to debris, asphalt or concrete generated during excavating in paved areas, and wastes generated from various activities. Control Measures: Designated waste receptacles will be utilized. A concrete washout area will be used to manage concrete washout waste (see next pollutant source in this table). Liquids should be stored in secondary containment. Dumpsters will not typically be used on small projects. However, they will be utilized on larger projects where they will be serviced frequently by a licensed company. This potential pollutant source is part of the materials handling procedures and controls for the project.
Management of contaminated soils	No	No known contaminated soils exist on site. If contaminated soils are encountered, all activity will be stopped until the situation can be assessed. The Project Manager will be contacted for further direction. See Contaminated Soil Process Fact Sheet at the end of Tab 7.
Loading and unloading operations	Yes	Activities associated with this pollution source are potential spills during delivery and unloading of materials within the right-of-way. Control Measures: Loading and unloading operations should occur within the disturbance limits and should be limited to designated material storage and staging areas wherever feasible. For larger, longer duration projects, the staging area (permitted separately) is generally stabilized with rock or another non-erosive surface. Administrative controls may include materials management practices, good housekeeping practices, personnel training, providing spill kits where needed, and minimizing the number of areas where loading and unloading occur. The Project Manager will be contacted immediately for all spills.

Potential Source of Pollutant	Will the pollutant be on-site?	Activities associated with the pollutant and control measures selected to manage the source
Outdoor storage activities including erodible building materials, fertilizers, chemicals, etc.	Yes	Activities associated with this pollution source are storage of material and the potential for spills and leaks from these materials. Control Measures: Containment of the storage or staging area may include installation of silt fence, sediment control logs, temporary berms, etc. Storage of petroleum products or other liquid chemicals in quantities of 55 gallons or more must have secondary containment, or equivalent protection. This potential pollutant source along with several others (vehicle and equipment maintenance and fueling, sanitary waste and other waste handling) constitute the materials handling procedures and controls for the project which are detailed in Tab 7. Administrative controls may include materials management practices (such as covering chemicals and materials to prevent contact with stormwater where practicable, storing materials in proper containers with appropriate labeling, and only keeping limited supplies onsite), personnel training, and providing spill kits where needed. The Project Manager will be contacted immediately for all spills.
Vehicle and equipment maintenance and fueling	Yes	Potential pollution sources include fuels, oils, antifreeze, and other liquids associated with equipment performance. Fueling of equipment or vehicles and equipment repair may occur during all phases of construction activity. This project team anticipates using mobile fueling to refuel equipment, having fuel tanks onsite, fueling offsite or a combination. Control Measures: Limit areas where fueling and equipment maintenance activities occur at the site. Where possible, stage fueling /maintenance activities away from storm sewer system inlets/waterways. Spill kits should be staged where fueling is conducted. Use plastic sheeting, drip pans, dirt berms and other measures to contain fluids. Clean up and dispose of spilled material immediately. Administrative controls may include materials management practices, personnel training, and providing spill kits in vehicle maintenance areas. The Project Manager will be contacted immediately for all spills.

Potential Source of Pollutant	Will the pollutant be on-site?	Activities associated with the pollutant and control measures selected to manage the source
Significant dust or particulate-generating processes, e.g. saw cutting, wind erosion	Yes	Activities associated with this pollution source are the earth-disturbing activities during all phases of construction activities, including but not limited to excavating, grading, cutting, filling, backfilling, landscaping, etc. There is also the potential for wind to transport dust from disturbed areas including access roads., saw cutting can contribute to dust. Saw cutting is not anticipated for this project. Control Measures: Limit earth-disturbing activities to the extent feasible. Water disturbed areas and roads as needed during construction, use palliatives to control dust, install interim stabilization measures such as surface roughening, final stabilization, and other effective means.
Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.	Yes	Activities associated with this pollution source are limited due to the short-term nature of utility installation activities. Fueling and maintenance activities involving vehicles and equipment and the potential for use of fuels, oils, solvents, etc., are discussed above. Seeding operations typically occur during the final phase of the project and may involve use of fertilizers and tackifiers, as needed. Fertilizers are typically brought to the site by a seeding contractor during seeding operations and any remaining material is removed from the site by the contractor, thus minimizing exposure. Pesticides are not planned to be used at this site. There is a potential for mitigation of invasive annual weeds to establish perennial vegetation. Herbicides should be managed by licensed applicators and such products will not be stored on site. Control Measures: Liquids should be stored in secondary containment. Administrative controls may include materials management practices (such as covering chemicals and materials to prevent contact with stormwater where practicable, storing materials in proper containers with appropriate labeling, and only keeping limited supplies onsite), personnel training in proper use, and storage of materials.
Concrete/masonry truck and equipment washing, including the truck chute and associated fixtures and equipment	Yes	Activities associated with this pollution source are concrete pours that include but are not limited to pouring transmission pole foundations. Control Measures: Dedicated concrete washout areas that are clearly marked and maintained. Where applicable, urban mobile concrete washout structures can be used depending on the amount of concrete used on the project.

Potential Source of Pollutant	Will the pollutant be on-site?	Activities associated with the pollutant and control measures selected to manage the source
Dedicated asphalt and concrete batch plans, and masonry mixing stations	No	No dedicated asphalt or concrete batch plans, or masonry mixing stations are planned for this site.
Non-industrial waste sources such as portable toilets and worker trash	Yes	Activities associated with this potential pollutant source include the generation of non-industrial waste such as discarded building materials, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality. <u>Control Measures:</u> Good housekeeping practices will be implemented and trash will be collected in vehicles and disposed of offsite or in waste containers. Portable toilets should be properly anchored down and located away from the storm sewer system or waterways.
Reclaimed water approved for use in construction dust suppression	No	Reclaimed water is not to be used for dust suppression at this site.
Other areas or procedures where spills can occur	Yes	Damaged or broken controls measures can act as a pollutant source. CMs are inspected and if any are damaged, they are noted as such and repaired or removed. If any materials from the controls have been released, they are properly cleaned up and disposed of.

Tab 5 – Effluent Limitations, Control Measures for Stormwater Pollution Prevention

CONTROL MEASURES USED TO MEET EFFLUENT LIMITATIONS (PART I.B.1.A.I AND I.C.2.E)

a) Structural Control Measures

Structural CMs are those physical structures implemented at the site to minimize erosion and sediment transport. Most structural CMs tend to be sediment controls. The structural CMs that are planned to be used for the project are described below. Specific locations for CMs implemented at the site are indicated on the Site Maps, provided in Tab 2. Installation and maintenance details for these CMs are in Tab 6 or are provided with the Site Maps.

Stormwater runoff from all disturbed areas and soil storage areas for which permanent or temporary stabilization is not implemented, will flow to at least one CM to minimize sediment in the discharge. This may be accomplished through filtering, settling, or staining. The control must contain or filter flows in order to prevent the bypass of flows without treatment and must be appropriate for stormwater runoff from disturbed areas and for expected flow rate, duration, and flow conditions.

One goal of a SWMP is to allow for field fitting of CMs based on site-specific conditions that may favor use of one CM over another. Each structural CM listed below contains a brief list of other CMs that may be substituted, based on site specific conditions.

Check Dam:

Check dams are generally constructed from rock or sediment control logs. 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). Installation includes stacked rock or use of sediment control logs so that the center of the check dam is lower than the sides. The check dam will be installed across the entire width of the drainage swale in order to function properly. Check dams will be inspected for proper installation and sediment accumulation on the upgradient 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. Maintenance may include cleaning and replacing materials as needed to maintain function and design.

Temporary Berm:

Temporary berms are made of compacted soil and are continuous. Berms can be used for perimeter control, at the top of a slope to control run-on, at the toe of slopes, around storage areas, or in conjunction with drainage swales/diversion ditches. Berms are typically used to control the flow path of runoff at a construction site by diverting runoff around areas prone to erosion, such as steep slopes or around areas with stored materials to minimize the potential for the materials to come into contact with stormwater and move off-site. Berms are also used in conjunction with drainage swales to direct surface flows to a sediment trap or basin. Berms are a temporary feature and will be removed prior to final grading and permanent seeding. Inspections will be conducted to verify the continuous, compact nature of the berm. Maintenance may include repairing breaks or low spots.

Inlet/Culvert Protection:

Inlet protections consist of a barrier material placed in front of, around, or immediately upgradient from the inlet. The most common forms of inlet protection are wire or fabric socks filled with rock or other filtering material. As appropriate, curb check dams may be used in conjunction with inlet protections to reduce storm water velocity and increase the effectiveness of the inlet protections. Inlet protections are designed to slow stormwater flow into the inlet, allowing sediment time to settle and accumulate on the upgradient side to the structure. Inlet protections will be installed prior to earth-disturbing activity upgradient from the inlets. If conditions warrant, protection will be provided to prevent sediment from entering inlets from above or behind

the opening. Inlet protection will remain in place until all upgradient areas are stabilized. Inlet protections are typically used as the last CM in a treatment train. Erosion CMs will be utilized to the extent feasible to minimize sediment movement.

Inlet protections will be inspected for damage, structural integrity, proper installation in relationship to the curb, and need for sediment removal. Maintenance may include repairing or replacing as needed, repositioning the inlet protections and/or removing accumulated sediment.

Perimeter Control:

Perimeter controls serve as sediment controls and, when appropriate, can double as access control. At downgradient locations, perimeter controls will be installed where overland sheet flow has the potential to leave the site. In upgradient areas perimeter control may be added to define project boundaries, limit on-site flows or protect off-site features. Such controls should be suitable to the application. Perimeter control may consist of any number of CMs, including, but not limited to earthen berms, sediment control logs, silt fence, etc. Perimeter controls will be used around bore holes, trenches, and other locations where sediment is exposed and may accumulate. Perimeter controls will remain in place until areas upgradient of controls are stabilized. Perimeter controls will be inspected for proper installation, structural integrity and accumulated sediment. Maintenance may include repairing or replacing damaged sections and removing accumulated sediment.

Rock Socks/Curb Socks:

Rock socks or curb socks are wire or geotextile tubes filled with rock or gravel material. Rock socks may be used as inlet protection, outlet protection, swale protection, perimeter control, or in any area where concentrated flows need to be broken up and velocity reduced to prevent erosion. Rock socks serve to reduce water velocity allowing time for sediment to settle out, thus decreasing erosion potential and sediment transport. When used for swale protection rock socks need to extend the entire width of the expected flow with the center lower than the sides. For use as inlet or culvert protection, the rock sock should extend beyond the width of the inlet/culvert. Rock socks may be stacked to maximize performance. Delineators will be installed with curb socks for high traffic areas where installations present a potential traffic hazard or where they may be damaged by vehicles or snowplows. Rocks socks will be inspected for proper installation, structural integrity and accumulated sediment. Maintenance may include repairing or replacing damaged sections and removing accumulated sediment.

Silt Fence:

Silt fence consists of geotextile fabric installed with at least six inches of the fabric trenched into the soil; wooden stakes are attached on the downgradient side. Wire-backed fence may be used, or additional stakes or lathe may be added on the upgradient 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 upgradient side of the fence. Silt fence applications include, but are not limited to project perimeter control, secondary containment, back of curb protection and containment for any disturbed or staging area. Silt fence will be inspected regularly for sediment accumulation, tear or holes in the fabric, broken stakes, gaps in the fabric, or areas where the fabric needs to be re-attached to the wooden stakes. Maintenance may include repairing the items noted, removing sediment accumulation one-half the height of the fence, or replacing the fence as needed.

Designated Material Staging Area

A designated and/or stabilized staging area is a specific location on or near the project site for stockpiling/staging materials and equipment for use on-site. A staging area allows for a central location for deliveries and storage of equipment when not in use and reduces disturbance of areas of the site not scheduled for disturbance through construction activities. Staging areas generally consist of a cleared area of the site with vehicle tracking control and perimeter control (e.g., silt fence and/or construction fencing).

Staging areas will be implemented as needed on site. They should be positioned to reduce the need for relocation and be placed out of areas of active construction activity. Staging areas will be inspected for adequate vehicle tracking control and perimeter control. Controls associated with staging areas should be repaired or modified as needed. Maintenance may include replacing material used to stabilize the staging area (if applicable) and repairing or replacing damaged perimeter and access CMs.

Vehicle Tracking Control (VTC):

Vehicle tracking control will be implemented to minimize vehicle tracking of sediment from disturbed areas per (§I.B.1.a.i.a) and may consist of an excavated area with a geotextile liner and gravel, metal grate, asphalt/concrete "rumble strip", or other proprietary products. VTCs must include a structural CM such as a tracking pad or wash rack, and may also include non-structural CMs, such as sweeping or restricting traffic to paved areas. VTCs are designed to cause soil to vibrate off equipment and vehicles as they transition from disturbed soils to paved areas and should drain to a CM. The VTC will remain in place until access to the areas used by the control are no longer needed. Designated points of ingress and egress, where traffic transitions from a stabilized road surface (e.g., gravel or pavement) to disturbed soil, are likely to need vehicle tracking control or these areas must drain to a control that meets the requirements of (§I.B.1.a.i.b). VTCs may be moved or eliminated (if no longer needed) as on-site conditions and activities change. VTCs will 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.

In vegetated areas where access is anticipated to be minimal, turf mats or cattle guards, or proprietary products such as mud mats may be installed primarily to protect vegetation and provide a stabilized entrance. These materials will be inspected for damage and will be maintained as needed.

Sediment Control Log

A sediment control log consists of a net or geotextile fabric filled with straw, excelsior, wood mulch, or other fillers. Sediment control log applications include, but are not limited to, slope stabilization, perimeter control, check dams in swales, back of curb protection and temporary secondary containment for stockpiles, materials storage, or masonry. Sediment control logs reduce water velocity allowing sediment to accumulate on the upgradient side of the log. The basic installation for a net wrapped sediment control log is to prepare a shallow trench and secure the log in the trench using a stake or landscape pin. Logs should be installed based on the manufacturer's directions. Logs should be inspected for proper installation, structural integrity and sediment accumulation. A log that has been flattened out of round may not need to be replaced if they remain sufficient to function appropriately on the upgradient side of the log. Maintenance may include repairing or replacing damaged logs and removing accumulated sediment as specified by the CM detail.

Construction Fencing/Construction Markers

Construction fencing and/or construction markers will be utilized to delineate the limits of disturbance and may consist of orange plastic fencing, rope and t-posts, spray paint, staking, or other alternative markers as appropriate to site conditions and constraints. In some cases, perimeter sediment CMs may also double as a construction marker. CF/CMK is used to delineate where disturbances are permitted and to restrict access to unpermitted areas, especially sensitive areas that are not within the limits of disturbance. CF/CMK will be installed as needed prior to mobilization to a given area on the Project and will remain in place where needed until final stabilization measures have been implemented. CF/CMK will be inspected for damage that renders the CM ineffective such as torn plastic fencing, severed ropes, or removed stakes. Maintenance may include repairing or replacing damaged or removed CF/CMK.

Additional CMs may be added as site conditions change and will be identified in the SWMP prior to installation.

b) Non-structural Control Measures

Non-structural CMs are those practices which, when implemented, will minimize erosion and sediment or other pollutant transport. Practices implemented at this site include interim stabilization practices, permanent stabilization practices (see Tab 8), and site-specific scheduling for implementation of the practices, as well as site management practices, preventative maintenance, and personnel training. The potential non-structural CMs for the project are described below. Specific locations for CM implementation at the site are indicated on the Site Map, provided in Tab 2. Tab 6 provides the installation details for each CM identified.

Mulching:

Crimp mulching uses hay or straw material that is machine crimped into the soil to provide stability. Hydromulching uses fiber mulch mixed with water and sprayed onto soil to provide stability. Hydromulching mixtures also often contain a tackifier to better bond the fiber mulch together and to the soil. Mulching may be used on its own as a temporary soil stabilization method, or in conjunction with seeding for final stabilization. Mulch functions as a soil stabilizer by decreasing the velocity of sheet flow. Crimp mulch may be hay or cereal grain straw. Crimp mulch will likely be crimped into the soil using either a drill seeder or notched disk plow to the minimum depth of two inches and a maximum depth of four inches. To maximize effectiveness crimping equipment must run parallel to the contours of the land. Crimp mulch may not be appropriate for slopes that are equal to or greater than 3:1 or in areas with hard or rocky soil in which the crimper cannot penetrate. Hydromulch is better suited to areas with steeper slopes, difficult to access areas, and areas with hard or rocky soils. Inspections should look for areas where mulch is missing, thin or for areas where erosion has occurred. Maintenance items may include re-grading as necessary and reapplying as appropriate.

Seed and Stabilization (Temporary and Permanent Ground Cover):

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. As soon as practical, after the completion 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 tackifying, to protect the seed and soil from erosion during the germination and growth process. Seed areas will be inspected to ensure that the soil stabilization method (e.g., surface roughening, crimp mulch, etc.) was applied correctly and has not been compromised. The area will also be inspected for erosion and/or sediment deposition. Maintenance items may include re-grading and seeding bare or areas of thin vegetative growth and/or adding additional CMs as appropriate. If seeding cannot be accomplished due to seasonal or other constraints, temporary stabilization, such as mulch and mulch tackifier will be used. Additional discussion concerning temporary stabilization may be found in Section c in this Tab.

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

ECBs/TRMs are sheets of straw, excelsior, coconut, manmade fiber, or combination thereof, usually contained between layers of netting to provide structural integrity. ECBs/TRMs function by providing 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/TRM applications include, but are not limited to, slope and swale protection. ECBs can also optionally be used in cases where mulch would provide sufficient protection of the seedbed, but hydromulching or crimp mulching cannot or should not be used due to access limitations. ECBs/TRMs will be inspected for erosion underneath and at the sides of the material, sediment accumulation, rips tears and other structural problems. Maintenance may include removing sediment, re-securing material to ground and re-trenching or replacement, as needed.

Street Sweeping

Soils deposited on paved surfaces will be swept or cleaned as needed to reduce the potential of sediment transport and tracking. Sweeping operations consist of scraping large quantities of sediment from pavement and/or sweeping, via hand or mechanical means to remove as much deposited sediment as possible. All streets within and immediately surrounding a construction site will be cleaned of earth material when sediment has been deposited on the roadway and is being tracked off site. Scraped or swept material will not be deposited in the storm sewer. Sweeping and vacuuming may not be effective when soil is wet or muddy.

Surface Roughening

Surface roughening consists of grooves or tracks installed in the soil surface, along the contours (not up and down the slope which promotes erosion). 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 surface roughened. This may include areas where scheduling prevents the immediate implementation of final stabilization practices, the sides of stockpiles or other slopes. Surface roughening may be applied by creating a continuous furrow along the contours. 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 creating track marks along the contour. Inspection of surface roughened areas would include proper implementation, structural integrity and areas of erosion or sediment accumulation. Maintenance for surface roughening may include re-applying the technique or installation of new or additional CMs.

Protections of Pre-existing Vegetation

Protection of existing vegetation on a construction site can be accomplished through installation of a construction fence around the area requiring protection. In cases where upgradient areas are disturbed, it may also be necessary to install perimeter controls to minimize sediment loading to sensitive areas such as wetlands. Existing vegetation may be designated for protection to maintain a stable surface cover as part of construction phasing, or vegetation may be protected in areas designated to remain in natural condition under post-development conditions (e.g., wetlands, mature trees, riparian areas, open space). A 50 horizontal foot buffer of pre-existing vegetation or equivalent controls must be maintained between work areas and receiving waters unless infeasible. Maintenance may include removing sediment by hand, replacing construction fence or other plastic fencing used to limit access. If any damage were to occur to a vegetative buffer, a new or additional CM should be considered and the SWMP will be updated to document as to why the vegetation could not be left undisturbed.

Vegetation and Topography:

In limited disturbance areas, not installing a CM (CM) may be the best approach to minimize sediment transport off site. This is based on the concept that shallow overland flow may pick-up and transport sediment that is then dropped out within a vegetative buffer and installation of a downgradient physical CM is an unnecessary effort, expense, and disturbance that increases the amount of site restoration. VT as a CM was developed using a two-dimensional physically based and spatially distributed computer model with the following inputs and assumptions:

- Input – Site grade slopes. Assumption - Site grade slopes 10% or less allow shallow overland flow.
- Input - Vegetation cover density (surface roughness) represented by Mannings ‘n’.
- Input - Rainfall event specific to the project site for ECM design, typically a 5-year 30-minute storm.
- Input - Hydrologic Soil Group (HSG) for the disturbance and buffer area, typically obtained from the National Resource Conservation Service Web Soil Survey, online.
- Assumption - No upgradient or disturbance area concentrated flow paths through construction site.
- Assumption – 80% sediment removal, typical of sediment reduction targets for physical CMs is acceptable.
- Assumption - No construction traffic or disturbance activity within the vegetation buffer

- Requirement - The required vegetation buffer must be in the construction project limits and controlled by PSCo via written agreement with landowner, ownership, or easement).

The inputs above (vegetation cover, slope, soil type, and rainfall) can be conservatively collapsed into a simple table showing that for a given rainfall, the four different soil types (HSG A to D) require four different minimum vegetation buffer lengths for sediment to settle out of the stormwater sheet flow. This vegetation buffer distance table is to be referenced by field crews and used in combination with the HSG data provided on the SWMP drawings. The rainfall and soil data will be specific to each project.

The VT will have to be inspected to verify that sediment is not being transported beyond the buffer or project control area. In the event that the VT CM is not providing the level of sediment settling necessary, physical CMs may need to be installed or practices upgradient of the VT buffer modified. It is expected that the thin layer of sediment deposited in the VT buffer should not be removed. All CM type modifications and movement are to be noted on the SWMP Site Maps. A comprehensive design guideline, citing good engineering, hydrologic, and pollutant control practices, principles and criteria is contained in the CMs details located in Tab 2 or 6.

Wind Erosion Control

Wind erosion and dust control may be necessary if wind is transporting soil within or off site. Wind erosion control functions to stabilize the soil surface reducing the potential for wind erosion. Wind erosion control consists of applying water and/or other dust palliatives as necessary to prevent or alleviate erosion by the forces of wind. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives. If needed, a soil tackifier can be applied to control wind erosion. Disturbed areas should be inspected for obvious signs of wind erosion and CMs implemented, if needed. Areas with wind erosion controls in place should be inspected for structural integrity and coverage and repaired or replaced as appropriate.

Training

Employees and the contractor will be trained on good housekeeping, the proper use and storage of materials, and site management practices. PSCo construction supervisors and project managers participate in stormwater training on the company's learning management system. Additionally, lead stormwater management supervisors have given trainings to multiple companies that work frequently for PSCo.

PSCo also requires all of its SWMP developers, erosion CM installers, and stormwater inspectors to hold either a CISEC or CPESC certification or are in training for either of these two certifications.

Site Management Practices

Good housekeeping will be used to keep potential areas where pollutants exist clean and orderly. Containers, drums, and bags will be stored away from direct traffic routes to reduce the risk of accidental spills. Stack containers according to manufacturer's instructions to avoid damaging the containers from improper weight distribution. Containers will be stored on pallets or similar devices to prevent corrosion of containers that results from containers coming in contact with moisture on the ground. Liquids will be stored within curbed areas or secondary containment.

c) Other Specific Control Measures Used to Meet Effluent Limitations (Part I.B.1.a.i and ii)

Additional specific controls that must meet the following requirements:

Soil Compaction – Soil compaction must be minimized for areas where infiltration CMs will occur or where final stabilization will be achieved through vegetative cover. If compaction does occur in areas where final

stabilization will be achieved through vegetative cover, then decompaction of the soil must be completed prior to planting.

Topsoil Preservation – Unless infeasible, topsoil must be preserved for those areas of a site that will utilize vegetative final stabilization. Preserved topsoil can be left in place or stockpiled. Topsoil preservation measures may include the following:

- Limit construction disturbance areas, including those used for access by installing construction fence or other means to limit impacts to existing topsoil.
- In areas of grading or excavation, strip and segregate topsoil separately from other excavated materials.
- In areas with construction traffic where topsoil is likely to mix with subsoil, strip and stockpile topsoil.

Minimize Disturbances – Disturbances will be minimized to the extent feasible, especially on steep slopes.

Temporary Stabilization – Temporary stabilization must be implemented for earth-disturbing activities on any portion of the site where earth-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 and although not specifically outlined in the permit may also include temporary hard surfaces. The permittee may exceed the 14-day schedule 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 SWMP must document the constraints necessitating the alternative schedule, provide the alternate stabilization schedule, and identify all locations where the alternative schedule is applicable on the Site Maps.

Minimize Dust – On areas of exposed soil, minimize dust through the appropriate application of water or other dust suppression techniques. Water application must be conducted in a manner to prevent discharge offsite unless authorized by a separate CDPS or NPDES permit. See the Wind Erosion Control non-structural CM in the preceding section.

Other controls related to final stabilization, bulk storage, materials management, and corrective actions and releases are covered in other sections of this SWMP.

d) Documented Use Agreement (Part I.C.2.a.vi)

All CMs planned for the PSCo project are within the project limits/construction limits. (Note: There may be nearby CMs installed for another project; however, they are not being utilized by PSCo as a CM)

Tab 6 – Control Measure Specifications and Maintenance Requirements

AGGREGATE DRAINAGE CROSSING

DESCRIPTION

A TEMPORARY ACCESS CONTROL MEASURE (CM) TO CREATE A STABILIZED SURFACE ACCROSS A DRAINAGE SWALE. AGGREGATE SWALE CROSSING FLOW LINE TO MATCH UP-GRADIENT AND DOWN-GRADIENT SWALE ELEVATIONS AND NOT IMPEDE ROADSIDE SWALE FLOW.

DESIGN AND INSTALLATION

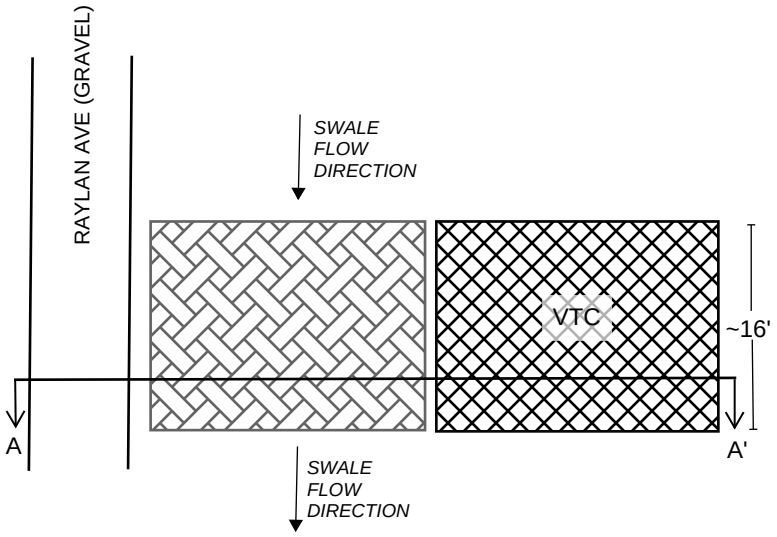
1. STRIP 9" OF TOPSOIL /SUBGRADE FROM SWALE AND STOCKPILE WITH DOWNGRADIENT CMs. SEGREGATE TOPSOIL FROM SUBGRADE.
2. INSTALL SEPARATION FABRIC ON EXPOSED SUBGRADE (BELOW AGGREGATE)..
3. INSTALL 9" THICK ROCK AGGREGRATE (D50 = 6") IN A FIXED POSITION TO MATCH EXISTING SWALE GRADE.

MAINTENANCE:

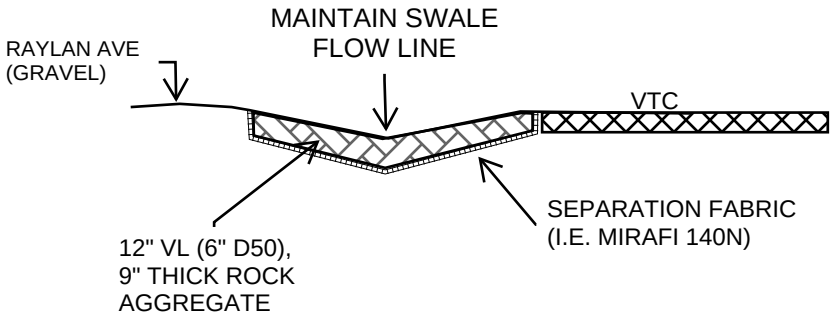
GENERALLY, AGGREGATE DRAINAGE CROSSING IS SELF-MAINTAINED. IF EXCESS SEDIMENT BUILDS UP, REMOVE FROM AGGREGATE AND DISPOSE OF PROPERLY.

POST CONSTRUCTION:

REMOVE AGGREGATE AND FABRIC FROM SWALE AND RESTORE SWALE TO PRE-EXISTING GRADE BY BACKFILLING WITH 4" OF STOCKPILED TOPSOIL FROM INTIAL EXCAVATION OF CROSSING.



PLAN VIEW
NOT TO SCALE



CROSS SECTION A-A'
NOT TO SCALE

(BF) BOUNDARY FENCE

DESCRIPTION

BOUNDARY FENCE IS USED AS A PERIMETER CONTROL TO DESIGNATE PROJECT LIMITS AND PROTECT SENSITIVE NATURAL AREAS SUCH AS OPEN SPACE, WETLANDS, AND RIPARIAN AREAS.

DESIGN AND INSTALLATION

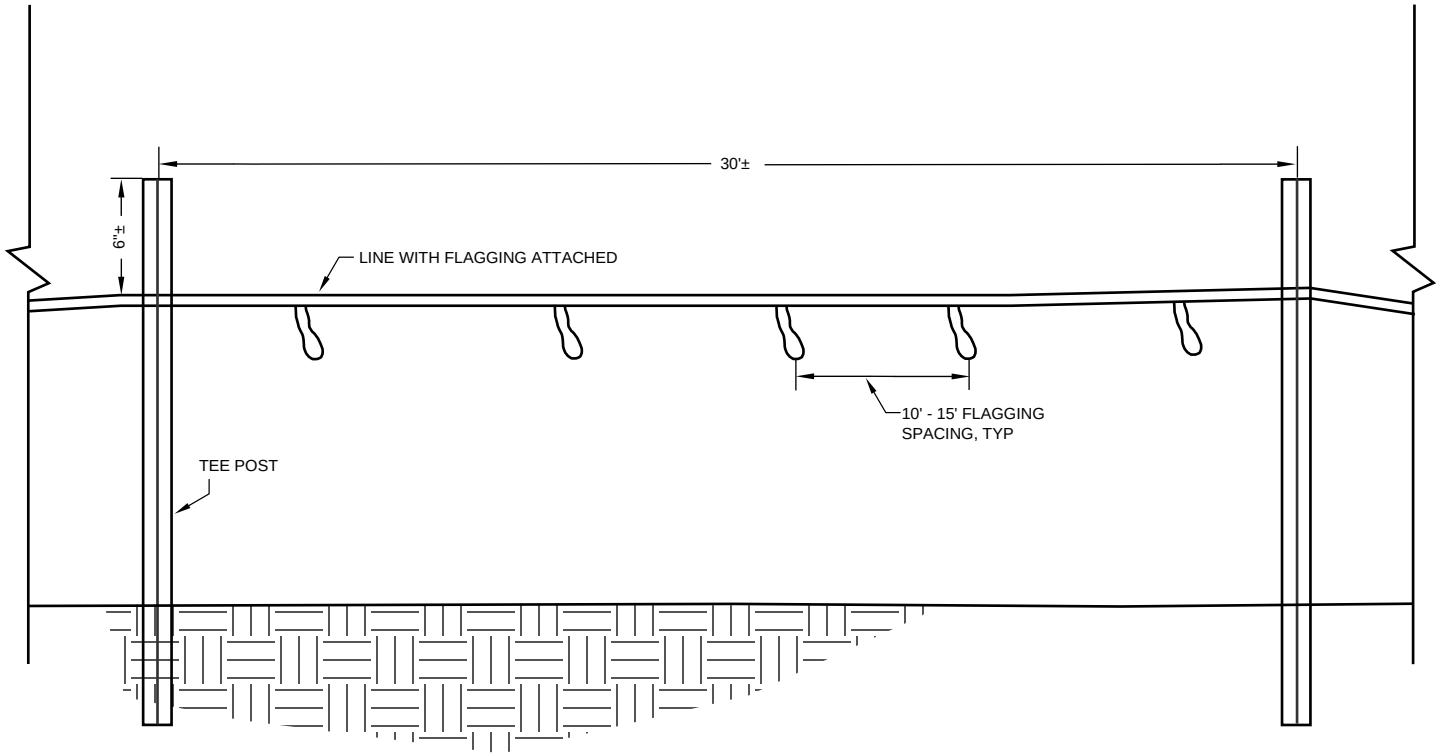
1. TEE POSTS SPACED ~30' SHALL BE USED WITH LINE CONNECTED BETWEEN AND FLAGGING ATTACHED. SEE DETAIL BELOW.
2. EASEMENTS, WETLANDS, AND WILDIFE AREAS TO BE STAKED OUT BY SURVEYOR BEFORE PLACEMENT OF BOUNDARY FENCE.
3. ALL EQUIPMENT USED TO INSTALL FENCING SHALL BE KEPT ON THE CONSTRUCTION SIDE OF PROJECT.
4. BOUNDARY FENCING SHALL BE REMOVED PRIOR TO FINAL STABILIZATION AND PERMANENT SEEDING.

MAINTENANCE:

MAINTAIN, REPLACE, AND REPAIR AS NEEDED TO ENSURE THERE IS NO DAMAGE TO TEE POSTS, LINE, AND FLAGGING. MAINTAIN LINE TENSION SO LINE SPACE BETWEEN LINE AND GROUND IS AT LEAST 3'.

ADDITIONAL NOTES:

REVIEW LOCAL JURISDICTION REQUIREMENTS FOR CM TYPES AND INSTALLATION METHODS.



Construction Fence (CF) SM-3

Description

A construction fence restricts site access to designated entrances and exits, delineates construction site boundaries, and keeps construction out of sensitive areas such as natural areas to be preserved as open space, wetlands and riparian areas.

Photograph CF-1. A construction fence helps delineate areas where existing vegetation is being protected. Photo courtesy of Douglas County.

Appropriate Uses

A construction fence can be used to delineate the site perimeter and locations within the site where access is restricted to protect natural resources such as wetlands, waterbodies, trees, and other natural areas of the site that should not be disturbed.

If natural resource protection is an objective, then the construction fencing should be used in combination with other perimeter control BMPs such as silt fence, sediment control logs or similar measures.

Design and Installation

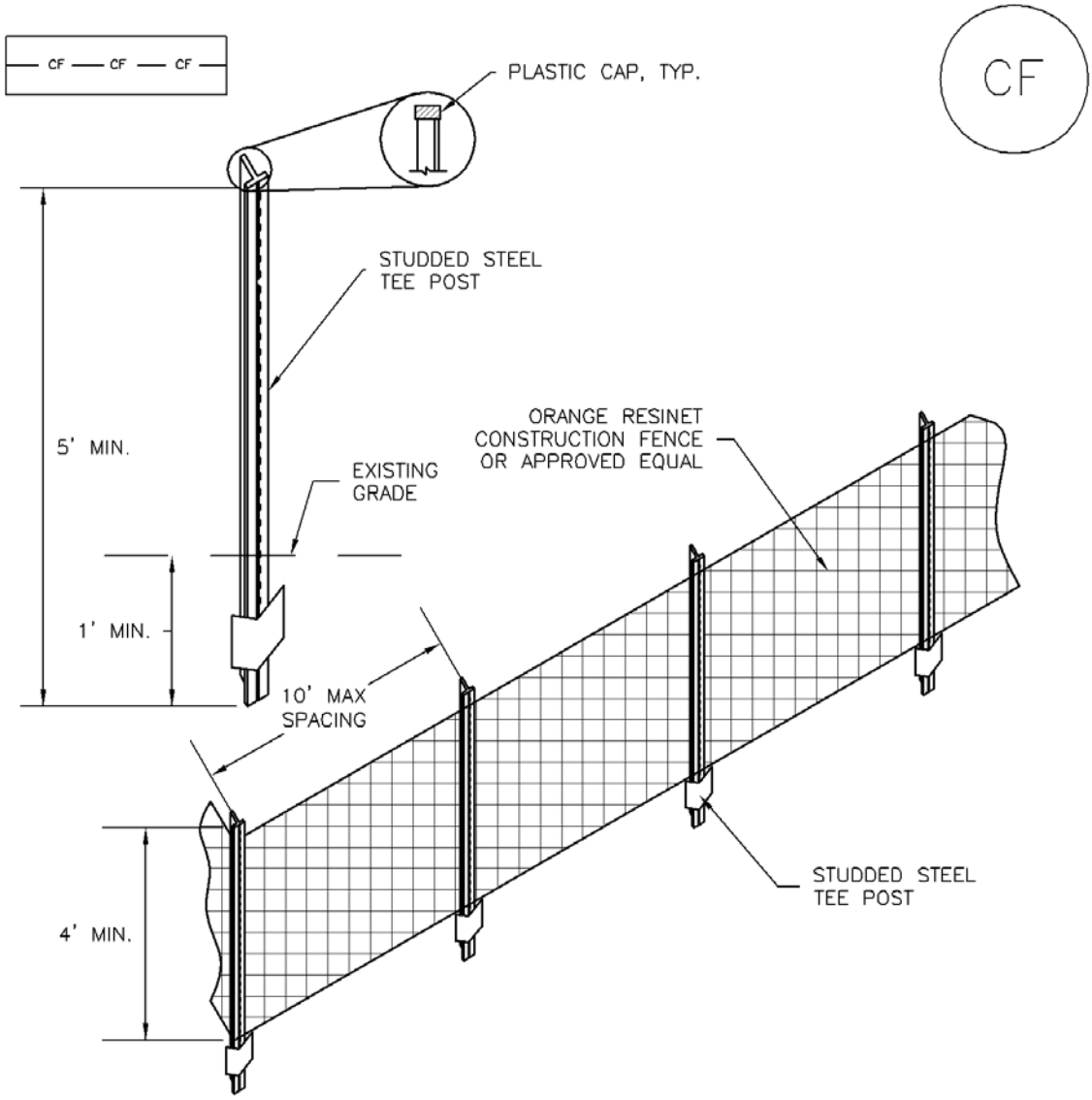
Construction fencing may be chain link or plastic mesh and should be installed following manufacturer's recommendations. See Detail CF-1 for typical installations.

Do not place construction fencing in areas within work limits of machinery.

Maintenance and Removal

- Inspect fences for damage; repair or replace as necessary.
- Fencing should be tight and any areas with slumping or fallen posts should be reinstalled.
- Fencing should be removed once construction is complete.

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



CF–1. PLASTIC MESH CONSTRUCTION FENCE

CONSTRUCTION FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF CONSTRUCTION FENCE.

2. CONSTRUCTION FENCE SHOWN SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

3. CONSTRUCTION FENCE SHALL BE COMPOSED OF ORANGE, CONTRACTOR–GRADE MATERIAL THAT IS AT LEAST 4' HIGH. METAL POSTS SHOULD HAVE A PLASTIC CAP FOR SAFETY.

4. STUDDED STEEL TEE POSTS SHALL BE UTILIZED TO SUPPORT THE CONSTRUCTION FENCE. MAXIMUM SPACING FOR STEEL TEE POSTS SHALL BE 10'.

5. CONSTRUCTION FENCE SHALL BE SECURELY FASTENED TO THE TOP, MIDDLE, AND BOTTOM OF EACH POST.

CONSTRUCTION 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. CONSTRUCTION FENCE SHALL BE REPAIRED OR REPLACED WHEN THERE ARE SIGNS OF DAMAGE SUCH AS RIPS OR SAGS. CONSTRUCTION FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

5. WHEN CONSTRUCTION FENCES ARE REMOVED, ALL DISTURBED AREAS ASSOCIATED WITH THE INSTALLATION, MAINTENANCE, AND/OR REMOVAL OF THE FENCE SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

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.

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

CWA CONCRETE WASHOUT AREA

DESCRIPTION:

ECO-PAN IS A PROPRIETARY SELF-CONTAINED, WATER-TIGHT CONCRETE WASHOUT WITH FORK CHANNELS AND EYELETS FOR PORTABILITY. THE PAN CAPTURES AND CONTAINS CONCRETE WASTEWATER AND WASHOUT MATERIAL.

MAINTENANCE:

INSPECT AND CLEAN OUT WHEN 3/4 FULL, NOT ALLOWING THE ECO-PAN TO OVERFLOW. INSPECT WASTEWATER LEVEL, REQUEST SERVICE, AND REPLACE WITH EMPTY ECO-PAN AS NEEDED. INSPECT ECO-PANS TO ENSURE THAT PROPER HOUSEKEEPING PROCEDURES ARE UTILIZED WHEN WASHING OUT EQUIPMENT.

ADDITIONAL NOTES:

1. ECO-PAN IS AN ALTERNATIVE TO AN ON-SITE CONSTRUCTED CONCRETE WASHOUT.
2. CONTRACTOR TO CHOOSE PAN SIZE BASED ON PROJECT NEEDS.
3. ALL WASHOUT WATER AND CONCRETE WILL BE DISPOSED OF PROPERLY.
4. ECO-PAN TO BE USED PER MANUFACTURER'S RECOMMENDATIONS.
5. ALTERNATIVE CONCRETE WASHOUT CONTAINMENT SYSTEM MAY BE USED IF APPROVED BY XCEL ENERGY.

2.35 YARD / 5 TON CAPACITY

1.5 YARD / 3 TON CAPACITY

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

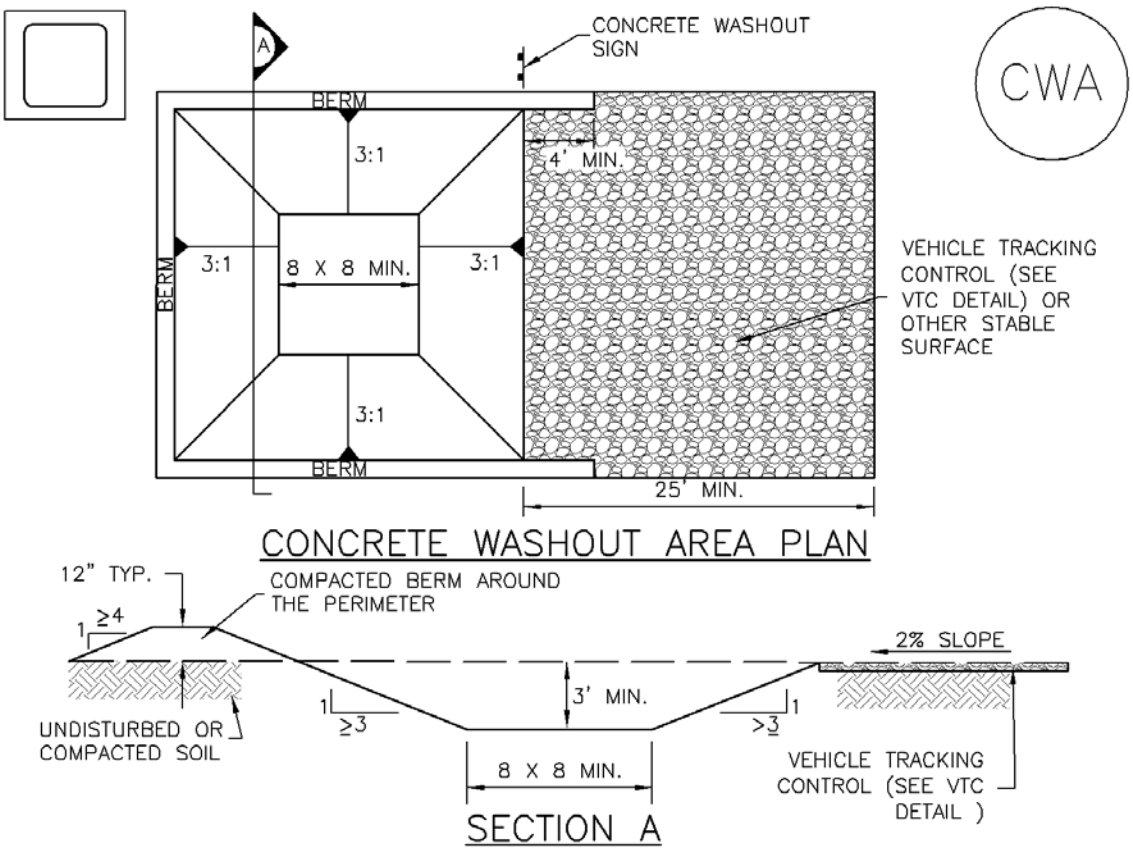
A key consideration for concrete washout areas is to ensure that adequate signage is in place identifying the location of the washout area. Part of inspecting and maintaining washout areas is ensuring that adequate signage is provided and in good repair and that the washout area is being used, as opposed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

DANDY RECYCLER™
CURB INLET AND GUTTER PROTECTION
SYSTEM GUIDE SPECIFICATION

PRODUCT:

DANDY RECYCLER™

MANUFACTURER:
Dandy Products Inc.
P.O. Box 1680
Powell, Ohio 43065
Phone: 800-591-2284
Fax: 740-881-2791
Email: sdunnpe@dandyproducts.com
Web: www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Recycler™ inlet and gutter protection system for inlets, median barrier inlets without grates, and gutters. The purpose is to keep silt, sediment, and construction debris out of the storm system.

2.0 **Material:**

2.1 The Dandy Recycler™ inlet protection system shall be a **sewn in the U.S.A**. fabric unit in the form of a cylindrical tube. Diameter of the tube is nominal 9". Lengths available are 3', 4', 5', 6', and 8'.

2.2 The Dandy Recycler™ is filled with a recycled crumble rubber material or aggregate on the Velcro end of the unit. This work it typically performed by others.

2.3 The Dandy Recycler™ unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Tensile Strength	ASTM D4632	lbs	450 x 300
Elongation	ASTM D4632	%	38% x 21%
Trapezoidal Tear	ASTM D4533	lbs	165 x 150
CBR Puncture	ASTM D6241	lbs	1000
HYDRAULIC PROPERTIES:			
Apparent Opening Size (AOS)	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec^{1}	4.9
Water Flow Rate	ASTM 4491	$gal/min/ft^2$	365
% Open Area (POA)	COE - 22125-86	%	29
UV Resistance (% Retained @ 2500 hrs)	ASTM D 4355	%	70

Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective April 2022 and are subject to change without notice.

3.0 Installation:

3.1 Place Dandy Recycler™ inlet protection unit on ground near the inlet, or in the gutter, where it is to be installed.

3.2 For oil and sediment model, to install or replace absorbent, open the Velcro end, and place absorbent inside the unit.

3.3 Using the lifting straps, maneuver the Dandy Recycler™ to the location where it will be used for best protection against silt, sediment, and construction debris out of the storm system.

3.4 Place the unit with no gaps between the adjoining curb or another unit.

4.0 Maintenance:

4.1 The contractor shall remove all accumulated sediment and debris from around and within the vicinity of unit after each rain event or as directed by engineer/inspector. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

4.2 *For oil and sediment model; remove and replace absorbent when near saturation.*

5.0 Method of Measurement:

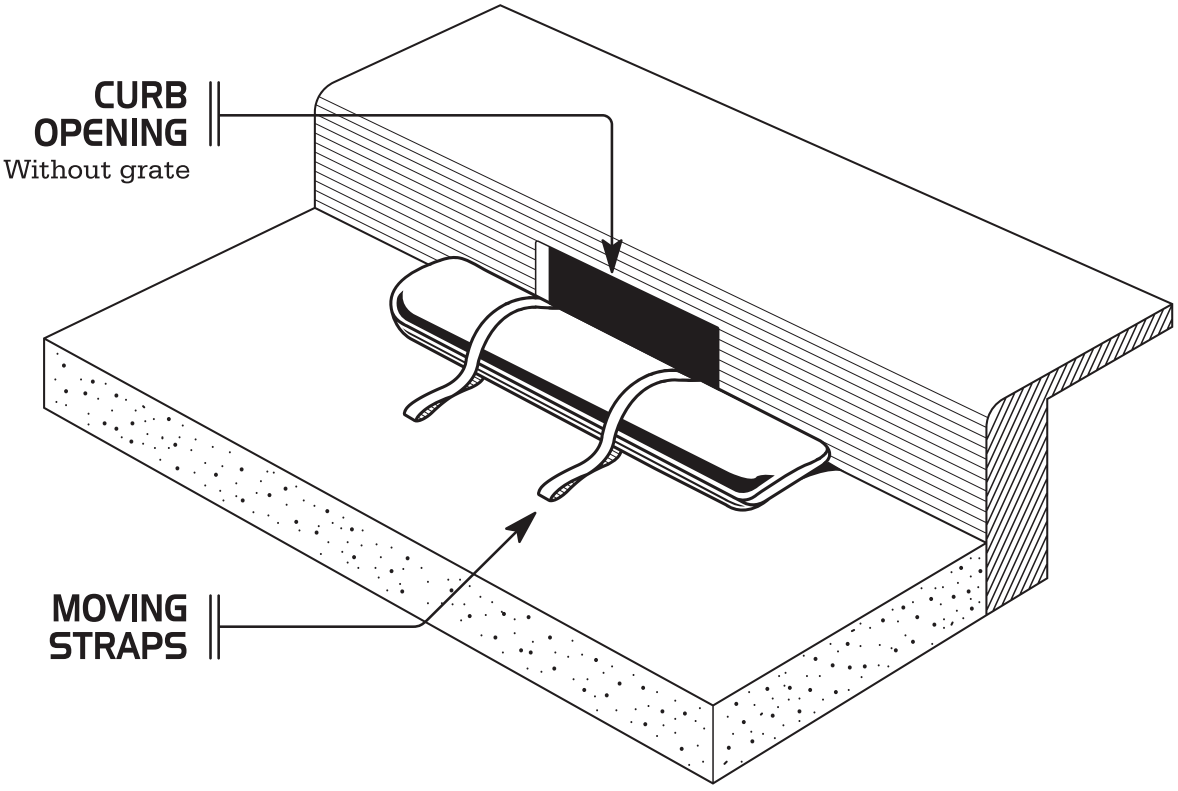
5.1 The quantity to be paid is for the actual number of Dandy Recycler™ inlet protection units installed, or by the lineal foot.

6.0 Basis of payment:

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the True Dam® inlet protection units.
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Recycler™	EA	Inlet Protection Unit (#_____Inlet)
Dandy Recycler™	EA	Inlet Protection by foot (#_____/ft)

DANDY RECYCLER™



EROSION LOG / BLANKET FOR CONCENTRATED FLOW AREA

(SCL-B) SEDIMENT CONTROL LOG W/ BLANKET (RL-B) ROCK LOG W/ BLANKET

DESCRIPTION

EROSION LOG TO ACT AS CHECK FOR FLOWS, BLANKET TO MINIMIZE SCOUR ON DOWNHILL SIDE OF LOG WHEN FLOW OVERTOPS EROSION LOG.

EROSION LOG CAN BE ROCK LOG, SEDIMENT CONTROL LOG, OR WEIGHTED SYNTHETIC ALTERNATIVE. EROSION BLANKET USED CAN BE DOUBLE LAYERS OF EROSION CONTROL BLANKET (ECB), SINGLE LAYER OF TURF REINFORCEMENT MAT (TRM), OR OTHER PERVIOUS MATERIAL AS APPROVED BY XCEL AND EROSION CONTROL TEAM. CONTRACTOR MAY SELECT/IMPLEMENT APPROVED BLANKET TYPE AT THEIR DISCRETION UNLESS OTHERWISE SPECIFIED IN THE PLANS.

SPACING OF CM IS SITE SPECIFIC AND DICATED BY SWMP DRAWINGS AND SITE CONDITIONS. WIDTH OF EROSION LOG ACROSS CONCENTRATED FLOW PATH VARIES GIVEN CHANNEL GEOMETRY AND MUST BE FIELD FIT.

DESIGN AND INSTALLATION

1. TRENCH AREA FOR NON-WEIGHTED EROSION LOG PLACEMENT PER RESPECTIVE DETAIL (TYP 1/3 DIAMETER OF LOG). WEIGHTED EROSION LOGS (I.E. RUBBER PELLET OR ROCK FILLED TYPES) DO NOT REQUIRE TRENCHING. PLACEMENT TO BE PERPENDICULAR CONCENTRATED FLOW PATH.

2. INSTALL EROSION BLANKET WITHIN CONCENTRATED FLOW PATH AND EXTENDING DOWNHILL FROM THE EROSION LOG. SEE SCHEMATIC BELOW FOR DIMENSIONS AND INSTALLATION/STAKING REQUIREMENTS. IF DOWN-GRADIENT BLANKET EXTENDS MORE THAN 18" BEYOND EROSION LOG, INSTALL BLANKET PER RESPECTIVE DETAIL REGARDING STAPLE SPACING AND ANCHOR TRENCHING.

3. INSTALL SELECTED EROSION LOG PER RESPECTIVE DETAIL (I.E. SCL, RL) WITHIN TRENCHED AND ON TOP OF EROSION BLANKET.

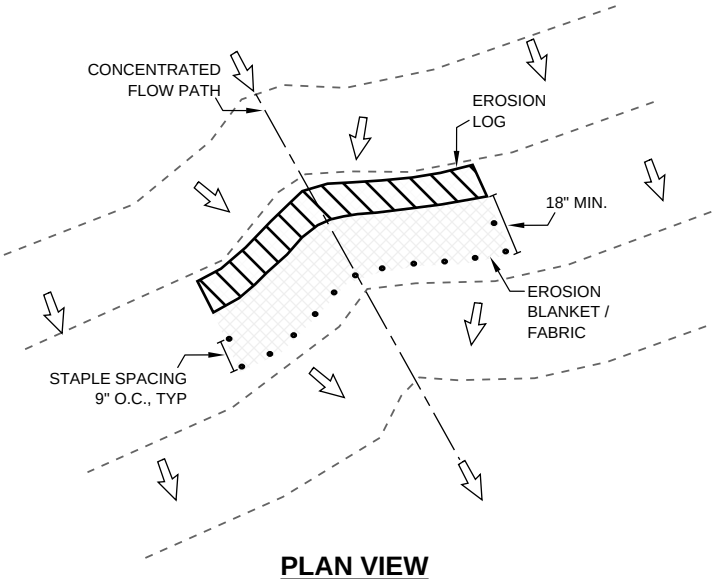
MAINTENANCE:

MAINTAIN EROSION LOG PER STANDARD LOG DETAIL INCLUDING UP-GRADIENT SEDIMENT REMOVAL.

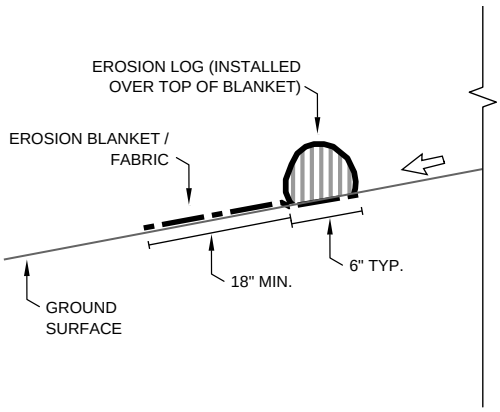
MAINTAIN BLANKET FOR GENERAL CONDITION AND FUNCTION, REPLACING BLANKET WHEN MORE THAN 5% OF BLANKET HAS LOST CONTINUITY (DEVELOPED HOLES). STAPLE BLANKET EDGE AS NEEDED TO SECURE BLANKET IN PLACE.

ADDITIONAL NOTES:

REVIEW LOCAL JURISDICTION REQUIREMENTS AND RESTRICTIONS WHEN SELECTING CM TYPES, INSTALLATION METHODS, AND MAINTENANCE REQUIREMENTS.



PLAN VIEW
NOT TO SCALE



CROSS SECTION VIEW
NOT TO SCALE

NOTE:
STAPLE BLANKET EVERY 9" ALONG SIDE AND DOWN-GRADIENT EDGES. BLANKET NOT TO BE TRENCHED EXCEPT WHERE BENEATH EROSION LOG OR IF BLANKET EXTENDS MORE THAN 18" BEYOND DOWN-GRADIENT END OF EROSION LOG.

LEGEND

EROSION LOG

EROSION BLANKET

FLOW DIRECTION

Description

Good housekeeping practices are designed to maintain a clean and orderly work environment. The most effective first steps towards preventing pollution in stormwater from work sites simply involve using common sense to improve the facility's basic housekeeping methods. Poor housekeeping practices result in increased waste and potential for stormwater contamination.

Photograph GH-1. Use dry clean-up methods to remove spilled materials. Photo courtesy of Colorado Nonpoint Source Program.

A clean and orderly work site reduces the possibility of accidental spills caused by mishandling of chemicals and equipment and should reduce safety hazards to personnel. A well-maintained material and chemical storage area will reduce the possibility of stormwater mixing with pollutants.

Some simple procedures a facility can use to promote good housekeeping include improved operation and maintenance of machinery and processes, material storage practices, material inventory controls, routine and regular clean-up schedules, maintaining well organized work areas, signage, and educational programs for employees and the general public about all of these practices.

Appropriate Uses

Good housekeeping practices require education and training, typically targeted to industries and businesses, municipal employees, as well as the general public.

Practice Guidelines

Good housekeeping practices include these general areas:

- Operation and Maintenance
- Material Storage
- Material Inventory
- Training and Participation.

Operation and Maintenance

Consider implementing the following practices:

- Maintain dry and clean floors and ground surfaces by using brooms, shovels, vacuums or cleaning machines, rather than wet clean-up methods.
- Regularly collect and dispose of garbage and waste material.

- Routinely inspect equipment to ensure that it is functioning properly without leaking and conduct preventative maintenance and needed repairs.
- Train employees on proper clean up and spill response procedures.
- Designate separate areas of the site for auto parking, vehicle refueling and routine maintenance.
- Promptly clean up leaks, drips and other spills.
- Cover and maintain dumpsters and waste receptacles. Add additional dumpsters or increase frequency of waste collection if overflowing conditions reoccur.
- Where outdoor painting and sanding occur, implement these practices:
    - Conduct these activities in designated areas that provide adequate protection to prevent overspray and uncontrolled emissions. All operations should be conducted on paved surfaces to facilitate cleanup.
    - Use portable containment as necessary for outside operations.
    - Clean up and properly dispose of excess paint, paint chips, protective coatings, grit waste, etc.
- Maintain vegetation on facility grounds in a manner that minimizes erosion. Follow the Landscape Maintenance and Pesticide, Herbicide and Fertilizer Usage BMPs to ensure that minimum amounts of chemicals needed for healthy vegetation are applied in a manner that minimizes transport of these materials in runoff.

Material Storage Practices

Proper storage techniques include the following:

- Provide adequate aisle space to facilitate material transfer and ease of access for inspection.
- Store containers, drums, and bags away from direct traffic routes to reduce container damage resulting in accidental spills.
- Stack containers according to manufacturer's instructions to avoid damaging the containers from improper weight distribution. Also store materials in accordance with directions in Material Safety Data Sheets (MSDSs).
- Store containers on pallets or similar devices to prevent corrosion of containers that results from containers coming in contact with moisture on the ground.
- Store toxic or hazardous liquids within curbed areas or secondary containers.

Material Inventory Practices

An up-to-date materials inventory can keep material costs down by preventing overstocking, track how materials are stored and handled onsite, and identify which materials and activities pose the most risk to the environment. Assign responsibility of hazardous material inventory to individuals trained to handle such materials. A material inventory should include these steps:

- Identify all chemical substances present at work site. Perform a walk-through of the site, review

purchase orders, list all chemical substances used and obtain Material Safety Data Sheets (MSDS) for all chemicals.

- Label all containers. Labels should provide name and type of substance, stock number, expiration date, health hazards, handling suggestions, and first aid information. Much of, this information can be found on an MSDS.

- Clearly identify special handling, storage, use and disposal considerations for hazardous materials on the material inventory.

- Institute a shelf-life program to improve material tracking and inventory that can reduce the amount of materials that are overstocked and ensure proper disposal of expired materials. Careful tracking of materials ordered can result in more efficient materials use. Decisions on the amounts of hazardous materials that are stored on site should include an evaluation of any emergency control systems that are in place. All storage areas for hazardous materials should be designed to contain spills.

Training and Participation

Frequent and proper training in good housekeeping techniques reduces the likelihood that chemicals or equipment will be mishandled. To promote good housekeeping, consider implementing these practices:

- Discuss good housekeeping practices in training programs and meetings.

- Publicize pollution prevention concepts through posters or signs.

- Post bulletin boards with updated good housekeeping procedures, tips and reminders.

Description

Mulching consists of evenly applying straw, hay, shredded wood mulch, rock, bark or compost to disturbed soils and securing the mulch by crimping, tackifiers, netting or other measures. Mulching helps reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Although often applied in conjunction with temporary or permanent seeding, it can also be used for temporary stabilization of areas that cannot be reseeded due to seasonal constraints.

Mulch can be applied either using standard mechanical dry application methods or using hydromulching equipment that hydraulically applies a slurry of water, wood fiber mulch, and often a tackifier.

Photograph MU-1. An area that was recently seeded, mulched, and crimped.

Appropriate Uses

Use mulch in conjunction with seeding to help protect the seedbed and stabilize the soil. Mulch can also be used as a temporary cover on low to mild slopes to help temporarily stabilize disturbed areas where growing season constraints prevent effective reseeding. Disturbed areas should be properly mulched and tacked, or seeded, mulched and tacked promptly after final grade is reached (typically within no longer than 14 days) on portions of the site not otherwise permanently stabilized.

Standard dry mulching is encouraged in most jurisdictions; however, hydromulching may not be allowed in certain jurisdictions or may not be allowed near waterways.

Do not apply mulch during windy conditions.

Design and Installation

Prior to mulching, surface-roughen areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where other methods are impractical because track walking with heavy equipment typically compacts the soil.

A variety of mulches can be used effectively at construction sites. Consider the following:

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

- Clean, weed-free and seed-free cereal grain straw should be applied evenly at a rate of 2 tons per acre and must be tacked or fastened by a method suitable for the condition of the site. Straw mulch must be anchored (and not merely placed) on the surface. This can be accomplished mechanically by crimping or with the aid of tackifiers or nets. Anchoring with a crimping implement is preferred, and is the recommended method for areas flatter than 3:1. Mechanical crimpers must be capable of tucking the long mulch fibers into the soil to a depth of 3 inches without cutting them. An agricultural disk, while not an ideal substitute, may work if the disk blades are dull or blunted and set vertically; however, the frame may have to be weighted to afford proper soil penetration.

- Grass hay may be used in place of straw; however, because hay is comprised of the entire plant including seed, mulching with hay may seed the site with non-native grass species which might in turn out-compete the native seed. Alternatively, native species of grass hay may be purchased, but can be difficult to find and are more expensive than straw. Purchasing and utilizing a certified weed-free straw is an easier and less costly mulching method. When using grass hay, follow the same guidelines as for straw (provided above).

- On small areas sheltered from the wind and heavy runoff, spraying a tackifier on the mulch is satisfactory for holding it in place. For steep slopes and special situations where greater control is needed, erosion control blankets anchored with stakes should be used instead of mulch.

- Hydraulic mulching consists of wood cellulose fibers mixed with water and a tackifying agent and should be applied at a rate of no less than 1,500 pounds per acre (1,425 lbs of fibers mixed with at least 75 lbs of tackifier) with a hydraulic mulcher. For steeper slopes, up to 2000 pounds per acre may be required for effective hydroseeding. Hydromulch typically requires up to 24 hours to dry; therefore, it should not be applied immediately prior to inclement weather. Application to roads, waterways and existing vegetation should be avoided.

- Erosion control mats, blankets, or nets are recommended to help stabilize steep slopes (generally 3:1 and steeper) and waterways. Depending on the product, these may be used alone or in conjunction with grass or straw mulch. Normally, use of these products will be restricted to relatively small areas. Biodegradable mats made of straw and jute, straw-coconut, coconut fiber, or excelsior can be used instead of mulch. (See the ECM/TRM BMP for more information.)

- Some tackifiers or binders may be used to anchor mulch. Check with the local jurisdiction for allowed tackifiers. Manufacturer's recommendations should be followed at all times. (See the Soil Binder BMP for more information on general types of tackifiers.)

- Rock can also be used as mulch. It provides protection of exposed soils to wind and water erosion and allows infiltration of precipitation. An aggregate base course can be spread on disturbed areas for temporary or permanent stabilization. The rock mulch layer should be thick enough to provide full coverage of exposed soil on the area it is applied.

Maintenance and Removal

After mulching, the bare ground surface should not be more than 10 percent exposed. Reapply mulch, as needed, to cover bare areas.

Rock Sock (RS) SC-5

Description

A rock sock is constructed of gravel that has been wrapped by wire mesh or a geotextile to form an elongated cylindrical filter. Rock socks are typically used either as a perimeter control or as part of inlet protection. When placed at angles in the curb line, rock socks are typically referred to as curb socks. Rock socks are intended to trap sediment from stormwater runoff that flows onto roadways as a result of construction activities.

Photograph RS-1. Rock socks placed at regular intervals in a curb line can help reduce sediment loading to storm sewer inlets. Rock socks can also be used as perimeter controls.

Appropriate Uses

Rock socks can be used at the perimeter of a disturbed area to control localized sediment loading. A benefit of rock socks as opposed to other perimeter controls is that they do not have to be trenched or staked into the ground; therefore, they are often used on roadway construction projects where paved surfaces are present.

Use rock socks in inlet protection applications when the construction of a roadway is substantially complete and the roadway has been directly connected to a receiving storm system.

Design and Installation

When rock socks are used as perimeter controls, the maximum recommended tributary drainage area per 100 lineal feet of rock socks is approximately 0.25 acres with disturbed slope length of up to 150 feet and a tributary slope gradient no steeper than 3:1. A rock sock design detail and notes are provided in Detail RS-1. Also see the Inlet Protection Fact Sheet for design and installation guidance when rock socks are used for inlet protection and in the curb line.

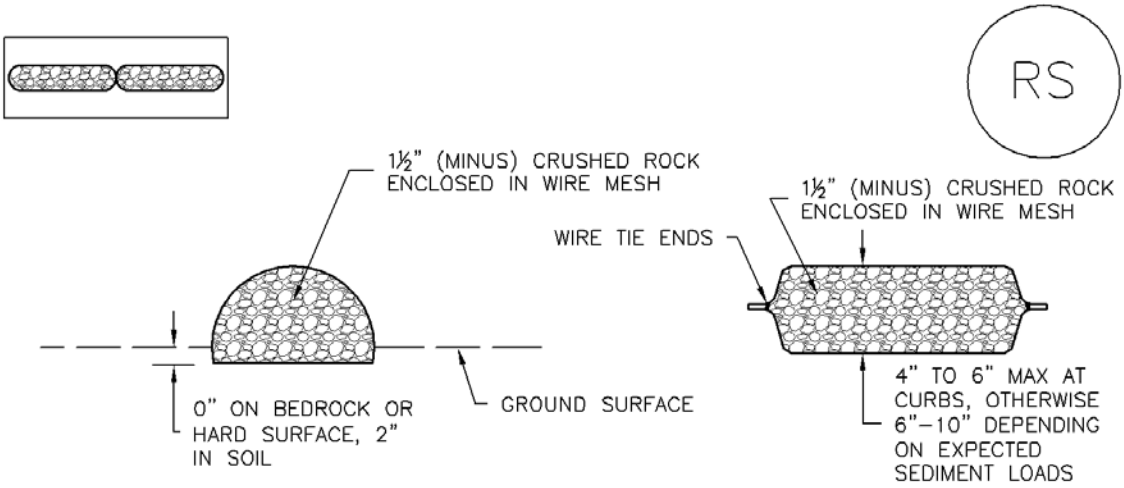
When placed in the gutter adjacent to a curb, rock socks should protrude no more than two feet from the curb in order for traffic to pass safely. If located in a high traffic area, place construction markers to alert drivers and street maintenance workers of their presence.

Maintenance and Removal

Rock socks are susceptible to displacement and breaking due to vehicle traffic. Inspect rock socks for damage and repair or replace as necessary. Remove sediment by sweeping or vacuuming as needed to maintain the functionality of the BMP, typically when sediment has accumulated behind the rock sock to one-half of the sock's height.

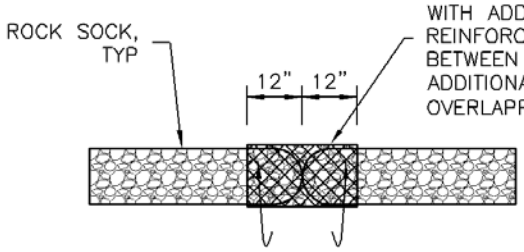
Once upstream stabilization is complete, rock socks and accumulated sediment should be removed and properly disposed.

Rock Sock	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No



ROCK SOCK SECTION

ROCK SOCK PLAN



ANY GAP AT JOINT SHALL BE FILLED WITH AN ADEQUATE AMOUNT OF 1½" (MINUS) CRUSHED ROCK AND WRAPPED WITH ADDITIONAL WIRE MESH SECURED TO ENDS OF ROCK REINFORCED SOCK. AS AN ALTERNATIVE TO FILLING JOINTS BETWEEN ADJOINING ROCK SOCKS WITH CRUSHED ROCK AND ADDITIONAL WIRE WRAPPING, ROCK SOCKS CAN BE OVERLAPPED (TYPICALLY 12–INCH OVERLAP) TO AVOID GAPS.

ROCK SOCK JOINTING

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1½"	90 – 100
1"	20 – 55
¾"	0 – 15
⅜"	0 – 5
MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.	

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF ROCK SOCKS.

2. CRUSHED ROCK SHALL BE 1½" (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1½" MINUS).

3. WIRE MESH SHALL BE FABRICATED OF 10 GAGE POULTRY MESH, OR EQUIVALENT, WITH A MAXIMUM OPENING OF ½", RECOMMENDED MINIMUM ROLL WIDTH OF 48"

4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2" CENTERS ON ENDS OF SOCKS.

5. SOME MUNICIPALITIES MAY ALLOW THE USE OF FILTER FABRIC AS AN ALTERNATIVE TO WIRE MESH FOR THE ROCK ENCLOSURE.

RS–1. ROCK SOCK PERIMETER CONTROL

ROCK SOCK 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 SOCKS SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF ROCK SOCKS 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 ROCK SOCK.

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

7. WHEN ROCK SOCKS ARE 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, 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 ROCK SOCK INSTALLATION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY OTHER SIMILAR PROPRIETARY PRODUCTS ON THE MARKET. UDFCD NEITHER NDORSES NOR DISCOURAGES USE OF PROPRIETARY PROTECTION PRODUCTS; 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.

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 compost. The most common type of sediment control log has straw filling and is often referred to as a "straw wattle." All sediment control logs 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 as if they are impermeable.

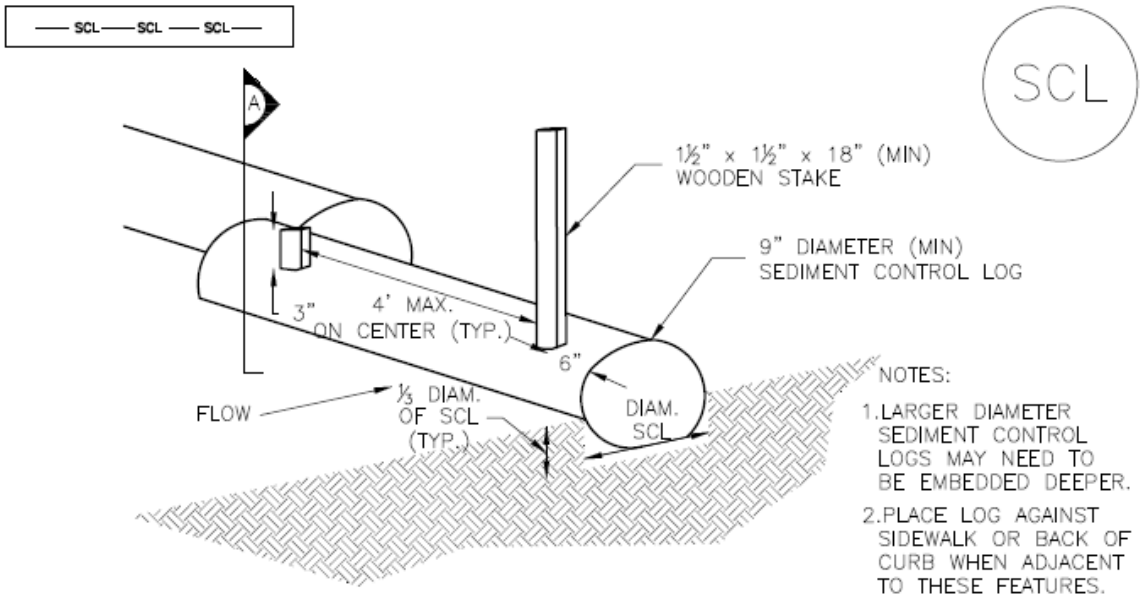
Design details and notes for sediment control logs are provided in the following details. Sediment logs must be properly installed per the detail to prevent undercutting, bypassing and displacement. When installed on slopes, sediment control logs should be installed along the contours (i.e., perpendicular to flow).

Improper installation can lead to poor performance. Be sure that sediment control logs are properly trenched (if lighter than 8 lb/foot), anchored and tightly jointed.

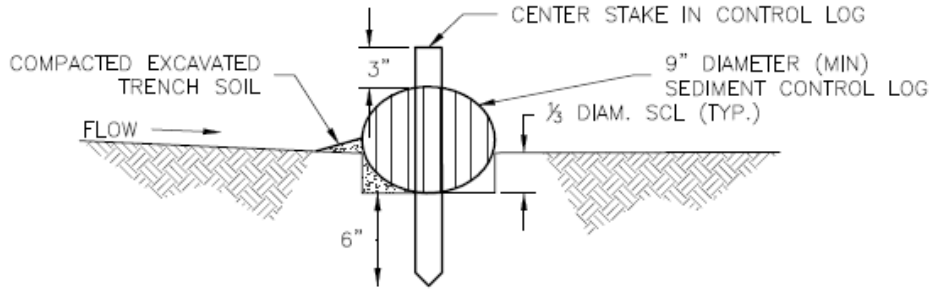
Maintenance and Removal

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.

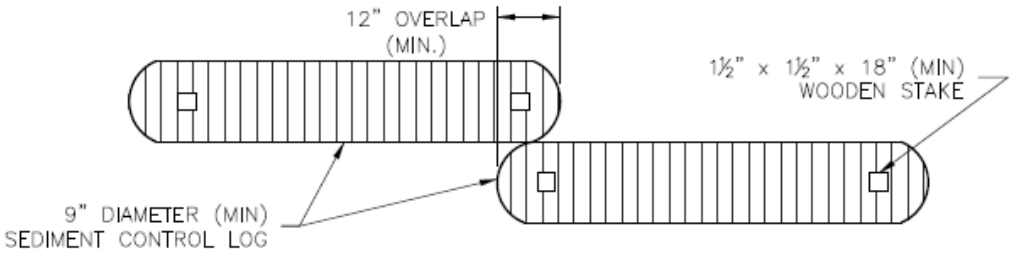
Once the upstream area is stabilized, remove and properly dispose of the logs. Areas disturbed beneath the logs may need to be seeded and mulched. Sediment control logs that are biodegradable may occasionally be left in place (e.g., when logs are used in conjunction with erosion control blankets as permanent slope breaks). However, removal of sediment control logs after final stabilization is typically appropriate when used in perimeter control, inlet protection and check dam applications. Compost from compost sediment control logs may be spread over the area and seeded as long as this does not cover newly established vegetation.



TRENCHED SEDIMENT CONTROL LOG

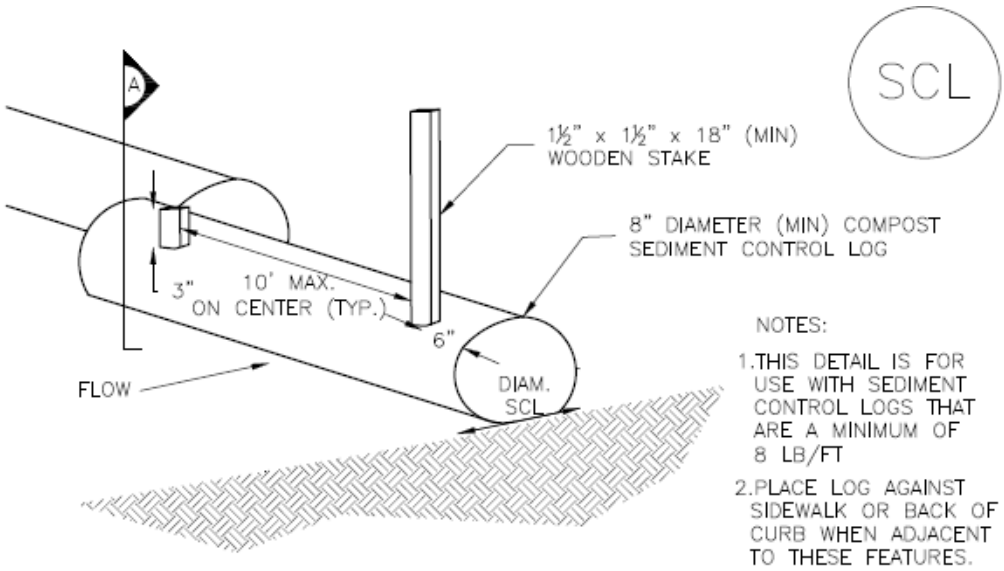


SECTION Ⓐ
TRENCHED SEDIMENT CONTROL LOG

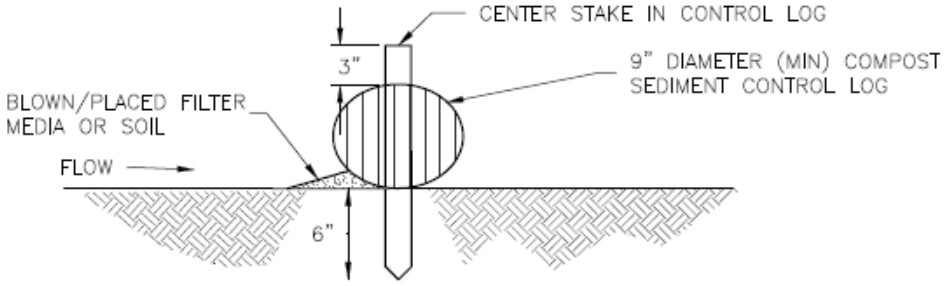


LOG JOINTS

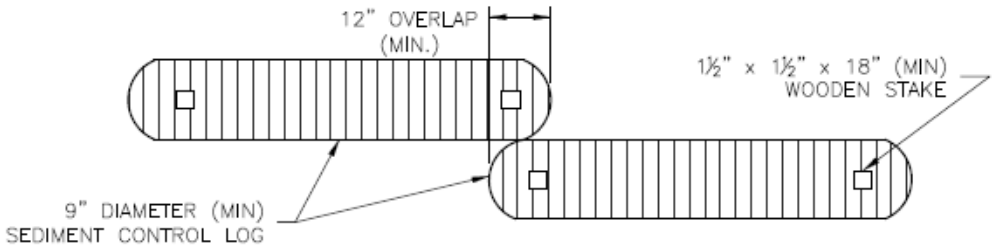
SCL–1. TRENCHED SEDIMENT CONTROL LOG



COMPOST SEDIMENT CONTROL LOG (WEIGHTED)

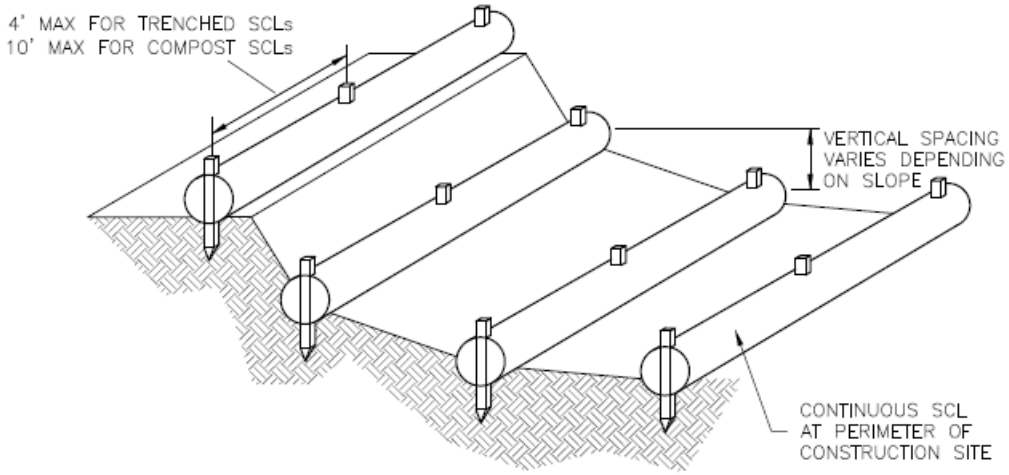


SECTION (A)
COMPOST SEDIMENT CONTROL LOG



LOG JOINTS

SCL–2. COMPOST SEDIMENT CONTROL LOG (WEIGHTED)



SCL–3. 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.

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. COMPOST LOGS THAT ARE 8 LB/FT DO NOT NEED TO BE TRENCHED.

6. THE UPHILL SIDE OF THE SEDIMENT CONTROL LOG SHALL BE BACKFILLED WITH SOIL OR FILTER MATERIAL 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 OR BLOWN IN PLACE.

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. COMPOST LOGS SHOULD BE STAKED 10' ON CENTER.

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.COMPOST FROM COMPOST LOGS MAY BE LEFT IN PLACE AS LONG AS BAGS ARE REMOVED AND THE AREA SEEDED. 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.

Street Sweeping and Vacuuming (SS) SM-7

Description

Street sweeping and vacuuming remove sediment that has been tracked onto roadways to reduce sediment transport into storm drain systems or a surface waterway.

Photograph SS-1. A street sweeper removes sediment and potential pollutants along the curb line at a construction site. Photo courtesy of Tom Gore.

Appropriate Uses

Use this practice at construction sites where vehicles may track sediment offsite onto paved roadways.

Design and Installation

Street sweeping or vacuuming should be conducted when there is noticeable sediment accumulation on roadways adjacent to the construction site. Typically, this will be concentrated at the entrance/exit to the construction site. Well-maintained stabilized construction entrances, vehicle tracking controls and tire wash facilities can help reduce the necessary frequency of street sweeping and vacuuming.

On smaller construction sites, street sweeping can be conducted manually using a shovel and broom. Never wash accumulated sediment on roadways into storm drains.

Maintenance and Removal

- Inspect paved roads around the perimeter of the construction site on a daily basis and more frequently, as needed. Remove accumulated sediment, as needed.
- Following street sweeping, check inlet protection that may have been displaced during street sweeping.
- Inspect area to be swept for materials that may be hazardous prior to beginning sweeping operations.

Street Sweeping/ Vacuuming	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	Yes

Soil Binders (SB) EC-3

Description

Soil binders include a broad range of treatments that can be applied to exposed soils for temporary stabilization to reduce wind and water erosion. Soil binders may be applied alone or as tackifiers in conjunction with mulching and seeding applications.

Acknowledgement: This BMP Fact Sheet has been adapted from the 2003 California Stormwater Quality Association (CASQA) Stormwater BMP Handbook: Construction (www.cabmphandbooks.com).

Photograph SB-1. Tackifier being applied to provide temporary soil stabilization. Photo courtesy of Douglas County.

Appropriate Uses

Soil binders can be used for short-term, temporary stabilization of soils on both mild and steep slopes. Soil binders are often used in areas where work has temporarily stopped, but is expected to resume before revegetation can become established. Binders are also useful on stockpiled soils or where temporary or permanent seeding has occurred.

Prior to selecting a soil binder, check with the state and local jurisdiction to ensure that the chemicals used in the soil binders are allowed. The water quality impacts of some types of soil binders are relatively unknown and may not be allowed due to concerns about potential environmental impacts. Soil binders must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces.

Soil binders should not be used in vehicle or pedestrian high traffic areas, due to loss in effectiveness under these conditions.

Site soil type will dictate appropriate soil binders to be used. Be aware that soil binders may not function effectively on silt or clay soils or highly compacted areas. Check manufacturer's recommendations for appropriateness with regard to soil conditions. Some binders may not be suitable for areas with existing vegetation.

Design and Installation

Properties of common soil binders used for erosion control are provided in Table SB-1. Design and installation guidance below are provided for general reference. Follow the manufacturer's instructions for application rates and procedures.

Soil Binders	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	Moderate

Table SB-1. Properties of Soil Binders for Erosion Control (Source: CASQA 2003)

Evaluation Criteria	Binder Type			
	Plant Material Based (short lived)	**Plant Material Based (long lived)**	**Polymeric Emulsion Blends**	**Cementitious-Based Binders**
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies	Varies	Varies	4,000 to 12,000 lbs/acre Typ.

Factors to consider when selecting a soil binder generally include:

- **Suitability to situation**: Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor.

- **Soil types and surface materials**: Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.

- **Frequency of application**: The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

An overview of major categories of soil binders, corresponding to the types included in Table SB-1 follows.

Plant-Material Based (Short Lived) Binders

- **Guar**: A non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lbs per 1,000 gallons. Recommended minimum application rates are provided in Table SB-2.

Table SB-2. Application Rates for Guar Soil Stabilizer

	Slope (H:V)				
	Flat	4:1	3:1	2:1	1:1
Application Rate (lb/acre)	40	45	50	60	70

- **Psyllium**: Composed of the finely ground muciloid coating of plantago seeds that is applied as a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lbs/acre, with enough water in solution to allow for a uniform slurry flow.

- **Starch**: Non-ionic, cold-water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived) Binders

- **Pitch and Rosin Emulsion**: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48 percent. The rosin should be a minimum of 26 percent of the total solids content. The soil stabilizer should be a non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

    - For clayey soil: 5 parts water to 1 part emulsion

- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

- **Acrylic Copolymers and Polymers**: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55 percent solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without inhibiting water infiltration, and should not re-emulsify when cured. The applied compound should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

- **Liquid Polymers of Methacrylates and Acrylates**: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100 percent acrylic emulsion blend of 40 percent solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

- **Copolymers of Sodium Acrylates and Acrylamides**: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient, as summarized in Table SB-3.

Table SB-3. Application Rates for Copolymers of Sodium Acrylates and Acrylamides

	Slope (H:V)		
	Flat to 5:1	5:1 to 3:1	2:2 to 1:1
Application Rate (lb/acre)	3.0-5.0	5.0-10.0	10.0-20.0

- **Polyacrylamide and Copolymer of Acrylamide**: Linear copolymer polyacrylamide is packaged as a dry flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 11 lb/1,000 gal. of water and applied at the rate of 5.0 lb/acre.

- **Hydrocolloid Polymers**: Hydrocolloid Polymers are various combinations of dry flowable polyacrylamides, copolymers, and hydrocolloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

- **Gypsum**: This formulated gypsum based product readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86 percent. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Installation

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
    - Crown or slope ground to avoid ponding.
    - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 or according to manufacturer's recommendations.
    - Apply solution under pressure. Overlap solution 6 to 12 in.
    - Allow treated area to cure for the time recommended by the manufacturer, typically at least 24 hours.
    - Apply second treatment before first treatment becomes ineffective, using 50 percent application rate.
    - In low humidity, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2.

Maintenance and Removal

Soil binders tend to break down due to natural weathering. Weathering rates depend on a variety of site-specific and product characteristics. Consult the manufacturer for recommended reapplication rates and reapply the selected soil binder as needed to maintain effectiveness.

Soil binders can fail after heavy rainfall events and may require reapplication. In particular, soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.

Areas where erosion is evident should be repaired and soil binder or other stabilization reapplied, as needed. Care should be exercised to minimize the damage to protected areas while making repairs.

Most binders biodegrade after exposure to sun, oxidation, heat and biological organisms; therefore, removal of the soil binder is not typically required.

Wind Erosion/Dust Control (DC) EC-14

Description

Wind erosion and dust control BMPs help to keep soil particles from entering the air as a result of land disturbing construction activities. These BMPs include a variety of practices generally focused on either graded disturbed areas or construction roadways. For graded areas, practices such as seeding and mulching, use of soil binders, site watering, or other practices that provide prompt surface cover should be used. For construction roadways, road watering and stabilized surfaces should be considered.

Photograph DC-1. Water truck used for dust suppression. Photo courtesy of Douglas County.

Appropriate Uses

Dust control measures should be used on any site where dust poses a problem to air quality. Dust control is important to control for the health of construction workers and surrounding waterbodies.

Design and Installation

The following construction BMPs can be used for dust control:

- An irrigation/sprinkler system can be used to wet the top layer of disturbed soil to help keep dry soil particles from becoming airborne.
- Seeding and mulching can be used to stabilize disturbed surfaces and reduce dust emissions.
- Protecting existing vegetation can help to slow wind velocities across the ground surface, thereby limiting the likelihood of soil particles to become airborne.
- Spray-on soil binders form a bond between soil particles keeping them grounded. Chemical treatments may require additional permitting requirements. Potential impacts to surrounding waterways and habitat must be considered prior to use.
- Placing rock on construction roadways and entrances will help keep dust to a minimum across the construction site.
- Wind fences can be installed on site to reduce wind speeds. Install fences perpendicular to the prevailing wind direction for maximum effectiveness.

Wind Erosion Control/ Dust Control	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	Moderate

Maintenance and Removal

When using an irrigation/sprinkler control system to aid in dust control, be careful not to overwater. Overwatering will cause construction vehicles to track mud off-site.

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.

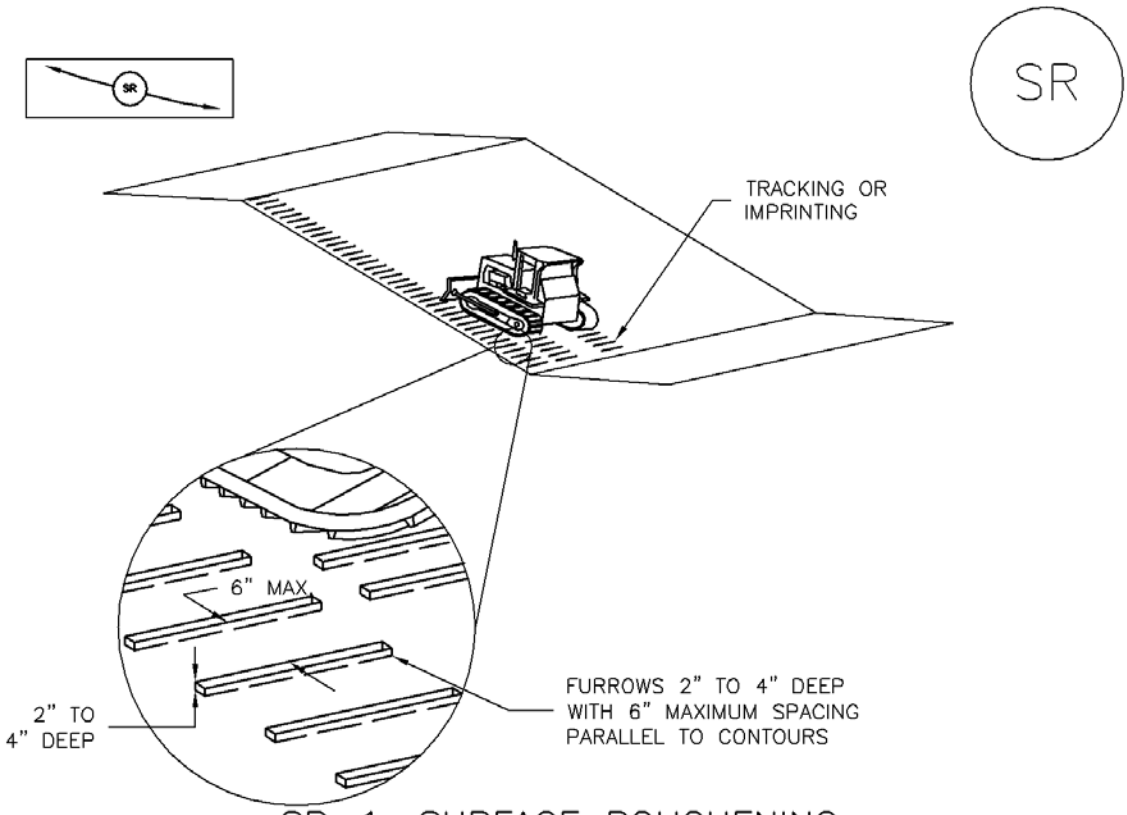
Surface Roughening	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

Maintenance and Removal

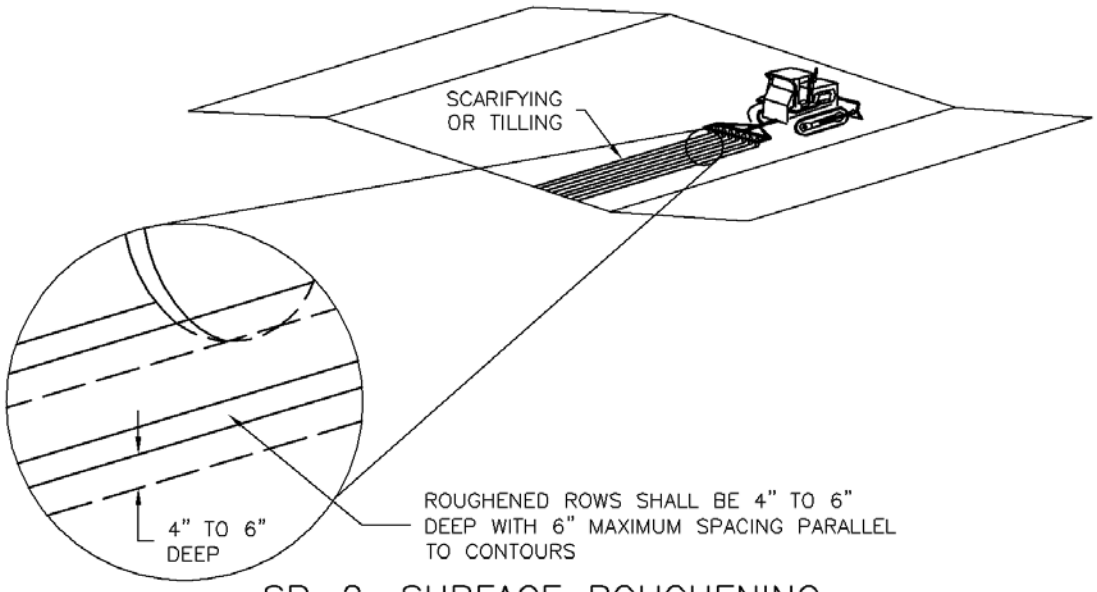
Care should be taken not to drive vehicles or equipment over areas that have been surface roughened. Tire tracks will smooth the roughened surface and may cause runoff to collect into rills and gullies.

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.

Temporary and Permanent Seeding (TS/PS) EC-2

Description

Temporary seeding can be used to stabilize disturbed areas that will be inactive for an extended period. Permanent seeding should be used to stabilize areas at final grade that will not be otherwise stabilized. Effective seeding includes preparing a seedbed, selecting an appropriate seed mixture, using proper planting techniques, and protecting the seeded area with mulch, geotextiles, or other appropriate measures.

Photograph TS/PS -1. Equipment used to drill seed. Photo courtesy of Douglas County.

Appropriate Uses

When the soil surface is disturbed and will remain inactive for an extended period (typically determined by local government requirements), proactive stabilization measures, including planting a temporary seed mix, should be implemented. If the inactive period is short-lived (on the order of two weeks), techniques such as surface roughening may be appropriate. For longer periods of inactivity of up to one year, temporary seeding and mulching can provide effective erosion control. Permanent seeding should be used on finished areas that have not been otherwise stabilized.

The USDCM Volume 2 *Revegetation* Chapter contains suggested annual grains and native seed mixes to use for temporary seeding. Alternatively, local governments may have their own seed mixes and timelines for seeding. Check jurisdictional requirements for seeding and temporary stabilization.

Design and Installation

Effective seeding requires proper seedbed preparation, selecting an appropriate seed mixture, using appropriate seeding equipment to ensure proper coverage and density, and protecting seeded areas with mulch or fabric until plants are established.

The USDCM Volume 2 *Revegetation* Chapter contains detailed seed mixes, soil preparation practices, and seeding and mulching recommendations that should be referenced to supplement this Fact Sheet.

Drill seeding is the preferred seeding method. Hydroseeding is not recommended except in areas where steep slopes prevent use of drill seeding equipment, and even in these instances it is preferable to hand seed and mulch. Some jurisdictions do not allow hydroseeding or hydromulching.

Temporary and Permanent Seeding	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

Seedbed Preparation

Prior to seeding, ensure that areas to be revegetated have soil conditions capable of supporting vegetation. Overlot grading can result in loss of topsoil and compaction, resulting in poor quality subsoils at the ground surface that

have low nutrient value, little organic matter content, few soil microorganisms, rooting restrictions, and conditions less conducive to infiltration of precipitation. As a result, it is typically necessary to provide stockpiled topsoil, compost, or other soil amendments and rototill them into the soil to a depth of 6 inches or more.

Topsoil should be salvaged during grading operations for use and spread on areas to be revegetated later. Topsoil should be viewed as an important resource to be utilized for vegetation establishment, due to its water-holding capacity, structure, texture, organic matter content, biological activity, and nutrient content. The rooting depth of most native grasses in the semi-arid Denver metropolitan area is 6 to 18 inches. If present, at a minimum of the upper 6 inches of topsoil should be stripped, stockpiled, and ultimately respread across areas that will be revegetated.

Where topsoil is not available, subsoils should be amended to provide an appropriate plant-growth medium. Organic matter, such as well digested compost, can be added to improve soil characteristics conducive to plant growth. Other treatments can be used to adjust soil pH conditions when needed. Soil testing, which is typically inexpensive, should be completed to determine and optimize the types and amounts of amendments that are required.

If the disturbed ground surface is compacted, rip or rototill the upper 12 inches of the surface prior to placing topsoil. If adding compost to the existing soil surface, rototilling is necessary. Surface roughening will assist in placing a stable topsoil layer on steeper slopes, and allow infiltration and root penetration to greater depth. Topsoil should not be placed when either the salvaged topsoil or receiving ground are frozen or snow covered.

Prior to seeding, the soil surface should be rough and the seedbed should be firm, but neither too loose nor compacted. The upper layer of soil should be in a condition suitable for seeding at the proper depth and conducive to plant growth. Seed-to-soil contact is the key to good germination.

Refer to MHFD's Topsoil Management Guidance for detailed information on topsoil assessment, design, and construction.

Temporary Vegetation

To provide temporary vegetative cover on disturbed areas which will not be paved, built upon, or fully landscaped or worked for an extended period (typically 30 days or more), plant an annual grass appropriate for the time of planting and mulch the planted areas. Temporary grain seed mixes suitable for the Denver metropolitan area are listed in Table TS/PS-1. Native temporary seed mixes are provided in USDCM Volume 2, Chapter 13, Appendix A. These are to be considered only as general recommendations when specific design guidance for a particular site is not available. Local governments typically specify seed mixes appropriate for their jurisdiction.

Permanent Revegetation

To provide vegetative cover on disturbed areas that have reached final grade, a perennial grass mix should be established. Permanent seeding should be performed promptly (typically within 14 days) after reaching final grade. Each site will have different characteristics and a landscape professional or the local jurisdiction should be contacted to determine the most suitable seed mix for a specific site. In lieu of a specific recommendation, one of the perennial grass mixes appropriate for site conditions and growth season listed in seed mix tables in the USDCM Volume 2 *Revegetation* Chapter can be used. The pure live seed (PLS) rates of application recommended in these tables are considered to be absolute minimum rates for seed applied using proper drill-seeding equipment. These are to be considered only as general

recommendations when specific design guidance for a particular site is not available. Local governments typically specify seed mixes appropriate for their jurisdiction.

If desired for wildlife habitat or landscape diversity, shrubs such as rubber rabbitbrush (*Chrysothamnus nauseosus*), fourwing saltbush (*Atriplex canescens*) and skunkbrush sumac (*Rhus trilobata*) could be added to the upland seed mixes at 0.25, 0.5 and 1 pound PLS/acre, respectively. In riparian zones, planting root stock of such species as American plum (*Prunus americana*), woods rose (*Rosa woodsii*), plains cottonwood (*Populus sargentii*), and willow (*Salix spp.*) may be considered. On non-topsoiled upland sites, a legume such as Ladak alfalfa at 1 pound PLS/acre can be included as a source of nitrogen for perennial grasses.

Timing of seeding is an important aspect of the revegetation process. For upland and riparian areas on the Colorado Front Range, the suitable timing for seeding is from October through May. The most favorable time to plant non-irrigated areas is during the fall, so that seed can take advantage of winter and spring moisture. Seed should not be planted if the soil is frozen, snow covered, or wet.

Seeding dates for the highest success probability of perennial species along the Front Range are generally in the spring from April through early May and in the fall after the first of September until the ground freezes. If the area is irrigated, seeding may occur in summer months, as well. See Table TS/PS-2 for appropriate seeding dates.

Table TS/PS-1. Minimum Drill Seeding Rates for Various Temporary Annual Grasses

Species[a] (Common name)	Growth Season[b]	Pounds of Pure Live Seed (PLS)/acre[c]	Planting Depth (inches)
1. Oats	Cool	35 - 50	1 - 2
2. Spring wheat	Cool	25 - 35	1 - 2
3. Spring barley	Cool	25 - 35	1 - 2
4. Annual ryegrass	Cool	10 - 15	½
5. Millet	Warm	3 - 15	½ - ¾
6. Winter wheat	Cool	20–35	1 - 2
7. Winter barley	Cool	20–35	1 - 2
8. Winter rye	Cool	20–35	1 - 2
9. Triticale	Cool	25–40	1 - 2

[a] Successful seeding of annual grass resulting in adequate plant growth will usually produce enough dead-plant residue to provide protection from wind and water erosion for an additional year. This assumes that the cover is not disturbed or mowed closer than 8 inches.

Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1 or where access limitations exist. When hydraulic seeding is used, hydraulic mulching should be applied as a separate operation, when practical, to prevent the seeds from being encapsulated in the mulch.

[b] See Table TS/PS-2 for seeding dates. Irrigation, if consistently applied, may extend the use of cool season species during the summer months.

[c] Seeding rates should be doubled if seed is broadcast, or increased by 50 percent if done using a Brillion Drill or by hydraulic seeding.

Table TS/PS-2. Seeding Dates for Annual and Perennial Grasses

	Annual Grasses (Numbers in table reference species in Table TS/PS-1)		Perennial Grasses	
Seeding Dates	**Warm**	**Cool**	**Warm**	**Cool**
January 1–March 15			✓	✓
March 16–April 30		1,2,3	✓	✓
May 1–May 15			✓	
May 16–June 30	5			
July 1–July 15	5			
July 16–August 31				
September 1–September 30		6, 7, 8, 9		
October 1–December 31			✓	✓

Mulch

Cover seeded areas with mulch or an appropriate rolled erosion control product to promote establishment of vegetation. Anchor mulch by crimping, netting or use of a non-toxic tackifier. See the USDCM Volume 2 *Revegetation* Chapter and Volume 3 Mulching BMP Fact Sheet (EC-04) for additional guidance.

Maintenance and Removal

Monitor and observe seeded areas to identify areas of poor growth or areas that fail to germinate. Reseed and mulch these areas, as needed.

If a temporary annual seed was planted, the area should be reseeded with the desired perennial mix when there will be no further work in the area. To minimize competition between annual and perennial species, the annual mix needs time to mature and die before seeding the perennial mix. To increase success of the perennial mix, it should be seeded during the appropriate seeding dates the second year after the temporary annual mix was seeded. Alternatively, if this timeline is not feasible, the annual mix seed heads should be removed and then the area seeded with the perennial mix.

An area that has been permanently seeded should have a good stand of vegetation within one growing season if irrigated and within three growing seasons without irrigation in Colorado. Reseed portions of the site that fail to germinate or remain bare after the first growing season.

Seeded areas may require irrigation, particularly during extended dry periods. Targeted weed control may also be necessary.

Protect seeded areas from construction equipment and vehicle access.

Stockpile Management (SP) MM-2

Description

Stockpile management includes measures to minimize erosion and sediment transport from soil stockpiles.

Appropriate Uses

Stockpile management should be used when soils or other erodible materials are stored at the construction site. Special attention should be given to stockpiles in close proximity to natural or manmade storm systems.

Photograph SP-1. A topsoil stockpile that has been partially revegetated and is protected by silt fence perimeter control.

Design and Installation

Locate stockpiles away from all drainage system components including storm sewer inlets. Where practical, choose stockpile locations that that will remain undisturbed for the longest period of time as the phases of construction progress. Place sediment control BMPs around the perimeter of the stockpile, such as sediment control logs, rock socks, silt fence, straw bales and sand bags. See Detail SP-1 for guidance on proper establishment of perimeter controls around a stockpile. For stockpiles in active use, provide a stabilized designated access point on the upgradient side of the stockpile.

Stabilize the stockpile surface with surface roughening, temporary seeding and mulching, erosion control blankets, or soil binders. Soils stockpiled for an extended period (typically for more than 60 days) should be seeded and mulched with a temporary grass cover once the stockpile is placed (typically within 14 days). Use of mulch only or a soil binder is acceptable if the stockpile will be in place for a more limited time period (typically 30-60 days). Timeframes for stabilization of stockpiles noted in this fact sheet are "typical" guidelines. Check permit requirements for specific federal, state, and/or local requirements that may be more prescriptive.

Stockpiles should not be placed in streets or paved areas unless no other practical alternative exists. See the Stabilized Staging Area Fact Sheet for guidance when staging in roadways is unavoidable due to space or right-of-way constraints. For paved areas, rock socks must be used for perimeter control and all inlets with the potential to receive sediment from the stockpile (even from vehicle tracking) must be protected.

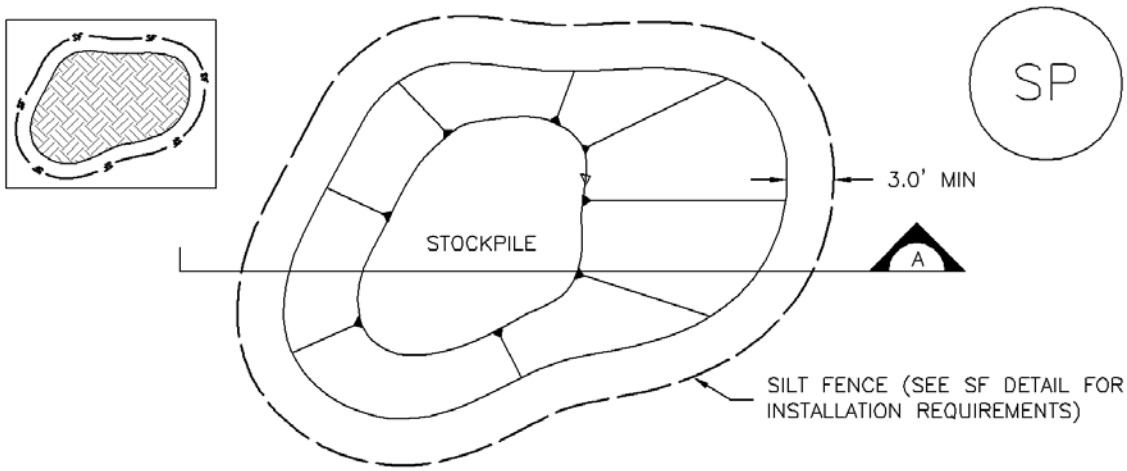
Maintenance and Removal

Inspect perimeter controls and inlet protection in accordance with their respective BMP Fact Sheets. Where seeding, mulch and/or soil binders are used, reseeding or reapplication of soil binder may be necessary.

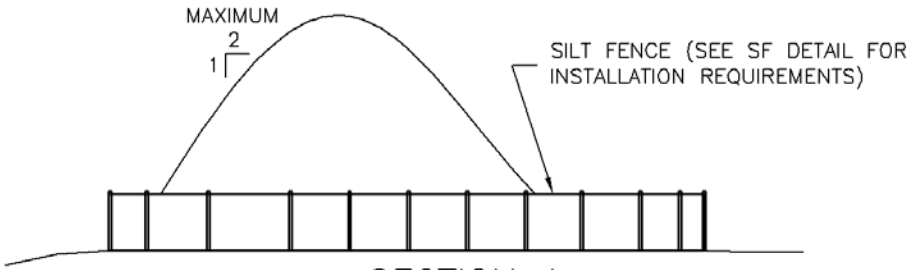
When temporary removal of a perimeter BMP is necessary to access a stockpile, ensure BMPs are reinstalled in accordance with their respective design detail section.

Stockpile Management	
Functions	
Erosion Control	Yes
Sediment Control	Yes
Site/Material Management	Yes

When the stockpile is no longer needed, properly dispose of excess materials and revegetate or otherwise stabilize the ground surface where the stockpile was located.



STOCKPILE PROTECTION PLAN



SECTION A

SP–1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF STOCKPILES.
   –TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30–60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

STOCKPILE 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.

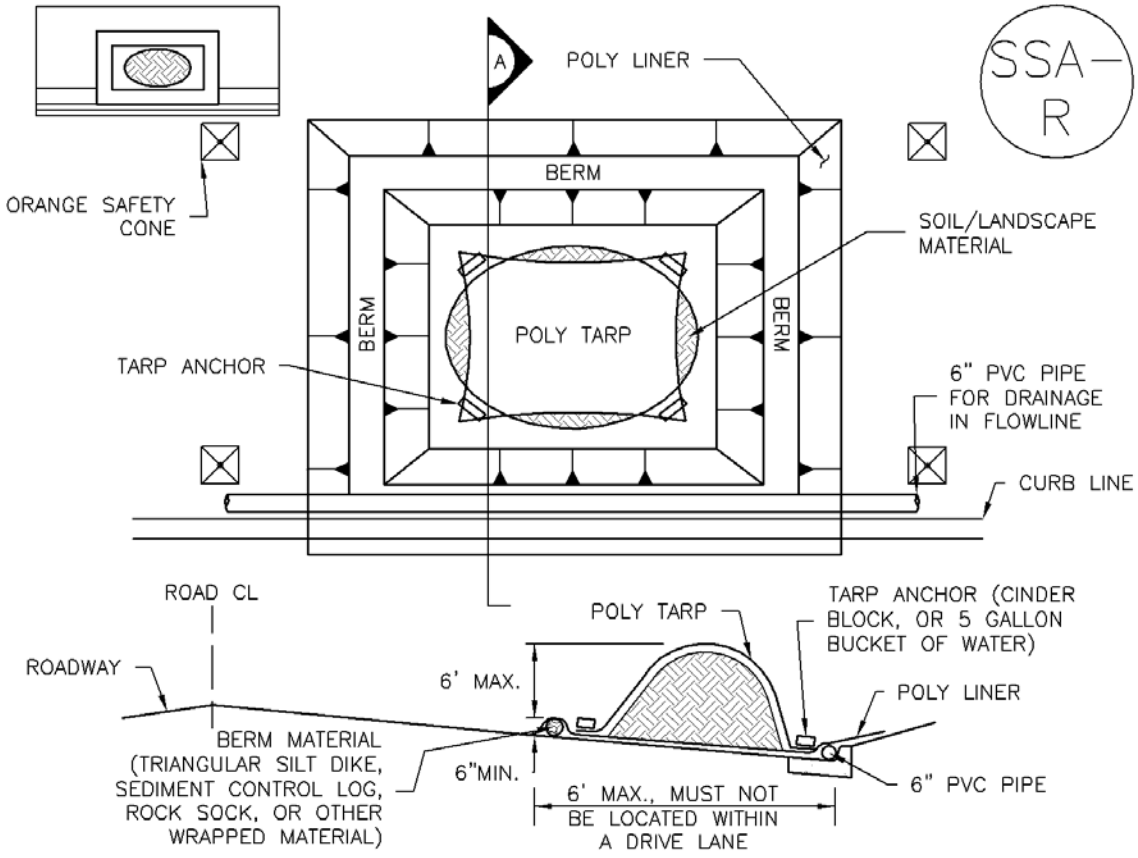
STOCKPILE PROTECTION MAINTENANCE NOTES

4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

(DETAILS ADAPTED FROM 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.



SP–2. MATERIALS STAGING IN ROADWAY

MATERIALS STAGING IN ROADWAYS INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF MATERIAL STAGING AREA(S).
   –CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. FEATURE MUST BE INSTALLED PRIOR TO EXCAVATION, EARTHWORK OR DELIVERY OF MATERIALS.

3. MATERIALS MUST BE STATIONED ON THE POLY LINER. ANY INCIDENTAL MATERIALS DEPOSITED ON PAVED SECTION OR ALONG CURB LINE MUST BE CLEANED UP PROMPTLY.

4. POLY LINER AND TARP COVER SHOULD BE OF SIGNIFICANT THICKNESS TO PREVENT DAMAGE OR LOSS OF INTEGRITY.

5. SAND BAGS MAY BE SUBSTITUTED TO ANCHOR THE COVER TARP OR PROVIDE BERMING UNDER THE BASE LINER.

6. FEATURE IS NOT INTENDED FOR USE WITH WET MATERIAL THAT WILL BE DRAINING AND/OR SPREADING OUT ON THE POLY LINER OR FOR DEMOLITION MATERIALS.

7. THIS FEATURE CAN BE USED FOR:
   –UTILITY REPAIRS.
   –WHEN OTHER STAGING LOCATIONS AND OPTIONS ARE LIMITED.
   –OTHER LIMITED APPLICATION AND SHORT DURATION STAGING.

MATERIALS STAGING IN ROADWAY 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.

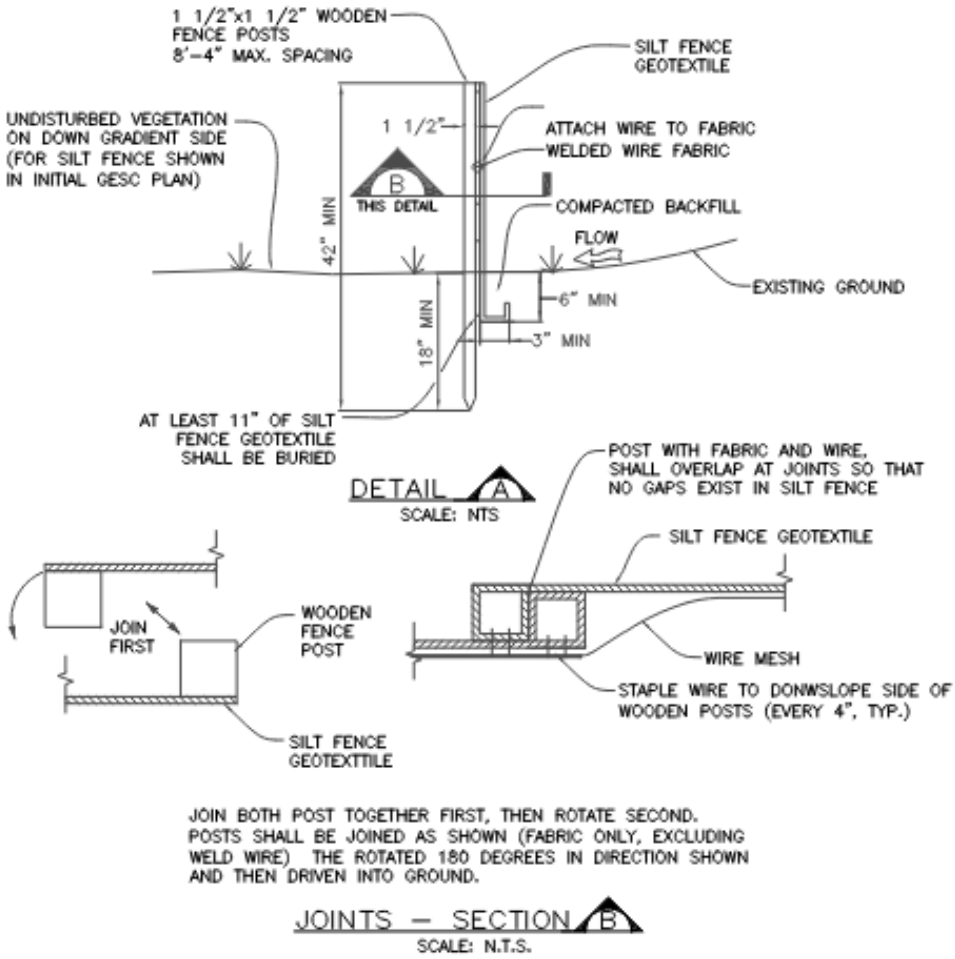
4. INSPECT PVC PIPE ALONG CURB LINE FOR CLOGGING AND DEBRIS. REMOVE OBSTRUCTIONS PROMPTLY.

5. CLEAN MATERIAL FROM PAVED SURFACES BY SWEEPING OR VACUUMING.

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 AURORA, COLORADO)

REINFORCED SILT FENCE



INSTALLATION NOTES:

1. SEE PLAN VIEW FOR:
   - LOCATION AND LENGTH OF FENCE.

2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.

3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - 6 TO 12 GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   - SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITES.

MAINTENANCE/ REMOVAL NOTES:

1. THE SWMP MANAGER SHALL INSPECT AS NECESSARY TO ENSURE THE ADEQUACY AND FUNCTIONALITY OF THE CONTROL MEASURE (CM).

2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES 25%.

3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.

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.

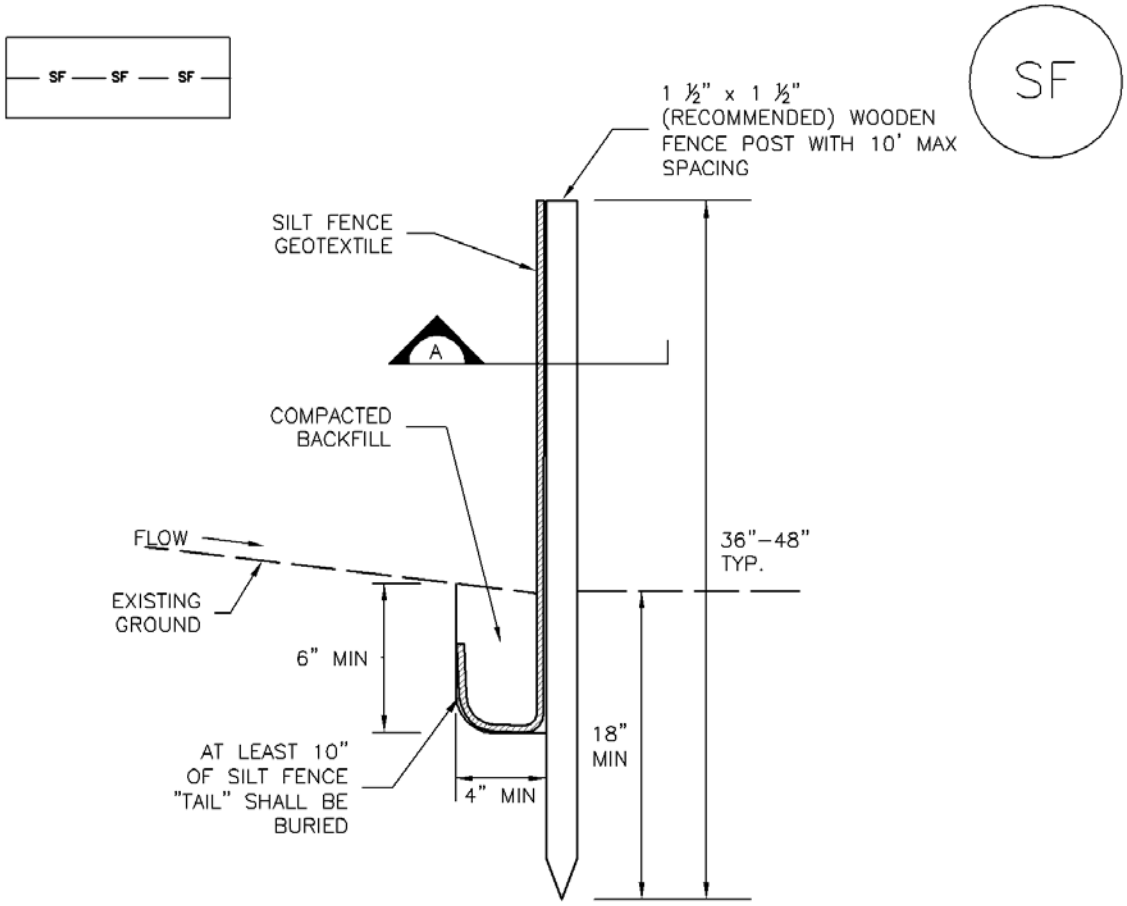
Silt Fence	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

Maintenance and Removal

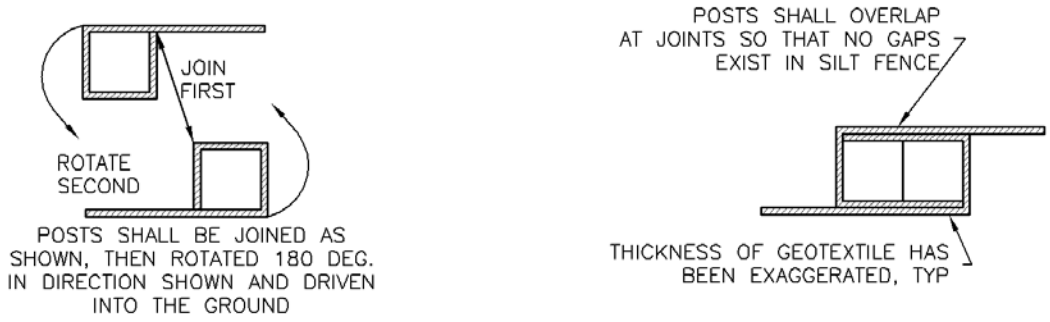
Inspection of silt fence includes observing the material for tears or holes and checking for slumping fence and undercut areas bypassing flows. Repair of silt fence typically involves replacing the damaged section with a new section. Sediment accumulated behind silt fence should be removed, as needed 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.

Sediment Basin (SB) SC-7

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.

Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume**: Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent "clean" runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft^3/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft^3/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.

- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.

- **Dam Embankment**: It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

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

- **Inflow Structure**: For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft^3) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works**: The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:

  - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.

  - **Orifice Plate or Riser Pipe**: Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.

  - **Floating Skimmer**: If a floating skimmer is used, install it using manufacturer's recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

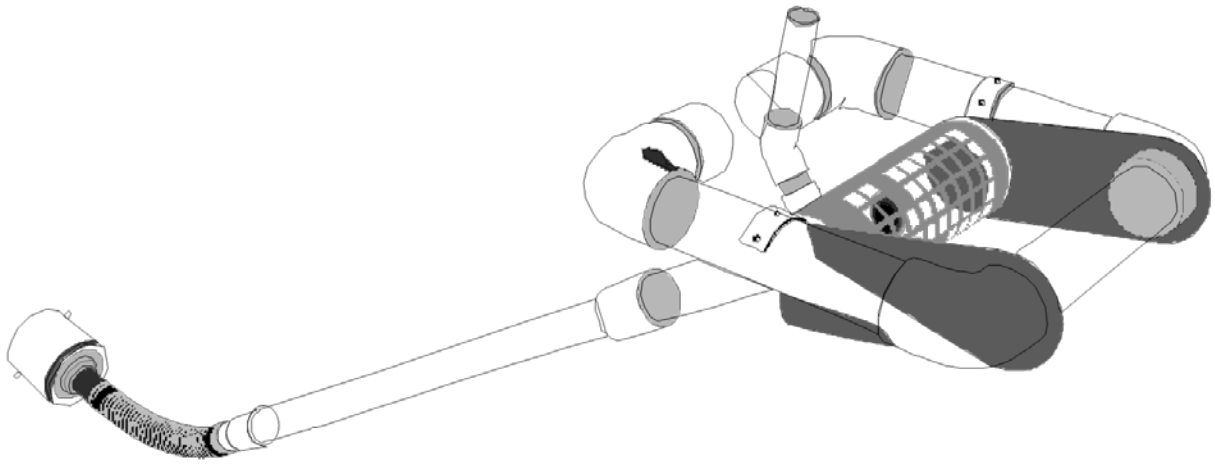


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
  - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
  - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.

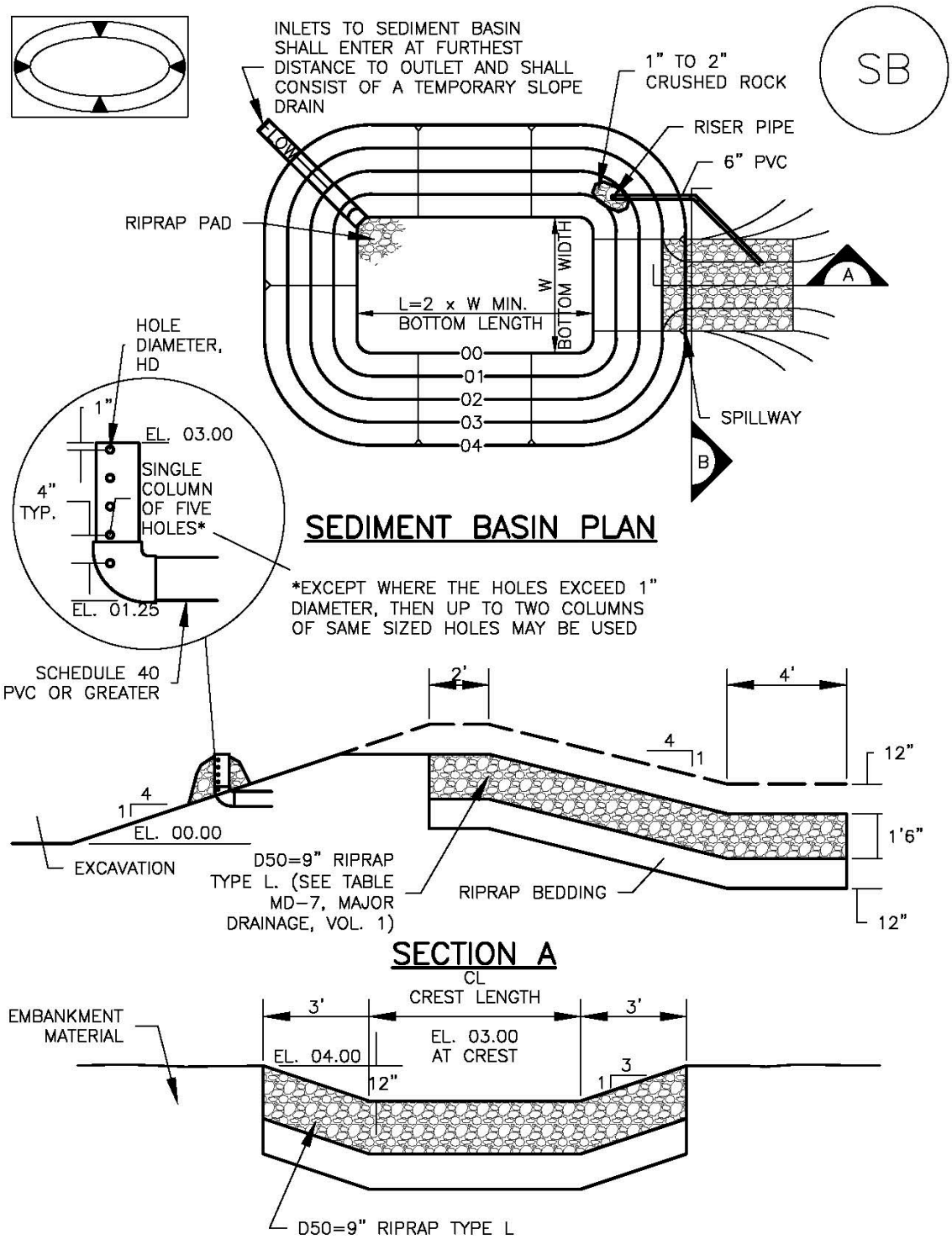

SB
INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF A TEMPORARY SLOPE DRAIN
FLOW
1" TO 2" CRUSHED ROCK
RISER PIPE
6" PVC
RIPRAP PAD
W BOTTOM WIDTH
L=2 x W MIN. BOTTOM LENGTH
00
01
02
03
04
A
B
SPILLWAY
HOLE DIAMETER, HD
1"
EL. 03.00
4" TYP.
SINGLE COLUMN OF FIVE HOLES*
EL. 01.25
SCHEDULE 40 PVC OR GREATER
SEDIMENT BASIN PLAN
*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED
2'
4'
4
1
12"
4
1
EL. 00.00
1'6"
EXCAVATION
D50=9" RIPRAP TYPE L. (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1)
RIPRAP BEDDING
12"
SECTION A
CL
CREST LENGTH
3'
3'
EMBANKMENT MATERIAL
EL. 04.00
EL. 03.00 AT CREST
12"
3
1
D50=9" RIPRAP TYPE L

TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/16
5	38 ½	8	21/32
6	43	9	21/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	7/8
10	58 ¼	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 1/8
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF SEDIMENT BASIN.
   - –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN 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 IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

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

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

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.

Vegetated Buffers (VB) SC-9

Description

Buffer strips of preserved natural vegetation or grass help protect waterways and wetlands from land disturbing activities. Vegetated buffers improve stormwater runoff quality by straining sediment, promoting infiltration, and slowing runoff velocities.

Photograph VB-1. A vegetated buffer is maintained between the area of active construction and the drainage swale. Photo courtesy of WWE.

Appropriate Uses

Vegetated buffers can be used to separate land disturbing activities and natural surface waters or conveyances. In many jurisdictions, local governments require some type of setback from natural waterways. Concentrated flow should not be directed through a buffer; instead, runoff should be in the form of sheet flow. Vegetated buffers are typically used in combination with other perimeter control BMPs such as sediment control logs or silt fence for multi-layered protection.

Design and Installation

Minimum buffer widths may vary based on local regulations. Clearly delineate the boundary of the natural buffer area using construction fencing, silt fence, or a comparable technique. In areas that have been cleared and graded, vegetated buffers such as sod can also be installed to create or restore a vegetated buffer around the perimeter of the site.

Maintenance and Removal

Inspect buffer areas for signs of erosion such as gullies or rills. Stabilize eroding areas, as needed. If erosion is due to concentrated flow conditions, it may be necessary to install a level spreader or other technique to restore sheet flow conditions. Inspect perimeter controls delineating the vegetative buffer and repair or replace as needed.

Vegetated Buffers	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	Yes

GENERAL INFORMATION

The FODS Composite trackout control system is designed to be used as a temporary construction entrance which provides site access while minimizing sediment leaving the site. The top surface of the FODS mat is a geometric pattern formed in the shape of pyramids. The mats are unidirectional and are meant to have the staggered pyramids in the direction of travel. Individual mats are connected together with hardware to form various configurations to fit your jobsite.

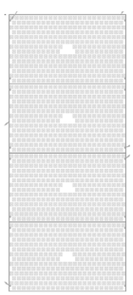
- Mat Size: 12'(w) x 7' (l) x 3 3/4" (t) (2 7/8" pyramid height)
- Mat Weight: 430lbs
- Pallet Size: 8-Mats
- Truck-Load: 96-Mats
- Hardware boxes are contained within the palletized mats

FEATURES & BENEFITS

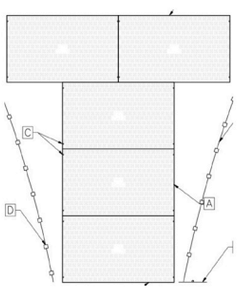
- Re-Usable
- Increased Effectiveness at Reducing Site Trackout
- U/V Stable
- Highly Visible
- Easy to Clean
- Economical
- Recyclable / Reduces Waste
- Extreme Durability
- Rapid Installation & Removal
- Excavation not required
- Chemical Resistant
- Rock-less
- Reduces Waste
- Easy and efficient to transport from site-site

TYPICAL INSTALLATION LAYOUTS

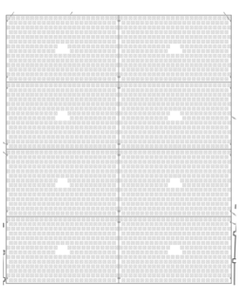
Each site must be evaluated to determine the proper layout, width, and duration of the FODS Trackout Control System (FTCS) based site conditions, entry and exit egress, traffic levels, site soil conditions, and ability to the maintain trackout system. Outlined below are a number of common layouts, the mats are unidirectional and due to the versatility of the mats design the FTCS can be engineered to fit the needs of any site:



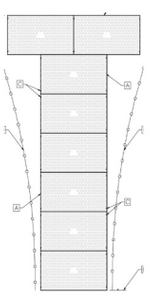
FODS 1x4



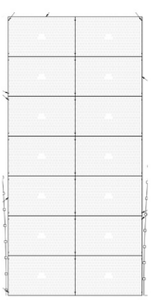
FODS 1x4T



FODS 2x4



FODS 1x7T



FODS 2x7

FODS Trackout Control Mat - Technical Data Sheet

COMMON USERS

- Heavy Civil Construction
- Urban Construction / Urban In-Fill
- Bridge & Highway Projects
- Residential Construction
- Land Development
- Forestry
- Energy Exploration
- Oil & Gas Pipeline
- Electrical Power-line
- Temporary Event Access
- Landfill & Waste Management
- Mining

SUITABLE INSTALLATION SUBSTRATE

- Un-Excavated Soil
- Excavated Soil (Min CBR: 4)
- Asphalt
- Concrete

FODS Trackout Control System should be installed near the site exit point, as close to the location where vehicles enter the roadway as is safely as possible. FODS mats should not be installed at a low point on the site where water will pool.

FODS ANCHORING SYSTEMS

- Form-Stakes (18" or 24")
- Cable Earth Anchor
- All-Thread Earth Anchor
- Concrete Sleeve Anchor (asphalt)

CLEANING / MAINTENANCE

Mats should be cleaned once 2.5" of sediment has built up in the lane of travel.

- Skid-steer broom attachment
- FODS Shovel
- Street Sweeper (requires adjusted bristle head
- Pressure Washer (must have ability to contain water)
- Water Truck (must have ability to contain water)

WARNINGS

- Caution is to be used when crossing mats with metal tracked equipment.
- Equipment with aggressive metal tracks should not cross mats
- Do not drag metal equipment across mats
- Do not use mats for bridging

******Before using earth anchors, call 811 for locates to mark underground utilities******

811 Know what's **below.** **Call** before you dig.

Protection of Existing Vegetation (PV) SM-2

Description

Protection of existing vegetation on a construction site can be accomplished through installation of a construction fence around the area requiring protection. In cases where upgradient areas are disturbed, it may also be necessary to install perimeter controls to minimize sediment loading to sensitive areas such as wetlands. Existing vegetation may be designated for protection to maintain a stable surface cover as part of construction phasing, or vegetation may be protected in areas designated to remain in natural condition under post-development conditions (e.g., wetlands, mature trees, riparian areas, open space).

Photograph PV-1. Protection of existing vegetation and a sensitive area. Photo courtesy of CDOT.

Appropriate Uses

Existing vegetation should be preserved for the maximum practical duration on a construction site through the use of effective construction phasing. Preserving vegetation helps to minimize erosion and can reduce revegetation costs following construction.

Protection of wetland areas is required under the Clean Water Act, unless a permit has been obtained from the U.S. Army Corps of Engineers (USACE) allowing impacts in limited areas.

If trees are to be protected as part of post-development landscaping, care must be taken to avoid several types of damage, some of which may not be apparent at the time of injury. Potential sources of injury include soil compaction during grading or due to construction traffic, direct equipment-related injury such as bark removal, branch breakage, surface grading and trenching, and soil cut and fill. In order to minimize injuries that may lead to immediate or later death of the tree, tree protection zones should be developed during site design, implemented at the beginning of a construction project, as well as continued during active construction.

Design and Installation

General

Once an area has been designated as a preservation area, there should be no construction activity allowed within a set distance of the area. Clearly mark the area with construction fencing. Do not allow stockpiles, equipment, trailers or parking within the protected area. Guidelines to protect various types of existing vegetation follow.

Protection of Existing Vegetation	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	Yes

Surface Cover During Phased Construction

Install construction fencing or other perimeter controls around areas to be protected from clearing and grading as part of construction phasing.

Maintaining surface cover on steep slopes for the maximum practical duration during construction is recommended.

Open Space Preservation

Where natural open space areas will be preserved as part of a development, it is important to install construction fencing around these areas to protect them from compaction. This is particularly important when areas with soils with high infiltration rates are preserved as part of LID designs. Preserved open space areas should not be used for staging and equipment storage.

Wetlands and Riparian Areas

Install a construction fence around the perimeter of the wetland or riparian (streamside vegetation) area to prevent access by equipment. In areas downgradient of disturbed areas, install a perimeter control such as silt fence, sediment control logs, or similar measure to minimize sediment loading to the wetland.

Tree Protection[1]

- Before beginning construction operations, establish a tree protection zone around trees to be preserved by installing construction fences. Allow enough space from the trunk to protect the root zone from soil compaction and mechanical damage, and the branches from mechanical damage (see Table PV-1). If low branches will be kept, place the fence outside of the drip line. Where this is not possible, place fencing as far away from the trunk as possible. In order to maintain a healthy tree, be aware that about 60 percent of the tree's root zone extends beyond the drip line.

Table PV-1
Guidelines for Determining the Tree Protection Zone
(Source: Matheny and Clark, 1998; as cited in GreenCO and WWE 2008)

	Distance from Trunk (ft) per inch of DBH		
Species Tolerance to Damage	*Young*	*Mature*	*Over mature*
Good	0.5'	0.75'	1.0'
Moderate	0.75'	1.0'	1.25'
Poor	1.0'	1.25'	1.5'
Notes: DBH = diameter at breast height (4.5 ft above grade); Young = <20% of life expectancy; Mature = 20%-80% of life expectancy; Over mature =>80% of life expectancy			

- Most tree roots grow within the top 12 to 18 inches of soil. Grade changes within the tree protection zone should be avoided where possible because seemingly minor grade changes can either smother

[1] Tree Protection guidelines adapted from GreenCO and WWE (2008). *Green Industry Best Management Practices (BMPs) for the Conservation and Protection of Water Resources in Colorado: Moving Toward Sustainability, Third Release.* See www.greenco.org for more detailed guidance on tree preservation.

roots (in fill situations) or damage roots (in cut situations). Consider small walls where needed to avoid grade changes in the tree protection zone.

- Place and maintain a layer of mulch 4 to 6-inch thick from the tree trunk to the fencing, keeping a 6-inch space between the mulch and the trunk. Mulch helps to preserve moisture and decrease soil compaction if construction traffic is unavoidable. When planting operations are completed, the mulch may be reused throughout planting areas.

- Limit access, if needed at all, and appoint one route as the main entrance and exit to the tree protection zone. Within the tree protection zone, do not allow any equipment to be stored, chemicals to be dumped, or construction activities to take place except fine grading, irrigation system installation, and planting operations. These activities should be conducted in consultation with a landscaping professional, following Green Industry BMPs.

- Be aware that soil compaction can cause extreme damage to tree health that may appear gradually over a period of years. Soil compaction is easier to prevent than repair.

Maintenance and Removal

Repair or replace damaged or displaced fencing or other protective barriers around the vegetated area.

If damage occurs to a tree, consult an arborist for guidance on how to care for the tree. If a tree in a designated preservation area is damaged beyond repair, remove and replace with a 2-inch diameter tree of the same or similar species.

Construction equipment must not enter a wetland area, except as permitted by the U.S. Army Corps of Engineers (USACE). Inadvertent placement of fill in a wetland is a 404 permit violation and will require notification of the USACE.

If damage to vegetation occurs in a protected area, reseed the area with the same or similar species, following the recommendations in the USDCM *Revegetation* chapter.

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.

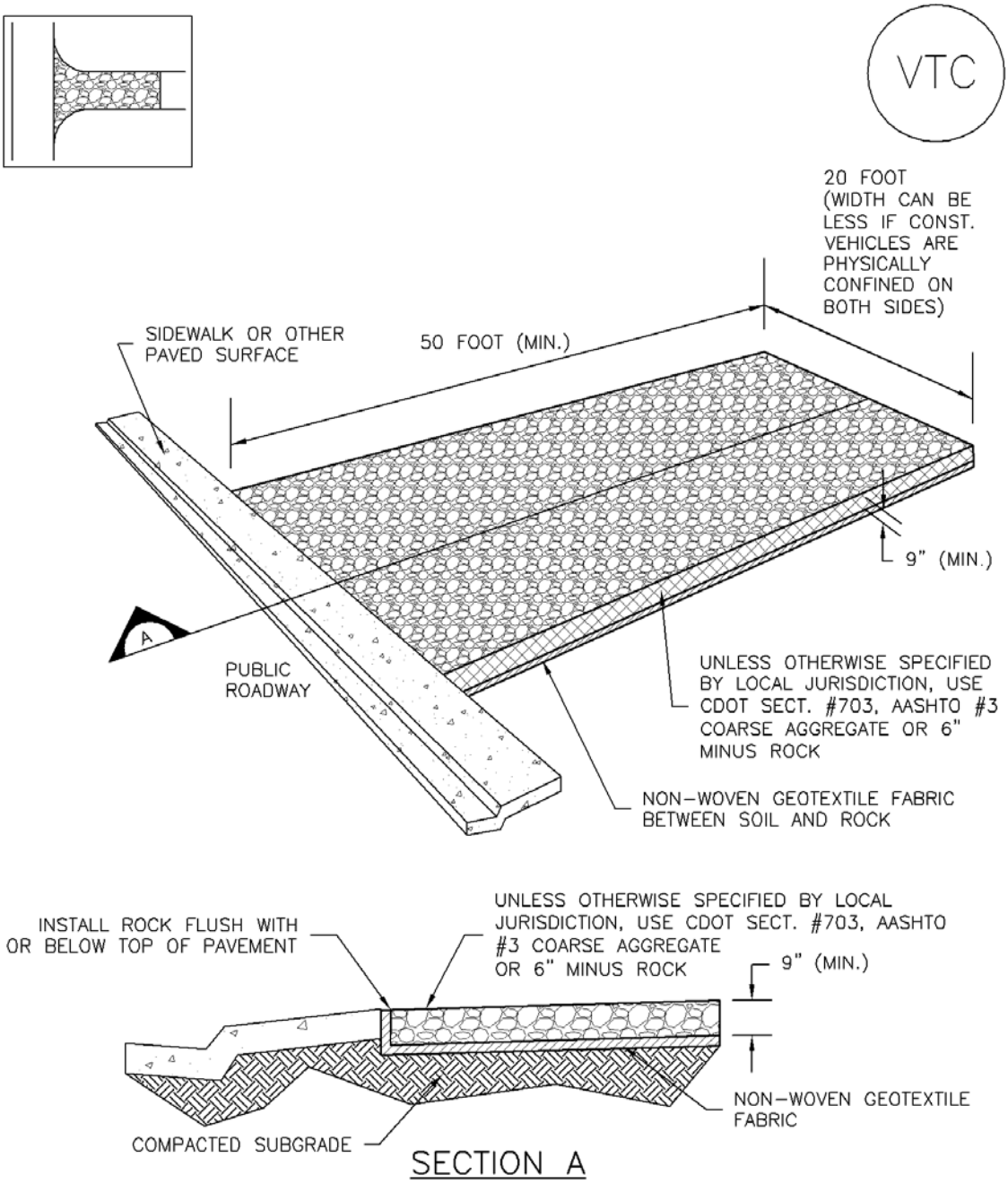
Ensure that drainage ditches at the entrance/exit area remain clear.

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

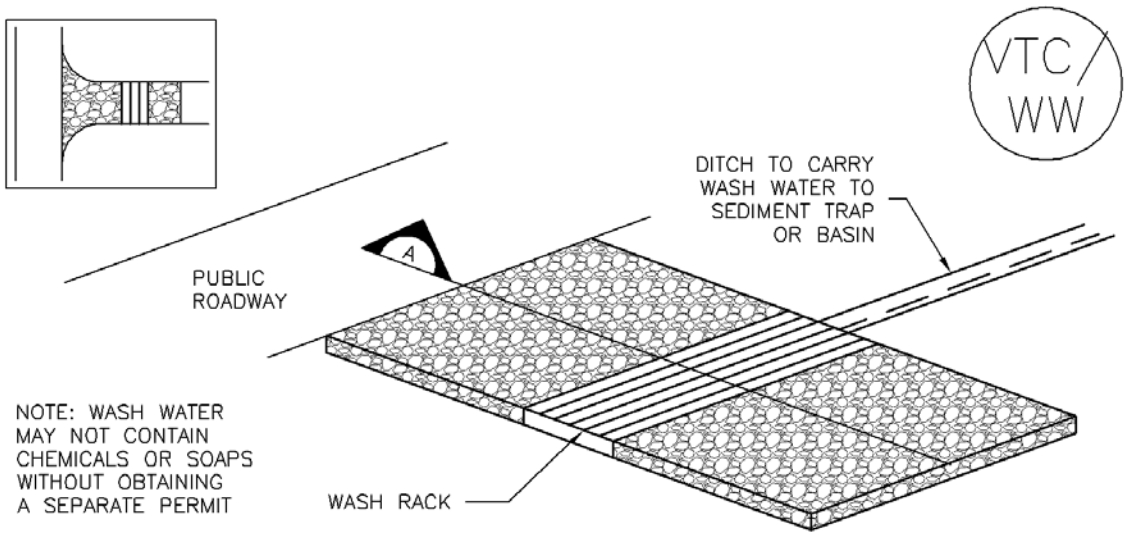
A stabilized entrance should be removed only when there is no longer the potential for vehicle tracking to occur. This is typically after the site has been stabilized.

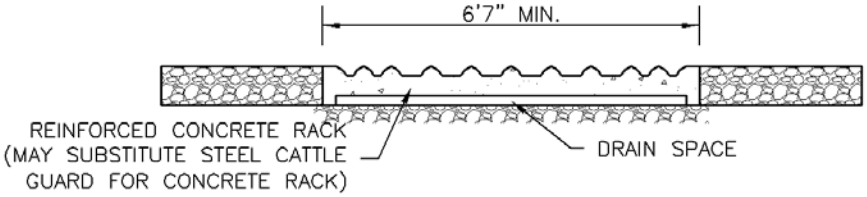
When wheel wash equipment is used, be sure that the wash water is discharged to a sediment trap prior to discharge. Also inspect channels conveying the water from the wash area to the sediment trap and stabilize areas that may be eroding.

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.



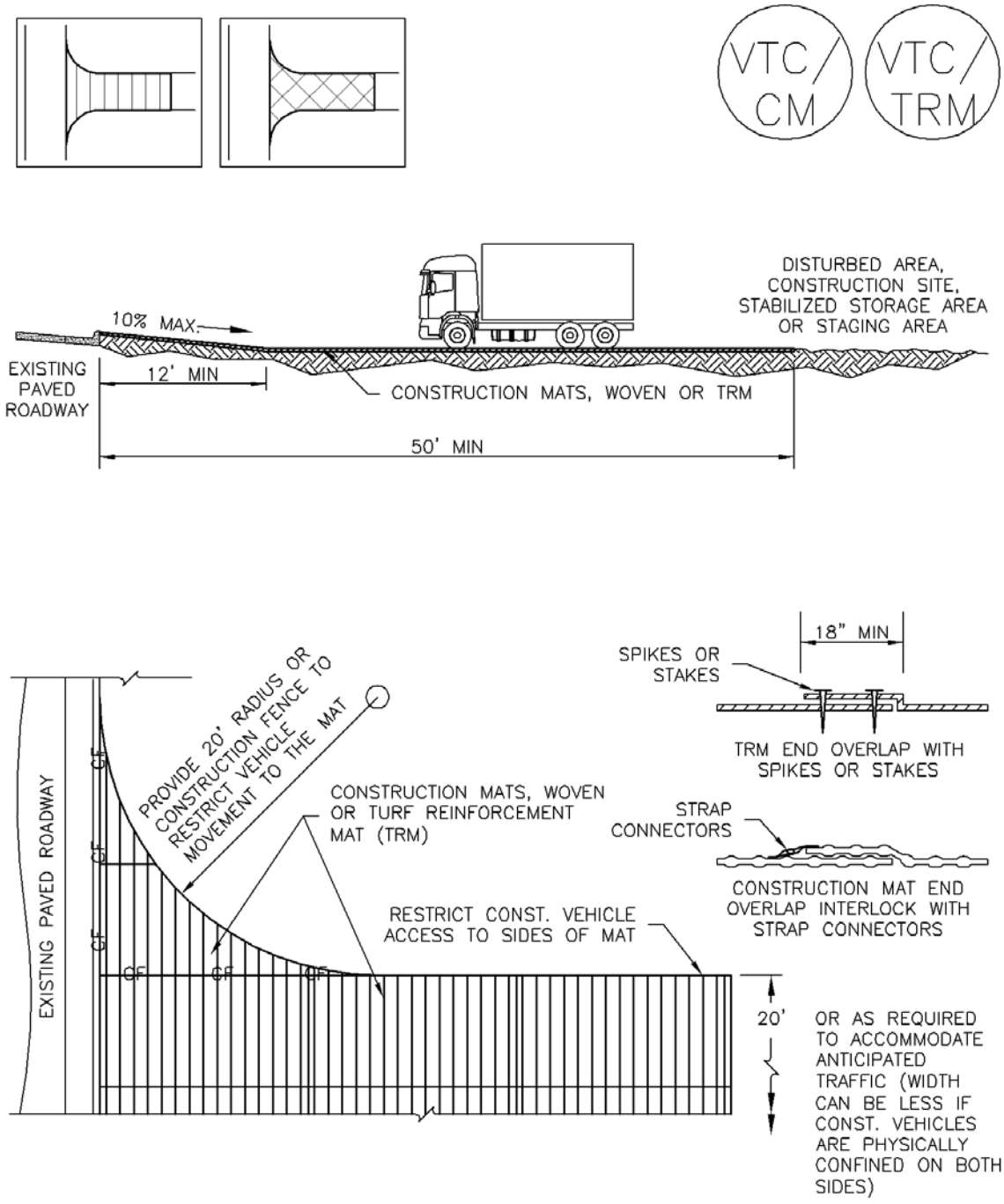
VTC-1. AGGREGATE VEHICLE TRACKING CONTROL





SECTION A

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)

(VTC) TRACKING PAD VEHICLE TRACKING CONTROL

DESCRIPTION

FLEXIBLE TRACKING PAD MATS ARE MADE TO FIT THE CONTOUR OF THE LAND. EACH SECTION, 12' BY 12', IS ROUGHLY 2,200 LBS AND CAN TYPICALLY BE INSTALLED, MAINTAINED, AND REMOVED WITH ON-SITE EQUIPMENT.

TRACKING PADS CAN BE USED TO PROVIDE A STABILIZED CONSTRUCTION ACCESS/EGRESS POINT TO REPLACE TRADITIONAL ROCK VTC. THIS REUSABLE PRODUCT IS PARTICULARLY BENEFICIAL FOR PAVED CONSTRUCTION ENTRANCES.

INSTALLATION OF THE TRACKING PAD RESULTS IN SUBSTANTIALLY LESS DISTURBANCE COMPARED TO TRADITIONAL ROCK VTC AS THE TRACKING PAD IS INSTALLED ON THE EXISTING SURFACE AND DOES NOT REQUIRE GRADING OR EXCAVATION. MAINTENANCE OF THE TRACKING PAD IS SIMPLE TO PERFORM USING SMALL CONSTRUCTION EQUIPMENT.

DESIGN AND INSTALLATION

DETERMINE NUMBER OF SECTIONS REQUIRED BASED ON SITE CONDITIONS, ANTICIPATED VEHICLE ACCESS, AND JURISDICTIONAL REQUIREMENTS FOR VTC SIZING. MINIMUM LENGTH REQUIRED IS 20'. INSTALL ADDITIONAL SEGMENTS AS NEEDED TO MINIMIZE TRACKOUT.

INSTALL TRACKING PAD WHERE IDENTIFIED ON THE ATTACHED SITE MAPS WITH TAB SIDE UP.

ANCHORING IS TYPICALLY NOT REQUIRED DUE TO THE WEIGHT OF THE TRACKING PADS, THOUGH IF DESIRED, DRIVE REBAR STAKES INTO THE UNDERLYING SOIL AT CONNECTION POINTS WHERE TRACKING PADS ARE INSTALLED ON UNPAVED SURFACES.

INSTALL PERIMETER CONTROL, SUCH AS CONSTRUCTION FENCE, ALONG EDGE OF TRACKING PAD TO PREVENT DRIVE-AROUND, FORCING ALL VEHICLES AND EQUIPMENT TO UTILIZE STABILIZED CONSTRUCTION ACCESS.

WHERE NECESSARY, ROUTE RUNOFF FROM UP-GRADIENT DISTURBED AREAS AWAY FROM STABILIZED ACCESS WITH DIVERSION. IF UNABLE TO DIVERT SURFACE FLOW FROM CROSSING TRACKING PAD, USE CMs TO MANAGE SEDIMENT LADEN WATER.

INSTALLATION OF TRACKING PAD ON GRADES LESS THAN 10% RECOMMENDED TO MINIMIZE VTC MOVEMENT DUE TO VEHICLE BRAKING OR ACCELERATION. INSTALLATION OF PADS ON STEEPER GRADES WILL REQUIRE CONTRACTOR OPERATIONAL SAFETY REVIEW AND LIKELY REQUIRE ADDITIONAL ANCHORING AND INCREASED MAINTENANCE.

MAINTENANCE:

INSPECTION FREQUENCY PER LOCAL JURISDICTION REQIUREMENT OR SITE SWMP.

TRACKING PAD REQUIRES MAINTENANCE WHEN SECTIONS BECOME DISPLACED OR WHEN SEDIMENT FILLS HALF OF THE TRACKS TO A DEPTH EQUAL TO 50% OF THE MAXIMUM TRACK HEIGHT.

LIFT MATS TO REMOVE LOOSE DEBRIS AND REPLACE MATS IN ORIGINAL LOCATION. RESET MISALIGNED OR DISPLACED MATS.

REMOVE ANY SEDIMENT TRACKED FROM SITE ONTO PAVED SURFACES IMMEDIATELY.

ADDITIONAL NOTES:

REVIEW LOCAL JURISDICTION REQUIREMENTS FOR CM TYPES AND INSTALLATION METHODS. ENSURE APPROVAL FROM JURISDICTION PRIOR TO USE.

Temporary Stream Crossing (TSC) SM-10

Description

Where an actively flowing watercourse must be crossed regularly by construction vehicles, a temporary crossing should be provided. Three primary methods are available:

- Culvert crossing
- Stream ford
- Temporary bridge

Culvert crossings and fords are the most commonly used methods. Due to the expense associated with a temporary bridge, these are used primarily on long-term projects.

Photograph TSC-1. A temporary stream crossing using culverts. Photo courtesy of Tom Gore.

Appropriate Uses

Construction vehicles shall be kept out of waterways to the maximum extent practicable. Use a temporary stream crossing when it is absolutely necessary to cross a stream on a construction site. Construct a temporary crossing even if the stream or drainageway is typically dry. Multiple stream crossings should be avoided to minimize environmental impacts.

A permit is required for placement of fill in a waterway under Section 404 of the Clean Water Act. The local office of the U.S. Army Corps of Engineers (USACE) should be contacted concerning the requirements for obtaining a 404 permit. In addition, a permit from the U.S. Fish and Wildlife Service (USFWS) may be needed if endangered species are of concern in the work area. Typically, the USFWS issues are addressed by a 404 permit, if one is required. The municipality of jurisdiction should also be consulted, and can provide assistance. Other permits to be obtained may include a floodplain development permit from the local jurisdiction.

Design and Installation

Design details are provided for these types of stream crossings:

TSC-1. Culvert Crossing

TSC-2. Ford Crossing

TSC-3. Flume Crossing

Temporary Stream Crossing	
Functions	
Erosion Control	Yes
Sediment Control	Yes
Site/Material Management	No

A culvert crossing should be sized appropriately with consideration for the duration of construction and seasonal variation of flows. The sizing methodology provided in the Temporary Diversion Methods Fact Sheet is also appropriate for determining the design flow for temporary stream crossings. Culvert sizing must account for the headwater and tailwater controls to properly size the culvert. For additional discussion on design of box culverts and pipes, see the *Major Drainage* chapter in Volume 1. The designer also needs to confirm that the riprap selected is appropriate for the conditions in the channel being crossed.

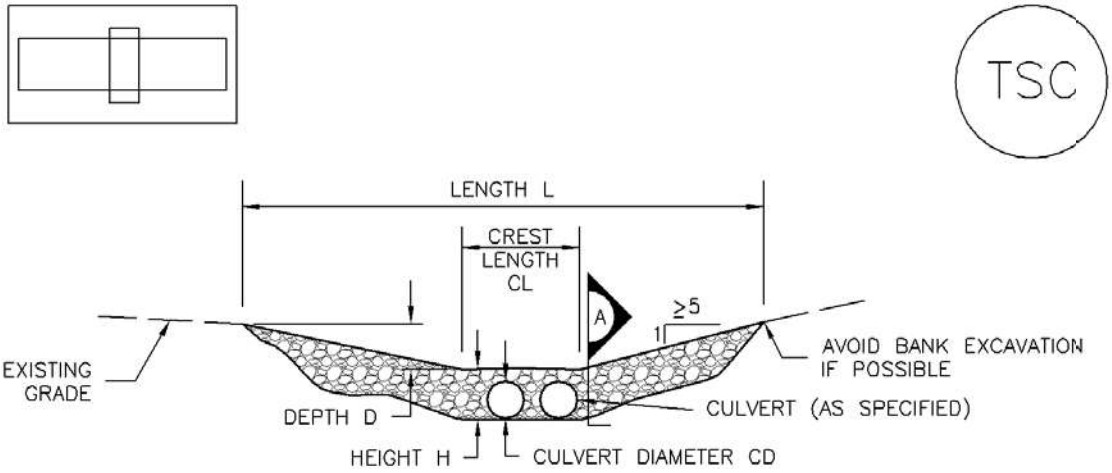
When a ford must be used, namely when a culvert is not practical or the best solution, the ford should be lined with at least a 12-inch thick layer of Type VL (D_{50} = 6 inches) or Type L (D_{50} = 9 inches) riprap with void spaces filed with 1-1/2 inch diameter rock. Ford crossings are recommended primarily for crossings of ephemeral (i.e. intermittently, briefly flowing) streams.

For a temporary bridge crossing, consult with a structural and/or geotechnical engineer for temporary bridge design or consider pre-fabricated alternatives.

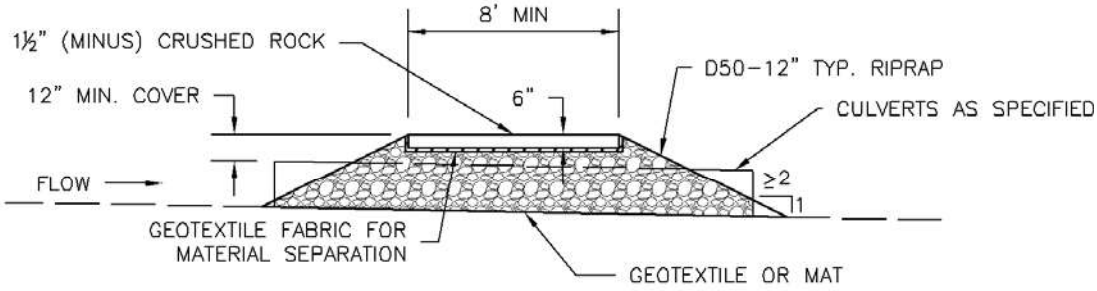
Maintenance and Removal

Inspect stream for bank erosion and in-stream degradation. If bank erosion is occurring, stabilize banks using erosion control practices such as erosion control blankets. If in-stream degradation is occurring, armor the culvert outlet(s) with riprap to dissipate energy. If sediment is accumulating upstream of the crossing, remove excess sediment as needed to maintain the functionality of the crossing.

Remove the temporary crossing when it is no longer needed for construction. Take care to minimize the amount of sediment lost into the stream upon removal. Once the crossing has been removed, stabilize the stream banks with seed and erosion control blankets.

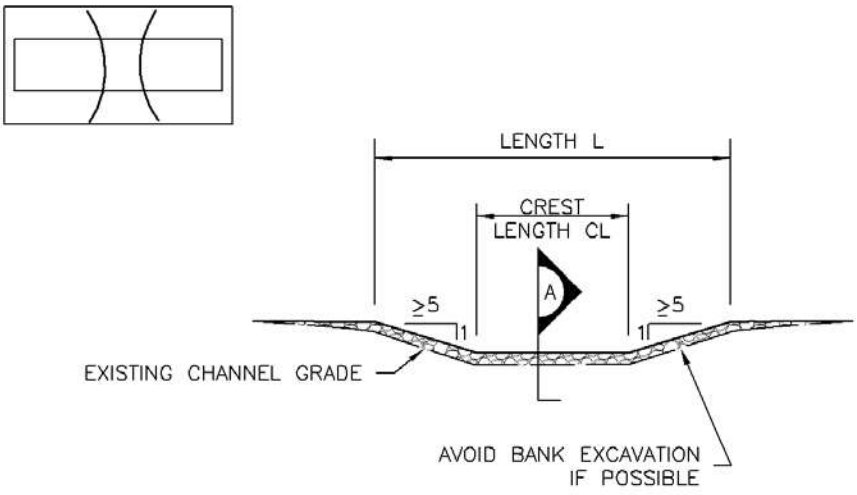


CULVERT CROSSING SECTION

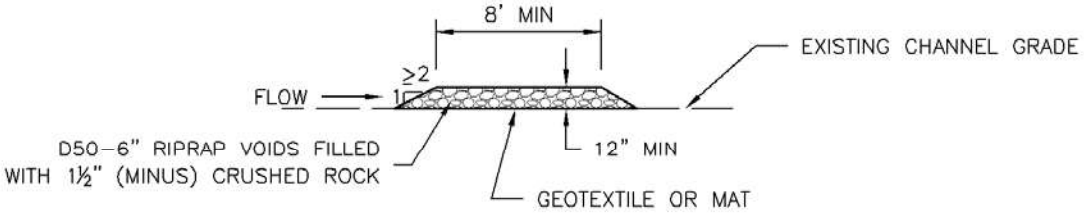


SECTION A

TSC-1. CULVERT CROSSING

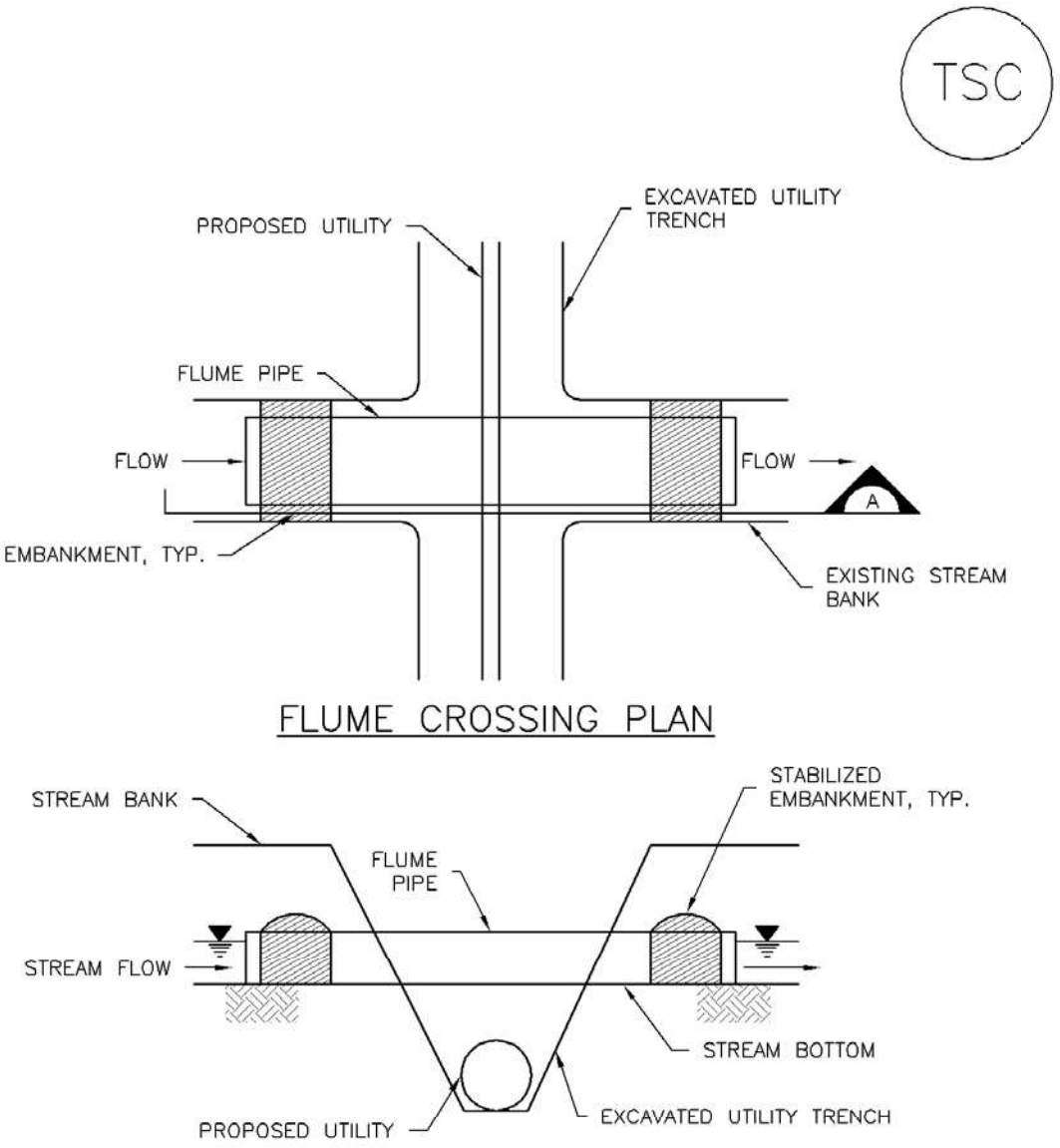


FORD CROSSING SECTION



SECTION A

TSC-2. FORD CROSSING



TSC–3. FLUME CROSSING

TEMPORARY STREAM CROSSING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATIONS OF TEMPORARY STREAM CROSSINGS.
   - –STREAM CROSSING TYPE (FORD, CULVERT, OR FLUME).
   - –FOR FORD CROSSING: LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).
   - –FOR CULVERT CROSSING: LENGTH (L), CREST LENGTH (CL), CROSSING HEIGHT (H), DEPTH (D), CULVERT DIAMETER (CD), AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.

2. TEMPORARY STREAM CROSSING DIMENSIONS, D50, AND NUMBER OF CULVERTS INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASEFLOW OR FLOOD EVENTS SHALL BE PROMPTLY REPAIRED.

3. SEE MAJOR DRAINAGE CHAPTER FOR RIPRAP GRADATIONS.

4. WHERE FAILURE OF A STREAM CROSSING CAN RESULT IN SIGNIFICANT DAMAGE OR HARM IT MUST BE DESIGNED BY A STRUCTURAL ENGINEER.

TEMPORARY STREAM CROSSING 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.

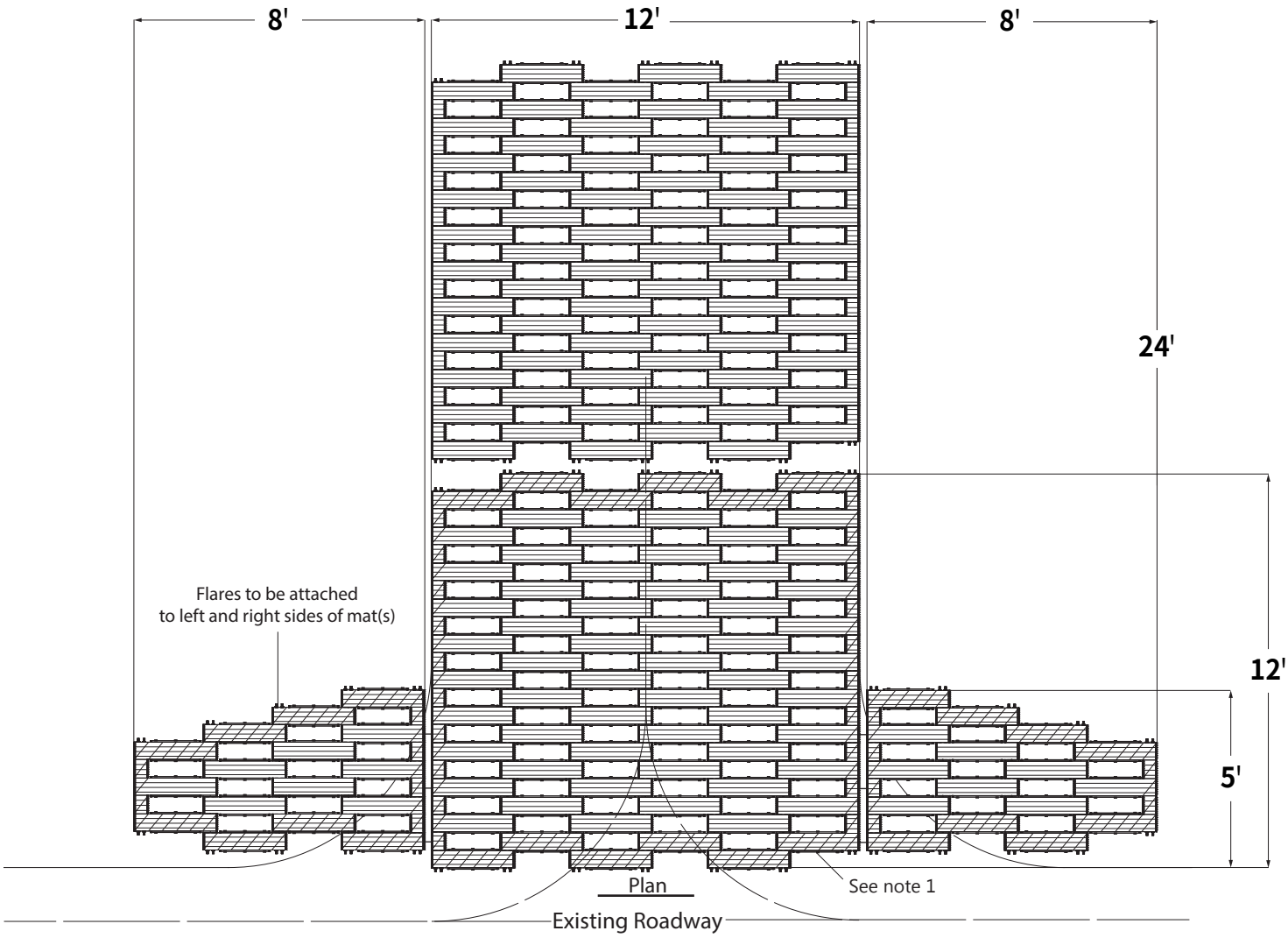
4. REMOVE SEDIMENT ACCUMULATED UPSTREAM OF CROSSING AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE CROSSING.

5. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED AND SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.

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

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.

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



NOTES

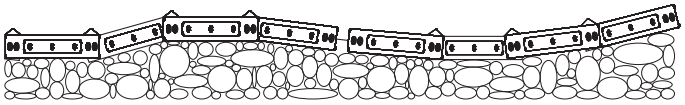
1. NO PICK (ROWS)
2. 12'x12' EXPANDABLE AS NECESSARY

INSTALLATION

-PLACE MATS WITH TAB SIDE UP
-NO TIE DOWN REQUIRED

MAINTENANCE

LIFT MATS AND REMOVE DEBRIS/ LAY MATS BACK IN PLACE



Do not install over jagged/rocky ground or soil

May be installed over uneven ground

Preferably installed over level ground

CDOT APL Reference No. 3781-14

TRACKING PADS LLC
trackingpads.com
8311 Pontiac St.
Commerce City, CO, 80022

Tracking Pad Details

Date: 5/2/2018

Sheet: 1 of 1

Memo

Date: Thursday, April 27, 2023

Project: Xcel Tline: Pathways Segment 3 Cheyenne County Build

To: Control MeasureDetails

From: Brian Brown, PE - HDR

Subject: Use of Vegetation & Topography (VT) instead of structural erosion Control Measures (CM)

This memo describes the specific conditions for which the installation of an erosion Control Measure (CM) is not recommended based on site conditions. Under certain conditions, not installing a CM may be the best approach to minimize sediment transport off site. This is based on the concept that shallow overland flow may pick-up and transport sediment that is then dropped out within a vegetative buffer depending on a variety of site conditions. Use of VT instead of a structural CM is dependent on the following factors:

- Rainfall – Rainfall intensity impacts the buffer distance. The rainfall rate across the site has been calculated to be calculated 1.19" to 1.25" in a 5-year, 30-minute storm. A 1.25" 5-year, 30-minute storm was utilized for model inputs. This rainfall depth is incorporated in the Table 1 distances.
- 80% sediment removal – structural CMs target 80% sediment removal. Actual removal rates vary but have been shown to be less than 80% in many studies. The 80% removal rate is one basis for the VT buffer distances reported in Table 1.
- **Disturbance area does <u>not</u> have concentrated flow** – This approach is based on sediment dropping out while suspended in an overland sheet flow condition. If there is concentrated flow prior to or due to construction, i.e. rill erosion across the work/disturbance area that continues down-gradient and off-site, then structural CMs are recommended.
- Low slope – local slope of the site impacts velocity, flow concentration, and other factors. Use VT should not be considered for slopes exceeding 10%.
- Soil Type – Soil type impacts likelihood of soil being transported in sheet flow. The larger the soil particles, i.e. sand, the harder to pick-up and transport. The smaller the particle, i.e. clay, the longer the transport distance. The NRCS predominant Hydrologic Soil Group (HSG) soil types for the project area are A and B. The hydrologic soil groups (HSG) are A – D and as follows:
    - A – sand or silty sand, High infiltration rate
    - B – sandy silt, moderately high infiltration rate
    - C – clayey silt, moderate to low infiltration rate

    - D – clay, low infiltration rate
- Vegetation cover – The vegetation cover (surface roughness) was accounted for in the VT model runs and found to provide similar buffer distances, therefore the most conservative vegetation density is reflected in Table1.
- Vegetation Buffer - The buffer distance measurement is along the flow direction, and measured from the limit of the work zone to the limit of the utility easement/ROW. **Vegetation buffer outside of the ROW may not be utilized for the required buffer distance.** Due to the project area, there is adequate area for sediment settling on-site.
- The use of this VT approach may be applied to linear and larger area disturbances that meet the parameters described in this memo.
- Table 1 results below include a 15% buffer beyond calculated model buffer distances.

Utilize Table 1 below for VT buffer distances. Buffer distances are an extrapolation of the ¾" and 1" rainfalls to a 1.25" rainfall.

VT Buffer	
Soil	Buffer Distance (ft)
A	3
B	8
C	34
D	66

Maintenance:

In the same manner that using existing conditions as a CM does not require installation of a CM, there is no maintenance of this CM. VT is either adequate or structural CMs should be installed.

Inspection:

Like structural CMs, the area down gradient of a VT CM should be walked and observed for the following which indicate that VT may not be adequate:

- signs of new rill erosion in work area or immediately down gradient of work area
- signs of sediment deposition well beyond the expected buffer distance or nearing area not controlled by Xcel property lease
- observations of work area or up gradient areas that are creating concentrated flow through and down gradient of the work area.
- Observe and discuss with contractor potential construction practices that could promote sheet flow and infiltration to minimize stormwater runoff from work area.

In the event that VT is inadequate to keep sediment on site at any local area, that local area must immediately have a structural down gradient CM installed, at a minimum. Sediment Control Log is the expected control measure. Site conditions will dictate actual CM to be used. Note: Sediment Control Logs cannot be used in across swales or drainageways.

VTC VEHICLE TRACKING CONTROL - SIGNAGE

DESCRIPTION

SIGNAGE-BASED VEHICLE TRACKING CONTROL IS A NON-STRUCTURAL CONTROL MEASURE USED TO REGULATE VEHICLE MOVEMENT ON-SITE AND PREVENT SEDIMENT TRACK-OUT FROM CONSTRUCTION AREAS. THIS APPROACH IS ONLY APPLICABLE FOR LIMITED ACCESS INTO RIGHT-OF-WAY FROM DIRT OR GRAVEL-PACKED ROADS. ACCESS INTO RIGHT-OF-WAY OFF OF PAVED ROADS WILL REQUIRE STRUCTURAL VEHICLE TRACKING CONTROL (VTC) MEASURES, SUCH AS VTRAX, FODS, OR SIMILAR PRODUCTS. SIGNAGE IS TYPICALLY INSTALLED AT POINTS OF INGRESS AND EGRESS WITHIN 50 FEET OF ACTIVE CONSTRUCTION ZONES TO DIRECT VEHICLES TOWARDS STABILIZED EXITS AND PREVENT DAMAGE TO VEGETATED OR PROTECTED AREAS.

DESIGN AND INSTALLATION

SIGNAGE CAN BE MADE USING DURABLE MATERIALS LIKE ALUMINUM OR CORRUGATED PLASTIC TO WITHSTAND WEATHER CONDITIONS. SIGNS SHOULD BE AT LEAST 18-INCHES BY 24-INCHES IN SIZE AND MOUNTED ON METAL T-POSTS OR WOODEN POSTS FOR VISIBILITY. SIGNAGE SHOULD BE PLACED AT A HEIGHT OF 4-6 FEET ABOVE GROUND LEVEL TO ENSURE IT IS CLEARLY VISIBLE TO VEHICLE OPERATORS.

1. CONTRACTOR TO DETERMINE INGRESS AND EGRESS POINTS THAT WOULD BENEFIT FROM SIGNAGE-BASED VEHICLE TRACKING CONTROL DUE TO EXISTING SITE CONDITIONS AND ACCESS FREQUENCY.

2. INSTALL SIGNS AND ENSURE SIGNS ARE SECURELY MOUNTED AND ORIENTED TOWARD VEHICLE DRIVERS FOR MAXIMUM EFFECTIVENESS.

SIGNS TO BE FIELD FIT BASED ON SITE CONDITIONS AND VISIBILITY REQUIREMENTS.

MAINTENANCE:

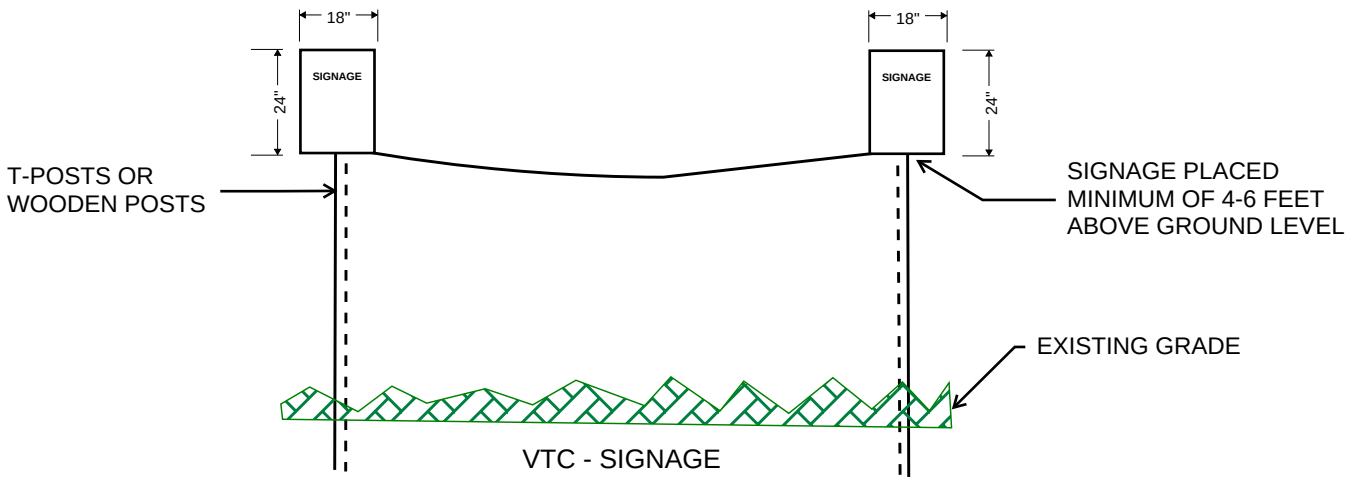
ENSURE SIGNAGE REMAINS IN GOOD CONDITION AND IS CLEARLY VISIBLE AT ALL TIMES. REPLACE OR REPAIR SIGNS THAT BECOME DAMAGED OR FADED. REMOVE ANY OBSTRUCTIONS THAT BLOCK SIGNAGE FROM VIEW AND ADJUST SIGNAGE LOCATIONS IF NEEDED BASED ON CHANGING SITE CONDITIONS.

ADDITIONAL NOTES:

SIGNAGE-BASED VEHICLE TRACKING CONTROL CAN BE SUPPLEMENTED WITH OTHER STRUCTURAL MEASURES, SUCH AS WHEEL WASHES OR STABILIZED CONSTRUCTION ENTRANCES, TO FURTHER REDUCE SEDIMENT TRACK-OUT. IF TRACKOUT ONTO ROADS OCCURS FREQUENTLY, CONTRACTOR TO INSTALL STRUCTURAL VEHICLE TRACKING CONTROL.

Private landowner(s) may utilize this access point. If construction access is needed, monitor trackout and avoid during muddy conditions. If trackout occurs from construction, contact contractor.

EXAMPLE VTC SIGNAGE LANGUAGE



WoodStraw®

Engineered Wood Strand Erosion Control Mulch

(970) 367-6111 - gus@mpinem.com - www.mpinem.com

Technical Description:
WoodStraw® engineered wood-strand mulch is an all-wood material composed of a blend of loose thin wood pieces, each with a high length-to-width ratio such that the pieces form a protective matrix when distributed on the soil. This long-strand soil erosion control mulch is a blend of geometrically regular wood elements that have a straw-like form and function. The materials are baled in green or air-dried condition and are inherently free of noxious weed seeds and other chemicals/additives detrimental to plant life. WoodStraw® is composed of long wood strands that have the following nominal properties:

Length: 2.5 inch to 8 inch
Width: 3/16th inch
Thickness: 1/10th – 1/7th inch

Less Than 10% Fine Material
WoodStraw® shall contain no more than 10% fine material or dust measured as a percentage of the total product by mass. *(Fine material is defined as particles less than 1" in length)*.

Packaging:
WoodStraw® is packaged in bales tied with poly bale twine and placed on pallets.

- Regular bales are 14" x 18" x 18"–22". The weight of a bale varies with water content.
- Large bales are 30" x 40" x 42"-50". The weight of a bale varies with water content.

Wood Species:

- The predominant wood species are Lodge-pole Pine, Hemlock, White Fir, Douglas Fir and other conifer species.

Applications:

- Hand Application
- Straw Blowers
- Helicopter Aerial Applications

Coverage Rate = 70%:
The manufacturer's recommended coverage rate for the proper application of WoodStraw® engineered wood strand mulch is **70% Ground Coverage** on flat, moderate, or steep ground up to a 1.5: 1 Slope.

Regular Bale: 156 Sq Ft per bale — Large Bale: 1,613 Sq Ft per bale
Regular Bale: 280 Bales per acre — Large Bale: 27 Bales per acre

WARNING: Failure to use the proper 70% rate of cover will void all assurances that the product will be effective for wind or water erosion. Failure to use the proper rate of cover will also hinder the product's ability to aid with revegetation.

Tab 7 – Materials Handling, Waste Management, and Spill Prevention and Response Plan

MATERIALS HANDLING (PART I.C.2.F)

Consistent with the permit requirements, all potential pollutants other than sediment will be handled and disposed of in a manner that does not cause contamination of stormwater. Non-sediment pollutants that may be present during construction activities include, but are not limited to:

- Exposed storage of building materials,
- Petroleum products including fuel, lubricants, hydraulic fluids, and form oil (this includes storage, leaks, and fueling),
- Condensate,
- Antifreeze,
- Landscaping materials,
- Fertilizers or chemicals,
- Sanitary waste materials,
- Trash and equipment maintenance,
- Concrete, mortar, or similar products, and
- Solvents, paints, or similar products.

If these materials are used, then the following practices will be implemented. These materials, and other materials used during construction with the potential to impact stormwater, will be stored, managed, used, and disposed of in a manner that minimizes the potential for releases to the environment and especially into the stormwater system. Several of these activities and their controls are also described in Tab 4 as potential sources of pollution.

a) Vehicle Maintenance

Vehicles entering the construction site should be properly maintained to prevent spills or leaks of hazardous fluids that would be exposed to stormwater. Vehicles used on-site will be inspected for leaks. Leaking vehicles will not be allowed to stay on-site or will use drip pans until the leak is repaired. The vehicle operator will be responsible for immediately commencing any necessary containment and clean up. Vehicles will not be parked in or near retention areas, natural drainage areas or surface waters. Drip pans will be used for secondary protection of on-site vehicles, if necessary. Maintenance and fueling areas, if needed, will be indicated on the Site Map. A spill kit will be available on site to clean up any spills or leaks.

b) Stockpiles

Different types of earth material may need to be stockpiled on the job site during the earth moving activities. All stockpiles will have erosion and/or sediment CMs implemented around the toe of the pile or will be located within an area with perimeter controls.

c) Solid Waste

Large amounts of solid waste are not anticipated to be generated during this project. The majority of solid waste will be collected in worker vehicles, removed from site, and properly disposed of. If larger quantities are generated than can be handled by individuals on site, then dumpsters will be provided in convenient, level locations away from traffic areas, storm drains, drainage areas, or retention areas. A licensed company will be contracted to empty the dumpsters, as needed. The site project managers will be responsible for monitoring the site to ensure that all site personnel and subcontractors use the proper waste disposal practices and facilities.

d) Concrete Washout Activities

A concrete washout is designed to capture wastewater and waste products resulting from the cleaning of concrete and masonry equipment and is the main CM for concrete washout waste. A concrete washout

may not be necessary if all washout operations are performed off-site. If a concrete washout is needed, it 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 may include small excavations located within the limits of disturbance or watertight vessels such as, small dumpsters, buckets, or a mobile disposal unit, etc. Concrete washouts require appropriate access control, tracking and containment. Signs should be placed at the washout area and elsewhere, as necessary, to clearly indicate the location of the concrete washout. If needed, the designated washout facility or facilities will be installed on site and the locations added to the Site Map.

Concrete washouts (CWAs) will be utilized for the Project and will be installed on site at the locations noted to the Site Map, located in Tab 2. Concrete washouts will be designated portable containers. When feasible, CWAs not to be installed within 400' of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources.

Maintenance may include the removal and proper disposal of excess material, cleaning or replacing the tracking material and general structural integrity of the installation, as needed. Concrete washouts will be cleaned of excess water and solids on a regular basis to maintain the proper function of the CM. The hardened concrete and/or excess wash water will be hauled away by an approved contractor to a designated facility designed to receive such materials.

No concrete waste will be discharged directly onto the ground without a containment feature and the washing activities cannot contribute pollutants to stormwater runoff. Discharges that may reach groundwater must flow through soil that has buffering capacity prior to reaching groundwater as necessary to meet the effluent limitations of the permit. Concrete washout water will not be discharged to state surface waters or to storm sewer systems. If unlined pits are used to contain concrete washout water, the following management practices must be implemented:

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

e) Portable Sanitary Facilities

Portable sanitary facility locations will be evaluated in the field and the most appropriate locations determined. Some factors that may influence the location will be access, convenience, level ground, traffic patterns, curb flowlines, paved surfaces, storm drains, and waterways or other stormwater conveyance areas. A licensed company will be hired to 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 over.

SPILL PREVENTION AND RESPONSE PLAN (PART I.B.1.A.II)

a) Spill Prevention

Spills and leaks must be minimized. Upon identification, spills and leaks must immediately be contained and mitigated per the spill prevention and response plan, as applicable (i.e. oil, grease, fluids associated with vehicle and equipment maintenance, toxic chemicals, hazardous substances, etc.). Spills and leaks will not be hosed down unless the wash water is adequately captured and appropriately disposed of.

The contractors on site will take all measures necessary to prevent spills that could impact stormwater. This includes, but is not limited to:

- Proper storage of all materials and chemicals,
- Proper maintenance and protection of all containers, and
- Proper handing/dispensing materials and chemicals.
- Bulk storage of 55 gallons or more for petroleum products and other liquid chemicals will have secondary containment, or equivalent protection, in order to contain spills and to prevent spilled material from entering state waters.

b) Spill Response Procedures and Notifications

Spill response procedures are outlined in the Environmental Directive for Contractors, a copy of which is at the end of this tab. Additional contacts are listed below:

Contacts and Notifications for Spills or Releases:

Xcel Environmental Group – 303-571-7100

(Xcel Environmental will make all necessary notifications to regulatory agencies including CDPHE.)

Local Emergency Number – 911

CDPHE – 1-877-518-5608

NRC – 1-800-424-8802

Contaminated Soil Process

Soils contaminated with hazardous materials or wastes can be encountered during installation of new electric or gas underground services and while maintaining existing services. This fact sheet outlines the process by which crews and planners should respond to contaminated soil.

How to Determine if Contaminated Soil is Present

- Contaminated soil may exhibit staining or unusual odors.
- Contaminated soil may be encountered in industrial areas, landfills or other areas of known environmental impacts like underground storage tanks from gas station operations, or associated with buried containers.

What to do if you encounter contaminated soil during work
Stop work and contact Environmental Services**

Pre-Planning Process

For project work in the design phase where there is a potential to encounter contamination – near by gas/fueling stations, industrial areas, landfills, railroads, or known, or potential areas of contamination

- Contact Environmental Services to assist in the site assessment and characterization process to evaluate and determine the need to address potential contamination, and health and safety needs.
- Each group has different criteria that need to be considered
- Environmental – Ensure regulatory compliance and protection of public health and the environment, to minimize Company liability
- Industrial Hygiene and Safety – worker protection driven by OSHA regulations

Resources on XpressNet

- Industrial Hygiene webpage HAZWOPER resources and HAZWOPER written program and Environmental Pages (‘All Media Checklist’)
- http://xpressnet/Safety/Workplace_Safety/Programs_G_-_O/Industrial_Hygiene_Program

For guidance/assistance when encountering contaminated soils contact Environmental Services on call #:

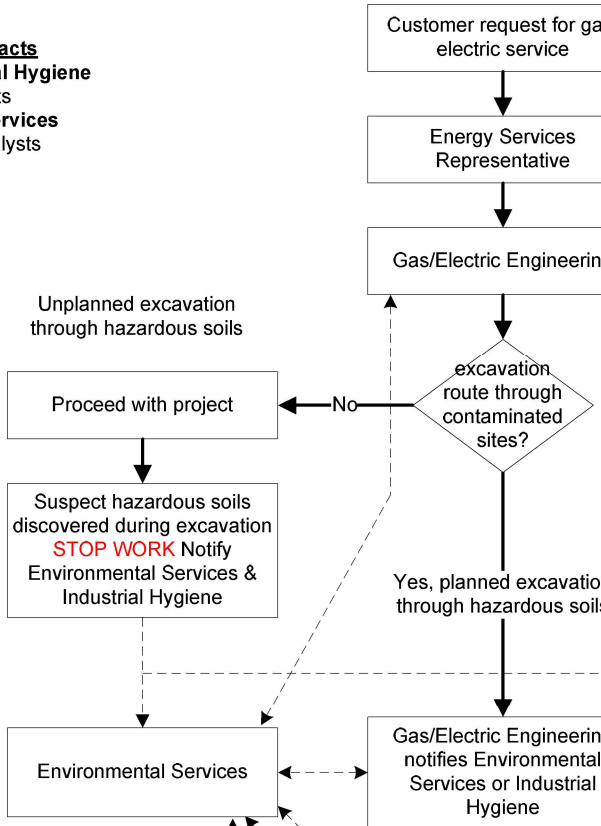
NSP - (612) 330-7873, PSCO - (303) 571-7100, SPS - (806) 674-1890

****Environmental Services will contact Industrial Hygiene and Safety***

Industrial Hygiene and Environmental Services Support Activities for Utility Excavation at Hazardous Waste Sites and other Contaminated Soils

Periodically, gas and electric service installations involve excavation in areas of soil contaminated by hazardous substances or other pollutants. Areas of known contamination include Superfund, CERCLIS, Brownfield, Radium, and UMTRA sites, leaking underground storage tanks (LUSTs), and old landfills. These sites were historically contaminated with industrial wastes including petroleum, solvents, lead, asbestos, radioactive radium and uranium mine tailings, and flammable methane gas from organic decomposition. Contaminated soils may also be encountered during excavation in areas not previously known to be contaminated. Soil contaminants may present hazards to workers in the form of toxic dust and vapor inhalation or skin exposures, and flammable atmospheres in excavations where hot work must be conducted for service installation tie-ins.

Xcel Energy Contacts
Safety & Industrial Hygiene
Industrial Hygienists
Environmental Services
Environmental Analysts



Environmental Services:
-reviews regulations, determines project environmental requirements
-assists in obtaining necessary environmental permits
- -Land Development
- -Construction Stormwater Discharge
- -Stream Crossing
- -Special Use Permits, etc.)

-reviews excavation locations for contamination in Superfund, CERCLIS, Brownfield, Radium, & UMTRA sites, LUSTs, old landfills
-liaison with Health Dep/EPA
-site assessment reports
-ID/characterize contamination
- -locations, depths, concentrations, plume dimensions, water table depth/flow, if known

-determines hazardous waste testing & disposal requirements
-communicates requirements
-Contacts Legal to assess environmental agreement requirements

Gas/Electric Construction:
1) selects qualified workers per Industrial Hygiene specifications
or
2) works with Industrial Hygiene to ensure workers become qualified

Industrial Hygiene:
-reviews site regulations, determines project health & safety requirements
- -worker training
- -respirators/PPE
- -worker air monitoring/ exposure assessment
- -atmospheric testing for toxics, flammables

-liaison with OSHA/Health Dep/EPA for training & air monitoring requirements
-communicates requirements
-project health & safety plan
-health & safety plan training
-site health & safety officer
-respirator & PPE selection
-respirator medical surveillance, training & fit tests
-respirator & PPE selection
-worker qualification verification
-hazardous soil screening
-atmospheric testing for toxics, flammables
-worker air monitoring/exposure assessment for air contaminants
-project documentation

Legend: project execution communication

ENV 8.150 G01 Rev 3.2
Environmental Directives For Contractors

Xcel Energy Environmental Services

November 3, 2022

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Xcel Energy
Environmental Directives for Suppliers

Supplier has entered into one or more contracts (the "Contract") with Xcel Energy Inc., or its subsidiaries or affiliates (referred to herein as "Xcel Energy"). As provided in the Contract, Supplier must comply with all applicable provisions of Xcel Energy's plant, Project, facility or Site policies and procedures, including but not limited to any instructions and procedures pertaining to plant or facility Site security, industrial safety, environmental directives, work authorization, equipment control and hazardous materials. As such, Supplier must comply with these Environmental Directives for Suppliers ("Directives").

Xcel Energy expects Supplier to support environmental compliance through its own policies and procedures, maintain all compliance, ensure the protection of human health and the environment, and to promote Xcel Energy's reputation as an environmental leader in the communities Xcel Energy serves. Supplier should consider energy efficiency, pollution prevention, conservation, and performing operations in an environmentally responsible manner in all decision-making and work activities. Supplier must communicate these same values and requirements to its employees and subcontractors.

The information in these Directives does not supersede any specific requirements listed in the Contract. Supplier is required to comply with all federal, state, and local laws, regulations, and requirements and any additional requirements or policies that may be required by Xcel Energy for the specific work at issue in the Contract. The subject areas listed in these Directives are not meant to provide an exhaustive list or complete summary of the types of safety, environmental or other concerns that Supplier must consider. Supplier is an independent Supplier. By providing these Directives to Supplier, Xcel Energy in no way assumes any of the duties, obligations, or liabilities attributed to Supplier under the Supplier or any **obligations that Supplier** must comply with federal, state, and local laws, regulations, and requirements to the extent there is a conflict between these Directives and the Contract, the Contract shall control.

The Xcel Energy Contract Manager will identify the appropriate Xcel Energy Environmental Services (XEES) staff to serve as the contact(s) for the project. XEES staff may be located in one of Xcel Energy's Corporate offices, a field office or service center, or at a power plant. Due to the complexity of some activities and the regulations, Supplier may have contact with more than one Xcel Energy "Subject Matter Expert" during performance of a Contract. Environmental and emergency contact numbers are listed at the end of these Directives for any inquires or notifications Supplier may have.

Adherence to these Directives does not constitute completion of Supplier's obligations under Xcel Energy's Supplier Safety Program or Safety Program requirements identified by Xcel Energy's Corporate Safety Department. Supplier is responsible for meeting all applicable safety requirements, including, but not limited to, the appropriate use of Personal Protective Equipment.

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Supplier's Responsibilities

A. Planning

Planning includes everything that happens before a Supplier begins work in the field. Supplier is tasked with several activities during this planning phase of work. The scope of work developed for various projects will determine the level of involvement and define roles and responsibilities for each contract and/or project. During the planning stages of a project, the Supplier should review all applicable laws, rules, regulations, permit requirements, and site-specific conditions that may impact or apply to the work. Supplier should also prepare for any spills, leaks, or accidents (or any unforeseen project emergency) that could occur during project implementation, so that Supplier is prepared to implement the appropriate response measures. Further details are provided below regarding spill response and reporting procedures. Before starting work, Supplier should identify an Emergency Coordinator and know the work location (the physical address where Supplier will be working) in the event an emergency arises. Before starting work, Supplier must also contact the XEES representative that has been designated as the representative for the project to discuss steps the Supplier is taking to ensure all activities are compliant with applicable environmental laws and regulations.

B. Hazard Analysis

Many activities performed by Supplier may be in or near areas that are contaminated or that were previously contaminated and have been remediated. To the extent practical, these areas should be identified in advance to avoid problem and delays caused by unforeseen site conditions. Supplier should conduct an appropriate site hazard analyses or undertake appropriate environmental due diligence prior to commencement of the work. Supplier should also have contingency plans in place in the event hazards are encountered**. When unexpected contamination is discovered in the field - stop work, and immediately provide notification to your Xcel Energy Contract Manager and XEES representative** to coordinate any immediate response actions and/or agency reporting. See further information below regarding spill response and reporting procedures.

C. Permitting

Permits apply to specific activities at specific locations and may have requirements that are more stringent than environmental laws and regulations. Supplier is responsible for identifying all necessary permits for Supplier work affecting Xcel Energy facilities or operations. Notwithstanding anything to the contrary set forth in the Contract, before starting work, Supplier must contact the designated XEES representative for the project to discuss whether Supplier or Xcel Energy will be the named applicant on the permit and whether the Supplier or Xcel Energy will be responsible for conducting permit research or preparing the permit application. Xcel Energy must be involved with any communications with regulatory agencies or made aware of any such communications prior to Supplier outreach to the regulatory agencies. Communication with regulatory agencies for Xcel Energy must include XEES and not be performed by the Supplier without XEES presence or permission. This includes permit discussions, application submittals, negotiation on permit conditions, and/or permit agreements. Supplier bears the responsibility for compliance with the permit terms and specified actions, limitations, notifications, and reporting requirements for Supplier's and its Subcontractor's activities. Failure to comply may subject the Supplier to significant fines and penalties as well as to project delays and potential shutdowns.

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D. Chemical Control

Supplier must review, approve, and track all chemicals used while working on Xcel Energy projects. This helps ensure that employees and Suppliers are not exposed to overly hazardous products, Safety Data Sheets (SDSs) are available for each product, and information for all required agency reporting is available. When selecting chemicals for use, Supplier should consider reducing disposal costs, reducing safety risks, buying only quantities needed to do the job, storing chemicals properly, checking expiration dates, and considering alternative products that may be an appropriate less-hazardous option. Supplier is responsible for ensuring that chemicals are used in accordance with all labels. Supplier must remove all unused chemicals and products at the completion of each job and as specified in the Contract. Supplier is not to abandon unused products at any Xcel Energy facility or jobsite.

Unless Supplier receives permission from XEES, Supplier will not use products containing chemicals present on Xcel Energy's Targeted Ingredients List and Supplier will not use products that it knows, or should know, contains Per and Polyfluoroalkyl Substances (also referred to as PFAS or PFCs) including PFOA, PFOS, GenX and other replacement PFAS. The listing of a chemical on the Targeted Ingredients List indicates that its use is restricted. This means that specific requirements must be met in order to use the product in a manner that complies with the applicable regulations. Xcel Energy's Targeted Ingredients List can be found in Appendix D of Xcel Energy's Chemical Hazard Communication Program or can be obtained from XEES or the designated Contract Manager upon Supplier's request. If the Supplier desires to use a chemical or product that contains PFAS or is on the Targeted Ingredient List, before using the chemical or product Supplier must provide documentation to XEES explaining why the use of the product or chemical is necessary and why chemical alternatives that are not on the Targeted Ingredients List with a lower overall risk are not suitable for the specified application, as well as any other information that Xcel Energy may reasonably request, such as any safety precautions Supplier intends to adopt. Proposed restricted chemicals cannot be used until permission to proceed has been given by XEES. By giving permission to proceed with the use of a chemical or product, Xcel Energy in no way assumes any of the duties, obligations, or liabilities attributed to Supplier under the Contract and in no way is endorsing the use of the chemical for any particular application.

E. Protected Species

Supplier must follow all requirements associated with Protected Species. Protected Species means all plants and animals that are listed as a threatened or endangered species under the Endangered Species Act, or are otherwise protected under federal, state or local laws and may include birds, animals, plants, or fish, as well as their nests and habitat. Supplier is responsible for knowing if its work is being performed in an area where Protected Species may be present. Supplier must adhere to all requirements for working in areas with Protected Species and/or habitat and must not remove or destroy an active nest of a Protected Species. Any incident involving death, injury or removal of a Protected Species or an active nest shall be immediately reported to XEES. Supplier should assume that all birds are a Protected Species and shall confer with XEES for determination of the bird's status as a Protected Species.

F. Waste

Supplier must comply with all applicable regulatory requirements, as well as Xcel Energy policies, for waste handling, including, but not limited to, hazardous wastes, universal wastes,

solid wastes, and special wastes. Supplier must coordinate closely with its Xcel Energy Contract Manager as well as directly with XEES. Supplier requirements include the following:

- Correctly identify wastes by type and keep wastes separate, accumulate wastes in appropriate containers, label all containers according to XEES requirements or the appropriate regulations, and conduct inspections as required.
- Store wastes only in areas that have been approved by the Xcel Energy Contract Manager or XEES. Storage areas for liquid wastes shall not be adjacent to storm intercepts, wetlands or surface waters. Storage areas must be inspected at least monthly.
- Supplier should segregate scrap metals and other recyclable wastes. Supplier must contact Xcel Energy Contract Manager for handling instructions if not previously arranged.
- Supplier may be responsible for handling and disposal of non-hazardous refuse (construction and demolition debris, scrap lumber, office waste, etc.). All such disposal must be at an appropriately permitted landfill.
- Supplier is responsible for notifying Xcel Energy Contract Manager and coordinating with XEES all handling and disposal of Hazardous, Universal, and/or special wastes.
- Supplier shall use waste vendors on Xcel Energy's Approved Vendor List when feasible. Supplier shall provide XEES with 30 days' advanced notice if it intends to use a vendor that is not on the Approved Vendor List. Supplier may obtain Xcel Energy's Approved Vendor List form the designated Xcel Energy Contract Manger.

Note that many Supplier-generated wastes are specific to a particular project and must be managed as specified in the Contract. Supplier should consider, and use commercially reasonable efforts to:

- Use nonhazardous materials instead of hazardous materials
- Reduce waste generation
- Recycle and reuse materials rather than dispose

G. Electrical Equipment (Oil-Filled)

Transformers, capacitors, and other electrical equipment often contain oil. The oil in this equipment may contain polychlorinated biphenyls (PCBs). PCBs are highly regulated, and the Supplier must know the regulations associated with PCB management. Supplier shall immediately alert the Contract Manager or XEES representative of any spills or releases from oil-filled electrical equipment. See further information below regarding spill response and reporting procedures. Supplier crews should assume that electrical equipment contains PCB in regulated concentrations until it is determined that it does not contain PCBs in regulated concentrations (i.e., known to be <50 ppm.) The Supplier is to deliver electrical equipment to the designated service center or disposal outlet as specified by the Contract.

H. Gas Pipeline and Gas Liquids Management

Gas liquids (gas condensate) are defined as liquid hydrocarbons that condense from natural gas because of changes in temperature, pressure, and/or flow. Xcel Energy has specific requirements identified in the Gas Standards Manual (in addition to applicable Federal, State, and other requirements) concerning handling of gas liquids. These requirements are available to the Supplier upon request. Prior to any gas work, removing gas liquids from the system, or performing work that may result in the removal of such from the system, Supplier must

coordinate activities with its Xcel Energy Contract Manager, site manager, and XEES. Supplier must assume that PCBs are present in the gas liquids, the liquids are ignitable, and pipe wrap coatings have asbestos unless and until it is verified that these conditions are not present. When gas liquids are present within these systems, samples must be collected for analysis and proper disposal.

I. Tank Management

Supplier is expected to comply with all applicable federal, state and local regulations and requirements for aboveground and underground storage tanks. Most States and localities have adopted regulations for tanks that, while similar to Federal regulations, may be different and more stringent. Local requirements may include the Uniform Fire Code or National Fire Protection Agency (NFPA) guidelines. Supplier must be aware of local requirements and contact the Fire Marshall, fire department, or appropriate local response agency as necessary, specified in the Contract or agreed upon with XEES. In addition, Xcel Energy may impose certain requirements for tanks above and beyond these regulations due to various circumstances. These requirements will be noted prior to contracting and will not supersede Contract conditions. Additionally, Supplier must follow all applicable Spill Prevention Control and Countermeasures (SPCC) requirements associated with any tank activities. Prior to installing a new tank, modifying an existing tank, adding materials, or performing maintenance, the Supplier must contact the Contract Manager or XEES representative to discuss steps Supplier has taken to ensure all applicable requirements have been met. These requirements can also include unique site-specific requirements for hazardous materials and tanks. In the event of a release to the environment of any regulated substance, Supplier must perform cleanup activities associated with the spill. See further information below regarding spill response and reporting procedures.

J. Demolition Activities

Supplier shall conduct a building hazard assessment prior to demolishing any building at Xcel Energy facilities. This assessment shall be conducted by a qualified professional as defined by the regulatory body governing such activities. Assessments shall include a determination as to whether regulated materials, including, but not limited to, lead, asbestos, or radioactive sources exist. These regulated materials must be properly managed prior to the demolition of the building.

K. Storm Water Management

Supplier is expected to comply with all applicable regulations, requirements, plans, and permits for the management of industrial and construction storm water. Supplier is responsible for ensuring that activities including but not limited to material handling and storage, maintenance and cleaning, construction, industrial processing and other operations occur in a manner consistent with the site's or facility's existing industrial or construction storm water management plan (SWMP). Supplier is responsible for controlling runoff from areas affected by its work to prevent the discharge of pollutants into nearby waterbodies or indirectly via storm sewer systems. Supplier shall complete routine site inspections of the worksite on a schedule consistent with the site's existing SWMP. Supplier is responsible for taking immediate corrective action on identified deficiencies associated with its storm water control measures.

Many states and localities have adopted industrial and construction storm water regulations that are consistent with, but more stringent than the federal requirements. If not specified in the

Contract, Supplier is responsible for working with its Xcel Energy Contract Manager, site manager, and XEES to define who is responsible for obtaining construction storm water permit coverage for the proposed activity, paying permitting fees, submitting the Notice of Intent, installing and inspecting the best management practices (BMPs) and completing the Notice of Termination. Unless specified otherwise in the Contract, the Supplier is responsible for temporary stabilization of the site until final restoration is completed. Supplier is expected to immediately report uncontrolled releases or damages to BMPs to the Xcel Energy Contract Manager.

L. Dewatering Activities

Dewatering activities need to be addressed as project planning is occurring. Supplier is responsible for contacting its Xcel Energy Contract Manager, site manager, and XEES in advance of dewatering activities to ensure that the proper authorizations are obtained. XEES is responsible for evaluating treatment options and assessing whether a dewatering permit is necessary, and if so, obtaining the permit. The Supplier is responsible for ensuring that the required sampling intervals are met, when applicable. Supplier is responsible for coordinating dewatering events with its Xcel Energy Contract Manager, site manager, and XEES to ensure that the required sampling can be arranged.

M. Other Common Substances and Hazards

Supplier understands that the project site may currently or historically have been used for electric or gas gathering, storage, transmission, distribution, or related facilities. Natural gas facilities may now transport and may continue to transport natural gas at significant pressures. Electric facilities may now transmit and may continue to transmit electric current at significant voltages, and conductors on electric lines may not be insulated. Power may have been generated historically or may currently be generated onsite by various means, including for example, nuclear, coal, wind, solar, hydro, gas or other means. Supplier may encounter hazardous or other regulated materials, including, but not limited to, petroleum, volatile organic compounds, coal ash, oil, lead, asbestos, naturally occurring radioactive materials, radioactive sources, or PCBs. Supplier must take necessary precautions for ensuring its work is performed safely and in compliance with all applicable laws and regulations with respect to these potential site conditions.

N. Spill Response and Reporting

Spill Prevention. Supplier must become familiar with Xcel Energy facility formal spill response plans and procedures. If a spill plan is not required or does not exist (as is often the case for non-Xcel Energy locations or Rights-of-Way), Supplier must still be prepared to take appropriate prevention and response measures. Supplier should have spill response kits and Personal Protective Equipment readily available on site to respond to spills.

- Good spill prevention measures should be implemented including, for example, good housekeeping – work area should be cleaned up immediately after the completion of jobs, minimize amount of chemicals in storage, etc.
- Store chemicals properly – store in fireproof cabinets or in designated areas, store drums away from traffic and run-off or sewers/waterways, keep drums closed, etc.
- Storage areas should be inspected on a regular basis to identify containers that may be in poor condition or leaking.
- Absorbent materials/pads should be available during all handling and transfer operations.

- Properly labeled drip pans should be in place when dispensing products from drums.
- Pump connections and hoses should be inspected for integrity and proper connection prior to each use.
- All chemicals or oil transfer operations must be continuously monitored to prevent overfill and spills.
- Know location of spills kits – replace any items used.

Spill Response. Supplier personnel performing an emergency response must be trained appropriately and cleanup spills, even small spills, immediately. Supplier must (1) protect its employees, subcontractors, and the public, and (2) protect the environment if a spill occurs. If a spill occurs, Supplier must evacuate the area if necessary and appropriate. The Supplier must ensure that all persons are kept away from the area of contamination until additional assistance arrives. In addition, to the extent that it is safe, the Supplier must make every effort to prevent the spread of contamination. Containing the flow of liquids, preventing contamination from entering a sewer or waterway, and preventing physical contact with the spilled material are all important.

Spill Reporting. There are federal, state, and local spill reporting laws that may apply in the event of a spill and Supplier may be responsible for spill reporting to federal, state, or local agencies. If it is an emergency, call "911" first to activate fire, police, or medical personnel as required. Next, notify the facility emergency number, if applicable. Finally, the Supplier must promptly notify the Xcel Energy Contract Manager and call the appropriate XEES emergency contact number identified below in Section P so that Xcel Energy can coordinate with the Supplier all spill reporting and communications with regulatory agencies and third parties about the spill. In the event of a chemical release or if a spill might reach or has reached water, a sewer, food, feed, garden, residential property, or school, or has otherwise gone off-site, contact XEES *immediately* (e.g., within 15 minutes of the spill)). If the Supplier activity identifies a potential historical release, work must be immediately stopped in the affected area to determine appropriate next steps. Upon identification of potential historical releases, Supplier shall immediately contact Xcel Energy Contract Manager and appropriate XEES staff. Once notified of a current or historic spill, Xcel Energy may decide to independently report the spill in addition to, or in lieu of, the Supplier. However, the Supplier remains responsible for all spill reporting obligations it may also have under applicable laws and regulations. Supplier shall make best efforts to coordinate with Xcel Energy on any communications to regulatory agencies and third parties about the spill, and Supplier shall keep Xcel Energy informed of all such communications.

O. Regulatory Inspections

Supplier shall notify the project manager and/or XEES when an authorized environmental governmental agency staff member is on site. Notice shall be provided as soon as the Supplier is aware that such a site visit or inspection will occur. XEES shall be provided the opportunity to participate in any scheduled site visit. Supplier will cooperate with authorized inspections at the direction of the XEES representative. Supplier will be prepared for inspections. Supplier must all ensure that records and documentation are kept up to date, and if appropriate or required by law, kept on site. Supplier will maintain good housekeeping practices for the work area. If agency sampling is planned, XEES staff will determine whether it is appropriate to take split samples and if so, who will take the samples.

P. Environmental and Emergency Contacts

ENVIRONMENTAL SERVICES EMERGENCY CONTACT NUMBERS				
	Colorado	Texas New Mexico Oklahoma	Minnesota South Dakota North Dakota	Wisconsin Michigan
Emergency Phone / Pager:	(303) 571-7100	(806) 674-1890 If no answer leave message with Name, Phone, Location, and Nature of Emergency. You will be contacted as soon as possible.	Spill Hotline (612) 330-5972 (24 hrs.)	Spill Hotline (715) 577-0003
24 Hour Hotline:	(800) 541-0918			
General Office Number:	(303) 294-2213	(806) 378-2196	(612) 330-7873	(715) 737-1346

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Tab 8 – Final Stabilization and Long-term Stormwater Management

FINAL STABILIZATION AND LONG-TERM STORMWATER MANAGEMENT (PART I.B.1.A.III AND I.C.2.J)

a) Description of Final Stabilization Practices

Upon completion of earth-disturbing activities, the site will be restored with vegetation in areas that currently have vegetation and with hard surfaces in areas that are currently paved, graveled, or otherwise hard surfaced. Disturbed areas of private land will be restored with landscaping to match the original landscaping or as agreed to by the landowner. For disturbed areas that will be stabilized with vegetation, final stabilization will consist of seeding in combination with another stabilization measure, such as crimp mulching, and/or installation of rolled erosion control products as appropriate for the site slope. Stabilization must be implemented within 14 days of achieving final grade or temporary stabilization measures must be employed. Areas where stabilization measures have been employed will be inspected and maintained until final stabilization is achieved.

The Site Map (Tab 2) will be updated to indicate which CMs will be used at specific locations during final stabilization. The Site Map is a dynamic document changing with field conditions. Proposed CMs are initially placed on the Site Map and then it is updated in the field to reflect changes as the project moves forward and final stabilization measures occur. Final stabilization for disturbed areas within roadways or road shoulders will be to return areas to their original condition – compacted with applicable re-installation of rock or gravel materials or paved with asphalt or concrete.

b) Final Stabilization Methods

Final stabilization includes those measures taken to control pollutants in stormwater after ground disturbing activities are complete. The following measures will be implemented:

Soil Preparation Measures Including Amendment

Prior to application of seed and mulch, areas to be stabilized with vegetation will be decompacted. No soil amendments are proposed.

Reapplication of Topsoil

Salvaged topsoil will be reapplied to areas that will be stabilized with vegetation after the subsoil has been decompacted and before seed and mulch are applied.

Seed Mix Selection and Application Method

The proposed seed mix for this project is the “Shotgun” grass seed mix from the El Paso County Conservation District and seed will be applied with a drill seeder.

Soil Stabilization Methods

After areas to be revegetated have been drill seeded, crimp mulch will be applied on top.

Return of Site to Cropland Use

There are portions of the project to be returned to cropland, those areas will be left in a surface roughened condition and SWMP inspector to note those areas on the site map. All other areas that are not returned to cropland will be stabilized with seed and mulch.

Maintenance of Appropriate Erosion and Sediment Control Measures Until Site is Stabilized

Downgradient perimeter sediment controls and downgradient inlet protections will be maintained in areas to be restabilized with vegetation until final stabilization is achieved.

Removal of Temporary Control Measures Once Site is Stabilized

Once final stabilization is achieved, all remaining perimeter sediment controls and downgradient inlet protections will be removed.

c) Final Stabilization Achievement

Final stabilization is achieved when construction activities at the site have been completed, permanent stabilization has been installed in all areas and has met the thresholds described below, and temporary CMs are removed. Areas being stabilized with a vegetative cover must have evenly distributed perennial vegetation, which may include trees and shrubs. The vegetation coverage must be, at a minimum, equal to 70 percent of what would have been provided by native vegetation in a local, undisturbed area or adequate reference site. Areas not stabilized with vegetative cover must receive equivalent permanent, physical erosion reduction methods. When final stabilization is achieved, temporary erosion and sediment CMs will be removed.

d) Long-term Stormwater Management

Long-term stormwater management for this project will be restoring the site to pre-construction conditions. There are no anticipated post-construction detention or water quality CMs that will be installed as part of this project.

Tab 9 –Inspection Frequency and Scope, Maintenance, and Blank Report Form

INSPECTIONS AND MAINTENANCE (PART I.D.1 THROUGH 5 AND PART I.B.1.B AND C)

a) Inspection Frequency

The site will be inspected thoroughly by a Qualified Stormwater Manager at the following frequency:

- At least one inspection every 7 calendar days, or
- At least one inspection every 14 calendar days, if post-storm event inspections are 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. The first site inspection should start within 7 calendar days of the commencement of construction activities, or
- An alternate schedule approved by the CDPHE Water Quality Control Division.

b) Reduced Inspection Frequency

The site will be inspected thoroughly by a qualified stormwater manager at the following reduced frequencies when one of the following conditions exists:

- Post-Storm Inspections at Temporarily Idle Sites – For permittees choosing to combine 14-day inspections and post-storm event inspections, if no construction activities will occur following a storm event, post-storm event inspections must be conducted prior to re-commencing construction activities, but no later than 72 hours after the end of any precipitation or snowmelt event that causes surface erosion. The delay of any post-storm event inspection must be documented in the inspection record. Routine inspections must still be conducted at least every 14 calendar days.

- Inspections at Sites Awaiting Final Stabilization – When the site, or portions of a site are awaiting establishment of a vegetative ground cover and final stabilization, the permittee must conduct a thorough inspection of the construction site and CMs at least once every 30 days. Post-storm event inspections are not required under this schedule. This reduced inspection schedule is allowed if all of the following criteria are met:

    - All construction activities resulting in ground disturbance are complete,
    - All activities required for final stabilization, in accordance with the SWMP, 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 locate those areas to be inspected in accordance with the reduced schedule allowed for in this paragraph.

- Winter Conditions Inspections Exclusion – Typically, this exclusion applies to elevations or locations where snow melt does not occur in the winter months. Inspections are not required for sites that meet all of the following conditions: construction activities are temporarily halted for the winter season, snow cover exists over the entire site for an extended period (i.e. high-elevation winter season) and melting conditions posing a risk of surface erosion do not exist. This inspection exception is applicable only during the period where melting conditions do not exist, and applies to the routine 7-day, 14-day and monthly inspections, as well as the post-storm-event inspections. When this inspection exclusion is implemented, the following information must be documented and retained:

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

c) Inspection Scope

Areas to be Inspected (Part I.D.5.a.)

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 (§I.D.5.a):

- Construction site perimeter,
- All disturbed areas including areas that are temporarily stabilized,
- Designated haul routes,
- Material and/or waste storage areas that are exposed to precipitation,
- Locations of pumped stormwater,
- Locations where stormwater has the potential to discharge offsite, and
- Locations where vehicles exit the site.

All erosion and sediment control practices identified in the SWMP will be evaluated to ensure that they are maintained and operating correctly.

Inspection Requirements (Part I.D.5.b)

- Visually verify whether all implemented CMs are in effective operational condition and are working as designed in their specifications to minimize pollutant discharges.
- Determine if there are new potential sources of pollutants.
- Assess the adequacy of CMs at the site to identify areas requiring new or modified CMs to minimize pollutant discharges.
- Identify all areas of non–compliance with the permit requirements and, if necessary, implement corrective action in accordance with the permit.

Inspection Report (Part I.D.5.c)

The inspection report form is located at the end of the tab. Inspection reports must identify any incidents of non-compliance with the terms and conditions of the general permit. 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. Inspection records must be retained for three years from the expiration or inactivation of permit coverage. However, PSCo's internal policy requires all records associated with this permit to be maintained for 10 years.

The inspection report will include:

- The inspection date.
- Name(s) and title(s) of personnel making the inspection.
- Weather conditions at time of inspection.
- Phase of construction at time of inspection.
- Estimated acreage of disturbance at time of inspection.
- Location(s) of discharges of sediment or other pollutants from the site.
- Location(s) of CMs that are still operating but need to be maintained.
- Location(s) of CMs that failed to operate as designed or proved inadequate for a particular location.
- Location(s) where additional CMs are needed that were not in place at the time of inspection.
- Description of the minimum inspection frequency utilized when conducting each inspection.
- Deviations from the minimum inspection schedule.
- After adequate corrective action(s) have been taken, or where a report does not identify any incidents requiring corrective action, the report must contain the flowing statement and provide the date of the statement: "I verify that, to the best of my knowledge and belief, that if any corrective

action items were identified during the inspection, those corrective actions are complete, and the site is currently in compliance with the permit."

Inspection reports must be signed by one of the individuals designated as a Qualified Stormwater Manager.

d) Control Measure Routine Maintenance (Part I.B.1.b)

All erosion and sediment control practices and other protective measures identified in the SWMP will be maintained in effective operating condition. 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 potential pollutant sources associated with the construction activity to prevent pollution or degradation of state waters. Observations leading to the required maintenance of CMs can be made during a site inspection, or during general observations of site conditions. The necessary repairs or modifications to a CM requiring routine maintenance must be conducted to maintain an effective operating condition. Routine maintenance of CMs will occur anytime that the condition of the CM or the accumulation of sediment or debris adversely impacts the functioning of the CM.

e) Corrective Actions/Replacement of Failed Control Measures (Part I.B.1.c)

Adequate site assessment will be performed as part of 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. Where site assessment results in the determination that new or replacement CMs are necessary, the CMs will be installed or maintained in accordance with this SWMP. Where CMs have failed, resulting in noncompliance, they will be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants. When new CMs are installed or CMs are replaced, the SWMP will be updated. If a control cannot be repaired or installed immediately a statement of why this could not occur will be added to the SWMP along with a proposed schedule. If any unauthorized release or discharge of sediment or other materials has occurred, it will be cleaned up to the extent feasible to minimize discharges in subsequent storm events.

CONSTRUCTION STORMWATER INSPECTON REPORT

Project Name:	Project Location (i.e. address, cross streets):
Xcel Project Manager/Construction Supervisor:	Xcel Onsite QC Inspector (if applicable):
Construction Contractor Supervisor/Foreman:	Qualified Stormwater Manager:
Stormwater Inspector – Alternate SW Manager (name & title)	Control Measure/BMP Installation Contractor:

Is the Inspector a Qualified Stormwater Manager? ☐ Yes ☐ No

Date of Inspection:	NPDES/CDPS Certification #:	Local/MS4/GESC Permit #:

Inspection Start Time:	Inspection Stop Time:

Current weather at time of inspection:

Phase of Construction

☐ Pre-Construction ☐ Initial ☐ Interim ☐ Final/Waiting for Growth ☐ Permit Closeout

Estimated Acreage of Disturbance at time of Inspection:

Type of Inspection

☐ Routine 7 day Inspection. At least one inspection every 7 calendar days (note that local MS4 may still require post storm inspections).

☐ Routine 14 day Inspection. At least one inspection every 14 calendar days, if post-storm event inspections are 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.

☐ Inspection for Discharges to Outstanding Waters. (Permittees must conduct site inspections at least once every 7 calendar days for sites that discharge to a water body designated as an Outstanding Water by the Water Quality Control Commission).

☐ Runoff Event (Post-storm event inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event with potential to cause 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).
Storm Start Date: _____ Storm Stop Date: _____ Approximate Amount:_____

☐ Inspections at Completed Sites/Areas. When the site or portions of a site are awaiting establishment of a vegetative ground cover and final stabilization, the permittee must conduct a thorough inspection of the stormwater management system at least once every **30 days**. (Post-storm event inspections are not required under this schedule but the local MS4 may still require post storm inspections).

☐ Winter Conditions Inspections Exclusion. Inspections are not required for sites that meet all of the following conditions: 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. This inspection exception is applicable only during the period where melting conditions do not exist, and applies to the routine 7-day, 14-day and monthly inspections, as well as the post-storm-event inspections. When this inspection exclusion is implemented, the following information must be documented: dates when snow cover existed, date when construction activities ceased, and date melting conditions began.

☐ Other:

☐ When site conditions make the schedule required in this section impractical, the permittee may petition the Division to grant an alternate inspection schedule. The alternative inspection schedule may not be implemented prior to written approval by the division and incorporation into the SWMP. The primary Qualified Stormwater Manager must approve any schedule deviations and subsequent petition to the Division.

SWMP Management

	Yes	No	N/A	Comments
Is the Permit(s) (Federal, State and/or Local/MS4/GESC) retained in the SWMP Notebook?	☐	☐	☐	
Is the SWMP Notebook located onsite? If not, provide a copy of documentation that was submitted requesting and granting alternate location?	☐	☐	☐	Location of SWMP
Is a site specific EPA SPCC Plan included in the SWMP (applies to bulk storage of hydrocarbon products greater than 1,320 gallons)?	☐	☐	☐	
Are changes to the SWMP Documents noted (i.e. new or altered narratives, control measure details, site map updates, haul roads/routes, access points, etc)?	☐	☐	☐	
Are inspection reports retained in the SWMP Notebook?	☐	☐	☐	
Are corrective actions/maintenance items from previous inspection complete (if not show items on page 2)?	☐	☐	☐	
Are there any new potential sources of pollutants onsite?	☐	☐	☐	

Control Measures at time of inspection							
	In SWMP Design	In Use	Not Needed at this time		In SWMP Design	In Use	Not Needed at this time
Erosion Control Measures				**Sediment Control Measures**			
Seeding	☐	☐	☐	Stabilized Construction Entrance (i.e. VTC, mud mat, VTRAX, FOD, other)	☐	☐	☐
Mulch/Mulch Tackifier	☐	☐	☐	Sediment Basin/Trap	☐	☐	☐
Soil Binder	☐	☐	☐	Inlet Protection	☐	☐	☐
Retention Blankets (i.e. ECB/TRM)	☐	☐	☐	Outlet Protection	☐	☐	☐
Embankment Protector	☐	☐	☐	Sediment Control Log	☐	☐	☐
Grading (i.e. Surface Roughening, etc)	☐	☐	☐	Silt Fence	☐	☐	☐
Berm/Diversion (i.e. water bars)	☐	☐	☐	Rock Socks	☐	☐	☐
Protection of Existing Vegetation	☐	☐	☐	Velocity dissipation device (i.e. check dams, water bars)	☐	☐	☐
Hot or Cold Patch:	☐	☐	☐	Big Reds/Dandy Recyclers	☐	☐	☐
Other: (specify)	☐	☐	☐	Vegetation and Topography	☐	☐	☐
Other: (specify)	☐	☐	☐	Other: (specify)	☐	☐	☐
Control Measures for Special Conditions				**Materials Handling, Spill Prevention, Waste Management and General Pollution Prevention**			
Dewatering Structure	☐	☐	☐	Stockpile Management	☐	☐	☐
Temporary Stream Crossing	☐	☐	☐	Erodible building materials	☐	☐	☐
Clear Water Diversion	☐	☐	☐	Concrete Waste Management	☐	☐	☐
Sensitive Area Fencing	☐	☐	☐	Solid Waste/Trash	☐	☐	☐
Access/Boundary Controls (i.e. construction fence)	☐	☐	☐	Vehicle and Equipment Management	☐	☐	☐
50 foot vegetative buffer to receiving water	☐	☐	☐	Liquids (stored in secondary containment)	☐	☐	☐
Other: (specify)	☐	☐	☐	Sweeping	☐	☐	☐
Other: (specify)	☐	☐	☐	Sanitary Facility	☐	☐	☐
Other: (specify)	☐	☐	☐	Other: (specify)	☐	☐	☐
Other: (specify)	☐	☐	☐	Other: (specify)	☐	☐	☐

GENERAL NOTES

CONSTRUCTION SITE ASSESSMENT ***off site Pollutant Discharges are a violation of the Permit and Reason for Stop Work***

When conducting a site inspection, the following areas, if applicable, must be inspected for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters: 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, and locations where vehicles exit the site.

The permittee must ensure all control measures remain in effective operating condition and are working as designed in their specifications to minimize pollutant discharges. Determine if there are new potiential sources of pollutants. Assess the adequacy of control measures at the site to identify areas requiring new or modified control measures to minimize pollutant discharges. Identify all areas of non-compliance with the permit requirements and, if necessary, implement corrective actions.

Control Measures must be maintained in accordance with good engineering, hydrologic and pollution control practices. Control Measure Requiring Routine Maintenance is defined as any control measure that is still operating in accordance with its design and the requirements of this permit, but requires maintenance to prevent a breach of the control measure. See also inadequate control measure.

The permittee must assess the adequacy of control measures at the site, and the need for changes to those control measures to ensure continued effective performance. When an inadequate control measure is identified (i.e., new or replacement control measures become necessary), the following corrective action requirements apply. The permittee is in noncompliance with the permit until the inadequate control measure is replaced or corrected and returned to effective operating condition in compliance. If the inadequate control measure results in noncompliance that meets the conditions of Part II.L., the permittee must also meet the requirements of that section. Inadequate Control Measure is defined as 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.

If a new control measures is needed the inspector must determine if that new control measure is categorized as “inadequate or maintenance” based on the definitions above.

All control measures identified in the SWMP shall be evaluated to ensure that they are maintained and operating correctly. Identify the condition of the control measure as either inadequate or in need of maintenance as defined above. Continuous and proactive maintenance is required on all Control Measures. Control Measures that are not operating effectively, have proven to be inadequate, or failed must be addressed as soon as possible, immediate in most cases.

Date of Initial Finding	Location (station #, pole #, intersection, etc)	Control Measure	Condition (Inadequate/Maintenance)	Description of Corrective Action/Comment	Date Complete & Initials

CONSTRUCTION SITE ASSESSMENT ***off site Pollutant Discharges are a violation of the Permit and Reason for Stop Work***

(a) Is there evidence of discharge of sediment or other pollutants from the site? ☐ Yes ☐ No

*If yes, explain the location of discharge and the corrective actions in the Construction Site Assessment section or General Notes

(b) Has sediment or other pollutants discharging from the site reached state waters or municipal separate storm sewer system? ☐ Yes ☐ No

*If yes, contact Xcel Energy's Environmental Services (303)294-2189. **No individual** shall notify local or State offices on Xcel Energy's behalf.

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:

Tab 10 – SWMP General Requirements, Reviews, Revisions, and Noncompliance Notifications

SWMP General Requirements (Part I.C.1)

a) SWMP Development (Part I.C.1.a)

A SWMP will be developed for each construction site covered by this permit. The SWMP must be prepared in accordance with good engineering, hydrologic and pollution control practices.

b) SWMP Implementation (Part I.C.1.b)

The permittee must implement the provisions of the SWMP as written and updated, from commencement of construction activity until final stabilization is complete. The division may review the SWMP.

For public emergency related sites, a SWMP will be created no later than 14 days after the commencement of construction activities.

c) SWMP Retention (Part I.C.1.c)

A copy of the SWMP must be retained on-site unless another location, specified by the permittee, is approved by the Division. The plan and inspection reports may be prepared, signed, and kept electronically, rather than in paper form, if the records are:

- In a format that can be read in a similar manner as a paper record, and
- Immediately accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be.

PSCo stores its SWMPs digitally in StormPro.

SWMP Availability (Part I.C.4)

A copy of the SWMP will be provided upon request to the Water Quality Control Division, EPA, or any local agency in charge of approving sediment and erosion plans, grading plans or stormwater management plans, and within the time frame specified in the request. If the SWMP is required to be submitted to any of these entities, it must include a signed certification in accordance with Part I.A.3 and Part II.K of the permit, certifying that the SWMP is complete and meets all permit requirements.

This SWMP will be available to the public under Section 308(b) of the CWA and Section 61.5(4) of the Colorado Discharge Permit System Regulations. PSCo will make plans available to members of the public upon request. However, PSCo may claim any portion of a SWMP as confidential in accordance with 40 CFR Part 2.

Noncompliance Notifications (Part II.L.7)

a) What to Report

The following instances of noncompliance will be reported to the PSCo Project Manager as soon as they are discovered (Part II.L.6):

- Any noncompliance which may endanger the health of the environment.
- Any unanticipated bypass which exceeds any effluent limitations in the permit.
- Any upset which causes an exceedance of any effluent limitation in the permit.
- Daily maximum violations for any of the pollutants limited by Part I.A of the state discharge permit including any toxic pollutant or hazardous substance, or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.

The report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

b) Verbal Notification

It is PSCo's policy that the Environmental Services Group performs all regulatory reporting for all of PSCo's activities. If an instance of noncompliance such as those listed above occurs at the site, immediately contact the PSCo Project manager, who will then call the Environmental Services Emergency Number. This number is 303-571-7100. This phone number is staffed 24 hours a day, 7 days a week by Environmental Services personnel. They will assist in determining the severity of the event and they will then make the appropriate notifications. Under no circumstance are non-Environmental Service personnel authorized to contact regulatory agencies.

c) Written Notification

The Environmental Services Group must also report all instances of noncompliance at the time monitoring reports are due. If no monitoring reports are required, these reports are due at least annually. The annual report must contain all instances of non-compliance.

Tab 11 – Preconstruction Photos

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

01. Staging Yard

02. Staging Yard

03. Staging Yard - ~60% Vegetative Cover

04. STR 332 – Facing S.

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

05. STR 356 – Facing NW

06. STR 356 - ~95% Vegetative Cover

07. STR 360 – Facing N.

08. STR 360 - ~95% Vegetative Cover

09. STR 362 - ~80% Vegetative Cover

10. STR 364 - ~80% Vegetative Cover

11. STR 366 – Facing NE.

12. STR 366 - ~95% Vegetative Cover

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

13. STR 412 - ~50% Vegetative Cover

14. STR 422 - ~80% Vegetative Cover

15. STR 422 - ~50% Vegetative Cover

16. STR 426 – Facing E.

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

17. STR 426 - ~85% Vegetative Cover

18. STR 428 – Facing W.

19. STR 428 - ~85% Vegetative Cover

20. STR 430 – Facing S.

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

21. STR 430 - ~95%Vegetative Cover

22. STR 431 – Facing W.

23. STR 432 ~85% Vegetative Cover

24. STR 431 - ~95% Vegetative Cover

25. STR 432 – Facing E.

26. STR 432 - ~95% Vegetative Cover.

27. STR 433

28. STR 433 - ~95% Vegetative Cover

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

29. STR 433 – Facing W.

30. STR 449 - Facing W.

31. STR 449 - ~90% Vegetative Cover

32. STR 452 – Facing S.

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

33. STR 452 - ~75% Vegetative Cover

34. STR 453

35. STR 453 ~85% Vegetative Cover.

36. Walls Yard – Facing N.

37. Walls Yard – ~60% Vegetative Cover

38. Walls Yard

39. Walls Yard – ~65% Vegetative Cover

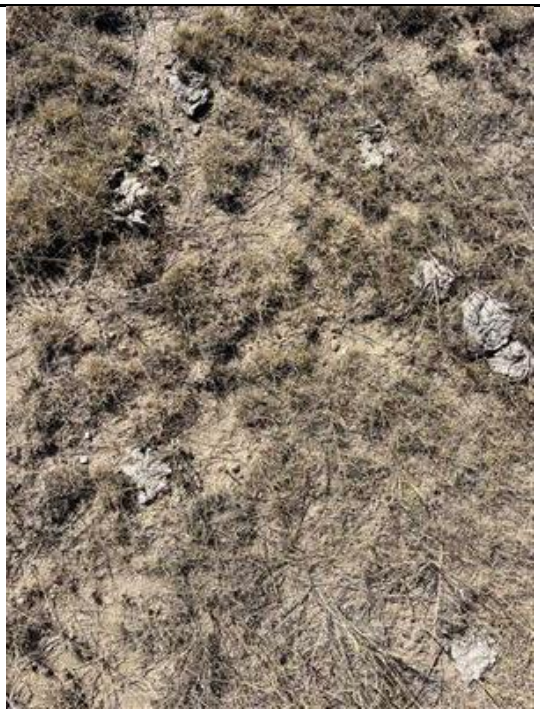
40. Walls Yard – ~60% Vegetative Cover

41. Walls Yard – Facing E.

42. Walls Yard - ~75% Vegetative Cover

43. Walls Yard – Facing SE.

44. Walls Yard – Facing S.



45. Walls Yard - ~60% Vegetative Cover

46. Walls Yard – Facing NW from entrance

47. Walls Yard - ~90% Vegetative Cover

48. Walls Yard

49. Walls Yard - ~90% Vegetative Cover

50. Walls Yard - ~65% Vegetative Cover

51. Walls Yard - ~60% Vegetative Cover

52. Walls Yard

53. Walls Yard - ~65% Vegetative Cover

54. STR 474 – Facing S.

55. STR 474 - ~95% Vegetative Cover

56. STR 498 – Facing E.

57. STR 498 - ~50% Vegetative Cover

58. STR 498 - ~65% Vegetative Cover

59. STR 500

60. STR 500 – ~95% Vegetative Cover

61. STR 501 - ~95% Vegetative Cover

62. STR 529

63. STR 529 - ~90% Vegetative Cover

64. STR 529 – Facing S.

Xcel Pathways Segment 5 - Elbert County
10/22/2024 – 10/23/2024

65. STR 529 - ~60% Vegetative Cover

66. STR 530

67. STR 530

68. STR 558 - ~85% Vegetative Cover

69. STR 559 - ~85% Vegetative Cover

70. STR 560 - ~85% Vegetative Cover

71. STR 562 - ~80% Vegetative Cover

72. STR 563 - ~85% Vegetative Cover

Tab 12 – Environmental Permits

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

Stormwater Permit Number: ESQ_____

EL PASO COUNTY
STORMWATER PERMIT FORM
Erosion and Stormwater Quality Control Permit (ESQCP)

EPC Project Number: _____

There are multiple Stormwater Permits. Please refer to Engineering Criteria Manual (ECM) Appendix I to determine which permit is applicable to your project.

This form initially acts as the permit application. Only once this form has been signed & approved, all other required documents have been submitted & approved, and the Notice to Proceed has been issued, does this form become an active permit.

Part I. Property Owner or Authorized Representative (Co-Permit Holder)	
Company/Organization	Public Service Company of Colorado (PSCo)
Name or Name of Representative	Chad Campbell
Title	Environmental Services Manager
Physical Address (not PO Box)	
Street Number and Street Name	3500 Blake St, Floor 3
City, State, Zip Code	Denver, CO 80205
Mailing Address (if differs from above)	
Street Number and Street Name	
City, State, Zip Code	
Phone Number - Office	303-285-6590
Phone Number - Cell	
Email Address	Chad.campbell@xcelenergy.com

Part II. Contractor/Operator (Co-Permit Holder)*	
Company/Organization	Public Service Company of Colorado (PSCo)
Name or Name of Representative	Chad Campbell
Title	Environmental Services Manager
Physical Address (not PO Box)	
Street Number and Street Name	3500 Blake St, Floor 3
City, State, Zip Code	Denver, CO 80205
Mailing Address (if differs from above)	
Street Number and Street Name	
City, State, Zip Code	
Phone Number - Office	303-285-6590
Phone Number - Cell	
Email Address	Chad.campbell@xcelenergy.com

*This section can be left blank through design review but must be filled in no later than at the Pre-Con Meeting.

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

Stormwater Permit Number: ESQ_____

EL PASO COUNTY
STORMWATER PERMIT FORM
Erosion and Stormwater Quality Control Permit (ESQCP)

EPC Project Number: _____

Part III. Qualified Stormwater Manager (QSM)*	
Company/Organization	Public Service Company of Colorado (PSCo)
Name	Tensy Thatcher
Phone Number - Office	970-646-0969
Phone Number - Cell	970-903-0595
Email Address	tensy.c.thatcher@xcelenergy.com

*This section can be left blank through design review but must be filled in no later than at the Pre-Con Meeting.

Part IV. Project Information	
Project Name	Xcel Tline: PWAY Segment 5 El Paso County Build
Address (or nearest major cross streets)	Start: 3.01 miles east of the intersection Edison Road and N County Line Road
Acreage	Total: 1025 acres Proposed Disturbance: 217 acres
Description of Project	Linear construction activities associated with the construction of a new 345 kV double circuit overhead electrical transmission line.
Schedule (input estimated month or season)	Start of Construction: 7/20/26 Completion of Construction: 2/9/2028 Final Stabilization: 6/9/2030

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

Stormwater Permit Number: ESQ_____

EL PASO COUNTY
STORMWATER PERMIT FORM
Erosion and Stormwater Quality Control Permit (ESQCP)

EPC Project Number: _____

REQUIRED SUBMISSIONS

See ECM Appendix I for the documentation required to be submitted, reviewed, and approved in conjunction with this Stormwater Permit Form.

RESPONSIBILITY FOR DAMAGE

The County and its officers and employees, including but not limited to the ECM Administrator, shall not be answerable or accountable in any manner for damage to property or for injury to or death of any person, including but not limited to the Permit Holder(s), persons employed by the Permit Holder(s), or persons acting on behalf of the Permit Holder(s), from any cause. The Permit Holder(s) shall be responsible for any liability imposed by law and for damage to property or injuries to or death of any person, including but not limited to the Permit Holder(s), persons employed by the Permit Holder(s), and persons acting on behalf of the Permit Holder(s), arising out of work or other activity permitted and done under a permit, or arising out of the failure to perform the obligations under any permit with respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit.

The Permit Holder(s) shall indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the Board of County Commissioners (BoCC) and ECM Administrator, from all claims, suits or actions of every name, kind and description brought for or on account of damage to property or injuries to or death of any person, including but not limited to the Permit Holder(s), persons employed by the Permit Holder(s), persons acting in behalf of the Permit Holder(s) and the public, resulting from the performance of work or other activity under the permit, or arising out of the failure to perform obligations under any permit with respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by state law. The Permit Holder(s) waives any and all rights to any type of expressed or implied indemnity against the County, its officers or employees. It is the intent of the parties that the Permit Holder(s) will indemnify, save, and hold harmless the County, its officers and employees from any and all claims, suits or actions as set forth above regardless of the existence or degree of fault of or negligence, whether active or passive, primary or secondary, on the part of the County, the Permit Holder(s), persons employed by the Permit Holder(s), or persons acting in behalf of the Permit Holder(s).

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

Stormwater Permit Number: ESQ_____

EL PASO COUNTY
STORMWATER PERMIT FORM
Erosion and Stormwater Quality Control Permit (ESQCP)

EPC Project Number: _____

APPLICATION AND PERMIT CERTIFICATION – PERMIT HOLDERS

We, as the Permit Holder(s), hereby certify that this application is correct and complete as per the requirements presented in the El Paso County Engineering Criteria Manual (ECM) and Drainage Criteria Manual (DCM) Volume 2. We, as the Permit Holder(s), have read and will comply with all of the requirements of the submitted Stormwater Management Plan (SWMP), Grading & Erosion Control (GEC) Plan, and any other documents specifying construction control measures to be used on the site, including permit conditions that may be required by the ECM Administrator. We understand that the approved plans are an enforceable part of the ESQCP. We further understand that we are to comply with all requirements set forth by the ECM and DCM Volume 2. We understand that the permitted area is that which is shown as the Limits of Disturbance on the GEC Plans. We further understand that a Construction Permit must be obtained and all necessary construction control measures are to be installed in accordance with the SWMP, GEC Plan, ECM, and DCM Volume 2 before land disturbance begins and that failure to comply will result in a Stop Work Order and may result in other penalties as allowed by law. We understand that the construction control measures are to be maintained on the site and be modified as necessary to protect stormwater quality as the project progresses. We further understand and agree to indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the BoCC and ECM Administrator, from all claims, suits or actions of every name, kind and description as outlined in Responsibility for Damage section above.

_____ 6/26/2026
Signature of Owner or Representative — Date

Chad Campbell
Print Name of Owner or Representative

Tensy Thatcher _____ 6/26/2026
Signature of Contractor/Operator or Representative* — Date
*If signed by a Rep, an Affidavit of Signature Authority must be included

Tensy Thatcher
Print Name of Contractor/Operator or Representative

APPLICATION AND PERMIT CERTIFICATION – EL PASO COUNTY

The following signature from the ECM Administrator signifies the approval of this ESQCP Application.

_____ _____
Signature of ECM Administrator — Date

COLORADO
Department of Public Health & Environment

CERTIFICATION TO DISCHARGE
UNDER
CDPS GENERAL PERMIT COR400000
STORMWATER ASSOCIATED WITH CONSTRUCTION ACTIVITY

Certification Number: **COR427002**

This Certification to Discharge specifically authorizes:

Owner Public Service Company of Colorado (PSCo)
Operator Public Service Company of Colorado (PSCo)
to discharge stormwater from the facility identified as

Xcel Tline: Pathways Segment 5 El Paso County Build

To the waters of the State of Colorado, including, but not limited to:

Mustang Creek, Big Sandy Creek, Horse Creek, Arkansas River

Facility Activity :	Pipeline
Disturbed Acres:	220 acres
Facility Located at:	3.01 miles east of the intersection Edison Road and N County Line Road Unincorporated, CO 80832 El Paso County Latitude 38.52436 Longitude -104.10977
Specific Information (if applicable):	

Certification is issued and effective: 03/19/2025
Expiration date of general permit: 3/31/2029

This certification under the general permit requires that specific actions be performed at designated times. The certification holder is legally obligated to comply with all terms and conditions of the COR400000 permit.

This certification was approved by:
Andrew Sayers-Fay Permits Section Manager
Clean Water Program
Water Quality Control Division

COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

Chad Campbell, Environmental Services Manager
Public Service Company of Colorado (PSCo)
1800 Larimer St., Suite 1300
Denver, CO 80202

Chad Campbell, Environmental Services Manager
Public Service Company of Colorado (PSCo)
1800 Larimer St., Suite 1300
Denver, CO 80202

DATE: 2025-03-19

MEMO RE: Certification, Colorado Discharge Permit System
Permit No., COR400000, Certification Number: COR427002

DIVISION CONTACTS: Permits Line 303-692-3517 cdphe_wqcd_permits@state.co.us

ATTACHMENTS: Certification COR427002, COR400000 General Permit

The Water Quality Control Division (the Division) has reviewed the application submitted for the Xcel Tline: Pathways Segment 5 El Paso County Build facility and determined that it qualifies for coverage under the CDPS General Permit for Stormwater Discharges Associated with Construction Activity (COR400000). Enclosed please find a copy of the permit certification, which was issued in accordance with the Colorado Water Quality Control Act.

FEE INFORMATION: 220 acres
An application fee of $270 (50% of the annual fee) will be assessed for all new applications. Beginning July 1, 2019 an annual fee of $540 category 7, subcat – Stormwater Construction >30 acres disturbed [per CRS 25-8-502] will be assessed and invoiced every July for as long as the permit certification is in effect.

It is the responsibility of the permittee to submit a termination application when the permit certification is no longer needed. Fees are assessed and invoiced for every permit certification that is active July 1 of the fiscal year. Permit certifications for which complete termination applications are received by June 30 of the current fiscal year will not be invoiced for the new fiscal year.

CERTIFICATION RECORDS INFORMATION:

The following information is what the Division records show for this certification.
For any changes to Contacts – Owner, Operator, Facility, or Billing – a "Notice of Change of Contacts form" must be managed through the Division's new platform called the Colorado Environmental Online Services (CEOS). The Notice of Change of Contacts form must be electronically signed by both the owner and the operator.

Facility: Xcel Tline: Pathways Segment 5 El Paso County Build — El Paso County
Construction Activities Pipeline
Owner (*receives all legal documentation pertaining to the permit certification):*
Chad Campbell, Environmental Services Manager — Phone number: 202-285-6590
Public Service Company of Colorado (PSCo) — Email: Chad.Campbell@xcelenergy.com
1800 Larimer St., Suite 1300
Denver, CO 80202
Operator (*receives all legal documentation pertaining to the permit certification):*
Chad Campbell, Environmental Services Manager — Phone number: 202-285-6590
Public Service Company of Colorado (PSCo) — Email: Chad.Campbell@xcelenergy.com
1800 Larimer St., Suite 1300
Denver, CO 80202

Facility Contact *(contacted for general inquiries regarding the facility):*

Tensy Thatcher, Environmental Analyst - Stormwater Compliance
Public Service Company of Colorado (PSCo)
1800 Larimer St., Suite 1300
Denver, CO 80202

Phone number: 970-903-0595
Email:
Tensy.c.thatcher@xcelenergy.com

Billing Contact *(receives the invoice pertaining to the permit certification):*

Chad Campbell, Environmental Services Manager
Public Service Company of Colorado (PSCo)
1800 Larimer St., Suite 1300
Denver, CO 80202

Phone number: 202-285-6590
Email: Chad.Campbell@xcelenergy.com

COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

CDPS GENERAL PERMIT COR400000

STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY

AUTHORIZATION TO DISCHARGE UNDER THE

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)

In compliance with the provisions of the Colorado Water Quality Control Act, (25-8-101 et seq., CRS, 1973 as amended) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq.; the "Act"), this permit authorizes the discharge of stormwater associated with construction activities, as defined in this permit, to be certified under this permit from those locations authorized to discharge from authorized locations throughout the State of Colorado to specified surface waters of the state, in accordance with the eligibility and permit application requirements, effluent limitations, monitoring requirements, inspection requirements, and other conditions set forth in this general permit.

This permit specifically authorizes the facility listed on the certification to discharge in accordance with permit requirements and conditions set forth in Parts I and II hereof. All discharges authorized herein must be consistent with the terms and conditions of this permit.

This permit becomes effective on, 04/01/2024 and will expire at midnight 03/31/2029.

Issued and signed this 31st day of January, 2024 and Effective April 1, 2024.

Andrew Sayers-Fay, Permits Section Manager Water Quality Control Division

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

PERMITS ACTION SUMMARY

Issued January 31, 2024, Effective April 1, 2024

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PART I

Note: At the first mention of terminology that has a specific connotation for the purposes of this permit, the terminology is electronically linked to the definitions section of the permit in Part I.E.

A. COVERAGE UNDER THIS PERMIT

1. Authorized Discharges

This general permit authorizes permittee(s) to discharge the following to state waters: stormwater associated with construction activity and specified non-stormwater associated with construction activity. The following types of stormwater and non-stormwater discharges are authorized under this permit:

a. Stormwater Discharges

i. Stormwater discharges associated with construction activity.

ii. Stormwater discharges associated with producing earthen materials, such as soils, sand, and gravel dedicated to providing material to a single contiguous site, or within ¼ mile of the construction site covered by this permit (e.g. borrow or fill areas).

iii. Stormwater discharges associated with dedicated asphalt, concrete batch plants, and masonry mixing stations (Coverage under this permit is not required if alternative coverage has been obtained).

b. Non-Stormwater Discharges

The following non-stormwater discharges are allowable under this permit if the discharges are identified in the stormwater management plan in accordance with Part I.C and if they have appropriate control measures in accordance with Part I.B.1.

i. Discharges from uncontaminated springs that do not originate from an area of land disturbance.

ii. 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 must not leave the site as surface runoff or reach receiving waters as defined by this permit. The addition of soaps, solvents and detergents is prohibited. Concrete or masonry on-site waste disposal is not authorized by this permit except in accordance with Part I.B.1.a.ii(c).

iii. Discharges of landscape irrigation return flow.

iv. Discharges from diversions of state waters within the permitted site.

c. Emergency Fire Fighting

Discharges resulting from emergency firefighting activities during the active emergency response are authorized by this permit.

2. Limitations on Coverage

Discharges not authorized by this permit include, but are not limited to, the discharges and activities listed below. Permittees may seek individual or alternate general permit coverage for the discharges, or utilize low risk discharge guidance (i.e. Surface Cosmetic Power Washing Operations to Land) or clean water policy documents (i.e. Clean Water Policy #14) as appropriate and available.

a. Discharges of non-stormwater

Discharges of non-stormwater, except the authorized non-stormwater discharges listed in Part I.A.1.b., are not eligible for coverage under this permit. Note: The prohibited discharges listed here are not an exhaustive list.

i. Discharges to surface water from water used to wash vehicles, equipment and external building washdown water. The addition of soaps, solvents and detergents is prohibited.

ii. Discharges from washout water for paint, form release oils, curing compounds, or other similar

construction materials. See Part I.B.1.a.ii(f).

iii. Discharges of fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.

iv. Discharges of reclaimed water, as defined in Regulation 84, that are approved for the use of construction dust suppression but are not applied in accordance with Regulation 84.

v. Discharges related to the application of potable water for dust suppression. See Part I.B.1.a.i(j).

b. Discharges currently covered by another individual or general permit.

c. Discharges currently covered by a Water Quality Control Division (division) Low Risk Guidance document or Clean Water Policy.

d. Discharges to outstanding waters that are long-term and/or have no or only short-term ecological or water quality benefit or clear public interest. See Part I.B.2.b.

e. Chemical additions.

Any chemical addition for the treatment of stormwater associated with construction activities is not authorized. This includes but is not limited to flocculants, polymers, and coagulants.

3. Permit Certification and Submittal Procedures

a. Duty to Apply

The owner(s)/operator(s) must apply for coverage under this permit for discharges from the following activities:

i. Construction activity that will disturb one acre or more; or

ii. Construction activity that is part of a common plan of development or sale; or

iii. Stormwater discharges that are designated by the division as needing a stormwater permit because the discharge:

(a) Contributes to a violation of a water quality standard; or

(b) Is a significant contributor of pollutants to state waters.

b. Application Requirements

To obtain authorization to discharge under this permit, applicants applying for coverage following the effective date of the renewal permit must meet the following requirements:

i. Owners and operators submitting an application for permit coverage will be co-permittees subject to the same benefits, duties, and obligations under this permit.

ii. Signature requirements: Both the owner and operator (permittees) of the construction site, as defined in Part I.E., must agree to the terms and conditions of the permit and submit a completed application that includes the signature of both the owner and the operator. In cases where the duties of the owner and operator are managed by the owner, both application signatures may be completed by the owner. Both the owner and operator are responsible for ensuring compliance with all terms and conditions of the permit, including implementation of the stormwater management plan.

iii. The applicant(s) must develop a stormwater management plan in accordance with the requirements of Part I.C. The applicant(s) must also certify that the stormwater management plan is complete, or will be complete, prior to commencement of any construction activity.

iv. In order to apply for certification under this general permit, the applicant(s) must submit a complete, accurate, and signed permit application form as provided by the division by electronic delivery at least 10 days prior to the commencement of construction activity, except those construction activities that are in response to a public emergency related site. Public emergency related sites must apply for coverage no later than 14 days after the commencement of construction activities. The provisions of this part in no way remove a violation of the Colorado Water Quality Control Act if a point source discharge occurs prior to the issuance of a CDPS permit.

v. The application in its entirety must be submitted via the division's online permitting system unless a waiver is granted by the division. If a waiver is granted, the application in its entirety, including signatures by both the owner and operator, must be submitted to:

Colorado Department of Public Health and Environment

Water Quality Control Division

Permits Section, WQCD-PS-B2

4300 Cherry Creek Drive South

Denver, CO 80246

vi. The applicant(s) must receive written notification that the division granted permit coverage prior to conducting construction activities, except for construction activities that are in response to a public emergency related site.

c. Division Review of Permit Application

Within 10 days of receipt of the application, and following review of the application, the division may:

i. Issue a certification of coverage under this general permit;

ii. Request additional information necessary to evaluate the discharge;

iii. Delay the authorization to discharge pending further review;

iv. Notify the applicant that additional terms and conditions are necessary; or

v. Deny the authorization to discharge under this general permit.

d. Alternative Permit Coverage

i. Division Required Alternative Permit Coverage:

The division may require an applicant or permittee to apply for an individual permit or an alternative general permit if it determines the discharge does not fall under the scope of this general permit, including if any additional terms and conditions are necessary in order to ensure that discharges authorized by this permit will not cause, have the reasonable potential to cause, or measurably contribute to an exceedance of any applicable water quality standard, including narrative standards for water quality. In this case, the division will notify the applicant or permittee that an individual permit application is required.

ii. Permittee Request for Alternative Permit Coverage:

A permittee authorized to discharge stormwater under this permit may request to be excluded from coverage under this general permit by applying for an individual permit. In this case, the permittee must submit an individual application, with reasons supporting the request, to the division at least 180 days prior to any discharge. When an individual permit is issued, the permittee's authorization to discharge under this permit is terminated on the effective date of the individual permit.

e. Submittal Signature Requirements

Documents required for submittal to the division in accordance with this permit, including applications for permit coverage and other documents as requested by the division, must include signatures by **both** the owner and the operator, except for instances where the duties of the owner and operator are managed by the owner.

Signatures on all documents submitted to the division as required by this permit must meet the Standard Signatory Requirements in Part II.K of this permit in accordance with 40 C.F.R.122.41(k).

i. Signature Certification

Any person(s) signing documents required for submittal to the division must make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

f. Field Wide Permit Coverage for Oil and Gas Construction

At the discretion of the division, a single permit certification may be issued to a single oil and gas permittee to cover construction activity related discharges from an oil and gas field at multiple locations that are not necessarily contiguous.

g. Permit Coverage without Application

Qualifying Local Program: When a small construction site is within the jurisdiction of a qualifying local program, the owner and operator of the construction activity are authorized to discharge stormwater associated with small construction activity under this general permit without the submittal of an application to the division. Sites covered by a qualifying local program are exempt from the following sections of this general permit: Part I.A.3.a.; Part I.A.3.b. (division application requirements); Part I.A.3.c. (division review); Part I.A.3.d. (division alternate permit coverage); Part I.A.3.f. (oil and gas field wide coverage); Part I.A.3.h. (permittee initiated actions); Part I.A.3.i. (residential lot coverage); Part I.A.3.j. (permit expiration and continuation of coverage); Part II.L.3 (transfer of ownership or control); II.W (fees).

Sites covered by a qualifying local program are subject to the following requirements:

i. Local Agency Authority: This permit does not pre-empt or supersede the authority of local agencies to prohibit, restrict, or control discharges of stormwater to storm drain systems or other water courses within their jurisdiction.

ii. Permit Coverage Termination: When a site under a Qualifying Local Program is finally stabilized, coverage under this permit is automatically terminated.

iii. Compliance with Qualifying Local Program: Qualifying Local Program requirements that are equivalent to the requirements of this permit are incorporated by reference. Permittees authorized to discharge under this permit must comply with the equivalent requirements of the Qualifying Local Program that has jurisdiction over the site as a condition of this permit.

iv. Compliance with Remaining Permit Conditions. Requirements of this permit that are in addition to or more stringent than the requirements of the Qualifying Local Program apply in addition to the requirements of the Qualifying Local Program.

v. Written Authorization of Coverage: The division or local municipality may require any owner/operator within the jurisdiction of a Qualifying Local Program covered under this permit to apply for, and obtain written authorization of coverage under this permit. The permittee must be notified in writing that an application for written authorization of coverage is required.

h. Permittee Initiated Permit Actions

Permittee initiated permit actions, including but not limited to modifications, contact changes, transfers, and terminations, must be conducted following Part II.L, Part I.A.3.e, division guidance and using appropriate division-provided forms.

i. When a permittee modifies or terminates all or portions of permit coverage to another permittee, the "old" permittee completing the modification or termination must provide to the division the new permittee's certification number(s) (ie. a land developer selling lots to home builders, etc.).

ii. When a permittee transfers permit coverage to another permittee, the "new" permittee completing the transfer must provide to the division an agreement completed and signed by the "old" permittee.

iii. When a permittee transfers permit coverage or modifies or terminates all or portions of permit coverage to another permittee, the "old" permittee completing the transfer, modification, or termination must provide to the division documentation of due diligence when the new permittee is not obtaining permit coverage. Documentation of due diligence may include certified letters, multiple attempts at email and phone contact.

i. Sale of Residence to Homeowner

Residential construction sites only: The permittee may remove residential lots from permit coverage once the lot(s) meets all of the following criteria:

i. The residential lot(s) has(have) been sold to the homeowner(s) for private residential use;

ii. A certificate of occupancy, or equivalent, is maintained on-site or electronically and is available during division inspections;

iii. The lot(s) is (are) less than one acre of disturbance;

iv. All construction activity conducted on the lot(s) by the permittee is complete, including the installation of sediment or erosion control measures that minimize sediment from exiting the lot, or the installation of temporary stabilization on remaining disturbance where the permittee is not responsible for final stabilization (i.e. backyard of single family home, etc.);

v. The permittee is not responsible for final stabilization of the lot(s); and

vi. The stormwater management plan was modified to indicate the lot(s) is (are) no longer part of the construction activity.

If the residential lot(s) meets the criteria listed above, then activities occurring on the lot(s) are no longer considered to be construction activities with a duty to apply and maintain permit coverage. Therefore, the permittee is not required to meet the final stabilization requirements and may terminate permit coverage for the lot(s).

j. Permit Expiration and Continuation of Permit Coverage

Authorization to discharge under this general permit will expire at midnight on March 31, 2029. While Regulation 61.4 requires the permittee to submit an application for continuing permit coverage 180 days before the permit expires, the division requires that a permittee or permittees desiring continued coverage under this general permit must reapply at least 90 days in advance of this permit expiration. The division will determine if the permittee(s) may continue to discharge stormwater under the terms of the general permit. An individual permit may be required for any facility not reauthorized to discharge under the reissued general permit.

If this permit is not reissued or replaced prior to the expiration date, it will be administratively continued and remain in force and effect. For permittees that have applied for continued permit coverage, discharges authorized under this permit prior to the expiration date will automatically remain covered by this permit until the earliest of:

i. An authorization to discharge under a reissued permit, or a replacement of this permit, following the timely and appropriate submittal of a complete application requesting authorization to discharge under the new permit and compliance with the requirements of the new permit. (Note: the division may not reissue a permit certification if there are outstanding past due fees per Regulation 61.15(d)); or

ii. The issuance and effect of a termination issued by the division; or

iii. The issuance or denial of an individual permit for the facility's discharges; or

iv. A formal permit decision by the division not to reissue this general permit, at which time the division will identify a reasonable time period for covered dischargers to seek coverage under an alternative general permit or an individual permit. Coverage under this permit will cease when coverage under another permit is granted/authorized; or

v. The division has informed the permittee that discharges previously authorized under this permit are no longer covered under this permit.

B. EFFLUENT LIMITATIONS

1. Requirements for Control Measures Used to Meet Effluent Limitations

The permittee must implement control measures to minimize the discharge of pollutants from all potential pollutant sources at the site which, if applicable, includes run-on. Control measures used to meet effluent limitations must be installed prior to commencement of construction activities and prior to each phase of construction that introduces new potential pollutant sources. Control measures must be selected, designed, installed and maintained in accordance with good engineering, hydrologic and pollution control practices. Control measures implemented at the site must be designed to prevent pollution or degradation of state waters.

a. Stormwater Pollution Prevention

The permittee must implement structural and/or nonstructural control measures that effectively minimize erosion, sediment transport, and the release of other pollutants related to construction activity.

i. Control Measures for Erosion and Sediment Control

Structural and non-structural control measures for erosion and sediment control may include, but are not limited to, wattles/sediment control logs, silt fences, earthen dikes, drainage swales, sediment traps, filter bags, subsurface drains, pipe slope drains, inlet protection, outlet protection, gabions, sediment basins, temporary vegetation, permanent vegetation, mulching, geotextiles, sod stabilization, and slope roughening, maintaining existing vegetation, preserving native topsoil, protection of trees, preservation of mature vegetation, phasing of site development, preserving natural topography, minimizing soil compaction in areas of vegetative final stabilization, and minimizing site access.

Specific control measures must meet the requirements listed below.

(a) Vehicle tracking controls must be implemented to minimize vehicle tracking of sediment from disturbed areas. Vehicle tracking controls must include a structural control measure (e.g. tracking pad or wash rack) and may include a non-structural control measure (e.g. sweeping or restricting vehicle traffic to paved areas).

(b) Stormwater runoff from all disturbed areas and soil storage areas must utilize or flow to one or more control measures to minimize erosion or sediment in the discharge. The control measure(s) must be selected, designed, installed and adequately sized in accordance with good engineering, hydrologic and pollution control practices for the intended application. The control measure(s) must contain or filter flows in order to prevent the bypass of flows without treatment and must be appropriate for stormwater runoff from disturbed areas and for the expected flow rate, duration, and flow conditions (e.g. sheet or concentrated flow).

(c) Selection of control measures should prioritize the use of control measures that minimize the potential for erosion (i.e. covering materials). Selection should also prioritize phasing construction activities to minimize the amount of soil disturbance at any point in time throughout the duration of construction.

(d) Outlets that withdraw water from or near the surface must be installed when discharging from basins and impoundments, unless infeasible.

(e) Maintain pre-existing vegetation for areas within 50 horizontal feet of receiving waters as defined by this permit, unless infeasible. In addition to maintaining 50 horizontal feet of pre-existing vegetation upgradient of a receiving water (unless infeasible), the permittee must install control measures upgradient of the vegetative buffer that meets the requirements of this section, Part I.B.1.a.i.

(f) Soil compaction must be minimized for areas where infiltration control measures are implemented or where final stabilization will be achieved through vegetative cover. If compaction does occur in areas where final stabilization will be achieved through vegetative cover, then decompaction of the soil must be completed prior to planting.

(g) Unless infeasible, topsoil must be preserved for those areas of a site that will utilize vegetative final stabilization. Preserved topsoil can be left in place or stockpiled.

(h) Minimize the amount of soil exposed during construction activity, including the disturbance of steep slopes.

(i) Diversion control measures used for clean water diversions must minimize soil transport and erosion within the entire diversion, minimize erosion during discharge, and minimize run-on into the diversion. The permittee must minimize the discharge of pollutants throughout the installation, implementation and removal of the diversion. Diversions must meet one or more of the following conditions:

(1) Lined or piped structures that result in no erosion for anticipated flow conditions.

(2) 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 designed 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) An alternative diversion criteria, approved by the division prior to implementation. The diversion method must be designed to minimize the discharge of pollutants and to prevent the potential for pollution or degradation to state waters as a result of the diverted flow through the diversion structure. In addition, the alternative diversion method must minimize the discharge of pollutants throughout the installation, implementation and removal of the diversion.

(j) Minimize dust. On areas of exposed soil, minimize dust through the appropriate application of water or other dust suppression techniques. Water application must be conducted in a manner to prevent discharge offsite unless authorized by a separate CDPS or NPDES permit.

(k) Control stormwater discharges, including both peak flowrates and total stormwater volume, to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.

ii. Practices for Other Common Pollutants

(a) Bulk storage (individual containers of 55 gallons or greater) for petroleum products and other liquid chemicals must have secondary containment, or equivalent protection, in order to contain spills and to prevent spilled material from entering state waters.

(b) Spills and leaks must be minimized. Upon identification, spills and leaks must immediately be contained and mitigated per the spill prevention and response plan, as applicable (i.e. oil, grease, fluids associated with vehicle and equipment maintenance, toxic chemicals, hazardous substances, etc.).

(c) Control measures designed for concrete washout waste, masonry operations, stucco waste, vehicle/equipment washing, and external building washdown must be implemented. This includes washout waste discharged to the ground as authorized under this permit and washout waste from concrete trucks and masonry operations contained on site. The permittee must ensure washing activities do not contribute pollutants to stormwater runoff, or receiving waters in accordance Part I.A.1.b.ii. Discharges that may reach groundwater must flow through soil that has buffering capacity prior to reaching groundwater, as necessary to meet the effluent limits in this permit, including Part I.B.3.a. The concrete or masonry washout location (including vehicle/equipment and external building washdown water, if applicable) must not be located in an area where shallow groundwater may be present and would result in buffering capacity not being adequate, such as near natural drainages, springs, or wetlands. This permit authorizes discharges to the ground of

concrete washout waste, but does not authorize on-site waste disposal per Part I.B.3.d.

(d) In the event that water remains onsite and contains pollutants either from firefighting activities or picked up from the site (i.e. in a gutter, sediment basin, etc.) after active emergency response is complete, the permittee must ensure the remaining water containing pollutants is properly removed and disposed of in order to minimize pollutants from discharging from the site, unless infeasible.

(e) Minimize the exposure of fertilizers, pesticides, and herbicides to stormwater during storage. Store and apply fertilizers, pesticides, and herbicides per manufacturer's directions.

(f) For washing applicators and containers used for paint, form release oils, curing compounds, or other similar construction materials, the wash water must be directed into a leak-proof container or leak-proof and lined pit designed so no discharges to groundwater occur or overflows occur due to inadequate sizing or precipitation. Liquid and hardened wastes must be appropriately disposed.

iii. Stabilization Requirements

The following requirements must be implemented for each site.

(a) 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 hydromulch. The permittee may exceed the 14-day schedule 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 stormwater management plan must document the constraints necessitating the alternative schedule, provide the alternate stabilization schedule, and identify all locations where the alternative schedule is applicable on the site map. Minimum inspection frequency and scope, as directed in Part I.D., must be followed for temporarily stabilized areas.

(b) Final stabilization must be implemented for all construction sites covered under this permit. Final stabilization is reached when the following are complete:

(1) All construction activities are complete.

(2) Permanent stabilization methods are complete. Permanent stabilization methods include, but are not limited to, permanent pavement or concrete, hardscape, xeriscape, stabilized driving surfaces and storage areas, vegetative cover, or equivalent permanent alternative stabilization methods. The division may approve alternative final stabilization criteria for specific operations. Vegetative cover must include the following criteria:

a. Evenly distributed perennial vegetation, which may include trees and shrubs;

b. Vegetation coverage, at a minimum, equal to 70 percent of what would have been provided by native vegetation in a local, undisturbed area or adequate reference site; and

c. If applicable, adherence to stabilization requirements does not negate the permittee's requirement to comply with the local jurisdiction's plant species requirements.

(c) Final stabilization must be designed and installed as a permanent feature. All control measures must be removed from the construction site, except when the control measure specifications allow the control measure to be left in place (i.e. bio-degradable control measures, permanent sedimentation basin, etc). Final stabilization measures for obtaining a vegetative cover or alternative stabilization methods include, but are not limited to, the following as appropriate:

(1) Seed mix selection and application methods;

(2) Soil preparation and amendments;

(3) Soil stabilization methods to provide adequate protection to minimize erosion (e.g. crimped straw, hydro mulch or rolled erosion control products);

(4) Appropriate sediment control measures as needed until final stabilization is achieved;

(5) Permanent pavement, hardscape, xeriscape, stabilized driving surfaces;

(6) Conversion of construction site back to prior cropland use. The permittee is not required to plant the crop prior to termination; and

(7) Other alternative stabilization practices as applicable.

b. Routine Maintenance

The permittee must ensure that all control measures remain in effective operating condition and are protected from activities that would reduce their effectiveness. Control measures must be routinely maintained in accordance with good engineering, hydrologic and pollution control practices. Observations leading to the required routine maintenance of control measures can be made during a site inspection, or during general observations of site conditions. The necessary repairs or modifications to a control measure requiring routine maintenance, as defined in Part I.E., must be conducted to maintain an effective operating condition. Control measures requiring routine maintenance are not subject to the requirements in Part I.B.1.c below.

c. Corrective Actions

The permittee must assess the adequacy of control measures at the construction site, and the need for changes to those control measures, to ensure continued effective performance.

When an inadequate control measure, as defined in Part I.E., is identified, the following corrective action requirements apply. The permittee is not in compliance with the permit until the inadequate control measure is replaced or corrected and returned to effective operating condition in compliance with Part I.B.1 and the general requirements in Part I.B.3. If the inadequate control measure results in noncompliance that meets the conditions of Part II.L, the permittee must also meet the requirements of that section.

i. The permittee must take all necessary steps to minimize or prevent the discharge of pollutants from the permitted area and manage any stormwater run-on onto the site 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 the control measure immediately after discovering the deficiency, the following must be documented in the stormwater management plan in Part I.D.5.c and kept on record in accordance with the recordkeeping requirements in Part II.

(a) Describe why it is infeasible to initiate the installation or repair immediately; and

(b) Provide a schedule for installing or repairing the control measure and returning it to an effective operating condition as soon as possible.

ii. If applicable, the permittee must remove and properly dispose of any unauthorized release or discharge within and from the permitted area (e.g., discharge of non-stormwater, untreated stormwater containing pollutants such as sediment, spill, or leak not authorized by this permit.) The permittee must clean up any contaminated surfaces, if feasible, to minimize discharges of the material in subsequent storm events, including water remaining from the response that contains pollutants after active emergency firefighting response is complete. Permittees are prohibited from hosing down an area to clean surface spills or leaks unless the wash water is adequately captured to not discharge off the site or to land and the captured water is properly disposed. In addition, the permittee must mitigate any accumulation of sediment outside of the site boundaries.

2. Discharges to an Impaired Waterbody or Outstanding Water

a. Total Maximum Daily Load (TMDL)

If the discharge from the site of permit coverage flows to or could reasonably be expected to flow to any water body for which a TMDL has been approved, and stormwater discharges associated with construction activity were assigned a pollutant-specific Wasteload Allocation (WLA) under the TMDL, the division may:

i. Ensure the WLA is implemented properly through alternative local requirements, such as by a municipal stormwater permit; or

ii. Notify the permittee of the WLA and amend the permittee's certification to add specific effluent limits, other requirements, and compliance schedules, as necessary and appropriate. The permittee may be required to do the following:

(a) Under the permittee's stormwater management plan, implement specific control measures based on requirements of the WLA, and evaluate whether the requirements are met through implementation of existing stormwater control measures or if additional control measures are necessary. Document the calculations or other evidence demonstrating that the requirements are expected to be met; and

(b) If the evaluation shows that additional or modified control measures are necessary, describe the type and schedule for the control measure additions or modifications.

iii. Discharge monitoring may also be required. The permittee may maintain coverage under the general permit provided they comply with the applicable requirements outlined above.

b. Outstanding Waters

i. Discharges to outstanding waters must be short-term and have a long-term ecological or water quality benefit or clear public interest. A state outstanding waters map can be found here.

ii. Sites that discharge to outstanding waters are required to have an increased inspection frequency found in Part I.D.3.

c. The division may require individual or alternate general permit coverage per Part I.A.3.d.i.

3. General Requirements

a. Discharges authorized by this permit must not cause, have the reasonable potential to cause, or measurably contribute to an exceedance of any applicable water quality standard, including narrative standards for water quality.

b. The division may require sampling and testing, on a case-by-case basis, in the event that there is reason to suspect that the stormwater management plan is not adequately minimizing pollutants in stormwater or in order to measure the effectiveness of the control measures in removing pollutants in the effluent. Such monitoring may include Whole Effluent Toxicity testing.

c. The permittee must comply with the lawful requirements of federal agencies, municipalities, counties, drainage districts and other local agencies including applicable requirements in Municipal Stormwater Management Programs developed to comply with CDPS permits. The permittee must comply with local stormwater management requirements, policies and guidelines including those for erosion and sediment control.

d. The division may include additional requirements as specified in the applicable watershed protection Control Regulations 71-74.

e. All construction site wastes must be properly managed to prevent potential pollution of state waters. This permit does not authorize on-site waste disposal.

f. This permit does not relieve the permittee of the reporting requirements in 40 CFR 110, 40 CFR 117 or 40 CFR 302. Any discharge of hazardous material must be handled in accordance with the division's Noncompliance Notification Requirements (see Part II.L of the permit).

C. STORMWATER MANAGEMENT PLAN REQUIREMENTS

1. Stormwater Management Plan General Requirements

a. The permittee must develop, implement, and maintain a stormwater management plan for each construction site listed under Part I.A.3.a, including, but not limited to, construction activity that will disturb one acre or more and/or are part of a common plan of development or sale covered by this permit.

i. The plan must be prepared in accordance with good engineering, hydrologic and pollution control practices.

ii. For public emergency related sites, the plan must be created no later than 14 days after the commencement of construction activities.

b. The permittee must implement the provisions of the plan as written and updated, from commencement of construction activity until final stabilization is complete. The division may review the plan.

c. A copy of the plan must be retained onsite or be onsite when construction activities are occurring at the site unless the permittee specifies another location and obtains written approval from the division. The plan and inspection reports may be prepared, signed, and kept electronically, rather than in paper form, if the records are:

i. In a format that can be read in a similar manner as a paper record; and

ii. Immediately accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be.

2. Stormwater Management Plan Content

The stormwater management plan, at a minimum, must include the following elements.

a. Qualified Stormwater Manager. The plan must list individual(s) by title and name who are designated as responsible for implementing the stormwater management plan in its entirety and meet the definition of a Qualified Stormwater Manager. This role may be filled by more than one individual.

b. Other Permits. The plan must list the applicable CDPS permits and low-risk discharge guidance documents associated with the permitted site (including the COR400000 general permit and the certification associated with the site) and the activities occurring on the permitted site (e.g. a CDPS Dewatering Permit). The plan must also list applicable US Army Corps of Engineers Section 404 permits. A copy of this general permit, applicable permit certification, and any applicable low-risk discharge guidance documents must be included in the stormwater management plan for each construction site.

c. Site Description. The plan must include a site description which includes, at a minimum, the following:

i. The nature of the construction activity at the site, including if it is a public emergency related site;

ii. The proposed schedule for the sequence for major construction activities and the planned implementation of control measures for each phase. (e.g. clearing, grading, utilities, vertical, etc.);

iii. Estimates of the total acreage of the site, and the acreage expected to be disturbed by clearing, excavation, grading, or any other construction activities;

iv. A summary of any existing data and sources used in the development of the construction site plans or stormwater management plan that describe the soil types found in the permitted area and the erodibility of the identified soil types;

v. A description of the percent cover from native vegetation on the site if the site is undisturbed, or the percent cover from native vegetation in a similar, local undisturbed area or adequate reference area if the site is disturbed. Include the source or methodology for determining the percentage. If a percent cover is not appropriate for the site location (i.e. arid), describe the technique and justification for the identified cover of native vegetation;

vi. A description of any allowable non-stormwater discharges at the site, including those being discharged under a separate CDPS permit, discharges under Part I.A.1.b, or a division low risk discharge guidance, and applicable control measures installed;

vii. A description of the general flow direction and where or how the discharge leaves the site, including a description of the immediate conveyance or area receiving the discharge and the receiving water(s) of the discharge, if different than the immediate conveyance or area. If the stormwater discharge is to a municipal separate storm sewer system, include the name of the entity owning that system, the location(s) of the stormwater discharge, and the receiving water(s);

viii. A description of all stream crossings located within the construction site boundary, if applicable;

ix. A description of the alternate temporary stabilization schedule, if applicable (Part I.B.1.a.iii(a); and

x. A description of the alternative diversion criteria as approved by the division, if applicable (Part I.B.1.a.i(i)(3)).

xi. A description of any effluent limitations that the permittees determines are infeasible and why they are infeasible, if applicable (Part I.B.1.a.i.(d, e, and g) and I.B.1.a.ii.(d).

d. Site Map. The plan must include a site map which includes, at a minimum, the following:

i. Construction site boundaries;

ii. Flow arrows that depict stormwater flow directions on and off-site;

iii. All areas of ground disturbance including areas of borrow and fill;

iv. Areas used for storage of soil;

v. Locations of all waste accumulation areas, including areas for liquid, concrete, masonry, and asphalt;

vi. Locations of dedicated asphalt, concrete batch plants and masonry mixing stations;

vii. Locations of other potential sources of pollution not listed in iii. through vi.

viii. Locations of all structural control measures;

ix. Locations of all non-structural control measures (e.g. temporary stabilization);

x. Locations and names, as listed in Part I.C.2.c.vii, of springs, streams, wetlands, diversions and other state waters within or bordering the site, including areas that require pre-existing vegetation be maintained within 50 feet of a receiving water, where determined feasible in accordance with Part I.B.1.a.i(e) (e.g. MS4 to unnamed tributary to the South Platte River);

xi. Locations of all stream crossings located within the construction site boundary;

xii. Locations where alternative temporary stabilization schedules apply; and

e. Potential Sources of Pollution. The plan must list all potential sources of pollution which may reasonably be expected to affect the quality of stormwater discharges associated with construction activity from the site.

i. The plan must include the following pollutant sources as these pollutants relate to every construction site:

(a) Disturbed and stored soils;

(b) Vehicle tracking of sediments;

(c) On-site waste management practices (waste piles, liquid wastes, dumpsters);

ii. The plan may include, but is not limited to, the following pollutant sources:

(a) Management of contaminated soils (contaminated soils may also occur from onsite spills or leaks), if known to be present, or if contaminated soils are found during construction;

(b) Loading and unloading operations;

(c) Outdoor storage activities (erodible building materials, fertilizers, chemicals, etc.);

(d) Vehicle and equipment maintenance and fueling;

(e) Significant dust or particulate generating processes (e.g., saw cutting material, including dust);

(f) Routine maintenance activities involving fertilizers, pesticides, herbicides, detergents, fuels, solvents, oils, etc.;

(g) Concrete/masonry truck/equipment washing, including washing of the concrete truck chute and associated fixtures and equipment;

(h) Dedicated asphalt, concrete batch plants and masonry mixing stations;

(i) Non-industrial waste sources such as worker trash and portable toilets; and

(j) Reclaimed water approved for use in construction dust suppression.

f. Materials Handling. The plan must describe handling procedures of all control measures implemented at the site to minimize impacts from handling significant materials that could contribute pollutants to runoff. These handling procedures can include control measures for pollutants and activities such as, exposed storage of building materials, paints and solvents, landscape materials, fertilizers or chemicals, sanitary waste material, trash and equipment maintenance or fueling procedures.

g. Spill Prevention and Response Plan. The plan must have a spill prevention and response plan. The plan may incorporate by reference any part of a Spill Prevention Control and Countermeasure (SPCC) plan under section 311 of the Clean Water Act (CWA) or a Spill Prevention Plan required by a separate CDPS permit. The relevant sections of any referenced plans must be available as part of the stormwater management plan consistent with Part I.C.4.

h. Implementation of Control Measures. The plan must include design specifications that contain information on the implementation of all the control measures in use on the site in accordance with good engineering, hydrologic and pollution control practices; including, as applicable, drawings, dimensions, installation information, materials, implementation processes, control measure-specific inspection expectations, and maintenance requirements.

i. The plan must include a documented use agreement between the permittee and the owner or operator of any control measures located outside of the permitted area that are utilized by the permittee's construction site for compliance with this permit, but not under the direct control of the permittee. The permittee is responsible for ensuring that all control measures located outside of their permitted area, that are being utilized by the permittee's construction site, are properly maintained and in compliance with all terms and conditions of the permit. The plan must include all information required of and relevant to any such control measures located outside the permitted area, including location, installation specifications, design specifications and maintenance requirements.

j. Temporary Stabilization, Final Stabilization and Long Term Stormwater Management.

   i. The plan must document the constraints necessitating an alternative temporary stabilization schedule, as referenced in Part I.B.1.a.iii(a), provide the alternate stabilization schedule, and identify all locations where the alternative schedule is applicable on the site map.

   ii. The plan must document all residential lots that utilize the Sale of Residence to Homeowner, as referenced in Part I.A.3.i, the lots that received temporary stabilization and meet all the requirements under Part I.A.3.i, and identify all the lot locations where Part I.A.3.i is applicable on the site map.

   iii. The plan must describe or locate where all final stabilization methods are used and what methods are used to achieve final stabilization of all disturbed areas at the site (e.g. pavement, vegetative cover, etc), as listed in Part I.B.1.a.iii(b).

   iv. The plan must describe how the permittee will establish final stabilization through vegetative cover or alternative stabilization method, as referenced in Part I.B.1.a.iii(c), and describe and locate any temporary control measures in place during the process of final stabilization (e.g. seed mix, soil amendments, final stabilization methods, return to cropland, etc.).

   v. The plan must describe and locate any planned permanent control measures to control pollutants in stormwater discharges that will occur after construction operations are completed, including but not limited to, detention/retention ponds, rain gardens, stormwater vaults, etc.

k. Inspection Reports. The plan must include documented inspection reports in accordance with Part I.D.5.c.

3. Stormwater Management Plan Review and Revisions

Permittees must keep the stormwater management plan current and maintain a record of changes made that includes the date and identification of the changes. The plan must be amended when the following occurs:

a. A change in design, construction, operation, or maintenance of the site requiring implementation of new or revised control measures;

b. The plan proves ineffective in controlling pollutants in stormwater runoff in compliance with the permit conditions;

c. Control measures identified in the plan are no longer necessary and are removed;

d. Corrective actions are taken onsite that result in a change to the plan; and

e. The site or areas of the site qualifying for reduced frequency inspections under Part I.D.4.

For stormwater management plan 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). The methods for notation may include notations on site maps, a log of changes, redline changes in the, or other measures. The permittee must ensure the site changes are reflected in the plan. The permittee is noncompliant with the permit until the plan revisions have been made.

4. Stormwater Management Plan Availability

A copy of the stormwater management plan must be provided upon request to the division, EPA, and any local agency with authority for approving sediment and erosion plans, grading plans or stormwater management plans within the time frame specified in the request. If the plan is required to be submitted to any of these entities, the submission must include a signed certification in accordance with Part I.A.3.e, certifying that the plan is complete and compliant with all terms and conditions of the permit.

All stormwater management plans required under this permit are considered reports that must be available to the public under Section 308(b) of the CWA and Section 61.5(4) of the CDPS regulations. The permittee must make plans available to members of the public upon request. However, the permittee may claim any portion of a stormwater management plan as confidential in accordance with 40 CFR Part 2.

D. SITE INSPECTIONS

Site inspections must be conducted in accordance with the following requirements. The required inspection schedules are a minimum frequency and do not affect the permittee's responsibility to implement control measures in effective operating condition as prescribed in the stormwater management plan, Part I.C.2.a.vi, as proper maintenance of control measures may require more frequent inspections. Site inspections must start within 7 calendar days of the commencement of construction activities on site.

1. Person Responsible for Conducting Inspections

The person(s) inspecting the site may be on the permittee's staff or a third party hired to conduct stormwater inspections under the direction of the permittee(s). The permittee is responsible for ensuring that the inspector meets the definition of a Qualified Stormwater Manager. The inspector may be different than the individual(s) listed in Part I.C.2.a.

2. Inspection Frequency

Permittees must conduct site inspections in accordance with one of the following minimum frequencies, unless the site meets the requirements of Part I.D.3. All inspections must be recorded per Part I.D.5.c.

a. At least one inspection every 7 calendar days; or

b. At least one inspection every 14 calendar days, if post-storm event inspections are 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.

c. When site conditions make the schedule required in this section impractical, the permittee may petition the division to grant an alternate inspection schedule. The alternative inspection schedule must not be implemented prior to written approval by the division and incorporation into the stormwater management plan.

3. **Inspection Frequency for Discharges to Outstanding Waters**

Permittees must conduct site inspections at least once every 7 calendar days for sites that discharge to a water body designated as an Outstanding Water by the Water Quality Control Commission. In order to determine if the immediate receiving water is to an Outstanding Water, the permittee can use this map of Outstanding Waters.

4. **Reduced Inspection Frequency**

The permittee may perform site inspections at the following reduced frequencies when one of the following conditions exists:

a. Post-Storm Inspections at Temporarily Idle Sites

For permittees choosing an inspection frequency pursuant to Part I.D.2.b and if no construction activities will occur following a storm event, post-storm event inspections must be conducted prior to re-commencing construction activities, and no later than 72 hours after the end of any precipitation or snowmelt event that causes surface erosion. If the post-storm event inspection qualifies under this section, the inspection delay must be documented in the inspection record per Part I.D.5.c. Routine inspections must still be conducted at least every 14 calendar days.

b. Inspections at Sites Awaiting Final Stabilization

When the site, or portions of a site, are awaiting establishment of a vegetative ground cover and final stabilization, the permittee must conduct a thorough inspection of the construction site and control measures at least once every 30 days. Post-storm event inspections are not required under this schedule. This reduced inspection schedule is allowed if all of the following criteria are met:

i. All construction activities resulting in ground disturbance are complete;

ii. All activities required for final stabilization, in accordance with Part I.B.1.a.iii(b) & (c) and with the stormwater management plan, 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

iii. The stormwater management plan has been amended to locate those areas to be inspected in accordance with the reduced schedule allowed for in this paragraph.

c. Winter Conditions Inspections Exclusion

Typically, this exclusion applies to elevations or locations where snow melt does not occur in the winter months. Inspections are not required for sites that meet all of the following conditions:

i. Construction activities are temporarily halted for the winter season (e.g. December – February due to site being inaccessible);

ii. Snow cover exists over the entire site for an extended period (i.e. high-elevation winter season); and

iii. Melting conditions posing a risk of surface erosion do not exist.

This inspection exception is applicable only during the period where melting conditions do not exist, and applies to the routine 7-day, 14-day and monthly inspections, as well as the post-storm-event inspections. When this inspection exclusion is implemented, the following information must be documented in accordance with the requirements in Part I.C.3 and Part I.D.5.c:

(a) Dates when snow cover existed;

(b) Date when construction activities ceased; and

(c) Date melting conditions began.

5. **Inspection Scope**

a. Areas to Be Inspected

When conducting a site inspection the following areas, if applicable, must be inspected for evidence of, or

the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters:

i. Construction site perimeter;

ii. All disturbed areas, including areas that are temporarily stabilized;

iii. Locations of installed control measures;

iv. Designated haul routes;

v. Material and waste storage areas exposed to precipitation;

vi. Locations of pumped stormwater;

vii. Locations where stormwater has the potential to discharge offsite, including visible erosion and sedimentation; and

viii. Locations where vehicles exit the site.

b. Inspection Requirements

Inspections must assess the following components:

i. Visually verify whether all implemented control measures are in effective operational condition and are working as designed in their specifications to minimize pollutant discharges.

(a) For pumped stormwater, assessment may include sediment plume, suspended solids, unusual color, decreased clarity, presence of odor or foam, etc.

ii. Determine if there are new potential sources of pollutants.

iii. Assess the adequacy of control measures at the site to identify areas requiring new or modified control measures to minimize pollutant discharges.

iv. Identify all areas of non-compliance with the permit requirements and, if necessary, implement corrective action(s) in accordance with Part I.B.1.c.

c. Inspection Reports

The permittee must keep a record of all inspections conducted for each permitted site. Inspection reports must identify any incidents of noncompliance with the terms and conditions of this permit. All inspection reports must be signed and dated in accordance with Part I.D.5.c.xiii and xiv below. Inspection records must be retained in accordance with Part II.J. At a minimum, the inspection report must include:

i. The inspection date;

ii. Name(s) and title(s) of personnel conducting the inspection;

iii. Weather conditions at the time of inspection;

iv. Phase of construction at the time of inspection;

v. Estimated acreage of disturbance at the time of inspection;

vi. Location(s) and identification of control measures requiring routine maintenance;

vii. Location(s) and identification of discharges of sediment or other pollutants from the site;

viii. Location(s) and identification of inadequate control measures;

ix. Location(s) and identification of additional control measures needed that were not in place at the time of inspection;

x. Description of corrective action(s) for items vii, viii, ix, above, dates corrective action(s) were completed, including requisite changes to the stormwater management plan, as necessary;

xi. Description of the minimum inspection frequency (either in accordance with Part I.D.2, Part I.D.3 or Part I.D.4.) utilized when conducting each inspection;

xii. Deviations from the minimum inspection schedule as required in Part I.D.2. This would include documentation of division approval for an alternate inspection schedule outlined in Part I.D.2.c;

xiii. After adequate corrective action(s) have been taken, or where a report does not identify any incidents requiring corrective action, the report must contain the following statement and provide the date of the statement:

"I verify that, to the best of my knowledge and belief, that if any corrective action items were identified during the inspection, those corrective actions are complete, and the site is currently in compliance with the permit."; and

xiv. Inspection reports must be signed by the individual(s) designated as a Qualified Stormwater Manager, as defined in Part I.E.

E. DEFINITIONS

For the purposes of this permit:

(1) Bypass the intentional diversion of waste streams from any portion of a treatment facility in accordance with 40 CFR 122.41(m)(1)(i) and Regulation 61.2(12).

(2) Common Plan of Development or Sale - A contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related. The division has determined that "contiguous" means construction activities located in close proximity to each other (within ¼ mile). Construction activities are considered to be "related" if they share the same development plan, builder or contractor, equipment, storage areas, etc. "Common plan of development or sale" includes construction activities that are associated with the construction of field wide oil and gas permits for facilities that are related.

(3) Construction Activity - Ground surface disturbing and associated activities (land disturbance), which include, but are not limited to, clearing, grading, excavation, demolition, installation of new or improved haul roads and access roads, staging areas, stockpiling of fill materials, and borrow areas. Construction does not include routine maintenance to maintain the original line and grade, hydraulic capacity, or original purpose of the facility. Activities to conduct repairs that are not part of routine maintenance or for replacement are construction activities and are not routine maintenance. Repaving activities where underlying and/or surrounding soil is exposed as part of the repaving operation are considered construction activities. Construction activity is from initial ground breaking to final stabilization regardless of ownership of the construction activities.

(4) Construction Site – The location where construction activity is occurring and associated discharges are covered by this permit, including offsite locations for storage, staging, etc. For use in this permit, the terms construction site, site, and facility are used interchangeably.

(5) Control Measure - Any best management practice or other method used to prevent or reduce the discharge of pollutants to state waters. Control measures include, but are not limited to, best management practices. Control measures can include other methods such as the installation, operation, and maintenance of structural controls and treatment devices.

(6) Control Measure Requiring Routine Maintenance - Any control measure that is still operating in accordance with its design and the requirements of this permit, but requires preventative maintenance to prevent a breach of the control measure in subsequent storms.

(7) Dedicated Asphalt, Concrete Batch Plants and Masonry Mixing Stations – Are batch plants or mixing stations located on, or within ¼ mile of, a construction site and that provide materials only to that specific construction site.

(8) Disturbed area – Any ground disturbance prior to final stabilization.

(9) Diversion – Discharges of state waters that are temporarily routed through channels or structures (e.g. in-stream, uncontaminated springs, non-pumped groundwater, temporary rerouting of surface waters, fords). For purposes of this permit, these diversions can also be referred to as clean water diversions.

(10) Final Stabilization - The condition reached when construction activities at the site have been completed, permanent stabilization methods are complete, and temporary control measures are removed. Areas being stabilized with a vegetative cover must have evenly distributed perennial vegetation. The vegetation coverage must be, at a minimum, equal to 70 percent of what would have been provided by native vegetation in a local, undisturbed area or adequate reference site.

(11) Good Engineering, Hydrologic and Pollution Control Practices: are methods, procedures, and practices that:

a. Are based on basic scientific fact(s).

b. Reflect best industry practices and standards.

c. Are appropriate for the conditions and pollutant sources.

d. Provide appropriate solutions to meet the associated permit requirements, including practice based effluent limits.

(12) Inadequate Control Measure - 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.

(13) Infeasible – Not technologically possible, or not economically practicable and achievable in light of best industry practices.

(14) Minimize - Reduce or eliminate to the extent achievable using control measures that are technologically available and economically practicable and achievable in light of best industry practice.

(15) Municipality - A city, town, county, district, association, or other public body created by, or under, State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or a designated and approved management agency under section 208 of CWA (1987).

(16) Municipal Separate Storm Sewer System (MS4) - A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

a. Owned or operated by a State, city, town, county, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or a designated and approved management agency under section 208 of the CWA that discharges to state waters;

b. Designed or used for collecting or conveying stormwater;

c. Are not a combined sewer; and

d. Are not part of a Publicly Owned Treatment Works (POTW). See 5 CCR 1002-61.2(62).

(17) Municipal Stormwater Management Program - A stormwater program operated by a municipality, typically to meet the requirements of the municipality's MS4 discharge certification.

(18) Native Vegetation – Plant species that are naturally occurring for the particular area (or region) and have adapted to and are well suited for the soil, temperature, nutrients, and precipitation of the particular area (region).

(19) Operator - The party that has operational control over day-to-day activities at a 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 (i.e. the general contractor).

(20) Outstanding Waters - Waters designated as outstanding waters pursuant to Regulation 31, Section 31.8(2)(a). The highest level of water quality protection applies to certain waters that constitute an outstanding state or national resource.

(21) Owner - 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 that may have ownership of, a long term lease of, or easements on the property on which the construction activity is occurring (e.g. the developer).

(22) Permittee(s) - The owner and operator named in the discharge certification issued under this general permit for the construction site specified in the certification.

(23) Point Source - Any discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. Point source does not include irrigation return flow. See 5 CCR 102-61.2(75).

(24) Pollutant - Dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sewage sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand, or any industrial, municipal or agricultural waste. See 5 CCR 1002-61.2(76).

(25) Presentation of credentials – A government issued form of identification, if in person; or (ii) providing name, position and purpose of inspection if request to enter is made via telephone, email or other form of electronic communication. A permittee's non-response to a request to enter upon presentation of credentials constitutes a denial to such request, and may result in violation of the permit.

(26) Process Water - Any water which, during manufacturing or processing, comes into contact with or results from the production of any raw material, intermediate product, finished product, by product or waste product.

(27) Public Emergency Related Site - A project initiated in response to an unanticipated emergency (e.g., mud slides, earthquake, extreme flooding conditions, disruption in essential public services), for which the related work requires immediate authorization to avoid imminent endangerment to human health or the environment, or to reestablish essential public services.

(28) 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 control measures implemented to meet the requirements of this permit.

(29) Qualifying Local Program - A municipal program for stormwater discharges associated with small construction activity that was formally approved by the division as a qualifying local program (Regulation 61.8(12).

(30) Receiving Water - Any surface state water into which stormwater associated with construction activities discharges. Examples include all water courses, even if they are usually dry, such as borrow ditches, arroyos, and other unnamed waterways.

(31) Severe Property Damage - Substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. See 40 CFR 122.41(m)(1)(ii).

(32) Significant Materials - Include, but not limited to, raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the permittee is required to report under section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA); fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharges.

(33) Small Construction Activity - The discharge of stormwater from construction activities that result in land disturbance of equal to, or greater than, one acre and less than five acres. Small construction activity also includes the disturbance of less than one acre of total land area that is part of a larger common plan of development or sale, if the larger common plan ultimately disturbs equal to, or greater than, one acre and less than five acres.

(34) Spill - An unintentional release of solid or liquid material which may pollute state waters.

(35) State Waters - Any and all surface and subsurface waters which are contained in or flow in or through this state, but does not include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been

completed.

(36) Steep Slopes - Where a local government, or industry technical manual (e.g. stormwater BMP manual) has defined what is to be considered a “steep slope”, this permit’s definition automatically adopts that definition. Where no such definition exists, steep slopes are automatically defined as those that are 3:1 or greater.

(37) Stormwater - Precipitation runoff, snow melt runoff, and surface runoff and drainage. See 5 CCR 1002-61.2(103).

(38) Total Maximum Daily Loads (TMDLs) - The sum of the individual wasteload allocations (WLA) for point sources and load allocations (LA) for nonpoint sources and natural background. For the purposes of this permit, a TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. A TMDL includes WLAs, LAs, and must include a margin of safety (MOS), and account for seasonal variations. See section 303(d) of the CWA and 40 C.F.R. 130.2 and 130.7.

(39) Upset - An exceptional incident in which there is unintentional and temporary noncompliance with permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation in accordance with 40 CFR 122.41(n) and Regulation 61.2(114).

F. MONITORING

The division may require sampling and testing, on a case-by-case basis. If the division requires sampling and testing, the division will send a notification to the permittee. Sampling and reporting procedures for any monitoring data collected will be included in the notification.

If monitoring is required, the following applies:

The thirty (30) day average must be determined by the arithmetic mean of all samples collected during a thirty (30) consecutive-day period; and

A grab sample, for monitoring requirements, is a single “dip and take” sample.

G. OIL AND GAS CONSTRUCTION

Stormwater discharges associated with construction activities directly related to oil and gas exploration, production, processing, and treatment operations or transmission facilities are regulated under the Colorado Discharge Permit System Regulations (5 CCR 1002-61), and require coverage under this permit in accordance with that regulation. However, references in this permit to specific authority under the CWA do not apply to stormwater discharges associated with these oil and gas related construction activities, to the extent that the references are limited by the federal Energy Policy Act of 2005.

PART II

Part II contains standard conditions required by federal regulation to be included in all NPDES permits (see 40 C.F.R. 122.41). Part I contains permit specific requirements.

A. DUTY TO COMPLY

1. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Colorado Water Quality Control Act and is grounds for: 1) enforcement action; 2) permit termination, revocation and reissuance, or modification; or 3) denial of a permit renewal application.
2. Federal Enforcement:
   a. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal (see 40 CFR 122.2) established under section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if the permit has not yet been modified to incorporate the requirement.
   b. The Clean Water Act provides that any person who violates section 301, 302, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any such sections in a permit issued under section 402, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed $25,000 per day for each violation. The Clean Water Act provides that any person who *negligently* violates sections 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment of not more than 1 year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation, or by imprisonment of not more than 2 years, or both. Any person who *knowingly* violates such sections, or such conditions or limitations is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than 3 years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both. Any person who knowingly violates section 301, 302, 303, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than $1,000,000 and can be fined up to $2,000,000 for second or subsequent convictions.
   c. Any person may be assessed an administrative penalty by the Administrator for violating section 301, 302, 306, 307, 308, 318 or 405 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

B. DUTY TO REAPPLY

If the permittee plans to continue an activity regulated by this permit after the expiration date of this permit, the permittee must submit a permit application at least 180 days before this permit expires as required by Regulations 61.4 and 61.10.

C. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or

reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. DUTY TO MITIGATE

The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. PROPER OPERATION AND MAINTENANCE

The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of this permit. See 40 C.F.R. §122.41(e).

F. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. Any request for modification, revocation, reissuance, or termination under this permit must comply with all terms and conditions of Regulation 61.8(8). See also 40 C.F.R. § 122.41(f).

G. PROPERTY RIGHTS

In accordance with 40 CFR §122.41(g) and Regulation 61.8(9): The issuance of a permit does not convey any property or water rights in either real or personal property, or stream flows or any exclusive privilege.

1. The issuance of a permit does not authorize any injury to person or property or any invasion of personal rights, nor does it authorize the infringement of federal, state, or local laws or regulations.
2. Except for any toxic effluent standard or prohibition imposed under Section 307 of the Clean Water Act or any standard for sewage sludge use or disposal under Section 405(d) of the Federal act, compliance with a permit during its term constitutes compliance, for purposes of enforcement, with Sections 301, 302, 306, 318, 403, and 405(a) and (b) of the Clean Water Act. However, a permit may be modified, revoked and reissued, or terminated during its term for cause as set forth in Section 61.8(8) of the Colorado Discharge Permit System Regulations. See 61.8(9)(c).

H. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Division, within a reasonable time, any information which the Division may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Division, upon request, copies of records required to be kept by this permit in accordance with 40 C.F.R. §122.41(h) and/or Regulation 61.8(3)(q).

I. INSPECTION AND ENTRY

The permittee shall allow the Division and the authorized representative, including U.S. EPA, and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials as required by law, to conduct inspections in accordance with 40 C.F.R. §122.41(i), Regulation 61.8(3), and Regulation 61.8(4):

1. To enter upon the permittee's premises where a regulated facility or activity is located or conducted in which any records are required to be kept under the terms and conditions of this permit;
2. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit and to inspect any facilities, equipment (including monitoring and control equipment), practices, operations or monitoring method regulated or required in the permit;
3. To enter upon the permittee's premises in a reasonable manner and at a reasonable time to inspect or investigate, any actual, suspected, or potential source of water pollution, or to ascertain compliance or noncompliance with the Colorado Water Quality Control Act or any other applicable state or federal statute or regulation or any order promulgated by the Division, and;

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

J. MONITORING AND RECORDS

1. Samples and measurements taken for the purpose of monitoring must be representative of the volume and nature of the monitored activity. See 40 C.F.R. § 122.41(j)(1).

2. Monitoring must be conducted according to test procedures approved under 40 C.F.R. part 136 for the analyses of pollutants unless another method is required under 40 C.F.R. subchapters N or O. In the case of pollutants for which there are no approved methods under 40 C.F.R. part 136 or otherwise required under 40 C.F.R. subchapters N or O, monitoring must be conducted according to a test procedure specified in this permit for such pollutants. See 40 C.F.R. § 122.41(j)(4); 122.44(i)(1)(iv)(A).

3. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the permittee or when requested by the Division or Regional Administrator.

4. Records of monitoring information must include:

   a. The date, exact place, and time of sampling or measurements;
   b. The individual(s) who performed the sampling or measurements;
   c. The date(s) analyses were performed
   d. The individual(s) who performed the analyses;
   e. The analytical techniques or methods used; and
   f. The results of such analyses.

5. The permittee shall install, calibrate, use and maintain monitoring methods and equipment, including biological and indicated pollutant monitoring methods. See Regulation 61.8(4)(b)(iii). All sampling shall be performed by the permittee according to sufficiently sensitive test procedures required by 40 C.F.R. 122.44(i)(1)(iv) or methods approved by the Division, in the absence of a method specified in or approved pursuant to 40 C.F.R. Part 136.

6. The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

7. Documentation required by this permit, including records of all data used to complete the application for permit coverage to be covered by this permit, stormwater management plans, inspection reports, etc., must be retained for at least three years from the date that permit coverage expires or is terminated. This period may be extended by request of EPA or the division at any time.

K. SIGNATORY REQUIREMENTS

1. Authorization to Sign: All documents required to be submitted to the Division by the permit must be signed in accordance with 40 CFR §122.22, Regulation 61.4, and the following criteria:

   a. For a corporation: By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term

environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. The responsible official may be a project manager if the project manager has level of control at a corporation as required in this subpart a.

b. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or
c. For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a federal agency includes (i) the chief or principal executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency. (e.g., Regional Administrator of EPA), and at the city, municipal, state or other government entity it typically will include a program director (e.g. Director of Public Works, Director of Transportation, Director of Parks and Recreation, etc.). For purposes of this section, a principal executive officer has responsibility for the overall operation of the facility from which the discharge originates.
d. By a duly authorized representative in accordance with 40 C.F.R. 122.22(b), only if:

   i. the authorization is made in writing by a person described in Part II.K.1.a, b, or c above;
   ii. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and,
   iii. The written authorization is submitted to the Division.

2. Any person(s) signing documents required for submittal to the Division must make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both. See 40 C.F.R. §122.41(k)(2).

L. REPORTING REQUIREMENTS

1. Planned Changes: The permittee shall give advance notice to the Division, in writing, of any planned physical alterations or additions to the permitted facility in accordance with 40 CFR §122.41(l) and Regulation 61.8(5)(a) and Part II.O. of this permit. Notice is required only when:

   a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR §122.29(b); or
   b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR §122.41(a)(1).
   c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. See 40 C.F.R. §122.41(l)(1)(iii).

2. Anticipated Non-Compliance: The permittee shall give advance notice to the Division, in writing, of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements. The timing of notification requirements differs based on the type of non-compliance as described below.

3. Transfer of Ownership or Control: The permittee shall notify the Division, in writing, ten (10) calendar days in advance of a proposed transfer of the permit. The notice must include a written agreement between the existing and new permittee(s) containing a specific date for transfer of permit responsibility, coverage and liability between them. This permit is not transferable to any person except after notice to the Division. The Division may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act. See Regulation 61.8(6); 40 C.F.R. §§ 122.41(l)(iii) and 122.61.

4. Monitoring reports: Monitoring results must be reported at the intervals specified in this permit.

   a. If the permittee monitors any pollutant at the approved monitoring locations listed in Part I more frequently than that required by this permit using test procedures approved under 40 CFR Part 136, or another method required for an industry-specific waste stream under 40 CFR subchapters N or O, the results of such monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Division. See 40 CFR 122.41(l)(4).
   b. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Division in the permit.

5. Submission of Discharge Monitoring Reports (DMRs): DMRs shall be submitted electronically through NetDMR system unless the permittee requests and is granted a waiver of the electronic reporting requirement by the Division pursuant to Regulation 61.8(4)(d).

6. Compliance Schedules: Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule in the permit, shall be submitted on or before the date listed in the compliance schedule section. The fourteen (14) calendar day provision in Regulation 61.8(4)(n)(i) has been incorporated into the due date.

7. Twenty-four hour reporting:

   a. In addition to the reports required elsewhere in this permit, the permittee shall report the following circumstances on the Division's submission form within twenty-four (24) hours from the time the permittee becomes aware of the circumstances, and shall submit to the Division a written report containing the information requested within five (5) working days after becoming aware of the following circumstances:
      i. Circumstances leading to any noncompliance which may endanger health or the environment regardless of the cause of the incident;
      ii. Circumstances leading to any unanticipated bypass which exceeds any effluent limitations in the permit;
      iii. Circumstances leading to any upset which causes an exceedance of any effluent limitation in the permit; or
      iv. Daily maximum violations for any of the pollutants limited by Part I.A of this permit as specified in Part III of this permit. This includes any toxic pollutant or hazardous substance or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.
   b. The report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.
   c. For noncompliance events related to combined sewer overflows, sanitary sewer overflows, or bypass events, these reports must include the data described above (with the exception of time of discovery) as well as the type of event (combined sewer overflows, sanitary sewer overflows, or bypass events), type of sewer overflow structure (e.g., manhole, combine sewer overflow outfall), discharge volumes untreated by the treatment works treating domestic sewage, types of human health and environmental impacts of the sewer overflow event, and whether the noncompliance was related to wet weather. See 40 CFR 122.41(l)(6)(i).

i. As of December 21, 2020 all reports related to combined sewer overflows, sanitary sewer overflows, or bypass events submitted in compliance with this section must be submitted electronically by the permittee to the Division.

8. Other non-compliance: A permittee must report all instances of noncompliance at the time monitoring reports are due. These reports may be submitted annually in accordance with Regulation 61.8(4)(p) and/or 61.8(5)(f), but may be submitted at a more frequent interval.

M. BYPASS

1. Definitions:

   a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility in accordance with 40 CFR §122.41(m)(1)(i) and/or Regulation 61.2(12).
   b. Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. See 40 CFR §122.41(m)(1)(ii).

2. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of 40 CFR 122.41(m)(3) and (m)(4). See 40 CFR §122.41(m)(2).

3. Notice of bypass:

   a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, the permittee shall submit prior notice, if possible, at least ten (10) days before the date of the bypass. See 40 CFR §122.41(m)(3)(i) and/or Regulation 61.9(5)(c).
   b. Unanticipated bypass. You must submit notice of an unanticipated bypass as required in Part II.L.7. See also 40 CFR §122.41(m)(3)(ii).

4. Prohibition of Bypass: Bypasses are prohibited and the Division may take enforcement action against the permittee for bypass, unless:

   a. the bypass is unavoidable to prevent loss of life, personal injury, or severe property damage;
   b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
   c. Proper notices were submitted to the Division.
      i. The Division may approve an anticipated bypass, after considering its adverse effects, if the Division determines that it will meet the three conditions listed.

N. UPSET

1. Definition: "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation. See 40 CFR §122.41(n) and Regulation 61.2(113).

2. Effect of an upset: An upset constitutes an affirmative defense to an action brought for noncompliance with permit effluent limitations if the requirements of section 3 are met. A determination made during administrative review of claims that noncompliance was caused by upset is final administrative action subject to judicial review in accordance with Regulation 61.8(3)(j).

   ***special note:** this provision is consistent with the definition of "Upset" as codified in Regulation 61.2(113). However, the Colorado regulatory definition of upset is less stringent than the federal code of regulations, which restricts the use of an upset defense to noncompliance with technology-based permit effluent limitations only.*

3. Conditions necessary for demonstration of an Upset: A permittee who wishes to establish the affirmative defense of upset shall demonstrate through properly signed contemporaneous operating logs, or other relevant evidence that:

   a. an upset occurred and the permittee can identify the cause(s) of the upset;
   b. the permitted facility was at the time being properly maintained; and
   c. the permittee submitted notice of the upset as required in Part II.L.7 (24-hour notice); and
   d. The permittee complied with any remedial measure necessary to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. See also 40 C.F.R. 122.41(n)(3)(i)-(iv).

   ***special note:** this provision is consistent with the definition of "Conditions necessary for demonstration of upset" as codified in Regulation 61.8(3)(j)(ii). However, the Colorado regulatory definition of upset is less stringent than the federal code of regulations, which restricts the use of an upset defense to demonstrate that a facility was properly operated and maintained. Colorado's regulatory definition of "Conditions necessary for demonstration of upset" is less stringent than the requirements of the federal Clean Water Act.*

4. In addition to the demonstration required above, a permittee who wishes to establish the affirmative defense of upset for a violation of effluent limitations based upon water quality standards shall also demonstrate through monitoring, modeling or other methods that the relevant standards were achieved in the receiving water.

5. Burden of Proof: In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

O. REOPENER CLAUSE

Procedures for modification or revocation. Permit modification or revocation of this permit or coverage under this permit will be conducted according to Regulation 61.8(8). This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations (and compliance schedule, if necessary), or other appropriate requirements if one of the following events occurs, including but not limited to:

1. Water Quality Standards: The water quality standards of the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. Wasteload Allocation: A wasteload allocation is developed and approved by the State of Colorado and/or EPA for incorporation in this permit.

3. Discharger-specific variance: A variance is adopted by the Water Quality Control Commission.

P. OTHER INFORMATION

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Division or U.S. EPA, the Discharger shall promptly submit such facts or information. See 40 C.F.R. § 122.41(l)(8).

Q. SEVERABILITY

The provisions of this permit are severable. If any provisions or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances and the application of the remainder of this permit shall not be affected.

R. NOTIFICATION REQUIREMENTS

1. Notification to Parties: All notification requirements, excluding application information submitted using the CEOS portal or twenty-four hour reporting via the submission form, shall be directed as follows:

   a. Oral Notifications, during normal business hours shall be to:

      CDPHE-Emergency Reporting Line: 1-877-518-5608; or

      Water Quality Protection Section – Compliance Program
      Water Quality Control Division

Telephone: (303) 692-3500
After hours notifications should be made to the CDPHE-Emergency Reporting Line: 1-877-518-5608.

b. Written notification shall be to:
Water Quality Protection Section – Compliance Program
Water Quality Control Division
Colorado Department of Public Health and Environment
WQCD-WQP-B2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

S. RESPONSIBILITIES

Reduction, Loss, or Failure of Treatment Facility: The permittee has the duty to halt or reduce any activity if necessary to maintain compliance with the effluent limitations of the permit. It shall not be a defense for a permittee in an enforcement action that it would be necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

T. OIL AND HAZARDOUS SUBSTANCES LIABILITY

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under Section 311 (Oil and Hazardous Substance Liability) of the Clean Water Act.

U. EMERGENCY POWERS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority granted by Section 510 of the Clean Water Act. Nothing in this permit shall be construed to prevent or limit application of any emergency power of the Division.

V. CONFIDENTIALITY

Any information relating to any secret process, method of manufacture or production, or sales or marketing data which has been declared confidential by the permittee, and which may be acquired, ascertained, or discovered, whether in any sampling investigation, emergency investigation, Colorado Open Records Act (CORA) request, or otherwise, shall not be publicly disclosed by any member, officer, or employee of the Water Quality Control Commission or the Division, but shall be kept confidential. Any person seeking to invoke the protection of this section shall bear the burden of proving its applicability. This section shall never be interpreted as preventing full disclosure of effluent data.

W. FEES

The permittee is required to submit payment of an annual fee as set forth in the 2016 amendments to the Water Quality Control Act. Section 25-8-502 (1.1) (b), and the Regulation 61.15 as amended. Failure to submit the required fee when due and payable is a violation of the permit and will result in enforcement action pursuant to Section 25-8-601 et. seq., C.R.S.1973 as amended.

X. DURATION OF PERMIT

The duration of a permit shall be for a fixed term and shall not exceed five (5) years. If the permittee desires to continue to discharge, a permit renewal application shall be submitted at least one hundred eighty (180) calendar days before this permit expires. Filing of a timely and complete application shall cause the expired permit to continue in force to the effective date of the new permit. The permit's duration may be extended only through administrative extensions and not through interim modifications. If the permittee anticipates there will be no discharge after the expiration date of this permit, the Division should be promptly notified so that it can terminate the permit in accordance with Regulation 61.

Y. SECTION 307 TOXICS

If a toxic effluent standard or prohibition, including any applicable schedule of compliance specified, is established

by regulation pursuant to Section 307 of the Clean Water Act for a toxic pollutant which is present in the permittee's discharge and such standard or prohibition is more stringent than any limitation upon such pollutant in the discharge permit, the Division shall institute proceedings to modify or revoke and reissue the permit to conform to the toxic effluent standard or prohibition.

Tab 13 – Inspection Reports

Tab 14 – Miscellaneous

Noxious Weed Management Plan

XCEL PATHWAYS SEGMENT 5

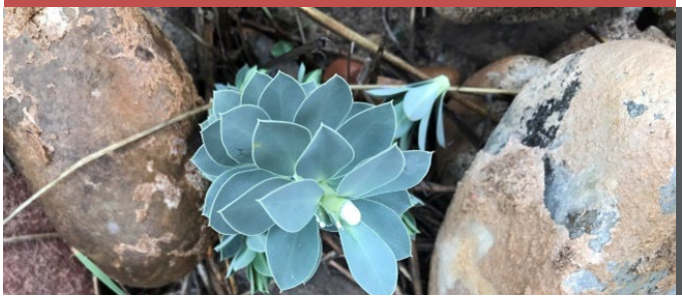
El Paso County, Colorado

Prepared for:

Public Service Company of Colorado
(PSCo d/b/a Xcel Energy)

Prepared by:

April 2025



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Section 1. Introduction

The Public Service Company of Colorado (PSCo), a Colorado corporation of Xcel Energy (Xcel), is proposing to build approximately 560 miles of new 345-kilovolt (kV) double-circuit transmission line as well as new and expanded substations. The Colorado Power Pathway project (Pathway or Project) is an investment proposed by Xcel to improve the state's electric grid, increase electric reliability and enable future renewable energy development around the state.

The Project includes five segments of new transmission line in the following counties: Weld, Morgan, Washington, Cheyenne, Kit Carson, Kiowa, Crowley, Pueblo, El Paso, Lincoln, Elbert, and Arapahoe. This Noxious Weed Management Plan (Plan) will focus only on those segments in El Paso County – Portions of Segment 5 (**Attachment A**: **Figures 1, 2** and **3**).

The new transmission line is comprised of a mix of monopole, tangent, and dead-end steel pole structures, with pole foundation diameters varying from 3 feet to 10 feet. Ground disturbance will consist of areas for pole placement, laydown yards, pull sites, and new access roads.

This Plan is based on standard best management practices (BMPs) and is not based on a site-specific weed survey. This Plan for the Project complies with federal, state, and local requirements regarding noxious weeds. This Plan has been prepared to support the noxious weed management activities associated with the project in El Paso County.

Section 2. Noxious Weed Management Requirements

When present in large numbers, noxious weed species can significantly degrade the quality and integrity of natural ecosystems. Noxious weed species can alter fire ecology, successional ecosystem processes, and impair overall ecosystem function. Some species have such serious economic and biological impacts that their control and management is mandated under Colorado State law (e.g., List A species).

Because of the adverse environmental effects of noxious weeds, federal and state governments have issued various orders and regulations regarding noxious weeds. The following are some of the regulations guiding noxious weed management.

2.1 Presidential Executive Order 13112—Invasive Species

Executive Order 13112, Invasive Species, was issued on February 3, 1999, to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that result from invasive species. This order directs federal agencies to prevent the introduction of invasive species, control and monitor invasive species, and restore native species and habitats that have been invaded (Federal Register 1999).

2.2 Colorado Noxious Weed Act

As defined by the Colorado Department of Agriculture (CDA), noxious weeds are plants that reduce agricultural productivity, lower real estate values, endanger human health and well-being, and damage scenic values (CDA 2025a). The Colorado Noxious Weed Act §§ 35-5.5-101 through 119, C.R.S. as amended, states that an organized and coordinated effort must be made

to stop the spread of noxious weeds.

Rules pertaining to administration of the Act include a noxious weed list that designates and classifies noxious weed species into categories for immediate eradication (CDA 2025a):

- **List A** contains 24 species of noxious weeds targeted for eradication. If individuals or populations of A List species are found, the local governing body must provide the State Weed Coordinator with mapping that includes information on location and density of the infestation.
- **List B** contains 35 species that are targeted for eradication, containment, or suppression based upon a given local governing body's management plan.
- **List C** contains 18 species for which the Commissioner of Agriculture, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, will develop and implement into state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands.

In addition to the three lists, the state maintains a noxious weed species "Watch List". It contains 19 species that CDA has determined pose a potential threat to the agricultural productivity and environmental values of the lands of Colorado. It is for advisory and education purposes only and is intended to encourage the collection of information needed to determine if the species should be listed as a noxious weed.

The term "noxious weed" includes species listed as noxious by the CDA (CDA 2025a) and additional plants listed as weeds within the County (CDA 2025b) and those with containment goals (CDA 2025c). Plant nomenclature for noxious weeds in this report follow the CDA website.

2.3 El Paso County Noxious Weed Management

The Noxious Weed Section of the Environmental Division of El Paso County monitors both public and private control of noxious weeds as required by the Colorado Noxious Weed Act (El Paso County 2025). The Environmental Division publishes two documents: the county's Noxious Weed Management Plan (El Paso County 2022) and Noxious Weeds and Control Methods document (El Paso County 2024a) as well as an engaged commission that provides advice to the county on noxious weed programming.

The El Paso County Noxious Weed Advisory Commission consists of three members of the county that actively engage in addressing noxious weed concerns within the county and communicate with the County's Environmental Division on control, development, management, programming, operation, and maintenance of noxious weed issues (El Paso County 2025). They hold end-of-the-year meetings with the Environmental Division, with the most recent update in October 2024. The county identified Canada thistle (*Cirsium arvense*), hoary cress (*Lepidium draba*), and musk thistle (*Carduus nutans*) as the biggest threat county-wide in terms of noxious weed management. Leafy spurge (*Euphorbia esula*) is an issue for the north-central areas of the county (El Paso County 2024b). In past years, Russian thistle (*Salsola tragus*) has been a species of concern for the county, albeit not being state listed.

El Paso County's Noxious Weed Management Plan (El Paso County 2022) outlines four main

objectives in the management techniques (El Paso County 2022): Prevention; Control; Restoration; and Education and Awareness. To assist with these objectives, the Environmental Division sends out noxious weed notification letters to landowners in El Paso County. In recent years, over 600 letters were sent out in 2024, and 750 letters were sent in 2023 (El Paso County 2024b). The County also assists landowners through integrated weed management plans that identify infestations with specific cultural, chemical, mechanical, or biological control methods (El Paso County 2022).

2.4 Colorado Natural Heritage Program

The Colorado Natural Heritage Program (CNHP) conducts county-level surveys to document biological resources and rank and track areas of high biodiversity significance as well as documenting noxious weeds. In 2000, CNHP surveyed El Paso County for critical biological resources (CNHP 2001). The report identified livestock grazing practices and local environmental conditions as potential introductions and proliferation of noxious weeds as well as transportation and recreation land uses as threats, as well (CNHP 2001).

CNHP identified one Potential Conservation Area (PCA) that overlaps with the Project in El Paso County: Chico Basin Shortgrass Prairie (CNHP 2024a). A PCA refers to "the ability of a conservation area to maintain healthy, viable targets over the long term (100+ years), including the ability to respond to natural or human-caused environmental change" (CNHP 2025) (**Attachment A**: **Figure 3**).

The Chico Basin Shortgrass Prairie PCA is considered a B2: Very High Biodiversity Significance. This PCA encompasses over 250 square miles of shortgrass prairie in northern Pueblo and southern El Paso counties. The site is characterized by a mixture of open, flat areas and gently rolling terrain that drains into mostly ephemeral streams and swales. The site includes extensive tracts of native shortgrass prairie with ground cover that consists primarily of closely grazed stands of blue grama (*Bouteloua gracilis*). Cholla (*Opuntia imbricata*) and yucca (*Yucca glauca*) occur scattered in areas and the overall plant diversity is low with the dominant species including blue grama, three-awn grass (*Aristida* spp.), galleta grass (*Hilaria jamesii*), sand dropseed (*Sporobolus cryptandrus*), rabbitbrush (*Ericameria nauseosus*), yucca, cholla, and prickly pear (*Opuntia* spp.) (CNHP 2024b).

Within El Paso County, the Chico Basin Shortgrass Prairie PCA overlaps with the proposed Project at structures 063 through 068 which covers approximately 1 mile of transmission line right-of-way (**Attachment A**: **Figure 3**).

Section 3. Project Area

3.1 Location

The Project area is located on the eastern side of El Paso County (**Attachment A**: **Figure 1**).

Within El Paso County, Segment 5 begins at proposed structure 063 and continues north and east for 20 miles then at structure 167, it crosses into Lincoln County for 1.5 miles before entering El Paso County at proposed structure 177. At proposed structure 197, the line crosses

back into Lincoln County for 4 miles. Then, at proposed structure 221 enters El Paso County again for another 20 miles before entering Elbert County at proposed structure 326 (**Attachment A**: **Figure 3**).

For permitting purposes in El Paso County, this Plan will only be addressing those Project components within El Paso County. Within the El Paso County portion, there are no proposed laydown yards or substations.

The Project area includes the limits of potential temporary and permanent impacts anticipated by Project construction. The Project area is found on the U.S. Geological Survey (USGS) 7.5-minute quadrangles: Truckton SE, CO (2022), Truckton NE, CO (2022), Rush, CO (2022), Holtwold Store, CO (2022), and Alta Vista, CO (2022) and has the following coordinates:

- Northern terminus (within El Paso County): 39.128640, -104.106821
- Southern terminus (within El Paso County): 38.521757, -104.109782 (datum is NAD 83).

Within El Paso County, the Project area is in the following Public Land Survey System:

- Sections 03, 10, 15, 16, 21, 27, 34 Township (T) 11 South (S), Range (R) 60 West (W);
- Section 02, 03, 11, 14, 22, 23, 27, 34 of T12S, R60W;
- Section 03, 10, 15, 23, 24, 25, of T13S, R60W;
- Section 13, 24, 25, and 36 of T14S, R60W;
- Section 12, 13, 24, 25, and 35 of T15S, R60W;
- Section 01, 12, 13, 14, 23, 24, 26, 35 of T16S, R60W; and
- Section 02, 11, 14, 15, 22, 27, 34, and 33 of T17S, R60W.

3.2 Land Use

Land use throughout the Segment 5 Project area varies from rural residential, agricultural and rangeland, and transportation uses.

3.3 Climate

The climate within the Project area is temperate. Annual precipitation based on 30-year averages (i.e., Normal) for nearby Ellicott 7S, CO station (1991-2020) is approximately 14.99 inches (AgACIS 2025). Winter precipitation occurs as snow. The average annual temperature ranges from 34 to 54 degrees Fahrenheit. The freeze-free period averages 160 days and ranges from 75 to 175 days (USDA-NRCS 2022).

3.4 Soils

Soils in the Project area are generally sandy loam, sandy clay loam and fine sandy loams, formed from eolian sands parent material, and are well-drained (USDA-NRCS 2025).

3.5 Vegetation and Habitat

The project area in El Paso County lies within two major resource regions. The northern half lies

within Southern Rocky Mountain Foothills major land resource area (MLRA) of the Rocky Mountain Range and Forest Region Land Resource Region (LLR). Stream erosion from the eastern front of the Rocky Mountain range assisted in the creation of large alluvial fan remnants, pediments, and terrace deposits which gave rise to soils with frigid or mesic soil temperature regimes. These soil types contributed to grassland species composition, including blue grama (*Bouteloua gracilis*), wheatgrasses (*Agropyron* spp. and *Pascopyrum smithii*), and buffalograss (*Bouteloua datyloides*) while shrub-grassland and foothill species include pinyon pine (*Pinus pinon*), juniper (*Juniperus* sp.), true mountain mahogany (*Cercocarpus montanus*), blue grama, wheatgrasses, and needle-and-thread grass (*Hesperostipa comata*) (USDA-NRCS 2022).

The southern half lies within the Upper Arkansas Valley Rolling Plains MLRA of the Western Great Plains Range and Irrigated Region LRR. This MLRA is also a very dry climate, and supports native short grasses. Blue grama, galleta, sideoats grama (*Bouteloua curtipendula*), ring muhly (*Muhlenbergia torreyi*), and alkali sacaton (*Sporobolus airoides*) are the major native species (USDA-NRCS 2022).

Based on land use in the Project area, local herbarium records (SEINet Portal Network 2025) and HDR Ecologist's experience in the region, the general habitat is expected to consist of a mixture of native and disturbed vegetation. Expected species in the Project area may include blanket flower (*Gaillardia pinnatifida*), Texas croton (*Croton texensis*), cowboy's delight (*Sphaeralcea coccinea*), fourwing saltbush (*Atriplex canescens*), sunflowers (*Helianthus* spp.), kochia (*Bassia scoparia*), rabbitbrush (*Ericameria nauseosa*), sand dropseed (*Sporobolus airoides*), yucca (*Yucca* spp.), blue gramma, wild rye (*Elymus canadensis*), giant ragweed (*Ambrosia trifida*), western wheatgrass (*Pascopyrum smithii*), smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), Mexican fireweed (*Bassia scoparia*), and western ragweed (*Ambrosia psilostachya*).

The Project area could contain state-listed noxious weeds including lesser burdock (*Arctium minus*), common mullein (*Verbascum thapsus*), Canada thistle, hoary cress, and musk thistle.

General habitat photos can be viewed in **Attachment B**.

Section 4. Noxious Weed Control – Pre-Construction

Prior to construction, Xcel will implement the following steps to minimize noxious weed propagation within the Project area:

- Training of crews as to how surface disturbance creates a more favorable environment for noxious weeds if seed stocks are in the area.
- Boundaries will be clearly marked using fencing or other physical barriers to limit unnecessary surface disturbance (see Stormwater Management Plans (SWMP) and report).
- Cleaning of equipment will be conducted to avoid bringing non-native soil or vegetation onto the site as these may contain unwanted seed stock. Equipment brought to the site must be free of clean of soil or vegetation from another site. Thorough power washing of wheels, tracks, undercarriage, and excavation equipment will be performed prior to site arrival. Equipment that leaves the site, i.e. for crew transportation or equipment repair,

and then returns to the site without leaving pavement does not need to be re-washed.

- A State SWMP permit that covers this construction activity will be obtained by Xcel, and the weed management plan will be integrated with the SWMP.

Section 5. Noxious Weed Control – During-Construction

Construction activities will expose soils in areas that have been previously disturbed and limited areas of undisturbed land. This disturbance creates a potential for the introduction and spread of noxious weeds in the Project area. Noxious weed species that occur in and adjacent to disturbed areas of the Project have the potential to spread into areas impacted by placement of new structures, use and construction of access roads for construction equipment and use of laydown yards. The goal of the Plan is to minimize the spread of noxious weeds due to the proposed Project's construction activities. By implementing measures intended to minimize the spread of noxious weeds during construction and minimizing the establishment of new noxious weed populations post construction, the proposed Project should minimize new and help reduce existing noxious weed infestations. The activities during construction will, at a minimum, include:

- Removal and stockpiling of topsoil for replacement in immediate area of excavation disturbance as this will create a more favorable soil strata for revegetation.
- Leaving 'drive & crush' areas alone to rebound naturally. This assume the topsoil layer and associated root structure remains in place but has only been compressed by construction activity.
- Crews continue to be diligent about minimizing the construction impact to avoid topsoil disturbance.
- Hand or drill seeding of appropriate seed mix has been applied along with mulch.
- The SWMP permit compliance will continue during construction and the weed management steps will work in conjunction with the SWMP.

Section 6. Noxious Weed Control – Post-Construction

Post-construction activities are based on the assumption that the site grades and topsoil have been restored, and appropriate seed mix has been applied. Post-construction weed control activities will commence in the year following completion of construction as that is when weed seed germination and growth is more apparent. NOTE: Weed control will only be addressed in areas disturbed by construction and will not address weed infestations outside of the disturbance area even if they are within Xcel's easement.

Table 1 outlines the state-listed noxious weeds that have a likelihood of occurring in the Project area and their state status along with management strategies for control.

Post-construction weed management priorities are based on the threat noxious weed species found in the Project area pose to the overall goal of maintaining the health of the ecosystem. Generally, List A species are the highest priority because they are often the most aggressive species with limited distribution. Within **Table 1**, myrtle spurge (*Euphorbia myrsinites*) is the only

species documented that is designated as a “List A” species in the Colorado Noxious Weed Act. It is designated for statewide eradication, has the most probability of a List A species to occur in the Project area, so if it is identified in the Project area, it needs to be addressed immediately. List B are next priority species and List C species are generally widespread and are not prioritized.

The best technique for controlling most noxious weeds is an integrated approach of mechanical, biological, and chemical controls. Mechanical control usually involves mowing, hand-pulling, or cutting. Biological control is the use of organisms (usually insects, but also livestock) that are deliberately introduced to an area to control weeds. Chemical control involves the application of one or more herbicides at the appropriate time of the year (all herbicides should be applied by a certified applicator according to the manufacturer’s directions).

Cultural

Where chemical controls are recommended, Xcel and its contractors work to minimize the use of chemicals that are harmful to beneficial insects in their vegetation management practices controlling shrubs, trees, and weed species within their rights-of-way and properties. This includes eliminating the use of neonicotinoids, a class of neuro-active insecticides, which have been found harmful to all invertebrate populations including bee populations and other native pollinators (Xcel Energy Undated).

The year following construction, two noxious weed treatments will be undertaken:

1. Early season (May-June) for cool-season noxious weeds (e.g., redstem filaree [*Erodium cicutarium*], downy brome [*Bromus tectorum*], field bindweed [*Convolvulus arvensis*]),
2. Late season (July-August) for the warm-season noxious weeds (e.g., thistles and knapweeds). Areas of infestations identified in these surveys will determine appropriate treatment and suppression methods.

Noxious Weed Treatment Measures

Xcel’s noxious weed management contractor will implement noxious weed control measures in accordance with existing regulations and local requirements. Post-construction control measures can include one or more of the following methods (that may be implemented during restoration activities):

- Treatment methods will be based on species-specific and area-specific conditions (e.g., proximity to water or riparian areas, agricultural areas, and time of year) with the County coordinator being notified prior to noxious weed eradication activities. If areas are not seeded until the following spring, Xcel will alter weed treatment timing based on weed control best practices.
- Mechanical methods rely on equipment that can be used to mow or disc weed populations. If such a method is used in areas to be restored, subsequent seeding will be conducted to re-establish a desirable vegetative cover that will stabilize the soils and slow the potential re-invasion of noxious weeds.

Table 1. Noxious Weed Species Recommended Control Techniques

Common Name (*Scientific name*)	State Status List	Chemical	Mechanical	Biological
Bull thistle (*Cirsium vulgare*)	List B	Aminopyralid (Milestone) Chlorsulfuron (Telar) Clopyralid (Transline) Aminocycophrachlor + Chlorsulfuron (Perspective)	Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before flower production.	Horses, goats and sheep may eat flower heads on a few young individual plants, but seeds likely pass through their digestive tracks unaltered; cattle avoid bull thistle. Dense stands and large plants are usually avoided. Thus, bull thistle can become an "increaser" in over-grazed systems. The bull thistle gall fly (*Urophora stylata*), has been found to be ineffective in Colorado.
Canda thistle (*Cirsium arvense*)	List B	Aminopyralid (Milestone) Clopyralid + Triclopyr Aminocycophrachlor + Chlorsulfuron (Perspective)	Hand pulling and tilling cause root fragments that stimulate new plant growth. Mowing can be effective if done every 10-20 days. Combine with herbicides for enhanced control.	Cattle, goats, and sheep will graze when plant are young and succulent in the spring. Follow up with fall herbicide application.
Chicory (*Cichorium intybus*)	List C	Aminopyralid (Milestone) 2, 4-D amine 2, 4-D+ Dicambra Picloram (Tordon 22K is restricted use chemical)	Mowing is not recommended; it leaves roots behind, stimulates flower production, disperses seeds, and expands the size of the infested area. Chopping the inflorescence just below the root crown and bagging the biomass may reduce vigor with consecutively treatment.	Chicory provides high quality forage for goats, sheep and cattle. It is sensitive to grazing; fall is best for control. Currently there are no biological control agents for chicory authorized in Colorado.
Chinese clematis (*Clematis orientalis*)	List B	2, 4-D amine, Imazapic (Plateau, Panoramic), and Aminopyralid (Milestone). 2, 4-D amine applied anytime actively growing. Other herbicides applied in fall.	Digging or hand pulling is effective when soil is moist. Make certain to pull all the roots and bag specimens carefully so as to not scatter seeds if flowering.	No approved biological control agents.
Common mullein (*Verbascum*	List C	Chlorsulfuron (Telar XP)	Hand pull or dig when soil is moist, prior to flowering and seed production	*Gymnetron tetrum*, a seed eating weevil, biological control has been

thapsus)		2, 4-D Picloram (Grazon P+D is restricted use chemical) Picloram (Tordon 22K is restricted use chemical) Metsulfuron (Cimarron)	can be effective. If flowers are present, bag specimens carefully so as not to scatter any potential seeds.	found in eastern Washington State and is currently working on populations there. The weevil has not yet been approved for use in Colorado.
Dalmatian toadflax (*Linaria dalmatica*)	List B	Aminocycophrachlor + Chlorsulfuron (Perspective), Picloram (restricted use), and Chlorsulfuron (Telar).	For small infestations, pulling toadflax by hand can be effective. Pull every year for 5 to 6 years to deplete the reserves of the root system. Monitor the site for 10 - 15 years to remove seedlings produced from dormant seeds.	*Calophasia lunula*, a predatory noctuid moth, feeds on leaves and flowers of Dalmatian toadflax. *Eteobalea intermediella*, a root boring moth, and *Mecinus janthinus,* a stem boring weevil, are also available.
Diffuse knapweed (*Centaurea diffusa*)	List B	Aminocycophrachlor + Chlorsulfuron, (Perspective) Aminopyralid (Milestone), Clopyralid (Transline)	Any mechanical or physical method that severs the root below the soil surface will kill diffuse knapweed. Mowing or chopping is most effective when diffuse knapweed plants are at full bloom. Be sure to properly dispose of the flowering cut plants, since seeds can mature and become viable after the plant has been cut down.	Seedhead weevil (*Larinus minutus*) and the root weevil fly (*Cyphocleonus achates*) provide fair to good control when used together.
Downy brome or cheatgrass (*Bromus tectorum*)	List C	Pseudomonas fluorescens D7 inhibits cheatgrass and is currently approved by EPA and Colorado.	Mechanical methods are best for residential areas and small infestations. Collect, bag, and dispose of or destroy flowers; seeds can mature and germinate if left. Tilling must be deeper than 6 inches to work. Prescribed fire applied before seed maturity, (late spring or early summer), may kill seeds; the trick is to get green cheatgrass and litter to carry fire and at a hot enough temperature to destroy seeds and seedlings.	No approved biological control agents.
Field bindweed		Clarity + 2,4-D Amine, Tordon 22K *this is a Restricted Use Pesticide, and Roundup Ultra *non-selective herbicide, will	Cutting, mowing, or pulling has a negligible effect unless the plants are cut below the surface in the early seedling stage.	The bindweed gall mite, *Aceria mahlerbae,* has proven to be effective in reducing field bindweed infestations.

(*Convolvulus arvensis*)	List C	kill all vegetation* See Application timing on Noxious Weed Fact Sheets.		
Halogeton (*Halogeton glomeratus*)	List C	Metsulfuron + Chlorsulfuron (Cimmaron X-tra) or Chlorsulfuron (Telar XP). Apply pre-emergence to post-emergence stages in spring.	Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. The key to effective control is to prevent seed production and/or spread.	No approved biological control agents.
Hoary Cress (*Cardaria draba*)	List B	Metsulfuron (Escort XP), Chlorsulfuron (Telar), Imazapic (Plateau)	Mowing multiple times before the plants bolt allows for better chemical efficacy. For small infestation, hand pull and removal all roots.	No approved biological control agents.
Johnsongrass (*Sorghum halpense*)	List C	Glyphosate + Isopropylamine (Glyphomax) Glyphosate + Potassium 2, 4-D + Glyphosate + Isopropylamine (Recoil)	Hand-pulling or hoeing are best for small infestations. When larger, mowing, tilling, or plowing can assist with control when used in combination with herbicides. Key is to prevent seed production and spread through rhizomes (roots).	No approved biological control agents.
Leafy spurge (*Euphorbia esula*)	List B	Picloram (Tordon 22K), Imazapic (Plateau), 2,4-D Amine	Mowing every 2 to 4 weeks during the growing season can reduce seed production.	Livestock grazing using sheep and goat. Flea beetles (*Aphthona* spp.), can be effective, in particular, when combined with other methods.
Musk thistle (*Carduus nutans*)	List B	Aminopyralid (Milestone), Chlorsulfuron (Telar), and Clopyralid (Transline). Apply in spring from rosette through very early flower growth stages.	Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before flower production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. All flower buds and heads must be collected, bagged, and	*Trichosirocalus horridus* is the only biological control agent available for musk thistle in Colorado.

			disposed of or destroyed. Prescribed fire that results in high soil burn severity damages roots and above ground biomass, but is not recommended due to impacts on desired plants.	
Myrtle spurge (*Euphorbia myrsinites*)	List A	2, 4-D ester, Dicambra + 2, 4-D, and Picloram + 2	Hand pull or dig when soil is moist. Make certain to pull all the roots and wear rubber gloves and eye protection to protect yourself from the toxic milky sap. Treatment follow up is important to check root fragment resprouts that will occur when the tap root is severed too shallow.	Biocontrol is not an approved method of control for State List A species.
Puncturevine (*Tribulus terrestris*)	List C	Glyphosate (Roundup) 2,4-D + dicamba (Outlaw) Chlorsulfuron (Telar) Pendimethalin (Pedulum)	Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds.	There are two biological controls available for control of Puncturevine; *Microlarinus lareynii*, a seed feeding weevil, and *Microlarinus lypriformis*, a stem boring weevil.
Redstem filaree (*Erodium cicutarium*)	List C	Metsulfuron (Escort XP) or 2,4-D + dicamba (Rangestar). Apply at rosette stage of growth.	Hand pulling or digging when soil is moist, making sure to get the roots to prevent resprouting is effective. Removing flowers before the plant sets seed will also be effective.	No approved biological control agents.
Russian knapweed (*Rhaponticum repens*)	List B	Aminopyralid (Milestone), Aminocyclopyrachlor + Chlorsulfuron (Perspective). Most effective if applied in the fall when above-ground stems die back.	Cutting or mowing can stress plant and force it to use reserves. Tilling and disking can create root fragments that can sprout. However, repeated deep tillage (1 foot) over 3 years can kill much of the root system.	The gall midge, *Jaapiella ivannikovi*, is a fly that lays eggs in the shoot tips of Russian knapweed. It forms galls that reduce flowering, seed production, and stunts the plants' growth. This biocontrol will stress the stand of Russian knapweed but will not likely eliminate it. Not available to public.
Russian olive (*Elaeagnus angustifolia*)	List B	Triclopyr and imazapyr are the most effective herbicides. Both should be applied to the cambial layer of the tree immediately after cutting (cut-stump treatment).	Mowing or cutting can be effective, but often must be combined with either herbicides or excavation of the entire stump. Burning can be effective if conditions can support a long, hot fire.	*Tubercularia* canker can be effective.

Russian thistle (*Salsola tragus*)	Not state-listed but a county watch species (El Paso County 2024b)	Dicamba: Banvel, Clarity, Vanquish, 2,4- D, Glyphosate: Roundup	Pulling or light tilling are effective in early growth stages. Mowing during the flowering stage can be effective.	No approved biological control agents.
Saltcedar (*Tamarix* spp.)	List B	Triclopyr (Garlon 3A, Remedy) Glyphosate (Rodeo-approved aquatic label) Triclopyr (Garlon 4, Remedy) + Aminopyralid (Milestone)	A bulldozer or prescribed fire can be used to open up large stands. Must be followed up with herbicide treatment of resprouts.	The saltcedar leaf beetle (*Diohabda elongata*) larvae and adult feed on foliage causing stem dieback and potential death of the plant if defoliation is consistent.
Scotch thistle (*Onopordum acanthium*)	List B	Aminopyralid* (Milestone), Chlorsulfuron (Telar), Metsulfuron + Chlorsulfuron (Cimarron X-tra), Clopyralid (Transline) Aminocyclopyrachlor + chlorsulfuron (Perspective). Apply in spring rosette to early bolting growth stages. Two treatments in growing season required	Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres. Sever roots below the soil surface during the first year before the plant stores energy and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground.	No approved biological control agents.
Siberian elm (*Ulmus pumila*)	List C	Triclopyr (Garlon 3A, Garlon 4 Ultra, Pathfinder II) Glyphosate (Roundup, Accord XRT II, etc.) Imazapyr (Arsenal, Habitat, Chopper, Stalker, etc) Use in summer/early fall when actively growing.	Young seedlings can be pulled by hand or with weed-wrench. Mechanical methods alone for trees are not recommended, use with herbicide.	No known biological control agents effective or authorizes in Colorado.

Source: Colorado Department of Agriculture (2025a) and (Bernau and Eldredge 2018) for Russian thistle information.

Factsheets of the species can be viewed in ***Attachment C****.*

- Discing or other mechanical treatments, that would disturb the soil surface within native habitats, will be avoided in favor of an herbicide application, which is an effective means of reducing the size of noxious weed populations as well as preventing the establishment of new colonies.
- Seed selection will be based on site-specific conditions and the appropriate seed mix identified for those conditions, as presented in **Table 2**.
- Herbicide applications will be controlled to minimize the impacts on the surrounding vegetation. In areas of dense infestation, a broader application will be used and a follow-up seeding program may be implemented.

Table 1 presents typical species-specific recommended control measures which may be implemented. NOTE: **Table 1** is typical of approaches for weed management. Actual methods will depend on weed species encountered. These recommended control measures are from the Colorado Department of Agriculture website (CDA 2025a). Some of the noxious weed species are widespread and not found in defined populations, therefore treatment will be difficult and may not be prioritized. Treatment will only occur in areas where soil disturbance due to construction.

6.1 Seed mix

Restoration will consist of re-contouring the disturbed areas around structures, pull sites, and staging areas per grading plans and reseeding the area with the following seed mix. Areas of active agricultural cropping will not be re-seeded but will just be surface-roughened. The timing of subsequent seeding efforts will be based on the life of applied herbicides, if used. NOTE: This seed mix (**Table 2**) will be reviewed during construction and in consultation with supplier and appropriate County representative.

Table 2. Cool Desert Semi-Loam Seed Mixture*

Species	Seeding Rate (pounds per acre) of PLS**	Number of Seeds (per square foot)
Indian ricegrass (*Achnatherum hymenoides*)	2.00	6
Blue grama (*Boutelea gracilis*)	1.00	4
Sideoats grama (*Bouteloua curtipendula*)	2.00	10
Western wheatgrass (*Pascopyrum smithii*)	4.00	8
Lewis flax (*Linum lewisii*)	0.60	9
Purple prairie clover (*Dalea purpurea*)	0.50	9
Black-eyed susan (*Rudbeckia hirta*)	0.40	2
Prairie coneflower (*Ratibida columnifera*)	0.40	3
Western yarrow (*Achillea millefolium*)	0.10	1
Total	**11**	**52**

The seed mix shown in **Table 3 was developed by Applewood Seed Co. based on existing native grasses and forbs that occur in this region. Seed mix may be obtained from other suppliers.*
*** Pure Live Seed and recommended by Applewood Seed Co.*

Section 7. Discussion

Prevention is the best and most effective means to control invasive species. Additionally, understanding why species can become invasive is a key component to noxious weed management because it allows for targeted prevention strategies, early detection of infestation, and appropriate control measures.

One PCA, Chico Basin Shortgrass Prairie, overlaps with the proposed Project in southern El Paso County. Due to the High Biodiversity classification of this PCA, taking care to follow the mitigation measures outlined in **Section 8**, will further the protection of this sensitive ecosystem.

Anticipated disturbances associated with the proposed transmission line components may contribute to the continued spread of noxious weed species within affected areas. Livestock grazing management on private lands leased by Xcel may have continued detrimental impacts on sensitive ecosystems and have the potential to increase noxious weed species.

Besides the cultural, chemical, mechanical, and biological control methods outlined in **Section 6**, landowner-managed intensive livestock grazing management could benefit both the PCAs and other ecosystems.

Livestock grazing can have both negative and positive effects on pastureland management, including the alteration of plant species composition and abundance. Open range of cattle on landscapes can result in an abundance of non-native and noxious plant species due to their palatability. In these systems of range management, plant species are commonly referred to as increasers, decreasers, or invaders which is a result of years of overgrazing, generally by cattle (NDSU 2008).

“Decreasers” are generally plant species that are important ecological climax species but tend to decrease over time due to overgrazing. Examples of decreasers include big bluestem (*Andropogon gerardi*), western wheatgrass, and needlegrasses. These plants are the most desirable for livestock due to nutrient content, abundance, and palatability (NDSU 2008).

“Increasers” are also native plants that occur in the historical climax ecological community but are not as palatable and nutritious as the decreasers, so they tend to increase because of overgrazing on other species (NDSU 2008). In Colorado, blue grama, prairie junegrass (*Koeleria macrantha*), and threeawn (*Aristida* sp.) are the more common increasers.

“Invaders” are plant that become established due to disturbance such as grazing, road construction, and transmission line construction. These species were not part of the historical climax ecological community, and although they may be native (e.g., *Opuntia* spp.), many of them are introduced (e.g., knapweeds). Most invaders have little or no forage value (NDSU 2008). Furthermore, due to their “potential threat to the agricultural productivity and environmental values,” they are legally labeled noxious, and removal can be enforced by state law (CDA 2025a).

Shifting to regenerative mob grazing though holistic management strategies would improve the species composition and reduce the noxious weed pressure. Managed grazing has also

demonstrated value to reduce the risk and extent of wildfire and improve wildlife habitat. Under this type of land management, the livestock would not have access to the same area more than twice per year, emulating the American bison movement. All grasses are allowed full recovery before being grazed again (Savory and Butterfield 2016).

Section 8. Recommended Management and Mitigation Actions

Future construction and maintenance activities conducted by Xcel and its contractors have the potential to expose soils in areas that have been previously disturbed, creating a potential for the introduction and spread of noxious weeds in the Project area. The proposed Project would include ground-disturbing activities. Equipment associated with the Project activities could include drill trucks, back hoes, truck-mounted augers, cranes, man lifts, pickup trucks, and semi-truck/trailers pick-up trucks, boom crane trucks, and trailer puller reels.

In addition to the specific management recommendations listed for each species in **Table 2**, the following mitigation measures are recommended (as appropriate) to minimize the spread of noxious weeds:

- All construction equipment will remain in designated work areas.
- The area of ground disturbance will be kept to the minimum necessary.
- Minimize imported topsoil during construction. If importing is necessary, use certified weed-free soil.
- All equipment will be thoroughly cleaned before entering and exiting the Project area.
- All mulches and straw used at the site will be certified weed-free.
- All disturbed areas will be seeded after construction. Seeding will consist of species listed in **Table 3**. Cool, Arid Sandy Loam Seed Mixture will be spread on disturbed ground around structures, pull sites, and staging areas, as appropriate. The seed mix will be reviewed after the weed survey and in consultation suppliers and appropriate County representatives, as requested.
- All seed mixes, soil, and other plant material used for revegetation will be free of noxious weed seeds, roots, and other propagules.
- Only a Colorado-licensed Supervisor or Certified Operator will apply herbicides.
- All herbicides will be applied in accordance with the manufacturer's instructions.
- Broadcast herbicide spraying will be limited to areas of project ground disturbance, around each existing and new structure, and at staging areas. Weed treatment around each existing and new structure will be limited to disturbance associated with this line rebuild.
- The El Paso County Noxious Weed Coordinator will be notified prior to noxious weed treatments, as appropriate to the disturbance jurisdiction.
- The El Paso County Noxious Weed Coordinator, Nick Daniel (719-520.7846, nicholasdaniel@elpasoco.com), shall be notified to any changes made in this NWMP.

- Applicable BMPs from the Stormwater Management Plan will be implemented.

Section 9. References

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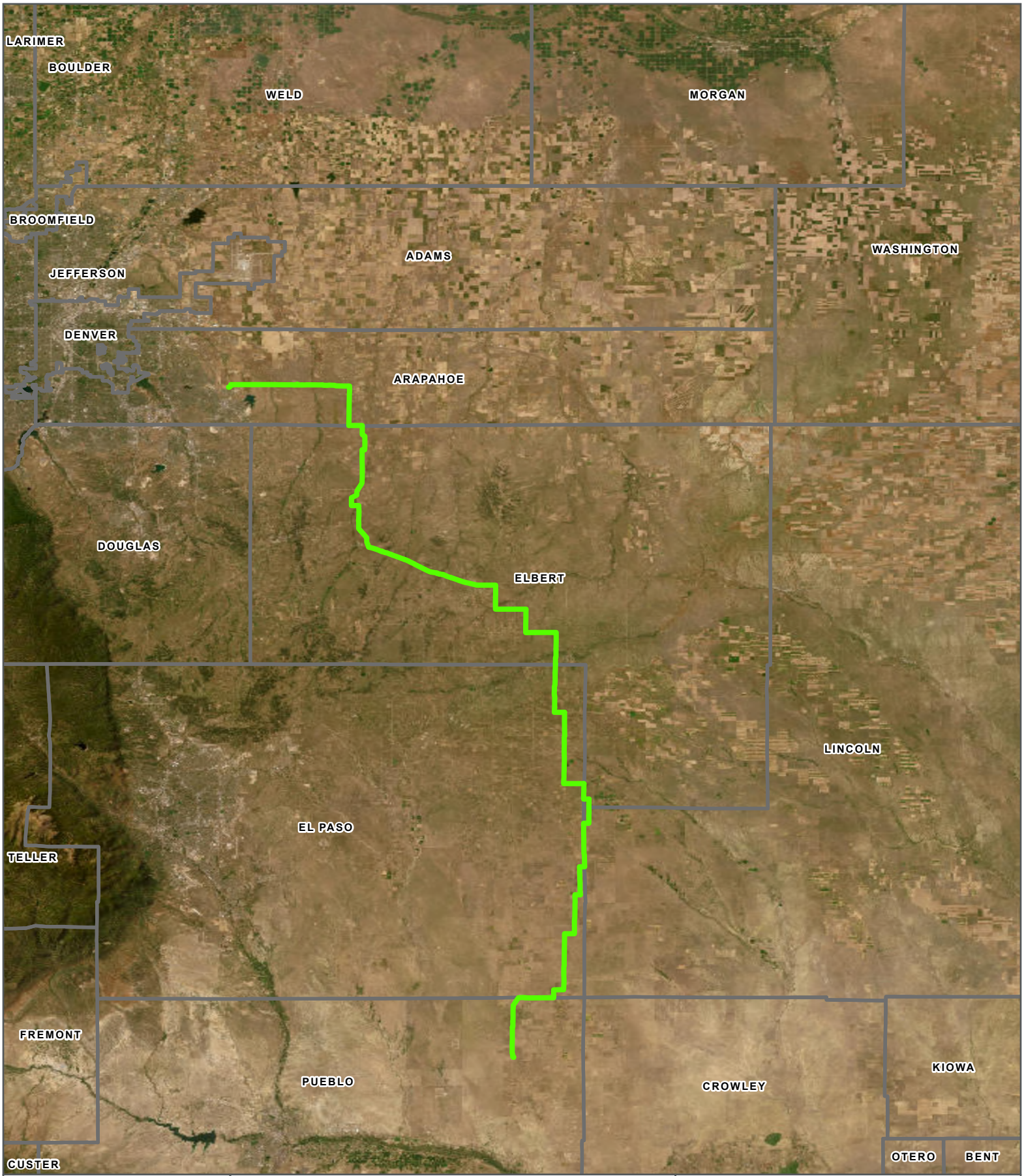
A

Figures



N

0 10 20
MILES

SEGMENT 5 CENTERLINE

COUNTY BOUNDARY

SOURCE: ESRI NAVIGATION

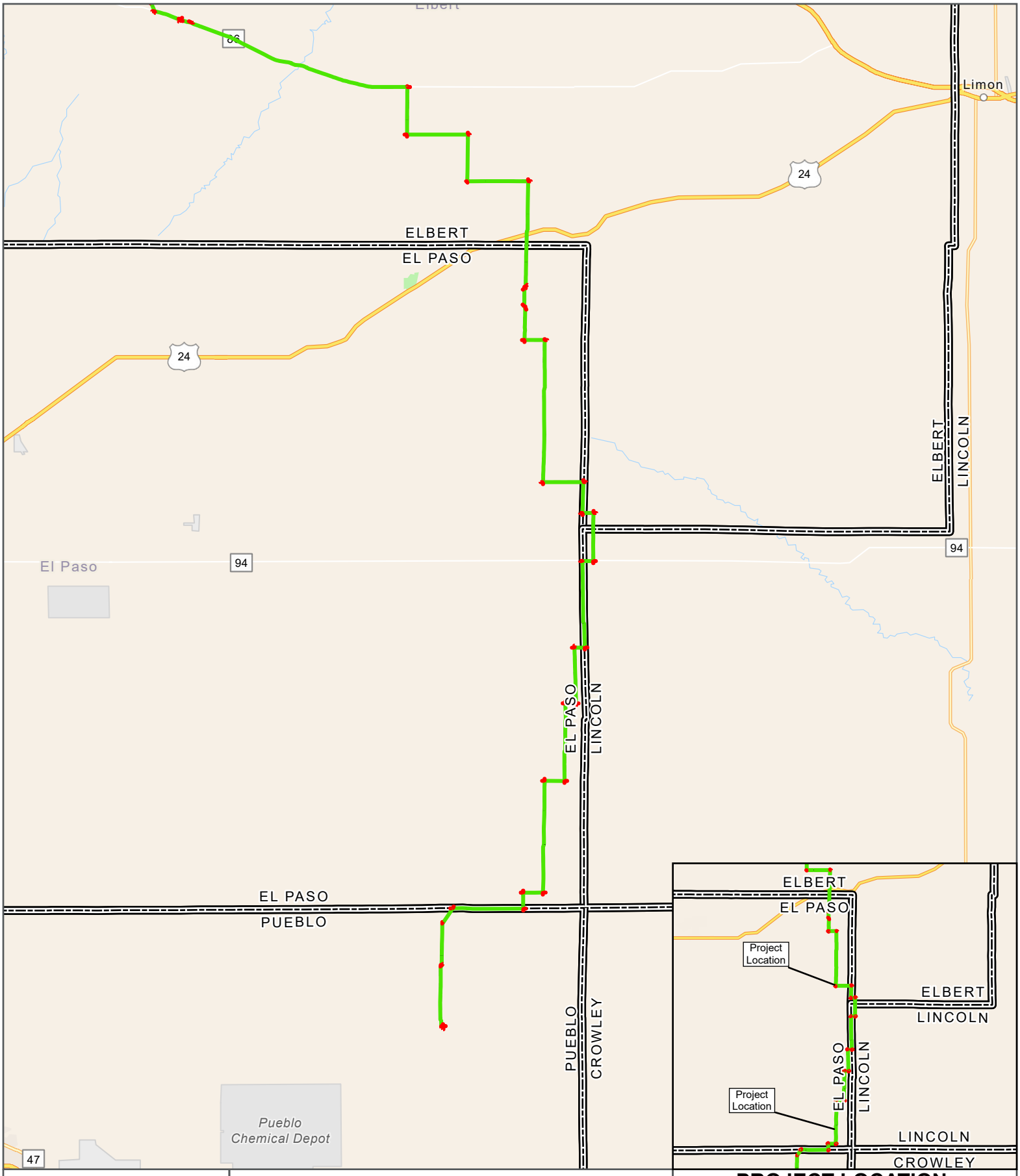
PROJECT LOCATION

XCEL POWER PATHWAYS
EL PASO COUNTY, COLORADO

MAY 2026

FIGURE 1

PATH: \\EGW-INFILGISP01\GIS_PRIME\2022\22-100_XCEL_POWERPATHWAYS_(BROWN)\SEGMENT 5\7.2_WIP\APRX\NR\SEGMENT_5_EL_PASO_COUNTY.APRX - USER: TKOBRYN - DATE: 3/17/2025



N

0 2.5 5
MILES

PREFERRED ROUTE CENTERLINE
EASEMENT
PULLSITE
COUNTY BOUNDARY

SOURCE: ESRI NAVIGATION

Xcel Energy

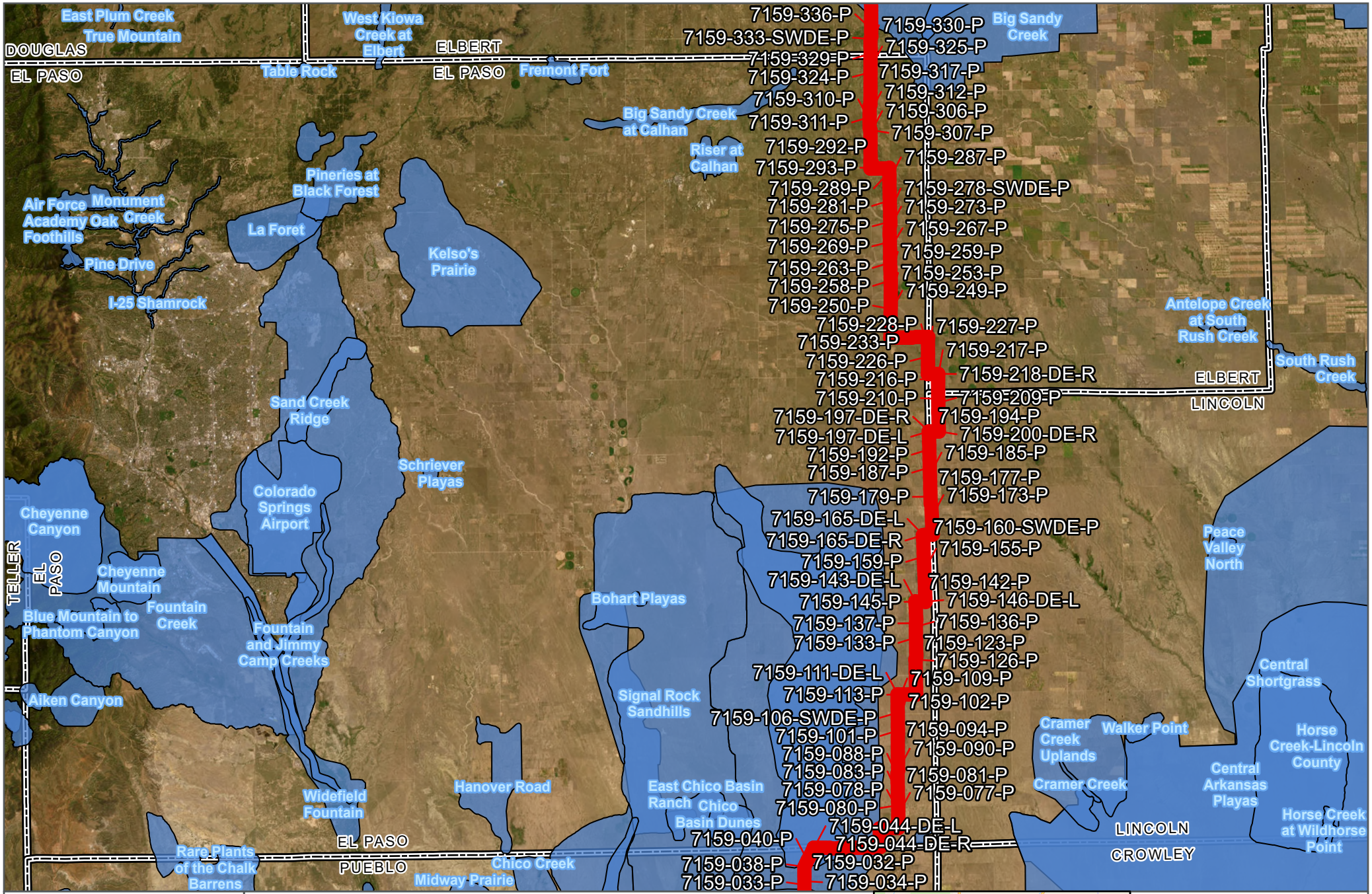
HDR

PROJECT LOCATION: EL PASO COUNTY SEGMENT 5

XCEL POWER PATHWAYS
EL PASO COUNTY, COLORADO

MAY 2026

FIGURE 2



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B

Site Photographs

Photo 1.

Date Taken:
October 22, 2024

Looking west at the proposed transmission line right-of-way between proposed structures 122 and 123.

Photo 2.

Date Taken:
October 22, 2024

Looking west at location of proposed structure 139. Habitat is short bunch grasses.

	Photo 3. Date Taken: October 22, 2024 Looking west at location of proposed structure 143 and the associated pull site. The transmission line turns east at this location.
	Photo 4. Date Taken: October 22, 2024 Looking east along the right-of-way at proposed structure 158.

	Photo 5. Date Taken: October 22, 2024 Looking east along the project ROW between proposed structures 166 and 167. The general habitat is short grasses with an isolated wetland in the right background.
	Photo 6. Date Taken: October 22, 2024 Looking west at the proposed structure 179 location.

	Photo 7. Date Taken: October 22, 2024 Looking west at the proposed structure 222 location.
	Photo 8. Date Taken: October 22, 2024 Looking west at the proposed structure 229 location. The habitat is mostly blue grama grasses (*Boutelea gracilis*).

	Photo 9. Date Taken: October 22, 2024 Looking west at the intersection of Corona Road (left side of photo) and North Rush Road between proposed structures 252 and 253.
	Photo 10. Date Taken: October 22, 2024 Looking east just south of the proposed structure 281 off Simla Highway.

Photo 11.

Date Taken:
October 22, 2024

Looking east at proposed structure 290 and the pull site in the background, along Harrisville Road.

Photo 12.

Date Taken:
October 22, 2024

Looking north at proposed structure 323 at the northern end of El Paso County.

C

Noxious Weed Fact Sheets

Bull Thistle Identification and Management

List B

© Iowa Plants

Bull thistle, *Cirsium vulgare* (Savi) Ten., is a biennial forb that was introduced to North America as a seed contaminant. Flowers are in a raceme arrangement. The gumdrop-shaped disk flowers are pinkish to dark purple in color and 1 ½ to 2 inches in diameter. The pappus has feather-like bristles; the receptacle is densely bristly. The flower bracts are somewhat tapered and covered with spines 2-5 mm long. Leaves are alternate with deeply lobed margins that are spiny. In mature plants the base of the leaves clasp the stem and extend down the stem to the lower node. The plant has one short, fleshy taproot with several lateral roots. There is debate about the effectiveness of self-pollination in bull thistle; outcrossing though pollination produces an abundance of viable seed. Flower buds and heads that are removed from the stalk can still mature and become viable. Seeds are capped with a circle of plume-like white hairs. Seeds remain viable for approximately three years. Mature plants can produce up to 4,000 seeds per plant. Bull thistle generally needs soil temperature between 50° and 80°F, moisture and canopy gaps to germinate seeds.

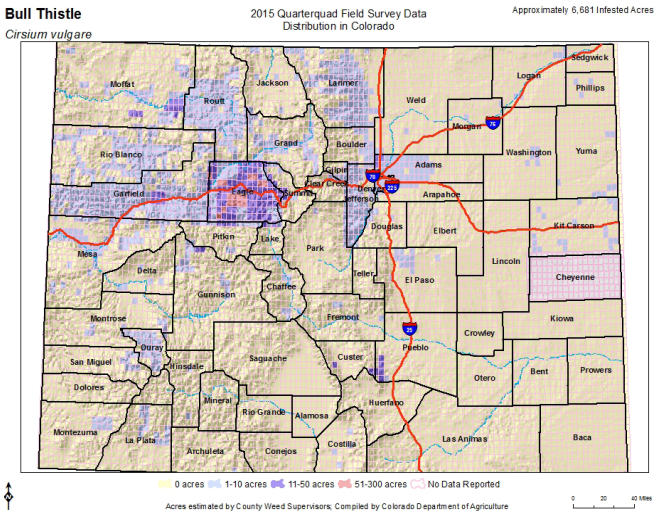
Bull thistle invades dry to moist environments. It prefers nitrogen-rich soils, and it grows on gravelly to clay-textured soils It thrives in areas such as pastures, overgrazed rangeland, roadsides, and logged areas. Bull thistle infestations are heaviest in the northwestern portion of Colorado. It is widespread throughout the United States and parts of Canada.

Heavy infestations reduce livestock forage. The presence of bull thistle in hay decreases the forage value and lowers the market price. It is an aggressive weed, but it will not withstand cultivation. Bull thistle is often a transient species, appearing in recently disturbed areas and becoming a dominant species for several years if left untreated. It can cause hay fever in some individuals.

Maintaining healthy pastures and rangeland, guarding against disturbance or overuse is the best prevention measure against bull thistle. As with most biennials, limiting seed production is critical to effective control. Chemical control is the most effective and efficient method of eradication if applied during the rosette stage, spring or early fall. To reduce seed production, plants with buds or flowers should be collected and bagged, disposed of or destroyed. Mechanical control, such as pulling, has limited effectiveness.

Bull thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/coweedcontacts for details.

2015 Quarter Quad Survey



© Bruce Ackley, OH State University

© Steve Dewey, UT State University

Key ID Points

1. Flowers arranged in a raceme; flower is gum-drop shaped.
2. Base of leaves clasp the stem & extend down the stem to node below
3. Top surface of leaves have stiff, rough hairs

Bull thistle

Cirsium vulgare (Savi) Ten.

List B

Integrated Weed Management Recommendations

Bull thistle

Cirsium vulgare (Savi) Ten.

Effective integrated management means using a variety of eradication methods that also includes restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes and restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of bull thistle growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored.

© Bonnie Million, NPS

CULTURAL CONTROL METHODS

Since bull thistle germinates in canopy gaps, maintain or restore a competitive forb and cool and warm season grass assemblage to reduce spacing between plants. Use locally adapted and ecologically appropriate seeds whenever possible to improve competitiveness. Ensure annual species are included in the native seed mix as well as perennial. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration efforts. Manage land uses so they do not cause soil disturbance or create bare mineral soil.

© Eric Coombs, OR Dept of Agriculture

BIOLOGICAL CONTROL METHODS

Horses, goats and sheep may eat flower heads on a few young individual plants, but seeds likely pass through their digestive tracks unaltered; cattle avoid bull thistle. Dense stands and large plants are usually avoided. Thus, bull thistle can become an "increaser" in over-grazed systems. Properly managed grazing can improve vigor of desired plants and indirectly reduce bull thistle. There is a biological control agent for this species, the bull thistle gall fly, *Urophora stylata*, but it was found to be ineffective in Colorado. Since it is not ethical to promote ineffective non-native insects in the state, this fly is not available in Colorado. For more information, visit the Colorado Department of Agriculture's Palisade Insectary website at www.colorado.gov/ag/biocontrol.

© UAF Cooperative Extension

MECHANICAL CONTROL METHODS

Methods, such as hoeing, tilling and digging, are best for infestations smaller than 0.5 acres. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads and buds must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Prescribed fire that leads to high soil burn severity can damage roots and above ground biomass of bull thistle but also damages desired plants. Fire favors bull thistle and is not recommended.

CHEMICAL CONTROL METHODS

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid* (Milestone)	6 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through bolting stage in spring, or to fall rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1 oz. product/acre (0.75 oz. active ingredient/acre)+ 0.25% v/v non-ionic surfactant	Spring from bolting to bud stages. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through flower bud stage in spring, or to fall rosettes.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage. *Product not permitted for use in the San Luis Valley.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 11/16

Canada Thistle Identification and Management

List B

Canada thistle (*Cirsium arvense*) is a non-native, deep-rooted perennial that spreads by seeds and aggressive creeping, horizontal roots called rhizomes. Canada thistle can grow 2 to 4 feet in height. The leaves are oblong, spiny, bright green, and slightly hairy on the undersurface. Unlike other noxious biennial thistles which have a solitary flower at the end of each stem, Canada thistle flowers occur in small clusters of 1 to 5 flowers. They are about 1 cm in diameter, tubular shaped, and vary from white to purple in color.

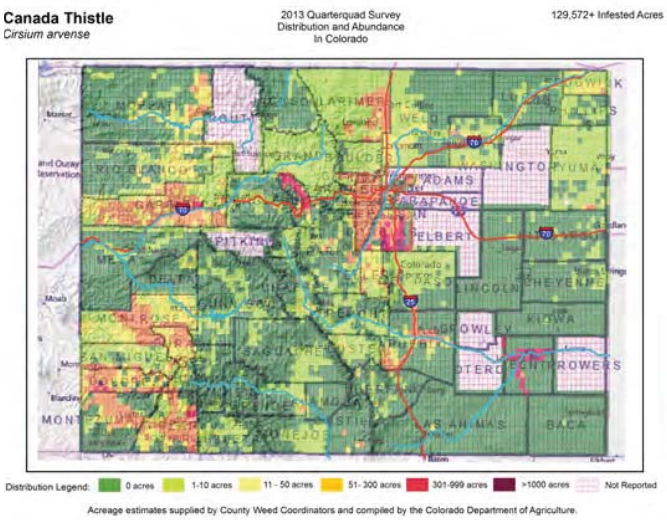
Canada thistle emerges from its root system from late April through May. It flowers in late spring and throughout the summer. It produces about 1,000 to 1,500 seeds per plant that can be wind dispersed. Seeds survive in the soil for up to 20 years. Additionally, Canada thistle reproduces vegetatively through its root system, and quickly form dense stands. Each fragmented piece of root, 0.25 inch or larger, is capable of forming new plants. The key to controlling Canada thistle is to eliminate seed production and to reduce the plant's nutrient reserves in its root system through persistent, long-term management.

Canada thistle is one of the most troublesome noxious weeds in the U.S. It can infest diverse land types, ranging from roadsides, ditch banks, riparian zones, meadows, pastures, irrigated cropland, to the most productive dryland cropland. Large infestations significantly reduce crop and cattle forage production and native plant species. It is a host plant to several agricultural pests and diseases. Canada thistle prefers moist soils, but it can be found in a variety of soil types. It has been found at elevations up to 12,000 feet.

Effective Canada thistle control requires a combination of methods. Prevention is the most important strategy. Maintain healthy pastures and rangelands, and continually monitor your property for new infestations. Established plants need to be continually stressed. Management options become limited once plants begin to produce seeds. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Canada thistle is designated as a "List B" species as described in the Colorado Noxious Weed Act. It is required to be either eliminated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, (303) 869-9030.

2013 Quarter Quad Survey



Key ID Points

1. Cluster of 1-5 white to purple flowers on a stem.
2. Floral bracts are spineless.
3. Small flowers that are 1 cm in diameter.
4. Perennial, rhizomatous plant with spiny, oblong, green leaves.

Canada thistle

Cirsium arvense

List B

Canada thistle

Cirsium arvense

Integrated Weed Management Recommendations

Integrated weed management is imperative for effective Canada thistle control. This weed needs to be continually stressed, forcing it to exhaust root nutrient stores, and eventually die. Mowing or grazing can be followed up with herbicide application. Avoid hand-pulling and tilling which can stimulate the growth of new plants.

CULTURAL

Prevention is the best control strategy. Maintain healthy pastures , riparian areas, and rangelands. Prevent bare ground caused by overgrazing, and continually monitor your property for new infestations. Establishment of select grasses can be an effective control.

BIOLOGICAL

Cattle, goats, and sheep will graze on Canada thistle when plants are young and succulent in the spring. Follow up grazing with a fall herbicide application. Insects are available, and provide limited control. Currently, collection and distribution methods for Canada thistle rust (*Puccinia punctiformis*) are being refined. For more information on Canada thistle biocontrol, contact the Colorado Department of Agriculture - Palisade Insectary at (970) 464-7916.

MECHANICAL

Due to Canada thistle's extensive root system, hand-pulling and tilling create root fragments and stimulate the growth of new plants. Mowing can be effective if done every 10 to 21 days throughout the growing season. Combining mowing with herbicides will further enhance Canada thistle control.

CHEMICAL

The table below includes recommendations for herbicides that can be applied to rangeland and some pastures. Treatments may be necessary for an additional 1 to 3 years because of root nutrient stores. Always read, understand, and follow the label directions.

Herbicide	Rate	Application Timing
Aminopyralid* (Milestone)	5-7 oz. product/acre + 0.25% v/v non-ionic surfactant OR 1 teaspoon product/gal water + 0.32 oz./gal water	Apply in spring at the pre-bud growth stage until flowering and/or to fall regrowth. Can also add chlorsulfuron (Telar) at 1 oz./acre to the mix.
Clopyralid + Triclopyr (Prescott; Redeem; others)	3 pints product/acre + 0.25% v/v non-ionic surfactant OR 1.25 oz. product/gal water + 0.32 oz./gal water	Apply until flowering and/or fall regrowth.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	5.5 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply to spring rosette to flower bud growth stage; or fall. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage.
Note: *Product not permitted for use in the San Luis Valley.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

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305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Updated:
07/2015

Chicory

Chichorium intybus

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Chicory (Chichorium intybus) a perennial forb native to Eurasia. Plants initially appear as a basal rosette with leaves similar to a common dandelion. The leaves are lanceolate shaped and have rough hairs on the upper and lower surfaces. They are slightly lobed or dissected with toothed margins and can be 3 inches to 10 inches in length. The lobes and dissections are not opposite, like dandelions. The leaves that appear on the flowering stem are similar in shape but smaller in size. Stems can reach up to 3 to 5 feet in height and are sticky to glabrous to the touch. The plants flowering stems appear later in the growing season, producing purple to blue to white flowers. The flowers are in clusters of 1 to 3, and individual flowers are about 1 inch in diameter with toothed petals. The root system consists of a large brown taproot, which will produce a milky sap if broken. Chicory generally reproduces by seeds, that can survive up to 4 years.

Habitats for Chicory include, pastures, turfgrass, hayfields, roadsides, waste ground, and any disturbed site. Plants can survive in infertile and dry conditions. Plants can even be present after a drought period. It is found throughout Colorado from elevations of 4,000 to 7,000 feet. The milky sap released from all parts of the plant can cause dermatitis if it contacts the skin. Animals will consume Chicory. If consumed by dairy cattle, it can leave a bitter taste to the milk.

The key to effective control of Chicory is preventing the establishment of the plant on disturbed sites. The plants can not resist persistent cultivation. Mechanical and chemical treatments are effective as well. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Chicory is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © All Photos from Kelly Uhing, Department of Agriculture; Except middle left Colorado State University Extension, East Adams County

Management Recommendations

http://www.colorado.gov/ag/weeds

Chicory

CULTURAL
Planting desirable grasses and forbs to outcompete chicory is an effective management tool. Reestablishing a healthy plant community where disturbed or bareground is present helps with management. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
Currently there is not any biocontrol available for Chicory. Biocontrol takes many years of research and development. For more information contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

MECHANICAL
Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. The key to effective control is to prevent seed production and/or spread. Mowing can also be an effective management option. Chicory plants don't respond well if mechanical treatments are persistent.

Integrated Weed Management:

Identifying and preventing the establishment of Chicory on disturbed sites proves to be the most effective control. Plants can also be controlled using a combination of chemical and mechanical treatments.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid (Milestone)	4-6 oz./acre or 1 teaspoon/gal water	Spring at actively growing stage. Add non-ionic surfactant @ 0.32 oz/gal water or 1 qt/100 gal water.
2,4-D Amine	2-4 qt./acre	Apply to early growth of flower bud stage in spring. DO NOT apply when outside temperature exceed 85 degrees. Add non-ionic surfactant @ 0.32 oz/gal water or 1 qt/100 gal water.
2,4-D+Dicamba	3 pints/acre	Apply to early growth stage to early bolting stage in spring.
Picloram (Tordon 22K *This is a Restricted Use Pesticide*)	1-2 pts/acre or 0.75 oz/gal water	Apply in spring seedling to early growth stages. DO NOT apply near trees/shrubs/high water table.

Photos © Top to Bottom; (Unklnown) Viginia Tech Weed Guide; Whitney Cranshaw, colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

Chinese clematis

Colorado Department of Agriculture

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weeds@state.co.us

Chinese clematis
Identification and Management

Identification and Impacts

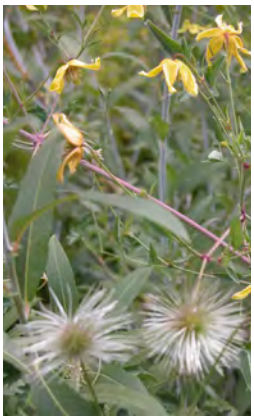
Chinese clematis *(Clematis orientalis)* is a herbaceous to woody vined perennial that is native to Eurasia. It is an escaped ornamental species that is a deciduous climber growing up to 12 feet. Solitary flowers have four yellow sepals (petal-like structures) that are often nodding. Each flower produces numerous feathery, long-tailed fruits which are conspicuous all winter. The plant flowers from August to September.

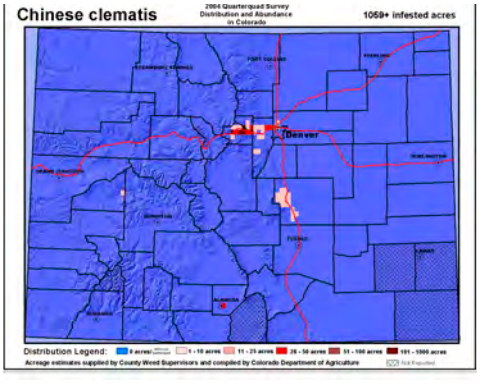
Habitats for Chinese clematis include roadsides, riparian corridors and rocky slopes. It is sometimes found in open woods. Plants prefer sunny areas but have shown to be somewhat shade tolerant. Chinese clematis prefers well-drained soils.

Chinese clematis can cause death to young trees and brush. It outcompetes native shrubs and herbaceous species. Plants will completely cover; rock walls, trees, bushes and fences. The juice of freshly crushed leaves and stems have blister causing agents.

The key to effective control of Chinese clematis is preventing the plants from going to seed. Pulling the woody stem prior to flowering can be an effective control. Chemical treatments are also effective when dealing with Chinese clematis. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Chinese clematis is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.





Photos and Map © Colorado Department of Agriculture.

Key ID Points

1. Solitary flowers with four yellow sepals.
2. A herbaceous to woody vine climbing perennial.

Updated on:
07/2015

Clematis orientalis

Management Recommendations

CULTURAL
Cultural controls are possible in theory, but are very time consuming and expensive. Complete removal of any seedlings or newly established plants by continual hand pulling is also possible.

BIOLOGICAL
There is no biological control available for Chinese clematis. Since biological control agents take years to research, develop and release, no releases are expected in the foreseeable future. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Hand pull or dig when soil is moist. Make certain to pull all the roots and bag specimens carefully so as to not scatter seeds if flowering.

Integrated Weed Management:

The most effective control method for dealing with Chinese clematis is preventing the plant from going to seed. Pulling the plant from the ground, by the woody stem, prior to the plant flowering is the most effective control. Chinese clematis also responds well to chemical treatments.

Chinese clematis

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
2,4-D amine	2 qts. product/acre at 4.0 lb active ingredient/gallon of product + 0.25% v/v non-ionic surfactant	Apply anytime when the plant if actively growing. Will damage neighboring brush species, if present.
Imazapic (Plateau, Panoramic)	12 oz. product/acre + 1 qt./acre methylated seed oil	Apply in the fall at flowering growth stage.
Aminopyralid (Milestone)	4 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering growth stage in the fall.
Additional herbicide recommendations for other species can be found at: **goo.gl/TvWnv9**		

Top to bottom photos, © (Top 2 photos) Stevens County (Washington State) Noxious Weed Control Board; and bottom photo David Hallinan, Bannock County Weed Superintendent, Idaho Weed Awareness Campaign.

Common mullein

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Common mullein (*Verbascum thapsus*) is a biennial forb native to Europe and Asia. The first year of the plant it produces a basal rosette. Basal rosettes can grow to 30 inches in diameter. The leaves are light-green in color and are covered in fine soft hairs. The woolly leaves are alternate and overlapping each other and can grow over a foot long. In spring of the second year the plant bolts an erect stem, that grows 2 to 6 feet tall. The flowers of the plant are borne in terminal spikes. These terminal spikes may reach up to 20 inches in length. The flowers are sulfur-yellow in color and have five petals. The flowers range from 3/4 of an inch to 1 1/2 inches in diameter. Numerous two chambered fruits produce 100,000 to 250,000 seeds per plant. Flowering and seed production typical occur from June to August. The plant has a deep taproot along with a fiberous root system.

Habitats for Common mullein are roadsides, waste places, right-of-ways, pastures, hay fields, and abandoned lands. It prefers gravelly soil types, but can grow in other soil types. Livestock will avoid eating Common mullein, due to the hairy leaves of the plants. The plants were originally introduced as a medicinal plant. The Europeans used the flowers for tea, and the leaves for many remedies like burns and rashes. Both the Europeans and the Indians smoked the dried leaves to treat bronchitis.

The key to effective control of Common mullein is preventing the production of seeds. This plant is difficult to control due to the large amount of seed produced and seed bank left in the soil. Mechanical, cultural, biological and chemical treatments can be successful if utilized together in an integrated weed management plan. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Common mullein is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

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Verbascum thapsus

Management Recommendations

Common mullein

CULTURAL
Cultural control can be effective in assistance with other treatment options. Once the parent plants have been removed, cultivating the area with desirable grasses and forbs may outcompete Common mullein seedlings. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
Gymnetron tetrum, a seed eating weevil, biological control has been found in eastern Washington State and is currently working on populations there. The weevil has not yet been approved for use in Colorado. Contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

MECHANICAL
Hand pull or dig when soil is moist, prior to flowering and seed production can be effective. If flowers are present, bag specimens carefully so as not to scatter any potential seeds. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Preventing the establishment and the seed production of Common mullein is key to controlling populations. If the population is established, using a combination of cultural, chemical, biological and mechanical treatments can aid in suppressing population size. Since plants produce thousands of seed treatments need to occur over an extended period of time.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Chlorsulfuron (Telar XP)	1-3 oz/acre	Apply to rosette stages in spring or fall prior to bolting. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.
2,4-D Picloram (Grazon P+D *this is a Restricted Use Pesticide*)	4 pts/acre	Apply to rosette stages in spring or fall prior to bolting. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water. DO NOT apply near trees/shrubs/high water table.
Picloram (Tordon 22K *this is a Restricted Use Pesticide*)	1-2 qts/acre	Apply to rosette stages to early growth stages in spring or fall. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water. DO NOT Apply near trees/shrubs/high water table.
Metsulfuron (Cimmaron)	1.0 oz/acre	Apply to rosette stages in spring or fall. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.

Photos © Top to Bottom; Kelly Uhing, Colorado Department of Agriculture; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

Dalmatian toadflax

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Showy yellow snapdragon-like flowers with an orange throat on elongated racemes.
2. Thick, waxy, bluish heart-shaped leaves that wrap the stem.

Updated on:
07/2015

Dalmatian toadflax Identification and Management

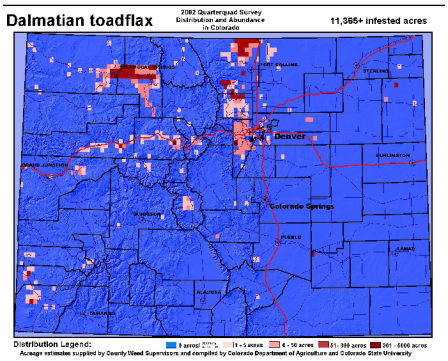
Identification and Impacts

Dalmatian toadflax (*Linaria dalmatica*) is a non-native, perennial forb introduced from the Mediterranean region as a folk remedy, fabric dye and ornamental. It reproduces both by seed and by extensive, creeping rhizomes. A single plant produces 500,000 seeds, most of which fall within 18 inches of the parent plant. Seeds can remain viable for at least 10 years. Dalmatian toadflax grows to 3 feet, and has bright yellow snapdragon-like flowers with an orange throat on elongated racemes. The alternate leaves are broad, with a thick, waxy cuticle and a bluish cast. Each leaf is heart-shaped and wraps the stem.

Habitats for Dalmatian toadflax include disturbed open sites, fields, pastures, rangeland, roadsides, cropland and forest clearings. Infestations can begin in small disturbed sites, then spread even to rangeland and wildlife habitats in excellent condition. Dalmatian toadflax is a highly aggressive plant that can genetically adapt to varied environmental conditions and herbicide controls. Its extreme competitiveness is due to early spring regeneration from vegetative buds on roots that are not dependent on soil moisture or native plant competition. Once established, toadflax quickly overruns native plants and becomes a monoculture that severely reduces forage, productivity, biodiversity and wildlife habitat.

The key to effective control of Dalmatian toadflax is prevention and integrating as many management strategies as possible. Prevention is always desirable when dealing with Dalmatian toadflax. Early detection and eradication can keep populations from exploding, making more management options available. With the plants varying genetically using many different approaches is important such as; chemical, mechanical, cultural and biological methods. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Dalmatian toadflax is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/csd and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Clockwise, from lower left, photos © John M. Randall of The Nature Conservancy; and Linda Wilson and Susan Turner of Invasive.org. Infestation map by Crystal Andrews, Colorado Department of Agriculture.

Linaria dalmatica

Management Recommendations

CULTURAL
It is imperative to seed managed areas with competitive grasses such as thickspike wheatgrass and streambank wheatgrass. The combination of herbicide spraying and seeding competitive grasses controls Dalmatian toadflax better than spraying alone. (K.G. Beck, CSU)

BIOLOGICAL
Calophasia lunula, a predatory noctuid moth, feeds on leaves and flowers of Dalmatian toadflax. Eteobalea intermediella, a root boring moth, and Mecinus janthinus, a stem boring weevil, are also available. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
For small infestations, pulling toadflax by hand can be effective. Pull every year for 5 to 6 years to deplete the reserves of the root system. Monitor the site for 10 - 15 years to remove seedlings produced from dormant seeds.

Integrated Weed Management:

Because of the high genetic variability of the toadflax species, it is critical to integrate as many management strategies as possible into the control program. Two local populations may respond differently to the same herbicides.

Keys to management are to prevent seed formation and vegetative spread by roots. Controlling toadflaxes is expensive and difficult, prevention is the best option.

Dalmatian toadflax

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4 oz. product/acre + 1% v/v methylated seed oil	Apply when flowering in spring and/or in the fall regrowth. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage.
Picloram* (Tordon/Picloram 22K - Restricted use pesticide)	1-2 qts./acre + 1% v/v methylated seed oil	Apply when flowering in spring and/or in the fall regrowth. DO NOT use near trees, desirable shrubs, water, or high water table.
Chlorsulfuron** (Telar)	1.5-2 oz./acre + 1% v/v methylated seed oil	Apply when flowering in spring and/or in the fall regrowth.
Note: *Not permitted for use in the San Luis Valley. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

Top photo, © Kelly Uhing, Colorado Department of Agriculture. *Calophasia lunula* larva photo © Bob Richard, USDA APHIS, Invasive.org. Handpulling toadflax photo © Lake Tahoe Environmental Education Coalition.

Diffuse knapweed

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Floral bracts have yellow spines with teeth appearing as a comb and a distrinct terminal spinte.
2. Flowers are white or lavender.
3. Seedlings have finely divided leaves

Updated on:
07/2015

Diffuse knapweed Identification and Management

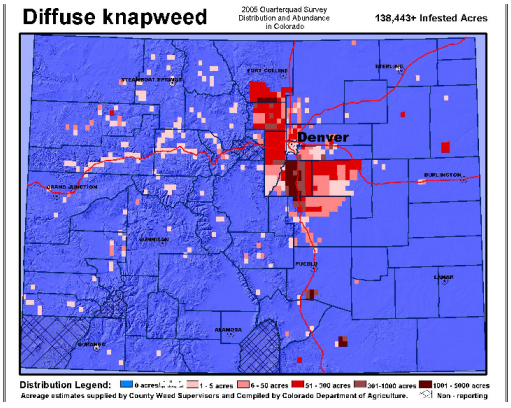
Identification and Impacts

Diffuse knapweed *(Centaurea diffusa)* is a non-native biennial forb that reproduces solely by seed. A biennial is a plant that completes its lifecycle within two years. During the first year of growth, diffuse knapweed appears as a rosette in spring or fall. During the second year in mid to late spring – the stem bolts, flowers, sets seed, and the plant dies. Once the plant dries up, it breaks off at ground level and becomes a tumbleweed which disperses the still viable seeds over long distances. A prolific seed producer, diffuse knapweed can produce up to 18,000 seeds per plant. Therefore, the key to managing this plant is to prevent seed production. Diffuse knapweed can grow 1 to 3 feet tall, and is diffusely branched above ground. This gives the plant a ball-shaped appearance and tumble-weed mobility when broken off. Leaves are small, and are reduced in size near the flowering heads. Flowers are mostly white, sometimes purple, urn-shaped, and are located on each branch tip. Bracts that enclose the flowerheads are divided like the teeth of a comb, and are tipped with a distinct slender spine. Upon drying, the bracts become rough, rendering them injurious to the touch. Flowers bloom July through August. Seed set usually occurs by mid-August.

Diffuse knapweed tends to invade disturbed, overgrazed areas. Other habitats may also include rangeland, roadsides, riparian areas, and trails. It is a tough competitor on dry sites and rapidly invades and dominates disturbed areas. Once established, diffuse knapweed outcompetes and reduces the quantity of desirable native species such as perennial grasses. As a result, biodiversity and land values are reduced, and soil erosion is increased.

The key to effective control of Diffuse knapweed is to prevent the plant from flowering and going to seed. An integrated weed management approach dealing with Diffuse knapweed is highly recommended. There are many options of mechanical, chemical, and biological controls, available. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Diffuse knapweed is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information, visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division at 303-239-4100.



Plant photo, top © Kelly Uhing. Infestation map above, Crystal Andrews. Flower photo © Cindy Roche. Rosette and leaf photos © Dale Swenarton.

Centaurea diffusa

Management Recomendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of diffuse knapweed. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
The seedhead weevil (*Larinus minutus*) and the root weevil fly (*Cyphocleonus achates*) provide fair to good control when used in combination with each other. Expect to wait at least 3 to 5 years for the insects to establish and achieve optimum results. This is an option for large infestations. To obtain the insects, contact the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
Any mechanical or physical method that severs the root below the soil surface will kill diffuse knapweed. Mowing or chopping is most effective when diffuse knapweed plants are at full-bloom. Be sure to properly dispose of the flowering cut plants, since seeds can mature and become viable after the plant has been cut down.

Integrated Weed Management:

Diffuse knapweed is best controlled in the rosette stage. It is imperative to prevent seed production. Do not allow diffuse knapweed flowers to appear. Management must be persistent in order to deplete the seed bank in the soil.

Diffuse knapweed

HERBICIDES : The following are recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 0.25% non-ionic surfactant	Pre-emergence or from seedling to mid-rosette stage. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage.
Aminopyralid* (Milestone)	5-7 oz./acre + 0.25% non-ionic surfactant	Spring at rosette to early bolt stage and/or in the fall to rosettes. Add 1 qt./acre 2,4-D or 3 oz. Perspective when treating in the bolting to flowering growth stages.
Clopyralid (Transline)	0.67-1.33 pints/acre + 0.25% non-ionic surfactant	Apply to spring/fall rosettes before flowering stalk lengthens. Add 1 qt./acre 2,4-D when treating in the bolting to flowering growth stages.
Note: *Not permitted for use in the San Luis Valley.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

Colorado State University

CDA CO

Weevil photo © J. Johnson, Univ. Idaho, bugwood.org. All other photos © Kelly Uhing.

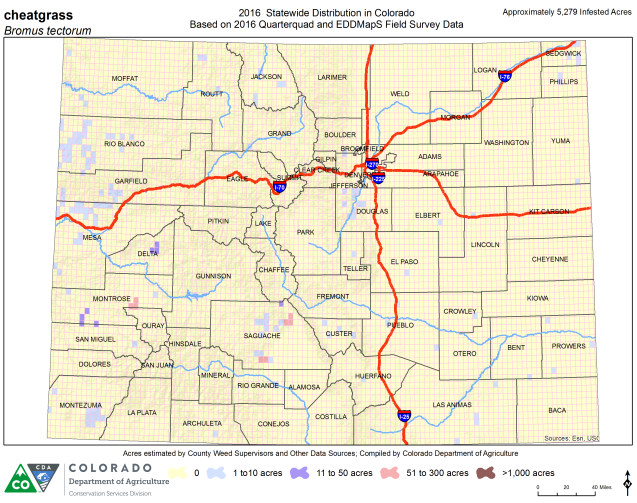
Cheatgrass Identification and Management

List C

©James Bailey, iNaturalist

Cheatgrass (*Bromus tectorum* L.) is a winter annual grass in the Poaceae family, also known as downy brome.

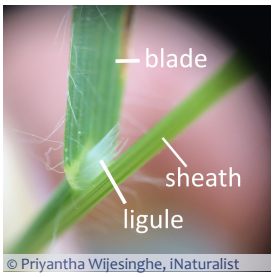
Mature plants reach up to 24 inches tall. The stems are smooth but the leaf blades and sheath are hairy (downy). The ligules are fringed, short and membranous. The culms range from five to 90 cm long, can be prostrate or vertical, and have fine short hairs. Its fibrous roots can be up to 60 inches long, but the majority of root biomass is within first 12 inches of the soil surface. Roots are efficient at absorbing soil moisture, allowing cheatgrass to grow quickly early in season, while other plants are still dormant. Green up can occur twice per season. Cheatgrass has an unique spectral signature during seed set and senescence when it turns reddish purple. During these shoulder growing season events, it is easily detectable from other vegetation with satellite imagery.



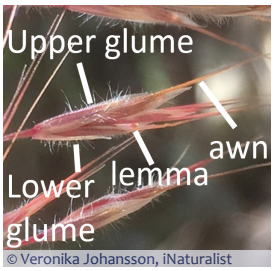
The flower is a simple one-sided panicle that characteristically flops over and hangs, branches and is open. Spikelets are usually terminal. Usually there are five to many florets; it has perfect flowers. The upper and lower glumes are usually unequal in length and shorter than florets; the lower glume ranges from 4 to 14 mm in length and is one veined. The upper glume is three-veined. The plant disarticulates above the glumes. The lemmas are usually downy, narrowly lanceolate with sharp tips and about 9 to 12 mm long. Usually there are five to many lemmas. Awns are usually present and range from 10 to 18 mm long. It is a prolific seed producer, capable of two seed crops per season. Seeds need to be buried in soil or litter and have fall moisture to germinate. The fall seed crop has greater reproductive success than spring. Seeds lack dispersal anatomy so fall close to parent plants but transport readily with animals, people and equipment. Seed longevity is about three years. Both inbreeding and cross breeding occur.

Cheatgrass is one of the most competitive non-natives in the Western US. It thrives in arid, semi arid, and cold environments. Colorado's high elevation range is not an issue for cheatgrass; plants were recently detected as high as 9,500 feet. It exhibits phenotypic plasticity and genetic diversity, making it highly adaptable to a variety of conditions, likely due to multiple introductions. Its presence has significant negative impacts throughout the West. Most notably, it alters fire regimes and thus engineers a positive fire feedback loop that favors its growth over other plants. This feedback loop is why cheatgrass forms monocultures throughout the West.

It is often confused with Japanese brome (*Bromus japonicus*), which has denser more compact spikelets, shorter awns, and changes from green to gold through the growing season.



© Priyantha Wijesinghe, iNaturalist



© Veronika Johansson, iNaturalist

© Leslie J. Mehrhoff, University of CT

Key ID Points

1. Downy leaf blades, sheaths, ligules
2. Glumes are unequal size, lemmas are downy
3. One-sided panicle that droops, red-purple during seed set & senescence
4. Fibrous roots

Cheatgrass

Bromus tectorum L.

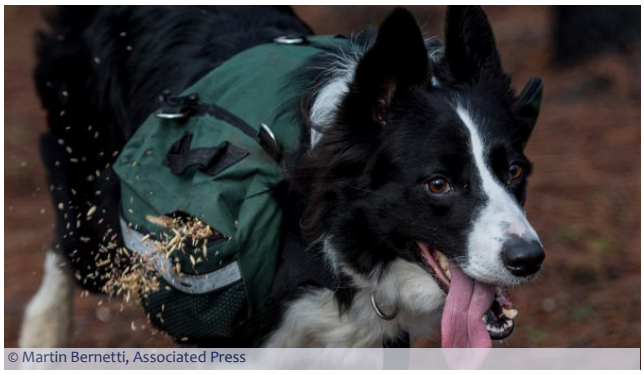
List C

Integrated Weed Management Recommendations

Cheatgrass

Bromus tectorum L.

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.



© Martin Bernetti, Associated Press

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CULTURAL

Biological soil crust is a soil health indicator of arid and semi arid sites; crusts inhibit cheatgrass seed germination. Aerial spread and cultivate soil crust where it is absent. Aerial and drill seeding bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*) with vesicular-arbuscular mycorrhizae; these are drought tolerant natives that are highly competitive against cheatgrass but require mycorrhizae. As these grasses establish and cheatgrass wanes slowly introduce additional species such as thickspike wheatgrass (*Elymus lanceolatus*), winterfat (*Krascheninnikovia lanata*), yarrow (*Achillea millefolium*) in the plant interspaces in subsequent years. Be cautious when purchasing seed as cheatgrass is often a contaminate, especially in mixes. Use seed pillows to disperse seeds.

MECHANICAL

Mechanical methods are best for residential areas and small infestations. Mowing and chopping are not recommeded; they leave roots behind, stimulate flower production, disperse seeds, and expand the size of the infested area. Collect, bag, and dispose of or destroy flowers; seeds can mature and germinate if left. Tilling must be deeper than 6 inches to work. Prescribed fire applied before seed maturity, (late spring or early summer), may kill seeds; the trick is to get green cheatgrass and litter to carry fire and at a hot enough temperature to destroy seeds and seedlings. Always combine prescribed fire with cultural methods, timed appropriately, and base it on site conditions and other plants present. Monitoring and adaptive management are critical if prescribed fire is used as a tool for control.

© Stacy Litz, Associated Press

© Helena Weed Control, Rocky Mountain Elk Foundation

BIOLOGICAL

Sheep and cattle will select green cheatgrass which also affects desired cool-season grasses. Properly managed grazing can improve vigor of desired species and directly reduce cheatgrass. Post-fire grazing management varies depending on site potential and objectives. Currently there are no biological control agents for cheatgrass authorized in Colorado. For more biocontrol information, visit the Colorado Department of Agriculture's Palisade Insectary website at: www.colorado.gov/ag/biocontrol

CHEMICAL

Pseudomonas fluorescens D7 inhibits cheatgrass and is currently approved by EPA and Colorado. NOTE: Herbicide recommendations to control cheatgrass in pastures and rangeland are found at: https://goo.gl/TvWnv9. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Consult local turf and ornamental experts for residential settings. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev.
2/19

Field bindweed

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

1. Leaves are shaped like arrowheads.
2. Flowers are funnel-shaped, white to pink, and have two small bracts one inch below the flower base.

Field bindweed Identification and Management

Identification and Impacts

Field bindweed (*Convolvulus arvensis*) is a non-native deep-rooted perennial that reproduces from seed and creeping, horizontal roots (rhizomes). Field bindweed stems are prostrate (grows low to the ground) and twining, and grow up to 6 feet long. Leaves are distinguishable by their arrowhead shape. The flowers are bell or trumpet-shaped, white to pink in color, and are about 1 inch long. Field bindweed seeds can remain viable in the soil for up to 40 years.

Field bindweed emerges from its root system in the spring. Flowering occurs from June to September and until the first fall frost. The number of seeds produced per plant ranges from 25 to 300 and seed production is variable depending on environmental conditions. Field bindweed is an extremely difficult noxious weed to control because, in part, of its taproot that may go 20 feet deep into the soil, and which repeatedly gives rise to numerous long rhizomes.

Field bindweed is a problem throughout Colorado. It is one of the most competitive perennial weeds. It is widespread in cultivated areas, pastures, lawns, gardens, roadsides, and waste areas from 4,000 to 8,000 feet in elevation.

To successfully manage field bindweed, containment and persistence in controlling existing stands are necessary in order to exhaust the root system and deplete the soil seed bank. This weed needs to be continually stressed, forcing it to exhaust root nutrient stores and eventually die. Of all control methods, prevention is most important. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. A healthy cover of desirable perennial plants will assist in discouraging field bindweed establishment.

Field bindweed is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jursidictions managing this species.

On the back of this sheet are field bindweed management recommendations. For more information, visit www.ag.state.co.us/csd/csdhome.html. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

White flower © Mary Ellen Harte, Invasive.org.
All other photos © Kelly Uhing.

Convulvulus arvensis

Management Recomendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of field bindweed. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for **weed invasions.**

Bindweed mite damage

BIOLOGICAL
The bindweed gall mite, *Aceria mahlerbae*, has proven to be effective in reducing field bindweed infestations. This is an option for large infestations. To obtain a mite release, contact the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
Cutting, mowing, or pulling has a negligible effect unless the plants are cut below the surface in the early seedling stage. Well-established populations have a large seed bank in the soil that can remain viable for over 40 years.

Integrated Weed Management:

Field bindweed requires active management once it is established because of its potential to regenerate rapidly. Even small infestations should be viewed as a serious threat and managed aggressively.

Contain and persistently control infestations in order to exhaust the root system and deplete the soil seed bank.

Maintain a healthy cover of perennial plants to discourage field bindweed establishment.

Field bindweed

HERBICIDES: The following are recommendations for herbicides that can be applied to range and pasturelands. *Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates.* Always read, understand, and follow the label directions. **The herbicide label is the LAW!**

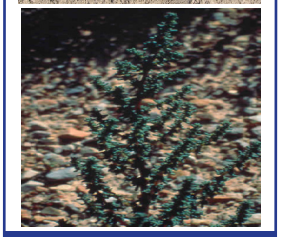
HERBICIDE	RATE	APPLICATION TIMING
Clarity + 2,4-D Amine	1 qt./acre or 1 oz/gal water	Just after full-bloom and/or fall. DO NOT apply near or under trees/shrubs or where soils have rapid permeability. DO NOT apply when outside temperatures will exceed 85 degrees. Add non-ionic surfactant @ 0.32oz/gal water or 1 qt/100 gal water.
Tordon 22K *this is a Restricted Use Pesticide*	1 qt./acre or 1 oz/gal water	Just after full-bloom and/or fall. DO NOT apply near or under trees/shrubs or where soils have rapid permeability. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water.
Roundup Ultra *non-selective herbicide, will kill all vegetation*	4 - 5 qts./acre or 4 - 5 oz/gal water	Apply at full-bloom and/or fall. Add non-ionic surfactant @ 0.32oz/gal water or 1qt/100 gal water. Use caution when applying near grasses or other desirable vegetation.

Halogeton

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us



Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Halogeton (Halogeton glomeratus) is an annual forb native to Asia. The plant ranges in heights of a few inches off the ground to 18 inches tall. Halogeton starts as a low growing multi-branched, spreading plant and then stems become erect with maturity. Plants begin as a blueish-green color in the spring turning redish-yellow later in the summer. Leaves are nearly tubular, small, and fleshy in nature. The ends of the leaf are tipped with a delicate needle-like spine. Flowers are inconspicuous, green and borne at the leaf axils. The root system is fiberous and spreading. Halogeton mainly reproduces by seeds. There are two different types of seeds produced. The seeds that are brown in color, generally will lie dormant and stay viable for many years. The seeds that are black in color will generally reproduce in the same growing season.

Habitats for Halogeton include roadsides, trails, areas where animals congregate, overgrazed sites, and is ideally adapted to the high desert/alkaline soils. The Plant can be toxic to grazing animals and at times it is readily grazed by animals. Sheep seem to be most affected by the toxic oxalates, cows can also be affected. Halogeton is hard to eradicate in plant populations have been present for more than 2 years, since seeds can stay viable up to 10 years.

The key to effective control of Halogeton is preventing the plant to establish viable populations. Halogeton does not outcompete native vegetation, so maintaining and revegetating sites that are overgrazed are effective management tools. Herbicide treatments can also be effective in plant populations are small. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Halogeton is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © Bottom right, Bottom left, and top left; Kelly Uhing, Department of Agriculture; All others Clinton Shock, Oregon State University, Bugwood.org

Halogeton glomeratus

Management Recommendations

CULTURAL
Outcompeting Halogeton proves to be the most economical treatment method. Planting desirable grasses and forbs on disturbed sites, and where Halogeton populations are establish will help control populations. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
Currently there is not any biocontrol available for Halogeton. Biocontrol takes many years of research and development. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

MECHANICAL
Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Using cultural and herbicide treatments in combination can help control Halogeton populations. Halogeton does not outcompete native vegetation, so maintaining healthy plant populations and revegetating areas that have been disturbed, proves to be the most economical method of treatment.

Halogeton

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron + Chlorsulfuron (Cimmaron X-tra)	2.0 oz/acre	Applypre-emergancetopost-emergancestages in spring. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.
Chlorsulfuron (Telar XP)	1/2 - 1 oz/acre	Applypre-emergancetopost-emergancestages in spring. Add non-ionic surfactant @ 0.32 oz/gal water or 1 pt/100 gal water.

Photos © Top to Bottom; (Unknown) Harney County Oregon; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

Hoary cress

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Hoary cress
Identification and Management

Identification and Impacts

Hoary cress *(Lepidium draba)* commonly known as whitetop, is a creeping perennial that is a member of the mustard family and native to Europe. The stems, in the rosette stage, may grow up to 2 inches in height and produce grayish-green leaves that are lance shaped. The leaves are alternate and 3/4 to 4 inches long. The upper leaves have 2 lobes that clasp the stem. The plant has numerous small, white flowers with 4 petals on stalks radiating from a stem. Seed capsules are heart-shaped with two small, flat, reddish brown seeds. One plant can produce from 1,200 to 4,800 seeds. The plants emerge in early spring with stems emerging from the center of each rosette in late April. Hoary cress flowers from May to June and plants set seed by mid-summer.

Habitats for Hoary Cress include: fields, waste places, meadows, pastures, croplands and along roadsides. It is typically found on unshaded, generally open areas of disturbed ground. It generally does better with moderate amounts of precipitation and grows well on alkaline soils.

Key ID Points

1. White flowers.
2. Grows erect 10-24” in height.
3. Leaf is 3/4-4” long with blunt end and fine white hairs.

The key to effective control of Hoary cress is prevention. Preventing the encroachment of these weeds is the most cost-effective management. Preventing invasions by limiting seed dispersal, monitoring and using weed free hay, and quarantine animals that may have grazed in infested areas. Beyond prevention, the key is early detection when infestations are small, and aggressive management. Integrated Weed Management is required for proper control. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Hoary cress is designated as a “List B” species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division.

Photos © Kelly Uhing, Colorado Department of Agriculture; Mark Schwarzlander, University of Idaho, Above map: Crystal Andrews, Colorado Department of Agriculture,

Lepidium draba

Updated on:
07/2015

Management Recommendations

http://www.colorado.gov/ag/weeds

Hoary cress

CULTURAL
Prevent the establishment of new infestations by minimizing disturbance and seed dispersal, eliminating seed production and maintaining healthy native communities. Contact your local Natural Resources Conservation Service for seed mix recommendations. Planting competitive legumes, such as alfalfa, can reduce Hoary cress in crop rotations.

BIOLOGICAL
There is no biological control avaiable for Hoary cress. Since biological control agents take years to research, develop and release, no releases are expected in the foreseeable future. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Mowing several times before the plants bolt stresses Hoary cress and forces the plant to use nutrient reserves stored in the root system. Combining mowing with herbicides will further enhance control of this weed. Mow repeatedly during the summer, then apply a herbicide in the fall.

Integrated Weed Management:

No single treatment provides effective, long term control. The best and first defense is always prevention. Once established, integrate a variety of combinations of competitive planting, crop rotations, and herbicides. This can reduce Hoary cress to manageable levels.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Chlorsulfuron* (Telar)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering. (Early spring to early summer)
Metsulfuron (Escort XP)	1 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply at flowering. (Early spring to early summer)
Imazapic (Plateau, Panoramic)	12 oz./acre + 2 pints/acre methylated seed oil or crop oil concentrate	Apply at late flower to post-flower growth stage. (Late spring to mid-summer)
Note: *This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.		
Additional herbicide recommendations for other species can be found at: **goo.gl/TvWnv9**		

Top to bottom photos, © R. Old, XID Servisces; A. Sparks Jr., University of Georgia; and Kelly Uhing

Colorado State University

CDA CO

Johnsongrass

Sorghum halpense

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Johnsongrass (Sorghum halpense) is a perennial grass native to the Mediterranean region. The erect stems of this grass grows to be 2 to 8 feet tall and they are generally solid. At the base of the stalks they are reddish pink in color. Leaves of this grass range from 6 to 20 inches long and are 1/2 to 1 inch wide. The blades are flat with a very distinctive white midvein with maturity. The ligules of the plant are membranous and are surrounded with fine hairs. The inflorescence of Johnsongrass are is a large open panicle, reddish to purple in color. The spikelets of the panicle are generally awn-tipped and shiny. Not all spikelets will contain awns, but the awns that are present can be bent and needle-like. Johnsongrass reproduces by seed and a thick fibrous rhizomes.

Habitats for Johnsongrass include; crop fields, hay fields, roadsides, fence rows, and waste areas. Originally introduced as a hay or forage crop, and thought to be a warm season grass, it has adapted in cooler climates. When found in areas that may frost or become moisture stressed, Johnsongrass becomes toxic to livestock. It produces hydrocyanic acid, which can cause livestock's cells to lose the ability to utilize oxygen, similar to cyanide poisoning.

The key to effective control of Johnsongrass is the establishment and to minimize disturbance in areas susceptible to infestation. Using an integrated approach to control population of already established plant infestations can be an effective management tool. Depending on size of the infestation chemical, cultural and mechanical control options are useful. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Johnsongrass is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © (First 2) Chris Evans, River to River CWMA; Steve Dewey, Utah State University; Charles Bryson, USDA Agricultural Research Services; Bonnie Harper-Lore, Federal Highway Administrations; All Bugwood.org

Management Recommendations

Johnsongrass

CULTURAL
Maintaining a healthy rangeland or pasture can help prevent the establishment of Johnsongrass. Planting native grasses and forbs to outcompete the grass can assist in control. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
Currently there is not any biocontrol available for Johsnongrass. Biocontrol takes many years of research and development. For more information, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 .

MECHANICAL
Hand pulling or hoeing when soil is moist, and infestations are small can be effective. When infestations are larger, mowing, tilling or plowing can assist with control when used in combination with herbicides. The key to effective control is to prevent seed production and/or spread through rhizomes.

Integrated Weed Management:

Preventing the establishment and maintaining healthy pastures by minimizing disturbance of the is most effective in controlling Johnsongrass. Using a combination of control methods can be effective if an infestation is already established. Cultural, chemical and mechanical treatments can be effective if used together.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Glyphosate + Isopropylamine (Glyphomax)	16 oz/acre	Apply in early growth stages before plant reaches 12 inches in height.
Glyphosate + Potassium	22 oz/acre	Apply in early growth stages before plant reaches 6 inches in height.
2,4-D + Glyphosate + Isopropylamine (Recoil)	1.25 -2.5 qts./acre	Apply in pre-seedhead stages of plant.

Photos © Top to Bottom; Steve Dewey, Utah State University, Bugwood.org; Whitney Cranshaw, Colorado State University, Bugwood.org; Kelly Uhing, Colorado Department of Agriculture

Leafy spurge

Euphorbia esula

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Leafy spurge Identification and Management

Key ID Points

1. Flowers are yellowish-green and have a pair of heart shaped yellow-green bracts below each inconspicuous flower.
2. The entire plant contains white, milky latex.

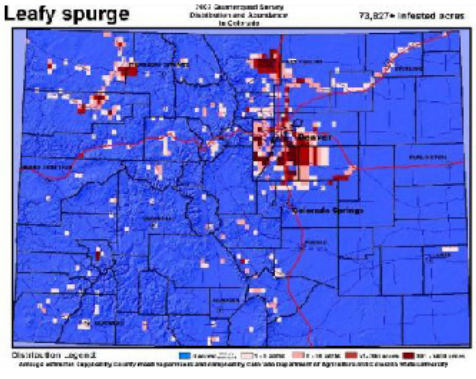
Identification and Impacts

Leafy spurge (*Euphorbia esula*) is a non-native deep-rooted perennial that spreads by seed and extensive, creeping roots. The roots can extend as deep as 30 feet into the soil and are extremely wide-spreading. The roots are brown and contain numerous pink buds that generally produce new shoots or roots. Leafy spurge can grow from 1 to 3 feet in height. The stems are smooth, pale green, and thickly clustered. Leaves are alternate, narrow, linear, and 1 to 4 inches long. The flowers are very small and yellowish-green. They are enclosed by very visible yellowish-green, heart-shaped bracts. The entire plant contains white, milky sap that exudes readily upon stem or leaf breakage. This sap can damage eyes and sensitive skin. Leafy spurge is one of the earliest plants to emerge in the spring. Flower clusters develop 1 to 2 weeks after stem emergence which is from mid-April to late May. One large leafy spurge plant can produce up to 130,000 seeds. Three-sided seed capsules explode when ripe and project the seeds up to 15 feet away from the parent plant.

Leafy spurge has adapted to a wide variety of habitats in the state and is very competitive with other plant species. Where it becomes established in rangeland, pasture, and riparian sites, it crowds out practically all other vegetation. The competitive, rapidly growing, and extensive root system makes leafy spurge very difficult to manage. Develop a management plan that uses several control methods that are compatible with your site.

The most effective method of control for Leafy spurge is to prevent its establishment through proper land management. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. New infestations are much more easily controlled than established infestations. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Leafy spurge is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. On the back of this sheet are leafy spurge management recommendations. For more information, please visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link. Or contact the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Flower photo, top, © Norman Rees, USDA, APHIS. Invasive.org. All other photos © Kelly Uhing.

Updated on:
07/2015

Management Recomendations

CULTURAL
Establishment of selected grasses can be an effective cultural control of leafy spurge. Contact your local Natural Resources Conservation Service for seed mix recommendations. Maintain healthy pastures and prevent bare spots caused by overgrazing. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Both sheep and goats can be effective grazers of leafy spurge. The flea beetles *Apthona nigriscutis*, *A. lacertosa*, and *A. cyparissiae*, are effective especially when combined with grazing and/or herbicides. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture, 970-464-7916.

Photo © USDA.

MECHANICAL
Due to the extensive root system, hand-pulling this plant is not a viable option. Mowing will reduce seed production if repeated every 2 to 4 weeks during the growing season, but will provide little long-term control.

Integrated Weed Management:

Persistent monitoring of areas with known or potential infestations is crucial to managing leafy spurge. A combination of management methods in a long-term management plan is imperative. The management objective is to exhaust the root system and deplete the soil seed bank.

Leafy spurge

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gallons per acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Aminocyclopyrachlor + chlorsulfuron (Perspective)* + Diflufenzopyr + dicamba (Overdrive, Distinct)	3-4 oz. Perspective/acre + 4 oz. Overdrive/acre + 1% v/v methylated seed oil	At flowering in the spring and/or fall.
Quinclorac (Paramount, Facel-L, Quinstar) + Diflufenzopyr + dicamba (Overdrive, Distinct)	12-24 oz. Quinstar/acre + 4 oz. Overdrive/acre + 1% v/v methylated seed oil	At flowering in the spring and/or fall.
Aminocyclopyrachlor + chlorsulfuron (Perspective)*	4.75-8 oz. product/acre + 1% v/v methylated seed oil	Post-emergence in spring until flowering, or to fall rosettes.
Note: *IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not permitted for use in the San Luis Valley. Perspective is not for use on grazed or feed forage.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

Musk Thistle Identification and Management

List B

© Bruce Ackley, OH State University

Musk thistle *Carduus nutans* L. is a non-native biennial forb that reproduces solely by seed. During the first year of growth, a rosette forms in spring or fall. During the second year in mid to late spring, the stem bolts, flowers, sets seed, and the plant dies.

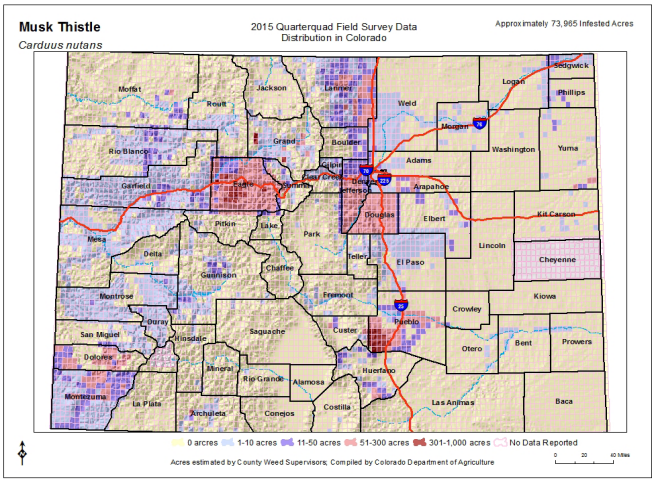
Musk thistle can grow up to 6 feet tall. The leaves have spines, are waxy, and dark green in color with a prominent light green to white midrib that can be seen from a distance. Leaves are dentately lobed; leaf bases sometimes extend down below the point of attachment. The terminal flower heads are purple, large in size (1.5 to 3 inches in diameter) and bend over as if nodding. These flower heads are made up of only disk flowers. They are surrounded by numerous, wide and stout lance-shaped, spine-tipped bracts that resemble an open pineapple. The pappus has plumose bristles that appear barbed under magnification. Musk thistle produces many flower heads. The tallest shoots flower first; lateral shoots develop in leaf axils. A robust plant may produce 100 or more flowering heads. Reproduction is usually via out-crossing through insect pollination, but self-pollination also occurs. Flowers emerge in May through September. Seeds develop shortly after flowers emerge. Flower buds can contain viable seeds from self-pollination. Seeds can mature on severed bud and flowerheads. Seeds remain viable in the soil for up to about 14 years. Seeds can germinate and emerge from spring through fall.

Musk thistle habitat is found in a variety of environments extending from shortgrass prairie to alpine. It is strongly associated with heavily disturbed sites, where over-use occurs or where site conditions are poor due to land management practices. This includes over-grazed areas, large fires, trails, ditches and roadsides. Infested livestock pasturs suffer from significantly decreased carrying capacity.

Because musk thistle reproduces solely from seed, the key for successful management is to prevent seed production. Once flowers emerge and start to produce seed, effective management options will become limited. Once sites are infested, musk thistle can form dense stands. Prevention, adjusting land management practices, a robust integrated treatment plan and restoration are critical to eliminating this species.

Musk thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For management directions for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/coweedcontacts for details.

2015 Quarter Quad Survey



© Chris Evans, University of IL

© Les Mehrhoff, DiscoverLife.org

Key ID Points

1. Leaf with white midrib and leaf margins with spines.
2. Pappus with plumose barbed bristles.
3. Wide, stout lance-shaped bracts with spiny tips.

Musk thistle

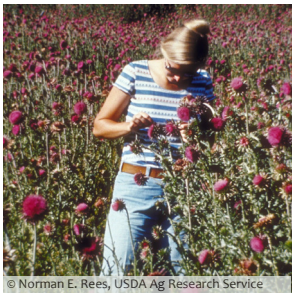
Carduus nutans L.

List B

Integrated Weed Management Recommendations

Musk thistle
Carduus nutans L.

Effective integrated management means using a variety of eradication methods that also includes restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes and restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of musk thistle growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Change land use practices. Use methods appropriate for the site.


© Norman E. Rees, USDA Ag Research Service

CULTURAL CONTROL METHODS

Musk thistle is not tolerant of competition and needs light to germinate seeds. Cultural methods should aim to maintain or restore a competitive assemblage of forbs, cool and warm season grasses. Implement whole site restoration of soils, plants and water regimes where stands of musk thistle exist where needed. Use locally adapted species that are ecologically appropriate for the site to improve competitiveness. Include annual as well as perennial species. Incorporate soil amendments, soil microbes and mycorrhizal fungi in restoration and land management efforts. Minimize soil compaction and disturbance, especially in wetlands and moist soil. Irrigation can increase competitive species.

© Eric Coombs, OR Dept of Agriculture

BIOLOGICAL CONTROL METHODS

Although horses, cattle, goats and sheep may eat flower heads on a few plants, seeds pass through their digestive tracks unaltered and spread. The leaf and stalk spines can cause domestic livestock to avoid mature musk thistle. Thus, musk thistle can become an "increaser" in over-grazed systems. Properly managed grazing can improve vigor of desired species and indireclty reduce musk thistle. *Trichosirocalus horridus* is the only biological control agent available for musk thistle in Colorado. The other species, *Rhinocyllus conicus*, is not host specific and will damage native thistles, and therefore cannot be released as an agent in Colorado. For more information, visit the Colorado Department of Agriculture's Palisade Insectary website at www.colorado.gov/ag/biocontrol.

© Friends of NV Wilderness Stewardship Team

MECHANICAL CONTROL METHODS

Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy, and in the second year before flower production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. All flowerbuds and heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Prescribed fire that results in high soil burn severity damage roots and above ground biomass, but is not recommended due to impacts on desired plants. Fire generally favors musk thistle germination.

CHEMICAL

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid* (Milestone)	6 oz./acre + 0.25% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1-2.6 oz. product/ acre + 0.25% v/v non-ionic surfactant	Apply in spring from rosette through very early flower growth stages. (Can prevent viable seed formation if applied no later than the first viable flowers begin to open.) **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes through flower bud stage in spring, or to fall rosettes.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Rev. 11/16

Myrtle spurge

Euphorbia myrsinites

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Myrtle spurge Identification and Management

Identification and Impacts

Myrtle spurge *(Euphorbia myrsinites)* is a low growing perennial with trailing fleshy stems. The leaves are fleshy, blue-green and alternate. Flowers are inconspicuous with yellow-green, petal-like bracts that appear from March to May. Myrtle spurge spreads by seed and plants are capable of projecting seeds up to 15 feet. The plant grows from a taproot, with new stems emerging in early spring and dying back in the winter. Plants can grow up to 8-12 inches high and 12-18 inches in width.

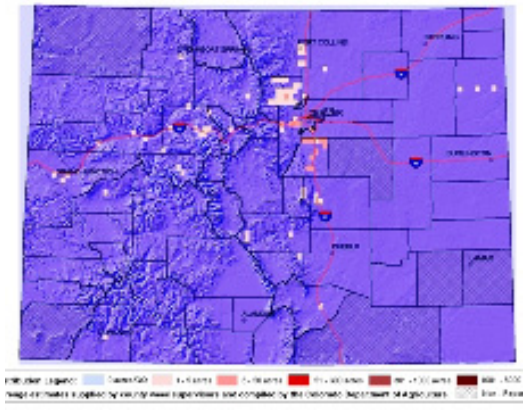
Myrtle spurge contains a toxic, milky sap which can cause severe skin irritations, including blistering. This plant is poisonous if ingested; causing nausea, vomiting and diarrhea. Wearing gloves, long sleeves, shoes, and eye protection is highly recommended when in contact with myrtle spurge, as all plant parts are considered poisonous.

Myrtle spurge is an invasive ornamental that is native to Eurasia. It is popular with xeriscapes and rock gardens, preferring sunny to partly sunny areas and well drained soils. Myrtle spurge rapidly escapes gardens and invades sensitive ecosystems, out competing native vegetation and reducing wildlife forage. Alternatives to planting myrtle spurge include native plants such as sulphur flower (*Erigonum umbellatum*), Kinnikinnick *(artcostaphylos uvursi*), or creeping mahonia (*Mahonia repens*). The soil seed reserve of myrtle spurge is estimated to be eight years. The site must be monitored for at least nine years after the last flowering adult plants have been eliminated and treatments repeated when necessary.

The key to effective control of myrtle spurge is to remove plants prior to seed set and to detect and remove new populations in natural areas early on. Small areas can be easily removed by mechanical means but should be done early to prevent triggering seed launching. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Myrtle spurge is designated as a "List A" species in the Colorado Noxious Weed Act. It is designated for statewide eradication. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Map of myrtle spurge infestation.



Key ID Points

1. Low growing plant with blue-green, waxy leaves.
2. Flowers are yellow-green petal like bracts that appear from March to May.

Updated on: 7/2015

Photos © Kelly Uhing, Colorado Department of Agriculture and (above) Crystal Andrews, Colorado Department of Agriculture.

Management Recommendations

CULTURAL
Keeping desirable vegetation healthy and thick will help keep invaders out. Prevent the establishment of new infestations by minimizing disturbance and seed dispersal. Survey your land regularly to detect new invaders and eradicate any new populations quickly.

BIOLOGICAL
Biocontrol is not an approved method of contol for State List A species. Eradication as the management objective for all List A species. For more information on insect biocontrol in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916

MECHANICAL
Hand pull or dig when soil is moist. Make certain to pull all the roots and wear rubber gloves and eye protection to protect yourself from the toxic milky sap. Treatment follow up is important to check root fragment resprouts that will occure when the tap root is severed too shallow.

Integrated Weed Management:

Since Myrtle spurge spreads mainly by seed, it is very important to prevent seed production and deplete the seed bank. Remove mature plants prior to setting seed and seedlings whenever present.

Populations can be managed mechanically and by spot treatment of herbicides. It is important to be persistent with follow up treatments for many years.

Myrtle spurge

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
2,4-D ester	2 qt./acre + 1% v/v methylated seed oil	Use a 2,4-D ester formulation that has a 4.0 lbs. active ingredient/acre. Apply during spring or during fall regrowth.
Dicamba + 2,4-D	1 pint/acre dicamba + 2-3 pints/acre 2,4-D (amine or ester)	Use a 2,4-D formulation that has a 4 lbs. active ingredient/gallon. Apply during spring or during fall regrowth.
Picloram (Tordon/Picloram 22K - Restricted use pesticide) + 2,4-D	20 oz./acre + 2-3 pints/acre 2,4-D (amine or ester)	Apply at flowering growth stage during spring or to fall regrowth. DO NOT use near trees, desirable shrubs, water, or high water table.

Additional herbicide recommendations for other species can be found at:
https://goo.gl/VFPCUv

Top to bottom photos © Unknown, A. Murray, Univ. of Florida; USDA ARS Archive; and unknown.

Puncturevine

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Key ID Points

Updated on:
08/09

Identification and Management

Identification and Impacts

Puncturevine (*Tribulus terrestris*) in a summer annual forb, and is native to Europe. The plant is prostrate or ascending, spreading into mat forming cover. The stems are trailing and can grow to 1 1/2 to 5 feet long. Leaves are formed into leaflets, with each leaflet containing 5 to 8 oval leaves. The leaves are hairy and opposite. The flowers appear in July through October. They have five petals and are yellow in color. Each flower node will produce a fruit, at maturity the fruit will break into 5 seed capsules. Each seed capsule will produce 2-4 seeds. Each capsule is hard and contains many spines, almost tack like. The shape of the seed capsule has been referred to as a "goathead." The seeds will propagate after the first moisture of the spring and then any wet period following. Seeds can stay viable for 4 to 5 years.

Habitats for Puncturevine include, but are not limited to roadsides, pastures, waste areas, cultivated fields, yards, and disturbed sites. The seed capsules can cause injury to humans, animals, and tires. Seeds can be found in hay, which may cause injury to animals. The capsules can also become entangled in wool, and decrease the quality. Due to the spiny nature of the plant, spreading seed over large areas is fairly easy.

The key to effective control of Puncturevine is preventing the plants to produce seed. Puncturevine can easily be dug up, making sure to get all the roots and to bag any flowering parts. Chemical and biological controls can also be effective as treatment options. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Puncturevine is designated as a "List C" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local jurisdictions managing this species. For more information, visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © From Bottom left; Steve Dewey, Utah State University, Bugwood.org; All other Kelly Uhing, Colorado Department of Agriculture

Tribulus terrestris

Management Recommendations

Puncturevine

CULTURAL
Cultural control for Puncturevine is a difficult task, since seed reserves can stay viable for 4 to 5 years. Preventing the plants from establishing, by eliminating bareground can assist in the process. For specific seed recommendations contact your local Natural Resources Conservation Services for seed mixes.

BIOLOGICAL
There are two biological controls available for control of Puncturevine; *Microlarinus lareynii*, a seed feeding weevil, and *Microlarinus lypriformis*, a stem boring weevil. Contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916 for more information.

MECHANICAL
Hand pull or dig when soil is moist, but make sure to wear gloves. Bag specimens carefully so as not to scatter seeds. This is helpful unless infestations are too large. The key to effective control is to prevent seed production and/or spread.

Integrated Weed Management:

Using a combination of control options can be effective in the control of Puncturevine. The plants are hard to eradicate, due to the seed viability of 4 to 5 years in the soil. Constant monitoring and management can be helpful.

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on equipment with an output of 30 gal/acre. Please read label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Glyphosate (Roundup) *Non-selectiveherbicide*	1.6% solution or 2 oz./gal water	Apply in early plant growth stages, emergance and rosettes.
2,4 D and Dicamba (Outlaw)	1-2 pints/Acre or 0.5-1.0 oz/gal water	Spring at emergence of seedlings continue through growing season. Add non-ionic surfactant 0.32 oz./gal water or 1 qt./100 gal water.
Chlorusulfuron (Telar)	1-3 oz./Acre	Apply pre-emergance or early post-emergance.
Pendimethalin (Pendulum)	2.1-4.2 qts/Acre	A pre-emegance spray.

Photos © Top to Bottom; (middle) Neal Spencer, USDA Agricultural Research Service European Labratory, Bugwood.org; (other 2)Kelly Uhing, Colorado Department of Agriculture

Redstem filaree

Erodium cicutarium

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

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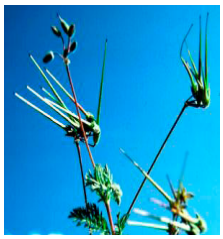
weeds@state.co.us

Redstem filaree Identification and Management



Key ID Points

1. The hairy red colored stems.
2. The opposite leaf pattern in the rosette stage.
3. The long-beak like fruit and seed.

Identification and Impacts

Redstem filaree *(Erodium cicutarium)* is a winter annual or biennial forb that has a spreading or erect profile and is native to the Mediterranean or Asia. Part of the Geranium family, Redstem filaree grows generally from a rosette stage, and can grow from the 3 inches to 2 feet tall. The stems are hairy and red in color. The leaves are opposite and finely divided with toothed or lobed margins. They are pubescent, grow on short stems and have a reddish tint. The root system is a shallow taproot with fiberous secondary roots. The five petaled flowers are a purplish-pink in color and are in clusters of 2 or more. Each flower will produce five long lobed fruits. Each fruit will have an awn like tail which will dry and split with maturity. Redstem filaree primarily reproduces by seed and generally germinates in early spring.

Habitats for Redstem filaree include: dry pasturelands, landscapes, turfgrass and it prefers sandy soils. It can easily outcompete desirable vegetation once established. Redstem filaree is drought tolerant and can withstand a heavy stocking rate. The plant is grazed by many different animals especially sheep.

The key to effective control of Redstem filaree is preventing establishment of the plant and seed production. There are many options for control of Redstem filaree depending on site ecology. Both chemical and mechanical control options are effective. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Redstem filaree is designated as a "List C" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

Photos © (Clockwise from lower left): Theodore Webster, USDA, Bugwood.org; (Unknown) Oregon State University; Howard F. Schwartz, Colorado State University, Bugwood.org; Richard Old, XID Services Inc., Bugwood.org; (Unknown) Oregon State University

Updated on: 08/09

Erodium cicutarium

Management Recommendations

CULTURAL
Prevent the establishment of Redstem filaree, in rangeland or pastureland by planting native grasses and forbs. Contact your local Natural Resources Conservation Service for seed mix recommendations that may help. Bareground is prime habitat for weed invasions.

BIOLOGICAL
Currently there is not any biocontrol available for Redstem filaree. Biocontrol takes many years of research and development. For more information, contact the Colorado Department of Agriculture's Insectary in Palisade, Colorado at 970-464-7916.

MECHANICAL
Hand pulling or digging when soil is moist, making sure to get the roots to prevent resprouting is effective. Removing flowers before the plant sets seed will also be effective. Be sure to bag specimens carefully so as not to spread seeds. Any kind of tillage to the area can also be effective.

Integrated Weed Management:

Locate and remove plants immediately before plants set seed to prevent the spread of Redstem filaree. Since the plant reproduces solely by seed, an integrated management effort must include the elimination of seed production and depletion of seed bank. Combing control methods of herbicide and mechanical can be effective.

Redstem filaree

HERBICIDES

NOTE: The following are recommendations for herbicides that can be applied to range and pasturelands. *Rates are approximate and based on equipment with an output of 30 gallons per acre.* **Always read, understand, and follow the label directions. The herbicide label is the LAW!**

HERBICIDE	RATE	APPLICATION TIMING
Metsulfuron (Escort XP)	.33 oz of product /acre +.025% v/v non-ionic surfactant	Apply rosette stage through early flower stage.
2,4-D + dicamba (Rangestar)	2 pt. + 1 pt. product / acre	Apply rosette stage of growth.

Colorado State

CDA

Above photos © (Top): Richard Old, XID Services Inc., Bugwood.org; (Middle) Whitney Cranshaw, Colorado State University, Bugwood.org; (Bottom) Kelly Uhing, Colorado Department of Agriculture

Russian Knapweed Identification and Management

List B

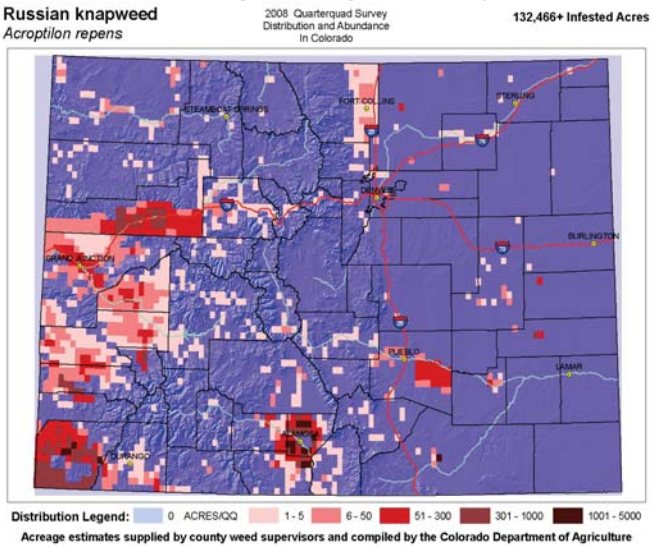
Russian knapweed (*Acroptilon repens*) is a non-native, deep-rooted perennial that spreads by aggressive, creeping, horizontal roots (rhizomes) and seeds. The roots are brown to black with a scaly appearance. Russian knapweed can grow up to 3 feet in height. The stems and leaves are covered with short gray hairs. The flowers are urn-shaped, pink to purple in color, and are solitary at the tips of the upper branches. Russian knapweed can be distinguished from other knapweeds by the smooth, papery, rounded bracts that surround the flowers. Russian knapweed emerges in early spring after soil temperatures remain above freezing. It produces flowers from June to August and sets seed in late summer to early fall. The seeds are viable for two to three years. Russian knapweed reproduces primarily from its root system. Buds on the horizontal roots can form adventitious shoots, August through the winter, that can grow to become independent plants. Once rosettes emerge in the spring, remaining root buds slough-off until they develop again in late summer. Additionally, root fragments can develop into new plants.

Russian knapweed is allelopathic, which means it contains a toxic substance that inhibits the growth of competing plants. This weed may also be toxic to horses resulting in serious injury or possibly death of the animal. Russian knapweed displaces native vegetation and reduces forage values on range and pasturelands.

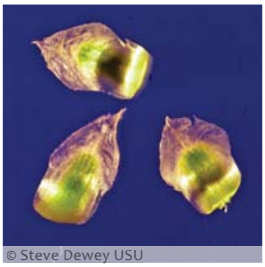
Habitat for Russian knapweed includes roadsides, ditch banks, riparian zones, pastures, rangeland, saline soils, clear cuts, and cropland. It typically invades degraded areas and sites with full sun.

The most effective method of control for Russian knapweed is to prevent its establishment through proper land management. Maintain healthy pastures and rangeland and continually monitor your property for new infestations. If Russian knapweed is already established, using an integrated weed management approach proves to be effective. Russian knapweed can be managed with herbicides or biocontrol insects, but long-term control must include planting competitive plant species to occupy bare ground once infested by the weed. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

2008 Quarter Quad Survey



Russian knapweed is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eliminated, contained, or suppressed depending on the local infestations. For more information, visit www.colorado.gov/ag/weeds and click on the Noxious Weed Program link or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-869-9030.



© Steve Dewey USU

Black, scaly root

Key ID Points

1. Distinguished from other knapweeds by the flower's smooth, papery bracts.
2. Roots are brown to black with scaly appearance.
3. Rosettes and lower leaves deeply lobed.
4. Upper leaves are smaller, smooth margined, and not lobed.

Russian knapweed

Acroptilon repens

List B

Integrated Weed Management Recommendations

The most effective control for Russian knapweed is to prevent its establishment through proper land management. An integrated weed management approach can be effective when dealing with Russian knapweed. It can be managed with herbicides or insects, but long-term control must include planting competitive plant species to occupy bare ground once infested by the weed.

Russian knapweed

Acroptilon repens

CULTURAL

Maintain healthy pastures and prevent bare spots caused by overgrazing. Bare ground is prime habitat for weed invasions. Establishing sod-forming grasses or vegetation with dense shade can be an effective cultural control of Russian knapweed. Contact your local Natural Resources Conservation Service for seed mix recommendations.

BIOLOGICAL

The gall midge, *Jaapiella ivannikovi*, is a fly that lays eggs in the shoot tips of Russian knapweed. It forms galls that reduce flowering, seed production, and stunts the plants' growth. This biocontrol will stress the stand of Russian knapweed but will not likely eliminate it. The Colorado Department of Agriculture - Palisade Insectary, 970-464-7916, is currently establishing this biocontrol . It is not yet available to the public.

MECHANICAL

Mowing several times before the plants bolt stresses Russian knapweed and forces it to use nutrient reserves stored in the root system. However, mowing alone will not eliminate the infestation and it can stimulate shoot sprouting the following year. Mowing combined with a fall herbicide application will enhance control. Tilling and disking can create root fragments that can sprout. However, repeated deep tillage (1 feet) over 3 years can kill much of the root system.

CHEMICAL

The following are recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. Please read label for exact rates. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Aminopyralid* (Milestone)	7 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply in the fall when above-ground stems die back and root buds are highly susceptible. Can also apply in the bud to senescence stages or in the spring during early bolt before flower buds form.
Aminocyclopyrachlor + Chlorsulfuron (Perspective)*	4-5 oz. product/acre + 1% v/v methylated seed oil	Apply in the fall when above-ground stems die back and root buds are highly susceptible. Can also apply in the bud to senescence stages or in the spring during early bolt before flower buds form. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage. Not for use on grazed or feed forage.
Note: *Product not permitted for use in the San Luis Valley. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Updated:
07/2015

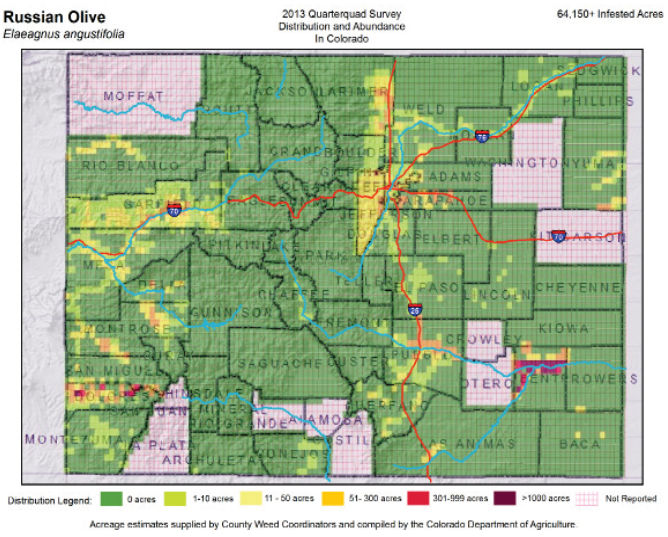
Russian Olive Identification and Management

List B

Russian olive (*Elaeagnus angustifolia*) is a perennial tree or shrub that is native in Europe and Asia. The plant has olive-shaped fruits, silver color at first then becoming yellow-red when mature. Russian olive can reproduce by seed or root suckers. Seeds are readily spread by birds and can remain viable for up to 3 years. Spring moisture and slightly alkaline soil tend to favor seedling growth. The plant's extensive root system sprouts root suckers frequently. The tree can reach up to 30 feet in height with branches that have 1 to 2 inch thorns. Leaves are 2 to 3 inches long, alternate, narrow, and have simple blades with smooth edges. The leaf's lower surface is silvery white, while the upper surface is light green in color. Flowers are 4 small sepals in light yellow clusters, fragrant, and appear May through June. Fruits mature from September to November. Russian olive twigs are flexible, reddish, and have surfaces coated with gray and scaly pubescence, becoming smooth.

Once thought to be a beneficial windbreak tree, it since has been deemed detrimental to the environment. Russian olive can grow in a variety of soil and moisture conditions, but prefers open, moist, riparian zones. It is shade tolerant and can be found along streams, floodplains, fields and open areas up to approximately 8,000 feet in elevation. Russian-olive can outcompete native plants, interfere with natural plant succession and nutrient cycling, and tax water reserves. Because Russian olive is capable of fixing nitrogen in its roots, it can grow on bare, mineral substrates and dominate riparian vegetation. Although Russian olive provides a plentiful source of edible fruits for birds, ecologists have found that bird species richness is actually higher in riparian areas dominated by native vegetation.

The key to effective control of Russian olive is preventing establishment of the trees or shrubs. If plants are already present, control options include cut-stump treatments and mechanical mowing. These treatments depend on size and location of the plant. Details on the back of this sheet can help you create a management plan compatible with your site ecology.



Russian olive is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information visit www.colorado.gov/ag/weeds and click on the Noxious Weed Management Program. Or call the State Weed Coordinator at the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.

© Patrick Breen, OSU

© Patrick Breen, OSU

Key ID Points

1. Leaves are silvery white.
2. Branches have 1 to 2 inch thorns.
3. Yellow-red fruits on mature plants.
4. Mature trees have shedding, reddish-brown bark.

Russian olive

Elaeagnus angustifolia

List B

Integrated Weed Management Recommendations

Russian olive

Elaeagnus angustifolia

Integrated weed management offers the most effective combination of control efforts through the "cut stump" treatment. Trees are cut down with a hatchet or chainsaw, then immediately treated with an approved herbicide on the surface of the cut stump. The most effective timing is late summer/early fall for herbicide transfer into the roots.

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© Scott Peterson, USDA

CULTURAL

Replace Russian olives with native trees. Prevent establishment of new trees by removing seedlings and saplings before they mature. Contact your local Natural Resources Conservation Service for recommendations of other possible trees or shrubs.

BIOLOGICAL

Tubercularia canker is an unapproved biocontrol. However, it overwinters on infected stems and spreads via rain-splash, animals, or pruning implements to open wounds in the bark. Infected tissue becomes discolored or sunken. Entire stems may be girdled and killed, and the disease can deform or kill stressed plants over time.

MECHANICAL

Saplings can be pulled with a weed-wrench or cut with brush-cutters. Trees can be girdled or cut with chainsaws. However, stump sprouting commonly occurs after cutting down the tree; and stump excavation without removing all parts of the roots can result in root sprouting. Treating cut-stumps with an herbicide can eliminate sprouting. Stump burning is practical when conditions support a long, hot fire and most effective in summer or early fall. Saplings are most sensitive to mechanical treatment.

CHEMICAL

The table below includes recommendations for herbicides that can be applied to range and pasturelands. Always read, understand, and follow the label directions. The herbicide label is the LAW!

Herbicide	Rate	Application Timing
Triclopyr (Garlon 4, Remedy)	20-30% solution in basal bark oil. The herbicide Pathfinder comes pre-mixed in oil and does not require dilution.	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. (Summer to fall; fall treatments showed fewer re-growth) Basal Bark Treatment: Spray till wet but not dripping; the roots above soil surface, root collar, and lower trunk to a height of 12-15 inches above ground (Late summer to fall)
Glyphosate* (Rodeo - approved aquatic label)	Undiluted (100% solution) or 50% solution in basil bark oil	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. Diluted solutions requires regular agitation. Treat summer to fall; fall treatments showed fewer re-growth.
Note: *These products are non-selective and will kill any vegetation contacted.		
Additional herbicide recommendations for this and other species can be found at: **goo.gl/TvWnv9**		

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305 Interlocken Parkway
Broomfield, CO 80021
303-869-9030
www.colorado.gov/ag/weeds

Updated:
07/2015

Saltcedar

Tamarix spp.

Colorado Department of Agriculture

305 Interlocken Pkwy
Broomfield, CO 80021

(303) 869-9030
weeds@state.co.us

Saltcedar Identification and Management

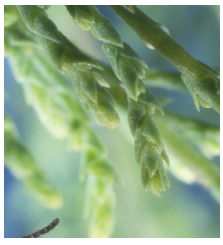
Identification and Impacts

Saltcedar, or tamarisk (*Tamarix spp.*), is a non-native deciduous evergreen shrub or small tree that grows from 5 to 20 feet tall. The bark on saplings and stems is reddish-brown. The leaves are small, scale-like and bluish-green in color. Tiny pink to white flowers have five petals and grow on slender racemes. Saltcedar reproduces by seeds as well as vegetatively. A mature plant can produce up to 600,000 seeds per year. Seeds are viable for up to 45 days under ideal conditions. Saltcedar buds break dormancy in February or March. Flowering occurs anytime between April and August. Ideal conditions for saltcedar seedling survival are saturated soil during the first few weeks of life, a high water table, and open sunny ground with little competition from other plants.

Saltcedar was introduced from central Asia, northern Africa, and southern Europe for ornamental purposes and for stream bank stabilization. It is now widespread in the United States. Saltcedar crowds out native stands of riparian and wetland vegetation. Saltcedar increases salinity of surface soil, rendering the soil inhospitable to native plant species. Saltcedar can be found along floodplains, riverbanks, streambanks, marshes, and irrigation ditches. It's heavy use of water has contributed to the intensity of the drought.

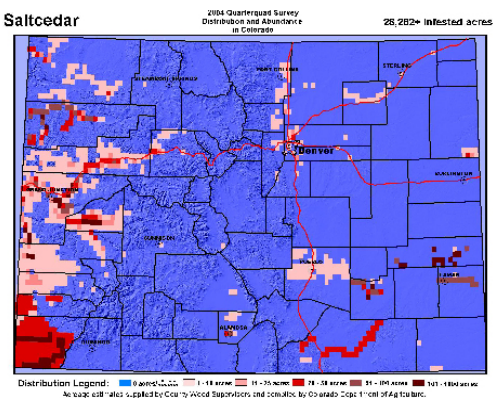
The most effective method of control for saltcedar is to prevent its establishment through proper land management. Monitor susceptible areas for new infestations. An integrated weed management approach has proven to be an effective control when dealing with saltcedar. Details on the back of this sheet can help to create a management plan compatible with your site ecology.

Saltcedar is designated as a "List B" species on the Colorado Noxious Weed Act. It is required to be either eradicated, contained, or suppressed depending on the local infestations. For more information, please visit www.colorado.gov/ag/csd and click on the Noxious Weed Program link. Or call the State Weed Coordinator of the Colorado Department of Agriculture, Conservation Services Division, 303-239-4100.



Key ID Points

1. Saltcedar is a tall shrub or small tree that has white to pink flowers in clusters called racimes.
2. Leaves are small and scaly.



Plant and flower photos © Kelly Uhing. Leaf photo © USDA Aphis PPQ. Infestation photo above, © Steve Dewey, Invasive.org. Tamarisk branch © Stevens County, WA Noxious Weed Control Board

Updated on:
07/2015

Management Recomendations

CULTURAL
After a saltcedar infestation is managed, revegetation is necessary in order to protect the soil resource and reduce the threat of reinvasion. Seeded grasses, willow stakes, and cottonwood cuttings can reduce the chances of saltcedar reinvading managed sites.

BIOLOGICAL
The saltcedar leaf beetle (*Diorhabda elongata*) larvae and adults feed on foliage. This causes stem dieback and potential death of the plant if defoliation is consistent. The leaf beetle should be available for limited distribution. For more information, contact the Palisade Insectary of the Colorado Department of Agriculture, 970-464-7916.

MECHANICAL
A bulldozer or prescribed fire can be used to open up large stands of saltcedar. These methods must be followed up with a herbicide treatment of the resprouts when they are 1 to 2 meters tall. Chainsaws, or loppers for smaller plants, are effective for cut-stump treatments to smaller infestations or in environmentally-sensitive management areas.

Integrated Weed Management:

Select the appropriate control method based on the size of the area and other environmental or cultural considerations. Re-seed controlled areas with desirable species to protect the soil resource and to prevent or slow saltcedar reinvasion. Follow up control efforts the same growing season and for several years afterwards.

Saltcedar

HERBICIDES: The following are recommendations for herbicides that can be applied to range and pasturelands. Rates are approximate and based on hand-held equipment with an output of 30 gallons per acre. Always read, understand, and follow the label directions. **The herbicide label is the LAW!**

Herbicide	Rate	Application Timing
Triclopyr (Garlon 4, Remedy)	20-30% solution in basal bark oil. The herbicide Pathfinder comes pre-mixed in oil and does not require dilution.	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. (Summer to fall) Basal Bark Treatment: Spray till wet but not dripping; the roots above soil surface, root collar, and lower trunk to a height of 12-15 inches above ground (Summer to fall)
Glyphosate* (Rodeo - approved aquatic label)	Undiluted (100% solution) or 50% solution in basil bark oil	Cut-Stump Treatment: Apply to the cambial layer of the tree immediately after the cut-stump treatment and to roots above soil surface. Diluted solutions requires regular agitation. (Summer to fall)
Triclopyr (Garlon 4, Remedy) + Aminopyralid (Milestone)	3 qts. Garlon 4/acre + 7 oz. Milestone/acre + 0.25% v/v non-ionic surfactant	Broadcast foliar treatment: Apply when plants are growing rapidly. (May to September)
Note: *These products are non-selective and will kill any vegetation contacted.		
Additional herbicide recommendations for other species can be found at: **goo.gl/TvWnv9**		

All photos © Kelly Uhing.

Scotch Thistle Identification and Management

List B

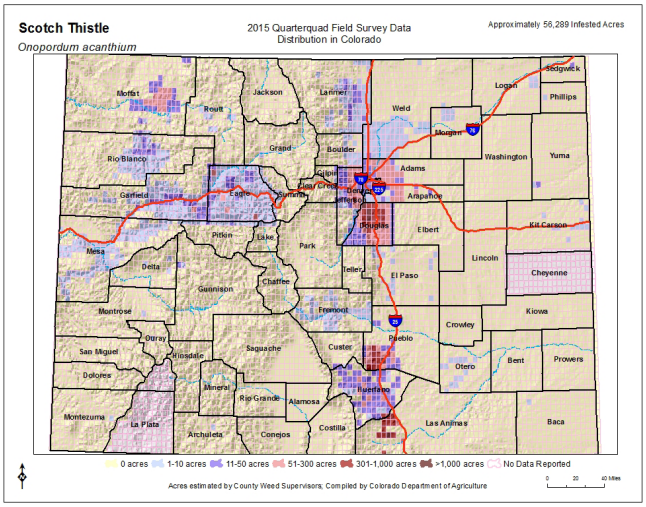
Scotch thistle includes two species, *Onopordum acanthium* L. and *O. tauricum* Willd. Both are non-native biennial forbs. During the first year of growth, both species appear as a rosette in spring or fall. During the second year in mid to late spring the stems bolt, the plants flower, set seed, and the plants die. Both Scotch thistle species can grow up to 12 feet tall and basal rosettes can be up to 2 feet in diameter. Stems are numerous and branched. Characteristically, the entire length of stems from both species have broad wings with spiny tips. *O. acanthium* leaves have an overall gray color from dense woolly hairs. *O. tauricum* leaves are glandular and not as hairy as *O. acanthium*. For both, leaves are spiny. Both species have a distinct mid-rib. Flower heads are terminal, violet to reddish in color, 1 to 3 inches in diameter, and arranged in a raceme. One plant can produce up to 100 flower heads. The spine-tipped bracts curve away from the flowering head. The flower receptacle is fleshy and has pits to hold seeds. The plants flower from mid-June to September. Scotch thistle seeds have the ability to mature in flower buds and heads that have been removed from the stalk. Both species can produce up to 14,000 seeds per plant. Seeds remain viable for up to 30 years but germinate readily with moisture in spring and fall.

Scotch thistle invades rangeland, overgrazed pastures, roadsides, and irrigation ditches. Both species prefer moist soil, such as areas adjacent to creeks and rivers. Roadsides appear to be especially vulnerable to invasion likely due to the water runoff from the shoulders. Maintaining healthy pastures and native plants, minimizing soil disturbance, changing land use practices to prevent overuse, and using seed-free equipment are critical measures to preventing infestations. As with most biennials, once established, limiting seed production is critical to effective control. Due to the robust, spiny nature of Scotch thistle, this plant can act as a living barbed wire fence, making areas impassible for wildlife, livestock, and people and unpalatable to cattle.

To control seed production, plants with buds or flowers should be collected, bagged and immediately disposed of or destroyed. Chemical control is most effective when plants are in rosette stage, spring or early fall. Mechanical controls can be used to eliminate small patches or plants in a later growth stage.

Scotch thistle is designated as a "List B" species in the Colorado Noxious Weed Act. It is required to be eradicated; some populations may be contained or suppressed depending on state regulations. For state regulations described for each county, refer to the most recent Rule, or visit www.colorado.gov/ag/coweedcontacts for details.

2015 Quarter Quad Survey



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© Bonnie Million, NPS

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Key ID Points

1. Pitted fleshy flower receptacle.
2. Prominent mid-rib.
3. Wide lobed leaves with distinct mid-rib.
4. Wide spiny wings extend the length of the stem.

Scotch thistle

Onopordum acanthium L. and *O. tauricum* Willd.

List B

Integrated Weed Management Recommendations

Scotch thistle

Onopordum acanthium L. and *O. tauricum* Willd.

Effective integrated management means using a variety of eradication methods along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. As with most biennials, prevent seed production in the first and second year of growth. Prevent seed from dispersing, such as on contaminated equipment. Rest sites until they are effectively restored. Change land use practices. Use methods appropriate for the site.

CULTURAL CONTROL METHODS

Effectiveness begins with maintaining or restoring a competitive native forb and forb assemblage. Continue restoration efforts until native plants are robust and abundant. Use locally adapted native seeds whenever possible to improve competitiveness. Include cool season and warm season, as well as perennial and annual grasses in revegetation efforts. Soil may need to be restored by adding soil amendments, soil microbes, mycorrhizal fungi and nitrogen fixing plants such as legumes. Manage land uses so they do not create bare mineral soil or compact soil. Annual crop cultivation appears to be an effective control measure.

© Jacqui Turner, The Timaru Herald

BIOLOGICAL CONTROL METHODS

Domestic livestock are likely to avoid this plant due the large number of spines all over the plant. Goats and sheep may eat flower heads if plants are small. Since most livestock and herbivores avoid the leaves and stems, Scotch thistle can become an "increaser" in over-grazed systems. Properly managed grazing systems can increase desireable plant vigor and indirectly reduce Scotch thistle. There are no known biological control agents effective against scotch thistle or authorized in Colorado. For more information about biological control agents, visit the Colorado Department of Agriculture's Palisade Insectary website at www.colorado.gov/ag/biocontrol.

© Bugwood

MECHANICAL CONTROL METHODS

Methods, such as tilling, hoeing and digging, are best for infestations smaller than 0.5 acres; weigh this against other plants present, ecology and site condition. Sever roots below the soil surface during the first year before the plant stores energy and in the second year before seed production. Mowing, chopping and deadheading stimulates more flower production; these methods require consecutive years of season-long treatments. Flower heads must be collected, bagged, and disposed of or destroyed; seeds will mature and germinate if left on the ground. Fire gives Scotch thistle a competitive advantage. Large fleshy stems and leaves would not be consumed in a low severity fire and seeds would remain unaffected. High severity fires would likely damage native plants, which favors Scotch thistle if seeds are not killed and this is not recommended.

CHEMICAL

NOTE: The following are recommendations for herbicides that can be applied to pastures and rangeland. Rates are approximate and based on equipment with an output of 30 gal/acre. Follow the label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Aminopyralid* (Milestone)	7 oz. product/acre + 0.25-0.5% v/v non-ionic surfactant	Apply in spring rosette to early bolting growth stages or in fall to rosettes. *Product not permitted for use in the San Luis Valley.
Chlorsulfuron** (Telar)	1-2.6 oz. product/acre (0.75 oz. active ingredient/acre)+ 0.25% v/v non-ionic surfactant	Spring from bolting to flower bud stages. **This herbicide has residual soil activity that will affect all broadleaf seedlings germinating after application has occurred.
Metsulfuron + Chlorsulfuron (Cimarron X-tra)	2 oz. product/acre + 0.25-0.5% v/v non-ionic surfactant	Apply during rosette to flower bud stages.
Clopyralid (Transline)	0.67-1.33 pints product/acre + 0.25% v/v non-ionic surfactant	Apply to rosettes in spring or fall.
Aminocyclopyrachlor + chlorsulfuron (Perspective)* *Product not permitted for use in the San Luis Valley.	4.75-8 oz. product/acre + 0.25% v/v non-ionic surfactant	Apply from the seedling to the bolting stage. IMPORTANT: Applications greater than 5.5 oz. product/acre exceeds the threshold for selectivity. DO NOT treat in the root zone of desirable trees and shrubs. Not for use on grazed or feed forage.

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
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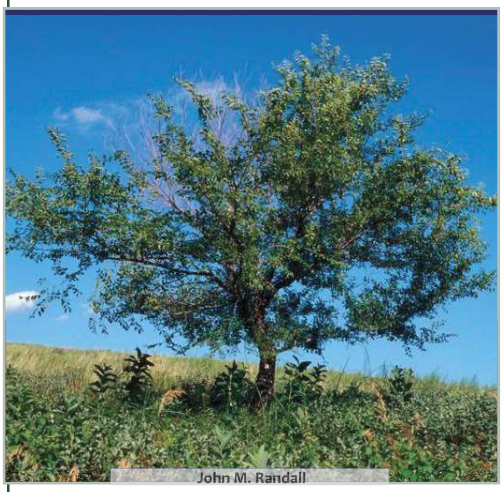
Rev. 11/16

Siberian Elm Identification and Management

List C


John M. Randall

Siberian elm (*Ulmus pumila*) is a hardy fast growing, mid-sized, deciduous tree or shrub. It is also known by the names dwarf elm, and little leaf elm. Siberian elm can get up to 70 feet tall and has an open crown with upward-growing branches and many flexible, brittle branchlets that easily break off. There is usually a large accumulation of leaves and woody litter that builds up in the understory beneath Siberian elm. Leaves grow alternately on branches, are heart-shaped at the base and taper to a long point, with small teeth along the entire margin. Siberian elm is commonly confused with other elms in the *Ulmaceae* family.

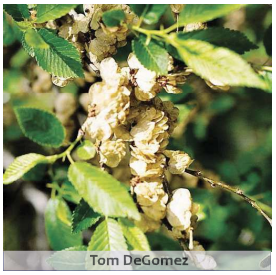
Reproduction is by seed, primarily dispersed by wind, but also by water, animals, and in the undercarriages of equipment and vehicles. Flowers are cross-pollinated by the wind, and trees can also be self-fertilizing. Small clusters of 3-15 perfect flowers are produced at intervals along the preceding year's branches. Individual flowers are 1/8" across, consisting of a green calyx with 4-5 lobes, 4-8 exerted stamens, and a flattened pistil with a divided style. The blooming period occurs from early to mid-spring before the leaves develop, lasting about one week. Seeds develop in a light green, oval-shaped, and flattened wing-like fruit known as a samara. Under damp conditions, the seeds have the capacity to germinate within a week or two, and can persist in the seed bank for up to eight years.

Patrick Breen

Siberian elm is native to northern China, eastern Siberia, Manchuria, and Korea and was likely introduced in the late 1860s through the ornamental trade. It was used in the Midwest as a windbreak. It commonly grows on disturbed grounds, moist stream banks, in pastures and rangelands, and along road and railroad rights-of-way. Siberian elm does not tolerate flooding and seldom invades mature forest because of its high requirement for sunlight. Siberian elm can dominate new locations in just a few years due to its adaptability, high rate of germination, and rapid growth.

The key to effective control of Siberian elm is to prevent establishment through proper land management. Maintain healthy riparian corridors, wetlands and rights-of-way, and continually monitor your property for new infestations. Siberian elm is a designated "List C" species in the Colorado Noxious Weed Act. For List C species, the goal is to provide additional education, research, and biological control resources to jurisdictions that choose to require management of the List C species. The following page provides management recommendations. For more information please visit: www.colorado.gov/ag/weeds or call the CDA at 303-869-9000, and ask to speak with staff in the Noxious Weed Program.

John M. Randall


Tom DeGomez

Robert Videki

Steve Hurst

Key Leaf ID Points:

1. Alternate, simple, 1"-2" long, dark green with conspicuous, grooved veins in a fishbone pattern,
2. Slightly hairy underneath when young; yellow in fall,
3. On short stalks, which are sometimes tinged dark red.

Siberian Elm

Ulmus pumila

List C

Integrated Weed Management Recommendations

Effective integrated management means using a variety of eradication methods in the same site along with restoration, prevention of seed production and dispersal, and monitoring. Maintain robust healthy native landscapes. Restore degraded sites. Avoid soil disturbance. Prevent seed production and seed dispersal, e.g. on contaminated equipment. Rest sites until restored. Modify land use practices. Use methods appropriate for the site, including land use practices.

Siberian Elm

Ulmus pumila

CULTURAL
Maintain healthy plant communities to prevent or limit Siberian elm infestations, and limit disturbance. Promptly re-vegetate disturbed areas, and prevent establishment of new trees by removing seedlings and saplings before they mature. Replace existing Siberian elms with native trees. Contact your local Natural Resources Conservation Service for recommendations of alternative trees or shrubs.

BIOLOGICAL
There are currently no known biological control agents effective against Siberian elm or authorized in Colorado. For more information on the use of biocontrol agents to control weeds in Colorado, please contact the Palisade Insectary of the Colorado Department of Agriculture at 970-464-7916.

MECHANICAL
Very young seedlings can be pulled fairly easily by hand or with a weed-wrench, especially in moist soil conditions. Cutting trees without chemical application often leads to significant basal and root sprouting. Mechanical methods alone are not recommended for older trees. Treating cut-stumps with herbicide is more effective than cutting alone and can eliminate sprouting.

CHEMICAL
Methods include foliar application, basal bark spray, cut stump, and success is influenced by factors like time of year, the growth form (low growing, multi-stemmed shrub vs mid-sized, single stem tree), etc. The following are recommendations for herbicides that can treat Siberian elm; follow-up applications will be necessary. Please reference the label for exact rates. Always read, understand, and follow the label directions. The herbicide label is the LAW!

HERBICIDE	RATE	APPLICATION TIMING
Triclopyr (Garlon 3A, Garlon 4 Ultra, Pathfinder II)	Foliar treatment: 1-1.5% v/v solution plus 0.5% v/v non-ionic surfactant	Summer/early fall when actively growing and fully leafed but before fall color begins.
Glyphosate (Roundup, Accord XRT II, etc.)	Cut stump/girdling: 20-30% solution in oil or water carrier, depending on chemical	
Imazapyr (Arsenal, Habitat, Chopper, Stalker, etc.)	Foliar treatment: 1-5% v/v solution plus 0.5% v/v non-ionic surfactant	

COLORADO
Department of Agriculture

Colorado Department of Agriculture - Conservation Services
305 Interlocken Parkway
Broomfield, CO 80021
(303) 869-9030
www.colorado.gov/ag/weeds

Colorado State University

Rev. 5/23

United States Department of Agriculture

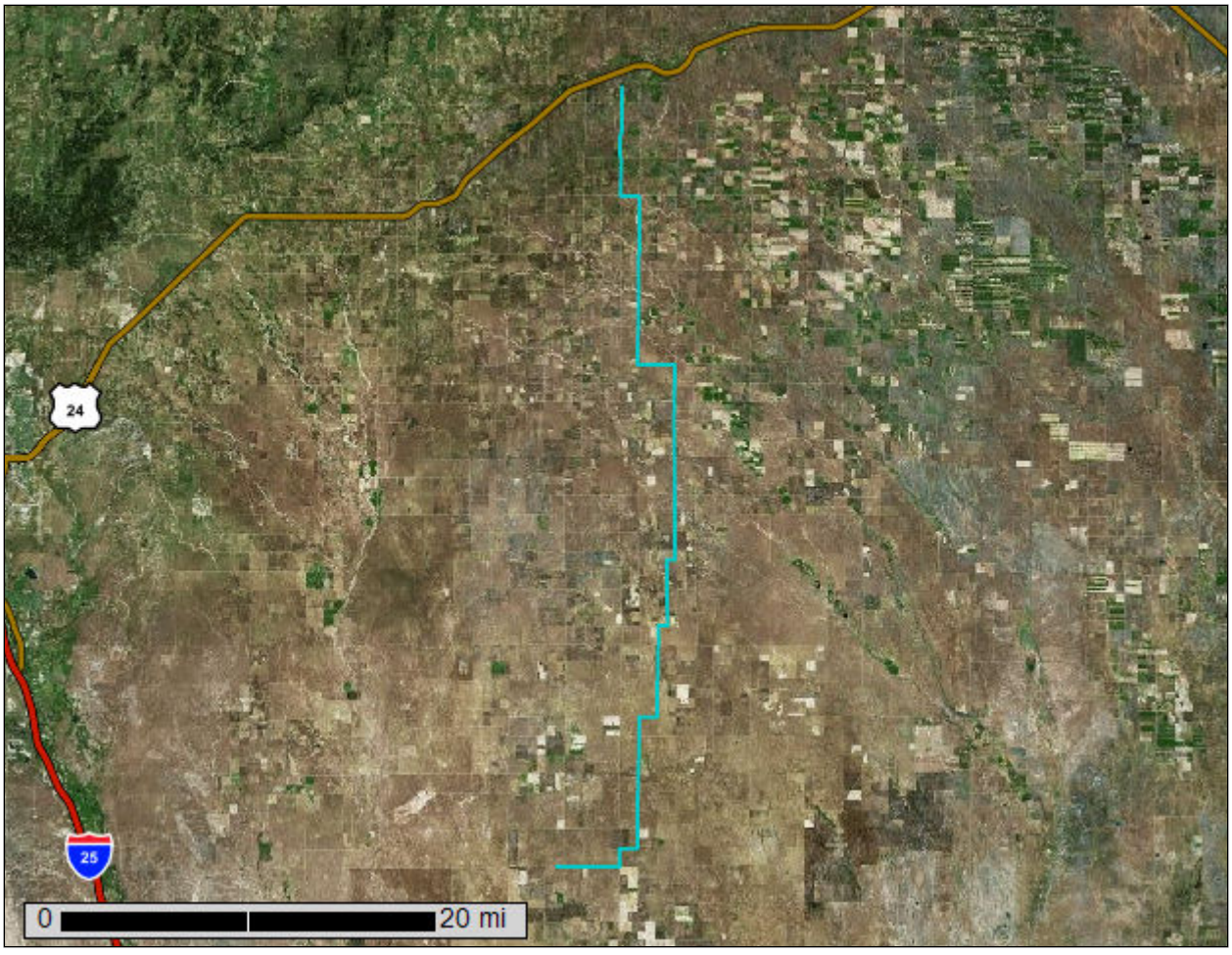
NRCS

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; Elbert County, Colorado, Western Part; and Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Pathways Segment 5 - El Paso County



January 23, 2025

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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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.

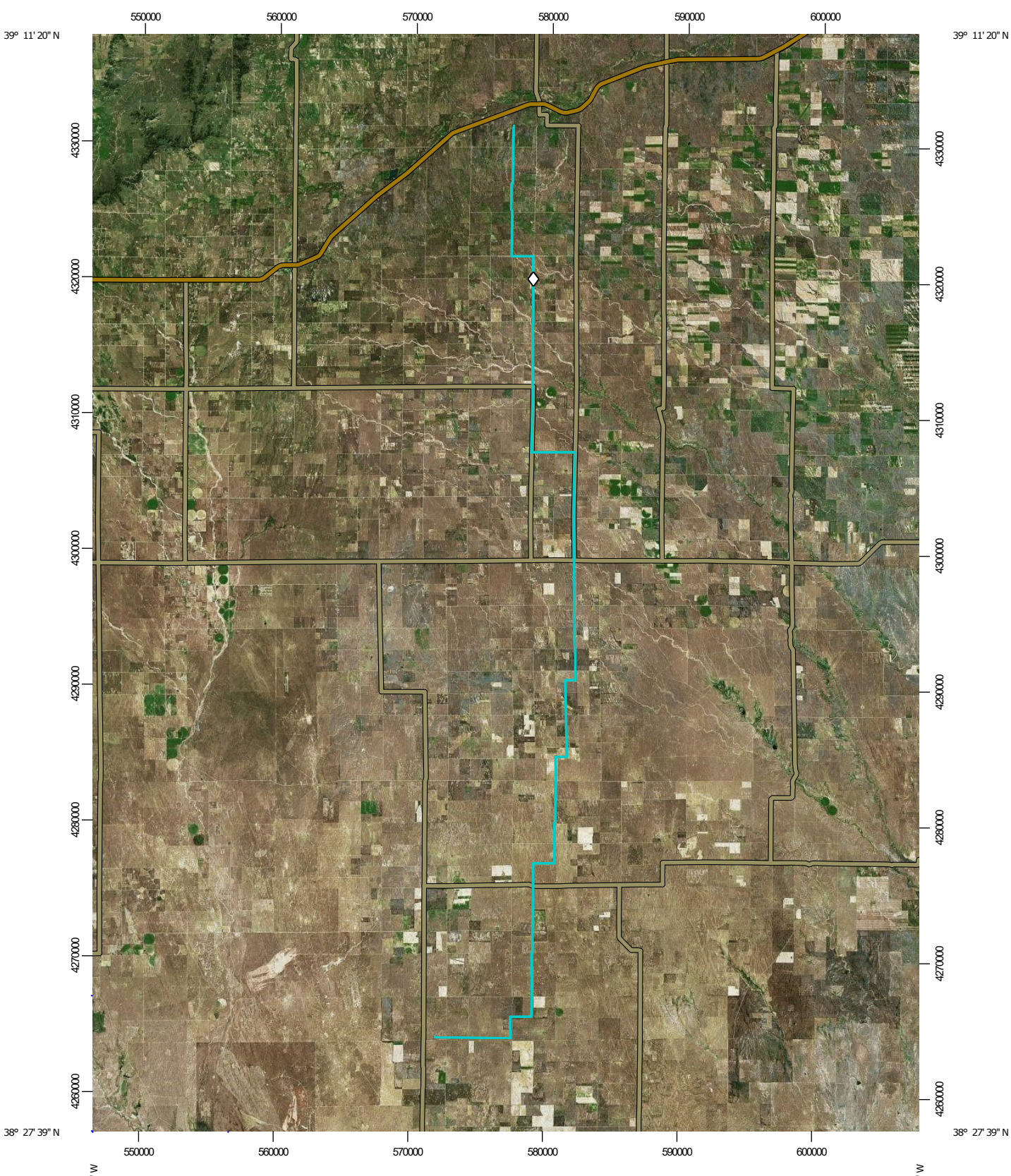
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.



Map Scale: 1:394,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5000 10000 20000 30000

Feet
0 15000 30000 60000 90000

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.

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 22, Sep 3, 2024

Soil Survey Area: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
Survey Area Data: Version 23, Aug 29, 2024

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

MAP LEGEND

MAP INFORMATION

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 (Segment 5 - El Paso)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	81.0	9.3%
3	Ascalon sandy loam, 3 to 9 percent slopes	18.7	2.2%
7	Bijou sandy loam, 3 to 8 percent slopes	4.9	0.6%
10	Blendon sandy loam, 0 to 3 percent slopes	2.6	0.3%
11	Bresser sandy loam, cool, 0 to 3 percent slopes	33.4	3.8%
12	Bresser sandy loam, cool, 3 to 5 percent slopes	111.9	12.9%
13	Bresser sandy loam, cool, 5 to 9 percent slopes	1.9	0.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	32.8	3.8%
47	Limon clay, 0 to 3 percent slopes	4.3	0.5%
60	Olney sandy loam, 0 to 3 percent slopes	155.5	17.9%
61	Olney sandy loam, 3 to 8 percent slopes	34.3	3.9%
73	Razor clay loam, 3 to 9 percent slopes	17.3	2.0%
79	Satanta loam, 0 to 3 percent slopes	10.1	1.2%
80	Satanta loam, 3 to 5 percent slopes	3.1	0.4%
81	Satanta-Neville complex, 3 to 8 percent slopes	5.8	0.7%
96	Truckton sandy loam, 0 to 3 percent slopes	59.3	6.8%
97	Truckton sandy loam, 3 to 9 percent slopes	47.0	5.4%
99	Truckton-Bresser sandy loams, 5 to 20 percent slopes	20.7	2.4%
100	Truckton-Bresser complex, eroded	7.8	0.9%
101	Ustic Torrifluvents, loamy	16.8	1.9%
102	Valent sand, 1 to 12 percent slopes, dry	22.1	2.5%
103	Valent sand, 9 to 20 percent slopes, dry	8.0	0.9%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
104	Vona sandy loam, warm, 0 to 3 percent slopes	0.7	0.1%
105	Vona sandy loam, warm, 3 to 6 percent slopes	0.5	0.1%
109	Yoder gravelly sandy loam, 1 to 8 percent slopes	1.9	0.2%
117	Vonid sandy loam, 0 to 5 percent slopes	64.9	7.5%
123	Olney-Vonid soils, 1 to 6 percent slopes, eroded	78.1	9.0%
Bd	Bijoudry loamy sand, 0 to 2 percent slopes	22.2	2.6%
Subtotals for Soil Survey Area		**867.9**	**99.9%**
Totals for Area of Interest		**868.7**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
24	Heldt clay loam, 0 to 3 percent slopes	0.1	0.0%
Subtotals for Soil Survey Area		**0.1**	**0.0%**
Totals for Area of Interest		**868.7**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Vo	Vonid sandy loam, 0 to 5 percent slopes	0.3	0.0%
Subtotals for Soil Survey Area		**0.3**	**0.0%**
Totals for Area of Interest		**868.7**	**100.0%**

Map Unit Descriptions (Segment 5 - El Paso)

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

7—Bijou sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tqxs
Elevation: 5,700 to 6,200 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Bijou and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bijou

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 8 inches: sandy loam
Bt2 - 8 to 21 inches: sandy loam
Bw - 21 to 28 inches: sandy loam
C - 28 to 79 inches: loamy coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.1 to 0.2 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

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

Minor Components

Valent

Percent of map unit: 10 percent
Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY015CO - Deep Sand
Hydric soil rating: No

Olnest

Percent of map unit: 5 percent
Landform: Hillslopes
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

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Blendon

Setting

Landform: Alluvial fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 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: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
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

11—Bresser sandy loam, cool, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tlph
Elevation: 5,850 to 6,880 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

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

Description of Bresser, Cool

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 0 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 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Truckton
Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Yoder
Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

12—Bresser sandy loam, cool, 3 to 5 percent slopes

Map Unit Setting
National map unit symbol: 2tlpd
Elevation: 6,300 to 6,800 feet
Mean annual precipitation: 13 to 19 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 140 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition
Bresser, cool, and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser, Cool

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 3 to 5 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 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Truckton

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Yoder

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear

Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

13—Bresser sandy loam, cool, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlpk
Elevation: 5,500 to 6,960 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Bresser, Cool

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 5 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 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Ascalon
Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Truckton
Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting
National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition
Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting
Landform: Stream terraces, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R069XY031CO - Sandy Bottomland
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

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

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

47—Limon clay, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 368p
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Limon, occasionally flooded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Limon, Occasionally Flooded

Setting

Landform: Alluvial fans, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from shale

Typical profile

A - 0 to 4 inches: clay
AC - 4 to 12 inches: silty clay
C - 12 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R069XY033CO - Salt Flat
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

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

60—Olney sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2qnms
Elevation: 3,800 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Olney

Setting

Landform: Sand sheets
Parent material: Eolian sands

Typical profile

A - 0 to 3 inches: sandy loam
BA - 3 to 12 inches: sandy loam
Bt - 12 to 24 inches: sandy clay loam
Btk - 24 to 36 inches: sandy loam
Bk1 - 36 to 46 inches: sandy loam
Bk2 - 46 to 79 inches: fine sandy loam

Properties and qualities

Slope: 0 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 (0.20 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: 25 percent
Maximum salinity: Very slightly saline (2.0 to 3.9 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy (G069XW017CO)

Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Minor Components

Vonid
Percent of map unit: 9 percent
Landform: Sand sheets
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G069XW019CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

Oterodry
Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G069XW019CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

Ustertic haplargids, ponded
Percent of map unit: 2 percent
Landform: Closed depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R069XY011CO - Closed Depression
Other vegetative classification: Clayey (G069XW001CO)
Hydric soil rating: No

61—Olney sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2qnmv
Elevation: 3,800 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

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

Description of Olney

Setting

Landform: Sand sheets
Parent material: Eolian sands

Typical profile

A - 0 to 3 inches: sandy loam
BA - 3 to 12 inches: sandy loam
Bt - 12 to 24 inches: sandy clay loam
Btk - 24 to 36 inches: sandy loam
Bk1 - 36 to 46 inches: sandy loam
Bk2 - 46 to 79 inches: fine sandy loam

Properties and qualities

Slope: 3 to 8 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 (0.20 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: 25 percent
Maximum salinity: Very slightly saline (2.0 to 3.9 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy (G069XW017CO)
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Minor Components

Vonid

Percent of map unit: 9 percent
Landform: Sand sheets
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Sandy Plains (069XY026CO_1), Loamy, Dry (G069XW019CO)
Hydric soil rating: No

Oterodry

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R069XY026CO - Sandy Plains

Other vegetative classification: Loamy, Dry (G069XW019CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

Ustertic haplargids, ponded
Percent of map unit: 2 percent
Landform: Closed depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R069XY011CO - Closed Depression
Other vegetative classification: Clayey (G069XW001CO)
Hydric soil rating: No

73—Razor clay loam, 3 to 9 percent slopes

Map Unit Setting
National map unit symbol: 369m
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Razor and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile
A - 0 to 3 inches: clay loam
Bw - 3 to 9 inches: clay loam
Bk - 9 to 31 inches: clay
Cr - 31 to 35 inches: weathered bedrock

Properties and qualities
Slope: 3 to 9 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

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

79—Satanta loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 369t
Elevation: 5,900 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Satanta and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Satanta

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Loamy eolian deposits

Typical profile
A - 0 to 10 inches: loam
Bt - 10 to 47 inches: clay loam
Bk - 47 to 60 inches: silt loam

Properties and qualities
Slope: 0 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
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit: 4 percent
Hydric soil rating: No

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

80—Satanta loam, 3 to 5 percent slopes

Map Unit Setting
National map unit symbol: 369w
Elevation: 5,900 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Satanta and similar soils: 95 percent

Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Satanta

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy eolian deposits

Typical profile
A - 0 to 9 inches: loam
Bt - 9 to 30 inches: clay loam
Bk - 30 to 60 inches: silt loam

Properties and qualities
Slope: 3 to 5 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
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit: 4 percent
Hydric soil rating: No

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

81—Satanta-Neville complex, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 369x

Elevation: 5,900 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Satanta and similar soils: 55 percent
Neville and similar soils: 44 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Satanta

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy eolian deposits

Typical profile

A - 0 to 9 inches: loam
Bt - 9 to 30 inches: clay loam
Bk - 30 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 8 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 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
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Description of Neville

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

A - 0 to 10 inches: fine sandy loam

C - 10 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 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 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
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Minor Components

Other soils

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

96—Truckton sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2yvrd
Elevation: 5,400 to 7,000 feet
Mean annual precipitation: 14 to 23 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

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

Description of Truckton

Setting

Landform: Fan remnants, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent
Landform: Hills, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 5 percent
Landform: Terraces, interfluves
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Pleasant, frequently ponded

Percent of map unit: 2 percent
Landform: Closed depressions
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Depression
Hydric soil rating: Yes

Urban land

Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded

Percent of map unit: 1 percent
Landform: Drainageways, flood plains
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

97—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2x0j2
Elevation: 5,300 to 6,850 feet
Mean annual precipitation: 14 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 85 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Truckton

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 3 to 9 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 8 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 7 percent
Landform: Low hills, interfluves
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

99—Truckton-Bresser sandy loams, 5 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2yvrp
Elevation: 6,000 to 6,950 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 46 to 50 degrees F

Frost-free period: 90 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 45 percent
Bresser and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, nose slope, head slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 5 to 20 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XC210CO - Sandy Foothill Palmer Divide
Hydric soil rating: No

Description of Bresser

Setting

Landform: Interfluves, fans
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

A - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam

Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 5 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 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XC210CO - Sandy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XC210CO - Sandy Foothill Palmer Divide
Hydric soil rating: No

Stapleton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Ecological site: R049XC210CO - Sandy Foothill Palmer Divide
Hydric soil rating: No

Cushman

Percent of map unit: 5 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Yoder

Percent of map unit: 5 percent
Landform: Hillslopes, fans
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XC214CO - Gravelly Foothill Palmer Divide
Hydric soil rating: No

100—Truckton-Bresser complex, eroded

Map Unit Setting

National map unit symbol: 3672
Elevation: 6,300 to 7,000 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton, eroded, and similar soils: 60 percent
Bresser, eroded, and similar soils: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton, Eroded

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 24 inches: sandy loam
C - 24 to 60 inches: coarse sandy loam

Properties and qualities

Slope: 1 to 9 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): High (1.98 to 6.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Bresser, Eroded

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 27 inches: sandy clay loam
BC - 27 to 36 inches: sandy loam
C - 36 to 60 inches: loamy coarse sand

Properties and qualities

Slope: 1 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 (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

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

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrifluvents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrifluvents

Setting

Landform: Stream terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 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 (0.20 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 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R069XY037CO - Saline Overflow
Other vegetative classification: OVERFLOW (069BY036CO)
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit: 4 percent
Hydric soil rating: No

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

102—Valent sand, 1 to 12 percent slopes, dry

Map Unit Setting
National map unit symbol: 2rgs5
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition
Valent, dry, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Valent, Dry

Setting
Landform: Dunes
Parent material: Eolian sands

Typical profile
A - 0 to 6 inches: sand
AC - 6 to 21 inches: sand
C1 - 21 to 36 inches: sand
C2 - 36 to 79 inches: sand

Properties and qualities
Slope: 1 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.99 to 42.51 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.1 to 0.2 mmhos/cm)
Sodium adsorption ratio, maximum: 0.1
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R069XY019CO - Deep Sand
Forage suitability group: Not Suited (G069XW000CO)
Other vegetative classification: Not Suited (G069XW000CO)
Hydric soil rating: No

Minor Components

Vonid

Percent of map unit: 10 percent
Landform: Sand sheets
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Not Suited (G069XW000CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

Olney

Percent of map unit: 5 percent
Landform: Sand sheets
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Not Suited (G069XW000CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

103—Valent sand, 9 to 20 percent slopes, dry

Map Unit Setting

National map unit symbol: 2rgs7
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Valent, Dry

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Eolian sands derived from sedimentary rock

Typical profile

A - 0 to 6 inches: sand
AC - 6 to 21 inches: sand
C1 - 21 to 36 inches: sand
C2 - 36 to 79 inches: sand

Properties and qualities

Slope: 9 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.99 to 42.51 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.1 to 0.2 mmhos/cm)
Sodium adsorption ratio, maximum: 0.1
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R069XY021CO - Choppy Sands
Forage suitability group: Not Suited (G069XW000CO)
Other vegetative classification: Not Suited (G069XW000CO)
Hydric soil rating: No

Minor Components

Vonid

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Not Suited (G069XW000CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

Olney

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Not Suited (G069XW000CO), Sandy Plains (069XY026CO_1)
Hydric soil rating: No

104—Vona sandy loam, warm, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t516
Elevation: 3,590 to 6,000 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vona, Warm

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 5 inches: sandy loam
Bt1 - 5 to 12 inches: sandy loam
Bt2 - 12 to 17 inches: sandy loam
Bk - 17 to 41 inches: sandy loam
BCk - 41 to 79 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: A
Ecological site: R067BY024CO - Sandy Plains
Forage suitability group: Loamy, Dry (G067BW019CO)
Other vegetative classification: Loamy, Dry (G067BW019CO), Sandy Plains #24 (067XY024CO_2)
Hydric soil rating: No

Minor Components

Olnest, warm
Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G067BW019CO)
Hydric soil rating: No

Otero
Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G067BW019CO), SANDY PLAINS (067XY024CO_1)
Hydric soil rating: No

Valent, warm
Percent of map unit: 5 percent
Landform: Sand sheets
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY015CO - Deep Sand
Other vegetative classification: Sandy, Dry (G067BW026CO), Deep Sands #15 (067XY015CO_3)
Hydric soil rating: No

105—Vona sandy loam, warm, 3 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2t517
Elevation: 3,400 to 6,000 feet
Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vona, Warm

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 5 inches: sandy loam
Bt1 - 5 to 12 inches: sandy loam
Bt2 - 12 to 17 inches: sandy loam
Bk - 17 to 41 inches: sandy loam
BCk - 41 to 79 inches: loamy sand

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 3.9 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R067BY024CO - Sandy Plains
Forage suitability group: Loamy, Dry (G067BW019CO)
Other vegetative classification: Sandy Plains #24 (067XY024CO_2), Loamy, Dry (G067BW019CO)
Hydric soil rating: No

Minor Components

Valent, warm

Percent of map unit: 5 percent
Landform: Sand sheets

Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY015CO - Deep Sand
Other vegetative classification: Sandy, Dry (G067BW026CO), Deep Sands #15 (067XY015CO_3)
Hydric soil rating: No

Olnest, warm

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G067BW019CO)
Hydric soil rating: No

Otero, warm

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G067BW019CO), SANDY PLAINS (067XY024CO_1)
Hydric soil rating: No

109—Yoder gravelly sandy loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 367c
Elevation: 6,200 to 6,900 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Yoder and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Yoder

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Noncalcareous alluvium derived from arkose

Typical profile

A - 0 to 6 inches: gravelly sandy loam
Bt - 6 to 12 inches: gravelly sandy clay loam
2C - 12 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 5 percent
Hydric soil rating: No

117—Vonid sandy loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2rgqc
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vonid

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 6 inches: sandy loam
Bt - 6 to 29 inches: sandy loam
Bk - 29 to 52 inches: sandy loam
C - 52 to 79 inches: loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy, Dry (G019XW019CO)
Other vegetative classification: Loamy, Dry (G019XW019CO)
Hydric soil rating: No

Minor Components

Olney

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Valent

Percent of map unit: 4 percent
Landform: Sand sheets
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY015CO - Deep Sand
Other vegetative classification: DEEP SANDS (067XY015CO_2), Loamy, Dry (G069XW019CO)
Hydric soil rating: No

Ustertic haplargids, ponded

Percent of map unit: 1 percent
Landform: Closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Depression
Other vegetative classification: Clayey (G069XW001CO)
Hydric soil rating: No

123—Olney-Vonid soils, 1 to 6 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2t51d
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Olney, eroded, and similar soils: 50 percent
Vonid, eroded, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olney, Eroded

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile

A - 0 to 2 inches: sandy loam
Bt - 2 to 14 inches: sandy clay loam
Bk1 - 14 to 36 inches: sandy loam

Bk2 - 36 to 79 inches: fine sandy loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 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: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.5 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy (G069XW017CO)
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Description of Vonid, Eroded

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 2 inches: sandy loam
Bt - 2 to 29 inches: sandy loam
Bk - 29 to 52 inches: sandy loam
C - 52 to 79 inches: loamy sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.5 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy, Dry (G019XW019CO)
Other vegetative classification: Loamy, Dry (G019XW019CO)
Hydric soil rating: No

Minor Components

Vonid

Percent of map unit: 5 percent
Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy, Dry (G019XW019CO)
Hydric soil rating: No

Olney

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Bd—Bijoudry loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tqxt
Elevation: 3,700 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Bijoudry

Setting

Landform: Sand sheets
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 7 inches: loamy sand
BA - 7 to 9 inches: sandy loam
Bt - 9 to 20 inches: sandy loam
BC - 20 to 24 inches: sandy loam
C1 - 24 to 41 inches: sand
C2 - 41 to 79 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.13 to 7.09 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R069XY026CO - Sandy Plains
Hydric soil rating: No

Minor Components

Valent

Percent of map unit: 10 percent
Landform: Sand sheets
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY019CO - Deep Sand
Hydric soil rating: No

Olney

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Hydric soil rating: No

Elbert County, Colorado, Western Part

24—Heldt clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xst9
Elevation: 3,830 to 6,430 feet
Mean annual precipitation: 13 to 19 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 110 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Heldt and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Heldt

Setting

Landform: Alluvial fans, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine textured alluvium derived from clayey shale

Typical profile

Ap - 0 to 4 inches: clay loam
Bw1 - 4 to 15 inches: clay
Bw2 - 15 to 26 inches: clay
Bk - 26 to 35 inches: clay
C - 35 to 80 inches: clay

Properties and qualities

Slope: 0 to 3 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

Minor Components

Nunn

Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

Vo—Vonid sandy loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2rgqc
Elevation: 4,000 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vonid

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 6 inches: sandy loam
Bt - 6 to 29 inches: sandy loam
Bk - 29 to 52 inches: sandy loam
C - 52 to 79 inches: loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R069XY026CO - Sandy Plains
Forage suitability group: Loamy, Dry (G019XW019CO)
Other vegetative classification: Loamy, Dry (G019XW019CO)
Hydric soil rating: No

Minor Components

Olney

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R069XY026CO - Sandy Plains
Other vegetative classification: Loamy (G069XW017CO)
Hydric soil rating: No

Valent

Percent of map unit: 4 percent
Landform: Sand sheets
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY015CO - Deep Sand
Other vegetative classification: DEEP SANDS (067XY015CO_2), Loamy, Dry (G069XW019CO)
Hydric soil rating: No

Ustertic haplargids, ponded

Percent of map unit: 1 percent
Landform: Closed depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Depression
Other vegetative classification: Clayey (G069XW001CO)
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Erosion Factors

Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

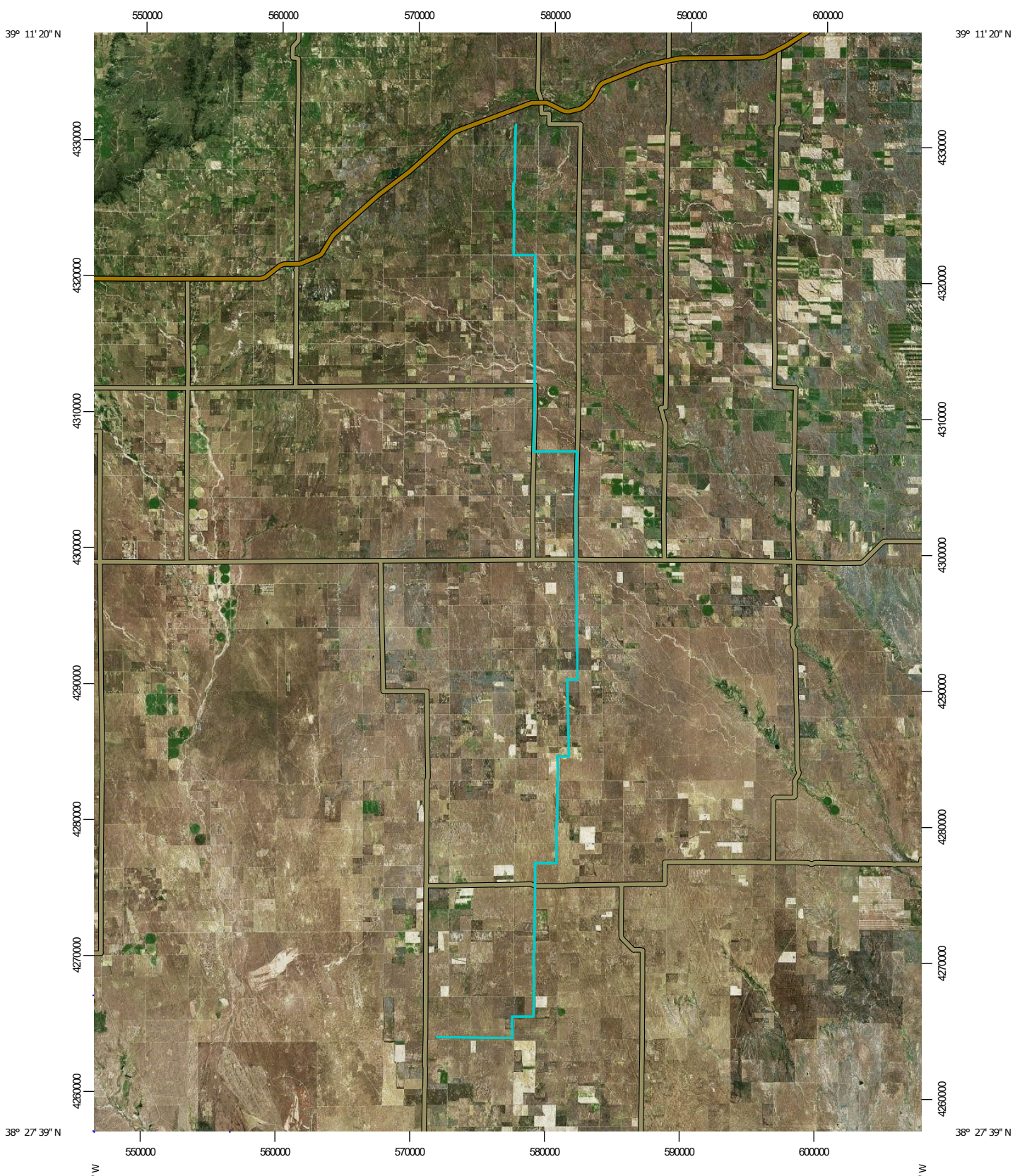
K Factor, Whole Soil (Segment 5 - El Paso)

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Factor K does not apply to organic horizons and is not reported for those layers.

Map—K Factor, Whole Soil (Segment 5 - El Paso)



Map Scale: 1:394,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5000 10000 20000 30000

Feet
0 15000 30000 60000 90000

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 Rating Polygons

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Lines

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Points

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

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.

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 22, Sep 3, 2024

Soil Survey Area: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
Survey Area Data: Version 23, Aug 29, 2024

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

MAP LEGEND

MAP INFORMATION

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.

Table—K Factor, Whole Soil (Segment 5 - El Paso)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	.24	81.0	9.3%
3	Ascalon sandy loam, 3 to 9 percent slopes	.17	18.7	2.2%
7	Bijou sandy loam, 3 to 8 percent slopes	.20	4.9	0.6%
10	Blendon sandy loam, 0 to 3 percent slopes	.20	2.6	0.3%
11	Bresser sandy loam, cool, 0 to 3 percent slopes	.15	33.4	3.8%
12	Bresser sandy loam, cool, 3 to 5 percent slopes	.15	111.9	12.9%
13	Bresser sandy loam, cool, 5 to 9 percent slopes	.15	1.9	0.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	.17	32.8	3.8%
47	Limon clay, 0 to 3 percent slopes	.17	4.3	0.5%
60	Olney sandy loam, 0 to 3 percent slopes	.17	155.5	17.9%
61	Olney sandy loam, 3 to 8 percent slopes	.17	34.3	3.9%
73	Razor clay loam, 3 to 9 percent slopes	.24	17.3	2.0%
79	Satanta loam, 0 to 3 percent slopes	.28	10.1	1.2%
80	Satanta loam, 3 to 5 percent slopes	.28	3.1	0.4%
81	Satanta-Neville complex, 3 to 8 percent slopes	.28	5.8	0.7%
96	Truckton sandy loam, 0 to 3 percent slopes	.28	59.3	6.8%
97	Truckton sandy loam, 3 to 9 percent slopes	.28	47.0	5.4%
99	Truckton-Bresser sandy loams, 5 to 20 percent slopes	.28	20.7	2.4%
100	Truckton-Bresser complex, eroded	.24	7.8	0.9%
101	Ustic Torrifluvents, loamy		16.8	1.9%
102	Valent sand, 1 to 12 percent slopes, dry	.02	22.1	2.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
103	Valent sand, 9 to 20 percent slopes, dry	.02	8.0	0.9%
104	Vona sandy loam, warm, 0 to 3 percent slopes	.15	0.7	0.1%
105	Vona sandy loam, warm, 3 to 6 percent slopes	.17	0.5	0.1%
109	Yoder gravelly sandy loam, 1 to 8 percent slopes	.15	1.9	0.2%
117	Vonid sandy loam, 0 to 5 percent slopes	.15	64.9	7.5%
123	Olney-Vonid soils, 1 to 6 percent slopes, eroded	.17	78.1	9.0%
Bd	Bijoudry loamy sand, 0 to 2 percent slopes	.10	22.2	2.6%
Subtotals for Soil Survey Area			**867.9**	**99.9%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
24	Heldt clay loam, 0 to 3 percent slopes	.28	0.1	0.0%
Subtotals for Soil Survey Area			**0.1**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Vo	Vonid sandy loam, 0 to 5 percent slopes	.15	0.3	0.0%
Subtotals for Soil Survey Area			**0.3**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Rating Options—K Factor, Whole Soil (Segment 5 - El Paso)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

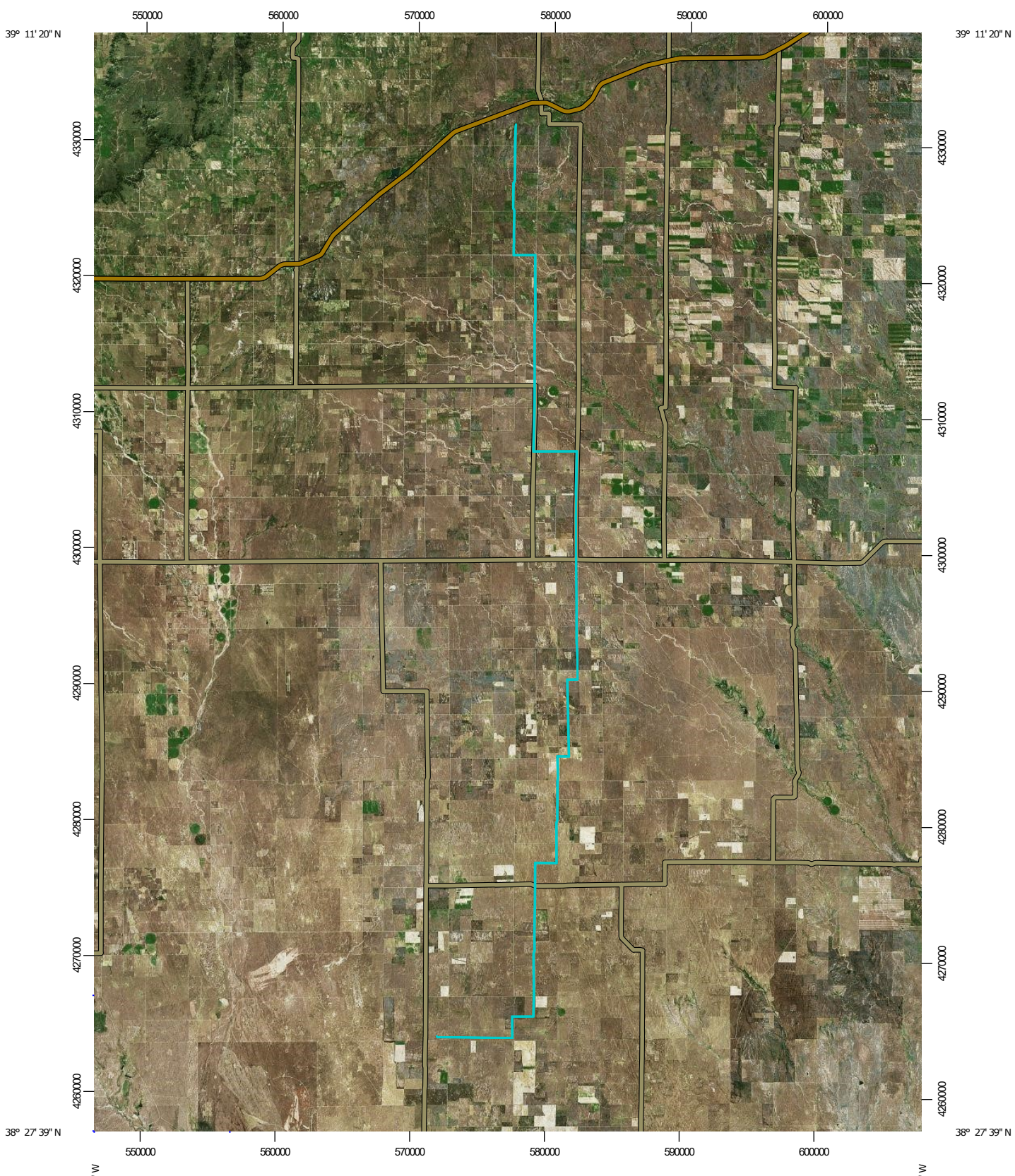
Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Wind Erodibility Group (Segment 5 - El Paso)

A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

Map—Wind Erodibility Group (Segment 5 - El Paso)



Map Scale: 1:394,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5000 10000 20000 30000

Feet
0 15000 30000 60000 90000

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 Rating Polygons

1
2
3
4
4L
5
6
7
8
Not rated or not available

Soil Rating Lines

1
2
3
4
4L
5
6
7
8
Not rated or not available

Soil Rating Points

1
2
3
4
4L
5
6
7
8
Not rated or not available

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.

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 22, Sep 3, 2024

Soil Survey Area: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

Soil Survey Area: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
Survey Area Data: Version 23, Aug 29, 2024

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

MAP LEGEND

MAP INFORMATION

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.

Table—Wind Erodibility Group (Segment 5 - El Paso)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	3	81.0	9.3%
3	Ascalon sandy loam, 3 to 9 percent slopes	3	18.7	2.2%
7	Bijou sandy loam, 3 to 8 percent slopes	3	4.9	0.6%
10	Blendon sandy loam, 0 to 3 percent slopes	3	2.6	0.3%
11	Bresser sandy loam, cool, 0 to 3 percent slopes	3	33.4	3.8%
12	Bresser sandy loam, cool, 3 to 5 percent slopes	3	111.9	12.9%
13	Bresser sandy loam, cool, 5 to 9 percent slopes	3	1.9	0.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	2	32.8	3.8%
47	Limon clay, 0 to 3 percent slopes	4	4.3	0.5%
60	Olney sandy loam, 0 to 3 percent slopes	3	155.5	17.9%
61	Olney sandy loam, 3 to 8 percent slopes	3	34.3	3.9%
73	Razor clay loam, 3 to 9 percent slopes	6	17.3	2.0%
79	Satanta loam, 0 to 3 percent slopes	5	10.1	1.2%
80	Satanta loam, 3 to 5 percent slopes	5	3.1	0.4%
81	Satanta-Neville complex, 3 to 8 percent slopes	5	5.8	0.7%
96	Truckton sandy loam, 0 to 3 percent slopes	3	59.3	6.8%
97	Truckton sandy loam, 3 to 9 percent slopes	3	47.0	5.4%
99	Truckton-Bresser sandy loams, 5 to 20 percent slopes	3	20.7	2.4%
100	Truckton-Bresser complex, eroded	3	7.8	0.9%
101	Ustic Torrifluvents, loamy		16.8	1.9%
102	Valent sand, 1 to 12 percent slopes, dry	1	22.1	2.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
103	Valent sand, 9 to 20 percent slopes, dry	1	8.0	0.9%
104	Vona sandy loam, warm, 0 to 3 percent slopes	3	0.7	0.1%
105	Vona sandy loam, warm, 3 to 6 percent slopes	3	0.5	0.1%
109	Yoder gravelly sandy loam, 1 to 8 percent slopes	5	1.9	0.2%
117	Vonid sandy loam, 0 to 5 percent slopes	3	64.9	7.5%
123	Olney-Vonid soils, 1 to 6 percent slopes, eroded	3	78.1	9.0%
Bd	Bijoudry loamy sand, 0 to 2 percent slopes	2	22.2	2.6%
Subtotals for Soil Survey Area			**867.9**	**99.9%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
24	Heldt clay loam, 0 to 3 percent slopes	6	0.1	0.0%
Subtotals for Soil Survey Area			**0.1**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Vo	Vonid sandy loam, 0 to 5 percent slopes	3	0.3	0.0%
Subtotals for Soil Survey Area			**0.3**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Rating Options—Wind Erodibility Group (Segment 5 - El Paso)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features

include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Segment 5 - El Paso)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

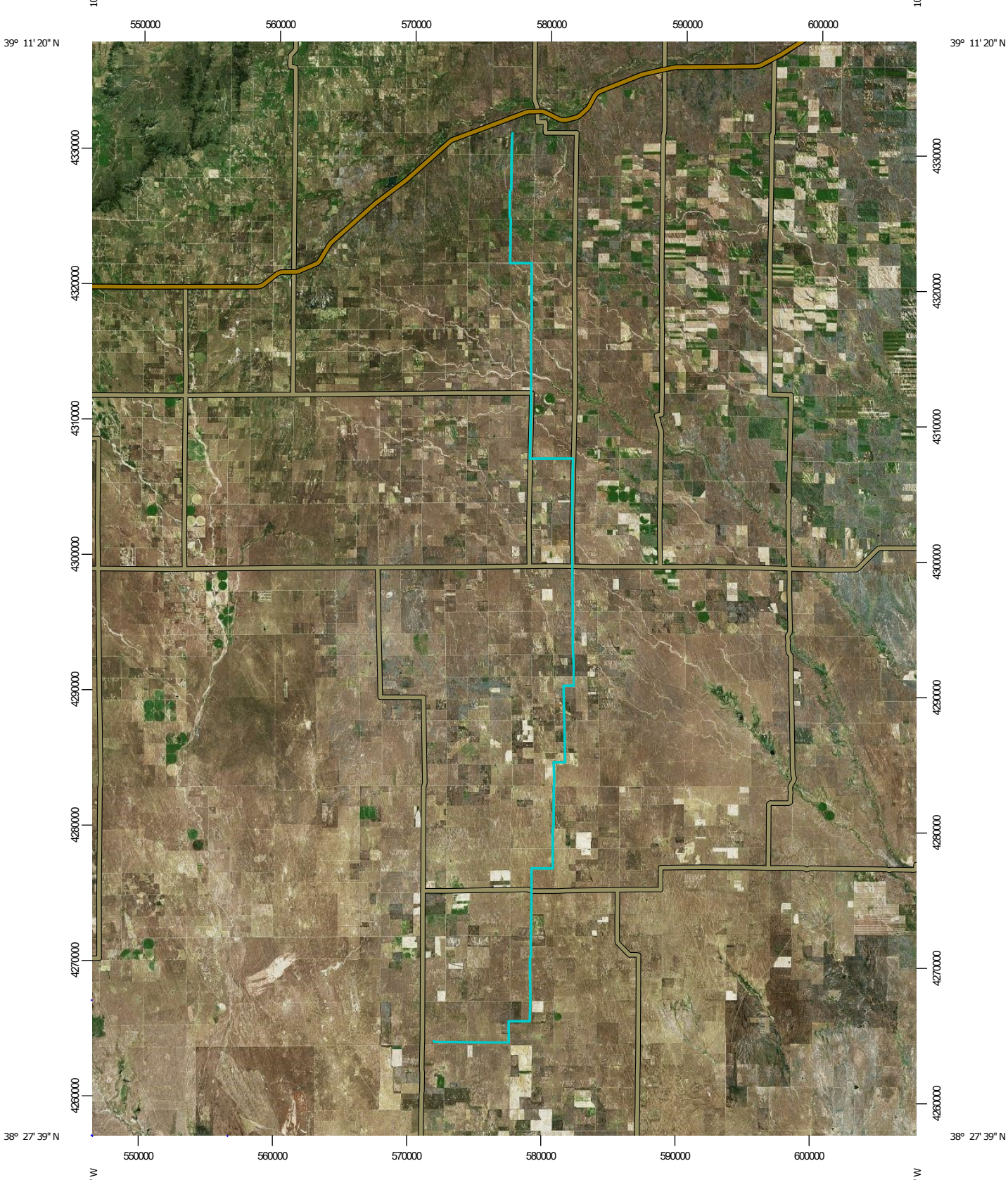
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map—Hydrologic Soil Group (Segment 5 - El Paso)



Map Scale: 1:394,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5000 10000 20000 30000

Feet
0 15000 30000 60000 90000

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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.

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Survey Area Data: Version 23, Aug 29, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

MAP LEGEND

MAP INFORMATION

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.

Table—Hydrologic Soil Group (Segment 5 - El Paso)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	B	81.0	9.3%
3	Ascalon sandy loam, 3 to 9 percent slopes	B	18.7	2.2%
7	Bijou sandy loam, 3 to 8 percent slopes	A	4.9	0.6%
10	Blendon sandy loam, 0 to 3 percent slopes	B	2.6	0.3%
11	Bresser sandy loam, cool, 0 to 3 percent slopes	B	33.4	3.8%
12	Bresser sandy loam, cool, 3 to 5 percent slopes	B	111.9	12.9%
13	Bresser sandy loam, cool, 5 to 9 percent slopes	B	1.9	0.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	32.8	3.8%
47	Limon clay, 0 to 3 percent slopes	C	4.3	0.5%
60	Olney sandy loam, 0 to 3 percent slopes	B	155.5	17.9%
61	Olney sandy loam, 3 to 8 percent slopes	B	34.3	3.9%
73	Razor clay loam, 3 to 9 percent slopes	D	17.3	2.0%
79	Satanta loam, 0 to 3 percent slopes	B	10.1	1.2%
80	Satanta loam, 3 to 5 percent slopes	B	3.1	0.4%
81	Satanta-Neville complex, 3 to 8 percent slopes	B	5.8	0.7%
96	Truckton sandy loam, 0 to 3 percent slopes	A	59.3	6.8%
97	Truckton sandy loam, 3 to 9 percent slopes	A	47.0	5.4%
99	Truckton-Bresser sandy loams, 5 to 20 percent slopes	A	20.7	2.4%
100	Truckton-Bresser complex, eroded	A	7.8	0.9%
101	Ustic Torrifluvents, loamy	B	16.8	1.9%
102	Valent sand, 1 to 12 percent slopes, dry	A	22.1	2.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
103	Valent sand, 9 to 20 percent slopes, dry	A	8.0	0.9%
104	Vona sandy loam, warm, 0 to 3 percent slopes	A	0.7	0.1%
105	Vona sandy loam, warm, 3 to 6 percent slopes	A	0.5	0.1%
109	Yoder gravelly sandy loam, 1 to 8 percent slopes	A	1.9	0.2%
117	Vonid sandy loam, 0 to 5 percent slopes	A	64.9	7.5%
123	Olney-Vonid soils, 1 to 6 percent slopes, eroded	B	78.1	9.0%
Bd	Bijoudry loamy sand, 0 to 2 percent slopes	A	22.2	2.6%
Subtotals for Soil Survey Area			**867.9**	**99.9%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
24	Heldt clay loam, 0 to 3 percent slopes	C	0.1	0.0%
Subtotals for Soil Survey Area			**0.1**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Vo	Vonid sandy loam, 0 to 5 percent slopes	A	0.3	0.0%
Subtotals for Soil Survey Area			**0.3**	**0.0%**
Totals for Area of Interest			**868.7**	**100.0%**

Rating Options—Hydrologic Soil Group (Segment 5 - El Paso)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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United States Department of Agriculture

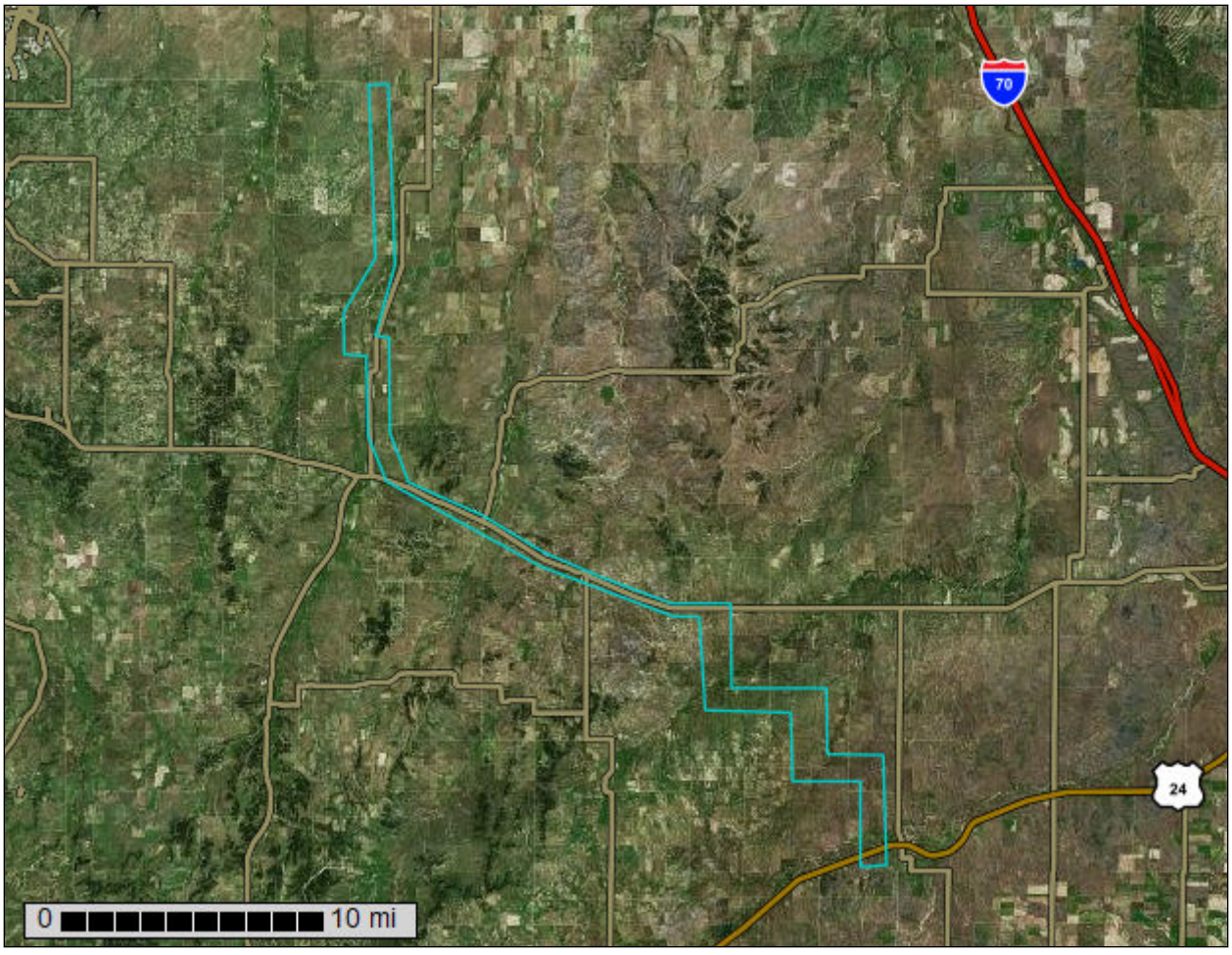
NRCS

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 Elbert County, Colorado, Western Part

Pathways Segment 5 - Elbert County



May 13, 2025

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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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.

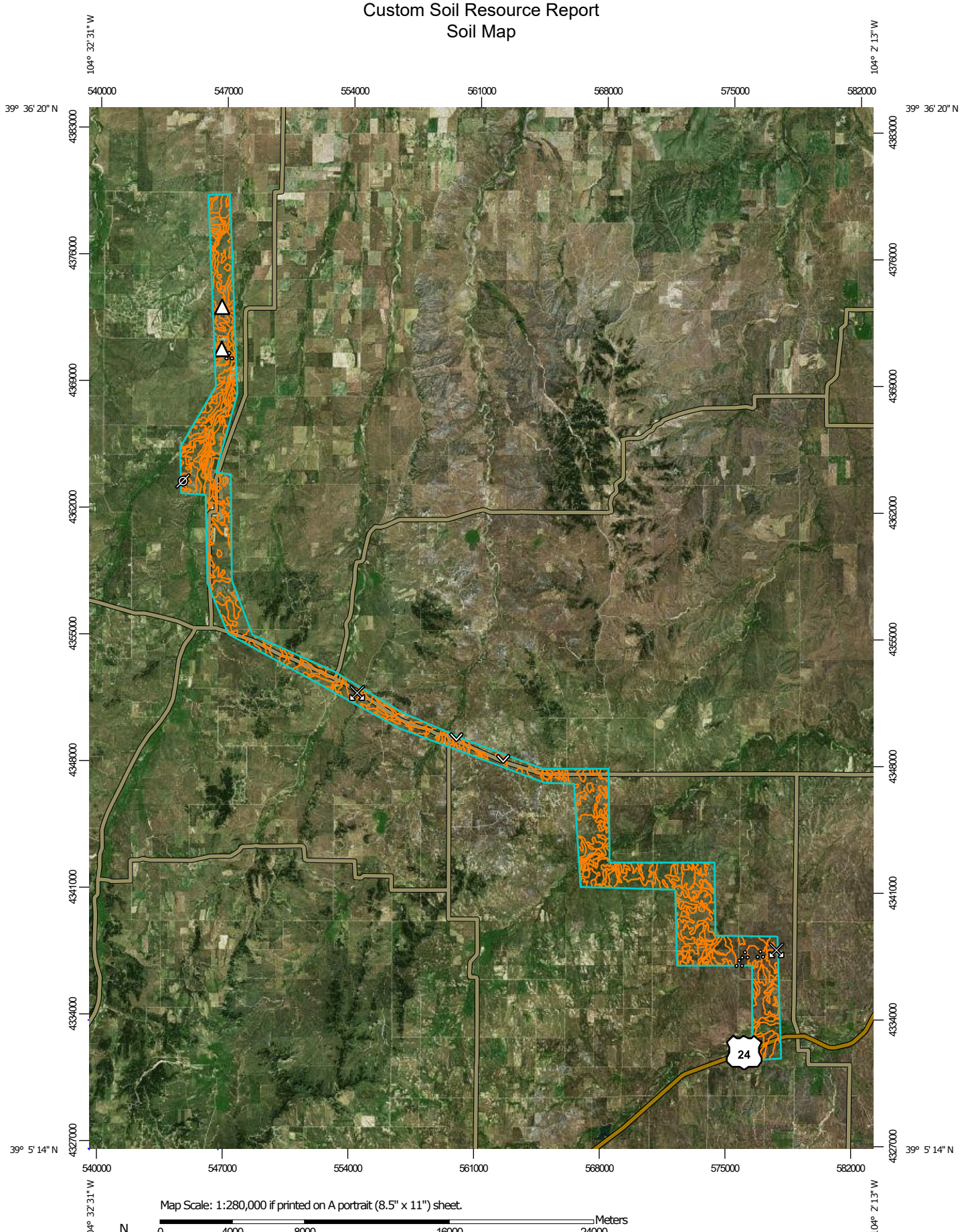
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:280,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 4000 8000 16000 24000

Feet: 0 10000 20000 40000 60000

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.

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: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

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
3	Baca-Wiley loams, 0 to 4 percent slopes	107.9	0.5%
4	Bluerim-Peyton sandy loams, 8 to 20 percent slopes	0.4	0.0%
5	Bresser sandy loam, 0 to 4 percent slopes	1,345.4	5.7%
6	Bresser sandy loam, cool, 5 to 9 percent slopes	5,056.8	21.5%
7	Bresser-Cushman complex, 4 to 20 percent slopes	1,178.4	5.0%
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	831.1	3.5%
9	Bresser-Truckton sandy loams, 8 to 25 percent slopes	1,720.1	7.3%
13	Cushman loam, 0 to 4 percent slopes	129.6	0.5%
14	Cushman-Ascalon complex, 4 to 15 percent slopes	2,558.9	10.9%
16	Cushman-Kutch complex, 8 to 25 percent slopes	2,030.9	8.6%
19	Ellicott loamy coarse sand, 0 to 4 percent slopes	426.9	1.8%
22	Haplustolls, moderately coarse, nearly level*	520.7	2.2%
23	Haplustolls, loamy, nearly level*	509.0	2.2%
24	Heldt clay loam, 0 to 3 percent slopes	713.6	3.0%
29	Kutch clay loam, 0 to 4 percent slopes	209.3	0.9%
30	Kutch clay loam, 4 to 8 percent slopes	2,263.0	9.6%
31	Kutch-Louviers complex, 8 to 25 percent slopes	490.6	2.1%
32	Nunn clay loam, 0 to 4 percent slopes	1,578.5	6.7%
35	Peyton-Elbeth sandy loams, 8 to 25 percent slopes	150.2	0.6%
38	Renohill clay loam, 4 to 8 percent slopes	131.3	0.6%
39	Renohill-Louviers complex, 8 to 25 percent slopes	213.0	0.9%
40	Torriorthents-Rock outcrop complex, steep	41.8	0.2%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
41	Truckton sandy loam, 3 to 9 percent slopes	781.0	3.3%
42	Truckton-Renohill complex, 8 to 25 percent slopes	0.5	0.0%
43	Weld loam, 0 to 4 percent slopes	324.0	1.4%
44	Weld loam, 4 to 8 percent slopes	122.2	0.5%
45	Wiley-Baca loams, 4 to 8 percent slopes	110.5	0.5%
47	Water	21.6	0.1%
Totals for Area of Interest		**23,569.4**	**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.

Elbert County, Colorado, Western Part

3—Baca-Wiley loams, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: jnkk
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Farmland of statewide importance

Map Unit Composition

Baca and similar soils: 45 percent
Wiley and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baca

Setting

Landform: Terraces, hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous eolian deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 18 inches: silty clay
H3 - 18 to 60 inches: loam

Properties and qualities

Slope: 0 to 4 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 (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Description of Wiley

Setting

Landform: Hills, terraces
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile

H1 - 0 to 3 inches: loam
H2 - 3 to 29 inches: silt loam
H3 - 29 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 4 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: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Weld

Percent of map unit: 13 percent
Hydric soil rating: No

Ascalon

Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustoll

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

4—Bluerim-Peyton sandy loams, 8 to 20 percent slopes

Map Unit Setting

National map unit symbol: jnkx
Elevation: 6,000 to 8,000 feet
Mean annual precipitation: 16 to 19 inches
Frost-free period: 80 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Bluerim and similar soils: 45 percent
Peyton and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bluerim

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 31 inches: sandy clay loam
H3 - 31 to 35 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Peyton

Setting

Landform: Ridges, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium and/or arkosic residuum

Typical profile

H1 - 0 to 3 inches: sandy loam
H2 - 3 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 8 to 15 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 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Minor Components

Elbeth

Percent of map unit: 10 percent
Hydric soil rating: No

Kettle

Percent of map unit: 7 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 3 percent
Hydric soil rating: No

5—Bresser sandy loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: jnl4
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Farmland of statewide importance

Map Unit Composition

Bresser and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 20 inches: sandy clay loam
H3 - 20 to 29 inches: sandy loam
H4 - 29 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 0 to 4 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
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Ascalon
Percent of map unit: 10 percent
Hydric soil rating: No

Truckton
Percent of map unit: 5 percent
Hydric soil rating: No

Weld
Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustoll
Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

6—Bresser sandy loam, cool, 5 to 9 percent slopes

Map Unit Setting
National map unit symbol: 2tlpk
Elevation: 5,500 to 6,960 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition
Bresser, cool, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser, Cool

Setting
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile
Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 5 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 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Ascalon

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Truckton

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

7—Bresser-Cushman complex, 4 to 20 percent slopes

Map Unit Setting

National map unit symbol: jnl6
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition

Bresser and similar soils: 40 percent
Cushman and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Hills, valley sides
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 20 inches: sandy clay loam
H3 - 20 to 29 inches: sandy loam
H4 - 29 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 4 to 20 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 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
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Cushman

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Truckton

Percent of map unit: 12 percent
Hydric soil rating: No

Ascalon

Percent of map unit: 10 percent
Hydric soil rating: No

Kutch

Percent of map unit: 8 percent
Hydric soil rating: No

8—Bresser-Stapleton sandy loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: jnl7
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 120 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Bresser and similar soils: 50 percent
Stapleton and similar soils: 25 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 20 inches: sandy clay loam
H3 - 20 to 29 inches: sandy loam
H4 - 29 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 8 to 20 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 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
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Stapleton

Setting

Landform: Valley sides, ridges, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 37 inches: sandy loam
H2 - 37 to 60 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 8 to 25 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): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 10 percent
Hydric soil rating: No

Cushman

Percent of map unit: 7 percent
Hydric soil rating: No

Weld

Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustoll

Percent of map unit: 2 percent
Landform: Swales
Hydric soil rating: Yes

9—Bresser-Truckton sandy loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: jnl8
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 125 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Bresser and similar soils: 45 percent
Truckton and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 7 inches: sandy loam
H2 - 7 to 20 inches: sandy clay loam
H3 - 20 to 29 inches: sandy loam
H4 - 29 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 8 to 20 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 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
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Truckton

Setting

Landform: Valley sides, ridges, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 15 inches: sandy loam
H3 - 15 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 25 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Ascalon
Percent of map unit: 8 percent
Hydric soil rating: No

Cushman
Percent of map unit: 7 percent
Hydric soil rating: No

Kutch
Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustoll
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

13—Cushman loam, 0 to 4 percent slopes

Map Unit Setting
National map unit symbol: jnjz
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition
Cushman and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cushman

Setting
Landform: Hills, ridges, valley sides

Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Kutch

Percent of map unit: 9 percent
Hydric soil rating: No

Nunn

Percent of map unit: 6 percent
Hydric soil rating: No

Ascalon

Percent of map unit: 5 percent
Hydric soil rating: No

14—Cushman-Ascalon complex, 4 to 15 percent slopes

Map Unit Setting

National map unit symbol: jnk0
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 130 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Cushman and similar soils: 55 percent
Ascalon and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cushman

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 4 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Description of Ascalon

Setting

Landform: Hills, valley sides, ridges
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous alluvium

Typical profile

H1 - 0 to 4 inches: sandy loam
H2 - 4 to 22 inches: sandy clay loam
H3 - 22 to 45 inches: sandy clay loam

H4 - 45 to 60 inches: fine sandy loam

Properties and qualities

Slope: 4 to 15 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 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 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 6 percent
Hydric soil rating: No

Kutch

Percent of map unit: 3 percent
Hydric soil rating: No

Renohill

Percent of map unit: 3 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

Louviers

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

16—Cushman-Kutch complex, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: jnk2
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches

Farmland classification: Not prime farmland

Map Unit Composition

Cushman and similar soils: 50 percent
Kutch and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cushman

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Description of Kutch

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from shale

Typical profile

H1 - 0 to 7 inches: clay loam
H2 - 7 to 30 inches: clay
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Ascalon

Percent of map unit: 7 percent
Hydric soil rating: No

Terry

Percent of map unit: 5 percent
Hydric soil rating: No

Renohill

Percent of map unit: 5 percent
Hydric soil rating: No

Aquic haploboroll

Percent of map unit: 3 percent
Landform: Swales
Hydric soil rating: Yes

19—Ellicott loamy coarse sand, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: jnk5
Elevation: 5,300 to 6,800 feet
Mean annual precipitation: 14 to 19 inches
Frost-free period: 130 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Stream terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Noncalcareous, arkosic sandy alluvium

Typical profile

H1 - 0 to 7 inches: loamy coarse sand
H2 - 7 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R049XY031CO - Sandy Bottomland
Hydric soil rating: No

Minor Components

Haplustolls

Percent of map unit: 6 percent
Hydric soil rating: No

Psammaquentic haplustoll

Percent of map unit: 4 percent
Landform: Terraces
Hydric soil rating: Yes

22—Haplustolls, moderately coarse, nearly level*

Map Unit Setting

National map unit symbol: jnk9

Elevation: 5,000 to 7,400 feet
Mean annual precipitation: 8 to 17 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Haplustolls, moderately coarse, nearly level, and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haplustolls, Moderately Coarse, Nearly Level

Setting

Landform: Stream terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Noncalcareous alluvium

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: stratified sandy loam to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (0.20 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 13 percent
Hydric soil rating: No

Fluvaquents

Percent of map unit: 7 percent
Landform: Terraces
Hydric soil rating: Yes

Ellicott

Percent of map unit: 7 percent
Hydric soil rating: No

Other soils

Percent of map unit: 3 percent
Hydric soil rating: No

23—Haplustolls, loamy, nearly level*

Map Unit Setting

National map unit symbol: jnkb
Elevation: 5,000 to 7,000 feet
Mean annual precipitation: 12 to 15 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Haplustolls, loamy, nearly level, and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haplustolls, Loamy, Nearly Level

Setting

Landform: Stream terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Nonclacareous loamy alluvium

Typical profile

H1 - 0 to 6 inches: clay loam
H2 - 6 to 60 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w

Hydrologic Soil Group: D
Ecological site: R067BY036CO - Overflow
Hydric soil rating: No

Minor Components

Nunn
Percent of map unit: 11 percent
Hydric soil rating: No

Fluvaquent
Percent of map unit: 9 percent
Landform: Terraces
Hydric soil rating: Yes

Bresser
Percent of map unit: 5 percent
Hydric soil rating: No

24—Heldt clay loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2xst9
Elevation: 3,830 to 6,430 feet
Mean annual precipitation: 13 to 19 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 110 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Heldt and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Heldt

Setting
Landform: Alluvial fans, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine textured alluvium derived from clayey shale

Typical profile
Ap - 0 to 4 inches: clay loam
Bw1 - 4 to 15 inches: clay
Bw2 - 15 to 26 inches: clay
Bk - 26 to 35 inches: clay
C - 35 to 80 inches: clay

Properties and qualities
Slope: 0 to 3 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

Minor Components

Nunn

Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

29—Kutch clay loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: jnkj
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Kutch

Setting

Landform: Hills
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from clayey shale

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 30 inches: clay
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Cushman

Percent of map unit: 8 percent
Hydric soil rating: No

Nunn

Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustoll

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

30—Kutch clay loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: jnkl
Elevation: 5,300 to 6,400 feet

Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition

Kutch and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kutch

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from clayey shale

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 30 inches: clay
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Renohill

Percent of map unit: 5 percent
Hydric soil rating: No

Nunn

Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustoll

Percent of map unit: 1 percent
Landform: Swales

Hydric soil rating: Yes

31—Kutch-Louviers complex, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: jnkm
Elevation: 5,300 to 7,500 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 120 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Kutch and similar soils: 40 percent
Louviers and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kutch

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from clayey shale

Typical profile

H1 - 0 to 4 inches: clay loam
H2 - 4 to 30 inches: clay
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Louviers

Setting

Landform: Valley sides, ridges, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from shale

Typical profile

H1 - 0 to 5 inches: clay
H2 - 5 to 14 inches: clay
H3 - 14 to 18 inches: weathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XB212CO - Shaly Foothill
Hydric soil rating: No

Minor Components

Cushman

Percent of map unit: 10 percent
Hydric soil rating: No

Nunn

Percent of map unit: 6 percent
Hydric soil rating: No

Renohill

Percent of map unit: 6 percent
Hydric soil rating: No

Ascalon

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

Aquic haplustoll
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

32—Nunn clay loam, 0 to 4 percent slopes

Map Unit Setting
National map unit symbol: 2tlpq
Elevation: 5,450 to 6,430 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Prime farmland if irrigated

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

Description of Nunn

Setting
Landform: Pediments, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
A - 0 to 6 inches: clay loam
Bt - 6 to 18 inches: clay
Btk - 18 to 30 inches: clay
Bk - 30 to 47 inches: clay loam
BCk - 47 to 80 inches: clay loam

Properties and qualities
Slope: 0 to 4 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 7 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 0.5

Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Heldt

Percent of map unit: 10 percent
Landform: Pediments, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Englewood

Percent of map unit: 5 percent
Landform: Pediments, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

35—Peyton-Elbeth sandy loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: jnkr
Elevation: 6,400 to 7,300 feet
Mean annual precipitation: 17 to 19 inches
Frost-free period: 75 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 50 percent
Elbeth and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Arkosic alluvium and/or arkosic residuum

Typical profile

H1 - 0 to 3 inches: sandy loam
H2 - 3 to 32 inches: sandy clay loam
H3 - 32 to 60 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 8 to 15 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 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Elbeth

Setting

Landform: Ridges, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 60 inches: sandy clay loam

Properties and qualities

Slope: 8 to 25 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 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Bluerim
Percent of map unit: 9 percent
Hydric soil rating: No

Kettle
Percent of map unit: 6 percent
Hydric soil rating: No

Pring
Percent of map unit: 3 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Hydric soil rating: No

38—Renohill clay loam, 4 to 8 percent slopes

Map Unit Setting
National map unit symbol: jnkv
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition
Renohill and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renohill

Setting
Landform: Hills, ridges
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile
H1 - 0 to 2 inches: clay loam
H2 - 2 to 14 inches: clay
H3 - 14 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities
Slope: 4 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained

Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Kutch
Percent of map unit: 6 percent
Hydric soil rating: No

Cushman
Percent of map unit: 6 percent
Hydric soil rating: No

Wiley
Percent of map unit: 5 percent
Hydric soil rating: No

Baca
Percent of map unit: 3 percent
Hydric soil rating: No

39—Renohill-Louviers complex, 8 to 25 percent slopes

Map Unit Setting
National map unit symbol: jnkw
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Renohill and similar soils: 40 percent
Louviers and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renohill

Setting

Landform: Hills, ridges, valley sides
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 2 inches: clay loam
H2 - 2 to 14 inches: clay
H3 - 14 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Louviers

Setting

Landform: Valley sides, ridges, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from shale

Typical profile

H1 - 0 to 5 inches: clay
H2 - 5 to 14 inches: clay
H3 - 14 to 18 inches: weathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XB212CO - Shaly Foothill
Hydric soil rating: No

Minor Components

Cushman

Percent of map unit: 15 percent
Hydric soil rating: No

Other soils

Percent of map unit: 10 percent
Hydric soil rating: No

Nunn

Percent of map unit: 5 percent
Hydric soil rating: No

40—Torriorthents-Rock outcrop complex, steep

Map Unit Setting

National map unit symbol: jnky
Elevation: 6,000 to 7,700 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Torriorthents, steep, and similar soils: 50 percent
Rock outcrop: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Torriorthents, Steep

Setting

Landform: Hills, ridges
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile
H1 - 0 to 4 inches: cobbly clay loam
H2 - 4 to 14 inches: clay
H3 - 14 to 18 inches: weathered bedrock

Properties and qualities
Slope: 15 to 65 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R067BY063CO - Gravel Breaks
Hydric soil rating: No

Description of Rock Outcrop

Typical profile
H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities
Slope: 15 to 65 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit: 14 percent
Hydric soil rating: No

Fluvaquentic haplustoll
Percent of map unit: 6 percent
Landform: Swales
Hydric soil rating: Yes

41—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2x0j2
Elevation: 5,300 to 6,850 feet
Mean annual precipitation: 14 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 85 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Truckton

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 3 to 9 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland
Percent of map unit: 8 percent
Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser
Percent of map unit: 7 percent
Landform: Low hills, interfluves
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

42—Truckton-Renohill complex, 8 to 25 percent slopes

Map Unit Setting
National map unit symbol: jnl0
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Frost-free period: 100 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition
Truckton and similar soils: 45 percent
Renohill and similar soils: 25 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting
Landform: Hills, valley sides, ridges
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or arkosic residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 15 inches: sandy loam
H3 - 15 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 25 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): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Renohill

Setting

Landform: Valley sides, ridges, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 2 inches: clay loam
H2 - 2 to 14 inches: clay
H3 - 14 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Cushman
Percent of map unit: 10 percent
Hydric soil rating: No

Kutch
Percent of map unit: 9 percent
Hydric soil rating: No

Wiley
Percent of map unit: 6 percent
Hydric soil rating: No

Nunn
Percent of map unit: 5 percent
Hydric soil rating: No

43—Weld loam, 0 to 4 percent slopes

Map Unit Setting
National map unit symbol: 2x0hz
Elevation: 4,550 to 6,900 feet
Mean annual precipitation: 13 to 20 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 115 to 155 days
Farmland classification: Prime farmland if irrigated

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

Description of Weld

Setting
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loess

Typical profile
Ap - 0 to 8 inches: loam
Bt1 - 8 to 12 inches: clay
Bt2 - 12 to 15 inches: clay loam

Btk - 15 to 28 inches: loam
Bk - 28 to 60 inches: silt loam
C - 60 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 4 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 3c
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Ascalon

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Wiley

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Baca

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

44—Weld loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: jnl2
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition

Weld and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weld

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits

Typical profile

H1 - 0 to 5 inches: loam
H2 - 5 to 45 inches: silty clay
H3 - 45 to 60 inches: clay loam
H4 - 60 to 64 inches: silt loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 6 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Baca
Percent of map unit: 10 percent
Hydric soil rating: No

Wiley
Percent of map unit: 6 percent
Hydric soil rating: No

Bresser
Percent of map unit: 3 percent
Hydric soil rating: No

Aquic haplustoll
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

45—Wiley-Baca loams, 4 to 8 percent slopes

Map Unit Setting
National map unit symbol: jnl3
Elevation: 5,300 to 6,400 feet
Mean annual precipitation: 14 to 17 inches
Farmland classification: Not prime farmland

Map Unit Composition
Wiley and similar soils: 45 percent
Baca and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wiley

Setting
Landform: Hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile
H1 - 0 to 3 inches: loam
H2 - 3 to 29 inches: silt loam
H3 - 29 to 60 inches: silt loam

Properties and qualities
Slope: 4 to 8 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 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Description of Baca

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous eolian deposits

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 18 inches: silty clay
H3 - 18 to 60 inches: loam

Properties and qualities

Slope: 4 to 8 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 (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Weld
Percent of map unit: 9 percent
Hydric soil rating: No

Ascalon
Percent of map unit: 6 percent
Hydric soil rating: No

Renohill
Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustoll
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

47—Water

Map Unit Composition
Water: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting
Landform: Lakes, rivers

Minor Components

Aquents
Percent of map unit: 5 percent
Landform: Marshes
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Erosion Factors

Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

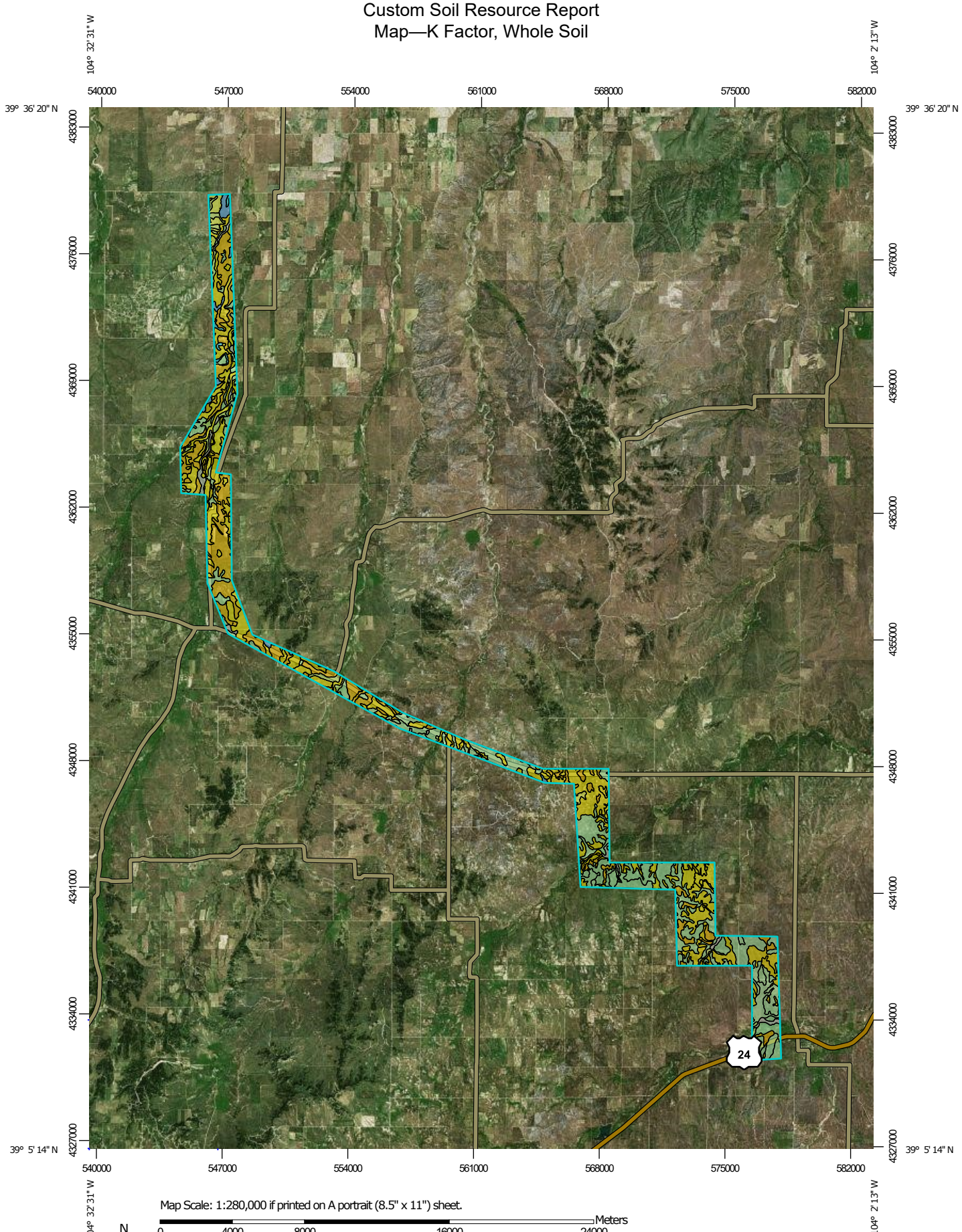
K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Factor K does not apply to organic horizons and is not reported for those layers.

Custom Soil Resource Report
Map—K Factor, Whole Soil



Map Scale: 1:280,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 4000 8000 16000 24000

Feet
0 10000 20000 40000 60000

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 Rating Polygons

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Lines

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Points

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

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.

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: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

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.

Table—K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Baca-Wiley loams, 0 to 4 percent slopes	.28	107.9	0.5%
4	Bluerim-Peyton sandy loams, 8 to 20 percent slopes	.24	0.4	0.0%
5	Bresser sandy loam, 0 to 4 percent slopes	.17	1,345.4	5.7%
6	Bresser sandy loam, cool, 5 to 9 percent slopes	.15	5,056.8	21.5%
7	Bresser-Cushman complex, 4 to 20 percent slopes	.17	1,178.4	5.0%
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	.17	831.1	3.5%
9	Bresser-Truckton sandy loams, 8 to 25 percent slopes	.17	1,720.1	7.3%
13	Cushman loam, 0 to 4 percent slopes	.28	129.6	0.5%
14	Cushman-Ascalon complex, 4 to 15 percent slopes	.28	2,558.9	10.9%
16	Cushman-Kutch complex, 8 to 25 percent slopes	.28	2,030.9	8.6%
19	Ellicott loamy coarse sand, 0 to 4 percent slopes	.17	426.9	1.8%
22	Haplustolls, moderately coarse, nearly level*		520.7	2.2%
23	Haplustolls, loamy, nearly level*	.24	509.0	2.2%
24	Heldt clay loam, 0 to 3 percent slopes	.28	713.6	3.0%
29	Kutch clay loam, 0 to 4 percent slopes	.17	209.3	0.9%
30	Kutch clay loam, 4 to 8 percent slopes	.17	2,263.0	9.6%
31	Kutch-Louviers complex, 8 to 25 percent slopes	.17	490.6	2.1%
32	Nunn clay loam, 0 to 4 percent slopes	.28	1,578.5	6.7%
35	Peyton-Elbeth sandy loams, 8 to 25 percent slopes	.17	150.2	0.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
38	Renohill clay loam, 4 to 8 percent slopes	.20	131.3	0.6%
39	Renohill-Louviers complex, 8 to 25 percent slopes	.20	213.0	0.9%
40	Torriorthents-Rock outcrop complex, steep	.15	41.8	0.2%
41	Truckton sandy loam, 3 to 9 percent slopes	.28	781.0	3.3%
42	Truckton-Renohill complex, 8 to 25 percent slopes	.24	0.5	0.0%
43	Weld loam, 0 to 4 percent slopes	.43	324.0	1.4%
44	Weld loam, 4 to 8 percent slopes	.24	122.2	0.5%
45	Wiley-Baca loams, 4 to 8 percent slopes	.37	110.5	0.5%
47	Water		21.6	0.1%
Totals for Area of Interest			**23,569.4**	**100.0%**

Rating Options—K Factor, Whole Soil

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

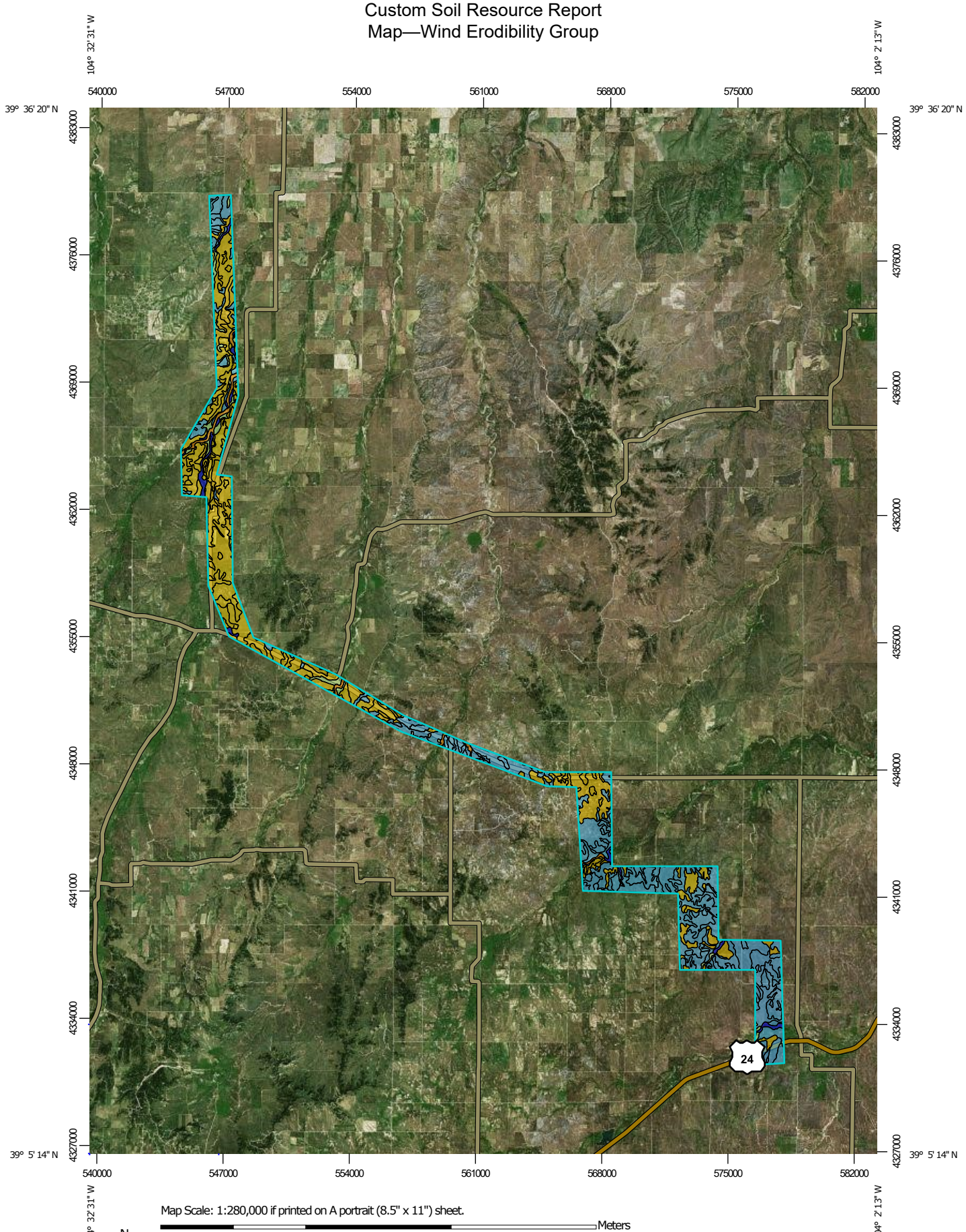
Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Wind Erodibility Group

A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

Custom Soil Resource Report
Map—Wind Erodibility Group



Map Scale: 1:280,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 4000 8000 16000 24000

Feet: 0 10000 20000 40000 60000

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 Rating Polygons

1
2
3
4
4L
5
6
7
8
Not rated or not available

Soil Rating Lines

1
2
3
4
4L
5
6
7
8
Not rated or not available

Soil Rating Points

1
2
3
4
4L
5
6
7
8
Not rated or not available

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.

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: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

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.

Table—Wind Erodibility Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Baca-Wiley loams, 0 to 4 percent slopes	6	107.9	0.5%
4	Bluerim-Peyton sandy loams, 8 to 20 percent slopes	3	0.4	0.0%
5	Bresser sandy loam, 0 to 4 percent slopes	3	1,345.4	5.7%
6	Bresser sandy loam, cool, 5 to 9 percent slopes	3	5,056.8	21.5%
7	Bresser-Cushman complex, 4 to 20 percent slopes	3	1,178.4	5.0%
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	3	831.1	3.5%
9	Bresser-Truckton sandy loams, 8 to 25 percent slopes	3	1,720.1	7.3%
13	Cushman loam, 0 to 4 percent slopes	6	129.6	0.5%
14	Cushman-Ascalon complex, 4 to 15 percent slopes	6	2,558.9	10.9%
16	Cushman-Kutch complex, 8 to 25 percent slopes	6	2,030.9	8.6%
19	Ellicott loamy coarse sand, 0 to 4 percent slopes	2	426.9	1.8%
22	Haplustolls, moderately coarse, nearly level*	8	520.7	2.2%
23	Haplustolls, loamy, nearly level*	4L	509.0	2.2%
24	Heldt clay loam, 0 to 3 percent slopes	6	713.6	3.0%
29	Kutch clay loam, 0 to 4 percent slopes	6	209.3	0.9%
30	Kutch clay loam, 4 to 8 percent slopes	6	2,263.0	9.6%
31	Kutch-Louviers complex, 8 to 25 percent slopes	6	490.6	2.1%
32	Nunn clay loam, 0 to 4 percent slopes	6	1,578.5	6.7%
35	Peyton-Elbeth sandy loams, 8 to 25 percent slopes	3	150.2	0.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
38	Renohill clay loam, 4 to 8 percent slopes	6	131.3	0.6%
39	Renohill-Louviers complex, 8 to 25 percent slopes	6	213.0	0.9%
40	Torriorthents-Rock outcrop complex, steep	6	41.8	0.2%
41	Truckton sandy loam, 3 to 9 percent slopes	3	781.0	3.3%
42	Truckton-Renohill complex, 8 to 25 percent slopes	3	0.5	0.0%
43	Weld loam, 0 to 4 percent slopes	6	324.0	1.4%
44	Weld loam, 4 to 8 percent slopes	6	122.2	0.5%
45	Wiley-Baca loams, 4 to 8 percent slopes	4L	110.5	0.5%
47	Water		21.6	0.1%
Totals for Area of Interest			**23,569.4**	**100.0%**

Rating Options—Wind Erodibility Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

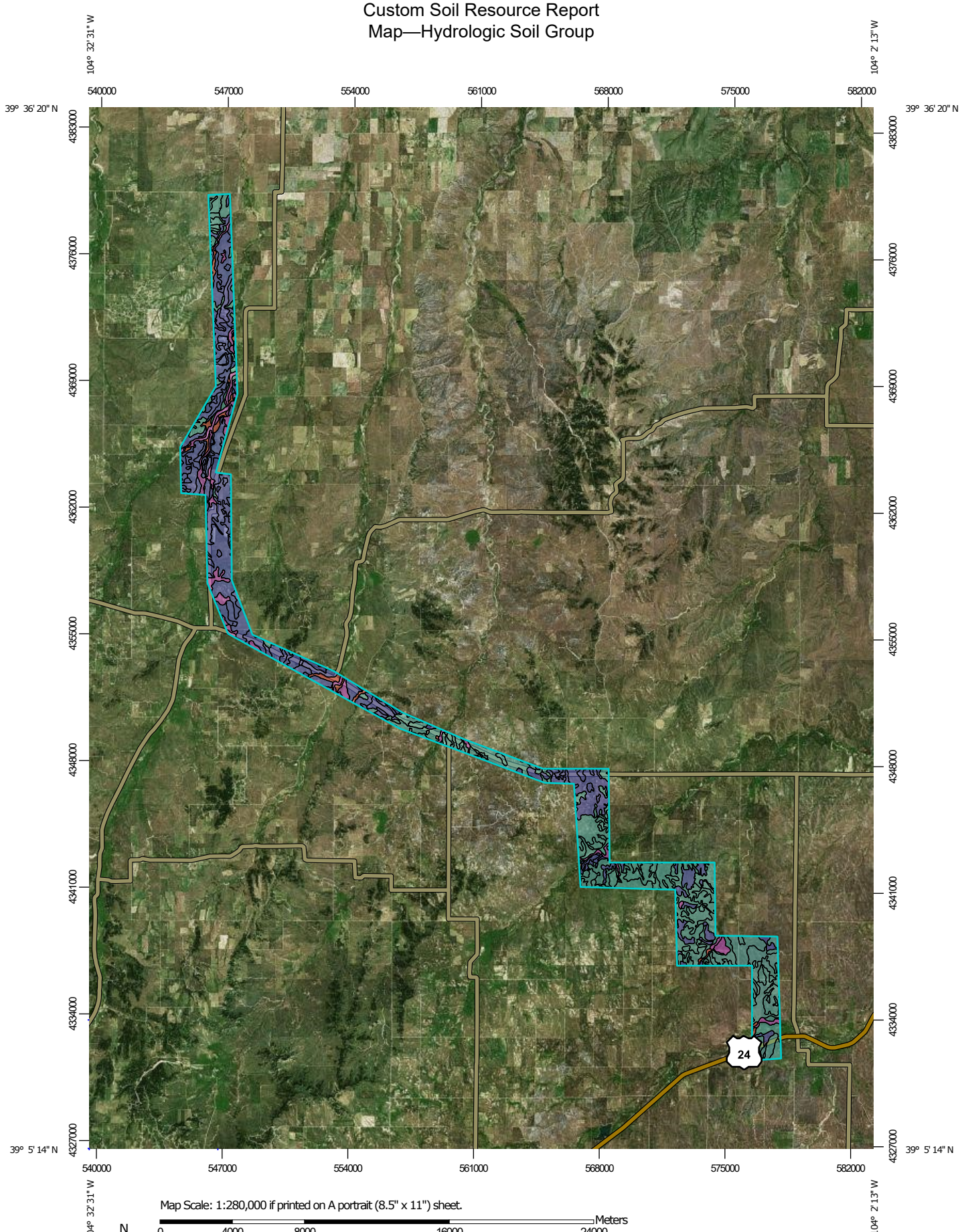
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:280,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 4000 8000 16000 24000

Feet: 0 10000 20000 40000 60000

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Elbert County, Colorado, Western Part
Survey Area Data: Version 20, Aug 29, 2024

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

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Baca-Wiley loams, 0 to 4 percent slopes	B	107.9	0.5%
4	Bluerim-Peyton sandy loams, 8 to 20 percent slopes	C	0.4	0.0%
5	Bresser sandy loam, 0 to 4 percent slopes	B	1,345.4	5.7%
6	Bresser sandy loam, cool, 5 to 9 percent slopes	B	5,056.8	21.5%
7	Bresser-Cushman complex, 4 to 20 percent slopes	B	1,178.4	5.0%
8	Bresser-Stapleton sandy loams, 8 to 25 percent slopes	B	831.1	3.5%
9	Bresser-Truckton sandy loams, 8 to 25 percent slopes	B	1,720.1	7.3%
13	Cushman loam, 0 to 4 percent slopes	C	129.6	0.5%
14	Cushman-Ascalon complex, 4 to 15 percent slopes	C	2,558.9	10.9%
16	Cushman-Kutch complex, 8 to 25 percent slopes	C	2,030.9	8.6%
19	Ellicott loamy coarse sand, 0 to 4 percent slopes	A	426.9	1.8%
22	Haplustolls, moderately coarse, nearly level*	A	520.7	2.2%
23	Haplustolls, loamy, nearly level*	D	509.0	2.2%
24	Heldt clay loam, 0 to 3 percent slopes	C	713.6	3.0%
29	Kutch clay loam, 0 to 4 percent slopes	C	209.3	0.9%
30	Kutch clay loam, 4 to 8 percent slopes	C	2,263.0	9.6%
31	Kutch-Louviers complex, 8 to 25 percent slopes	C	490.6	2.1%
32	Nunn clay loam, 0 to 4 percent slopes	C	1,578.5	6.7%
35	Peyton-Elbeth sandy loams, 8 to 25 percent slopes	B	150.2	0.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
38	Renohill clay loam, 4 to 8 percent slopes	C	131.3	0.6%
39	Renohill-Louviers complex, 8 to 25 percent slopes	C	213.0	0.9%
40	Torriorthents-Rock outcrop complex, steep	D	41.8	0.2%
41	Truckton sandy loam, 3 to 9 percent slopes	A	781.0	3.3%
42	Truckton-Renohill complex, 8 to 25 percent slopes	B	0.5	0.0%
43	Weld loam, 0 to 4 percent slopes	C	324.0	1.4%
44	Weld loam, 4 to 8 percent slopes	C	122.2	0.5%
45	Wiley-Baca loams, 4 to 8 percent slopes	B	110.5	0.5%
47	Water		21.6	0.1%
Totals for Area of Interest			**23,569.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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