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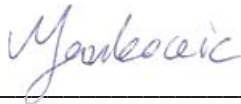
Prepared for:
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Date: 12-25-2025

Job number: 2023-11-1-Varko
PCD File No. PPR2527

SWMP Engineer’s Statement

The attached SWMP report and supporting information were prepared under my responsible charge and they comport with the standard of care. So far as is consistent with the standard of care, said report was prepared in general conformance with the criteria established by the County for SWMP and the Mile High Flood District.



Milan Jankovic, M.S., P.E #44321



02/22/2026

Date

Developer’s Statement

I, the Developer, have read and will comply with all commitments made on my behalf within this report.



Andrii Varko, Owner Developer
1185 N Curtis Rd
Colorado Springs, CO 80401

02/22/2026

Date

Prepared by:



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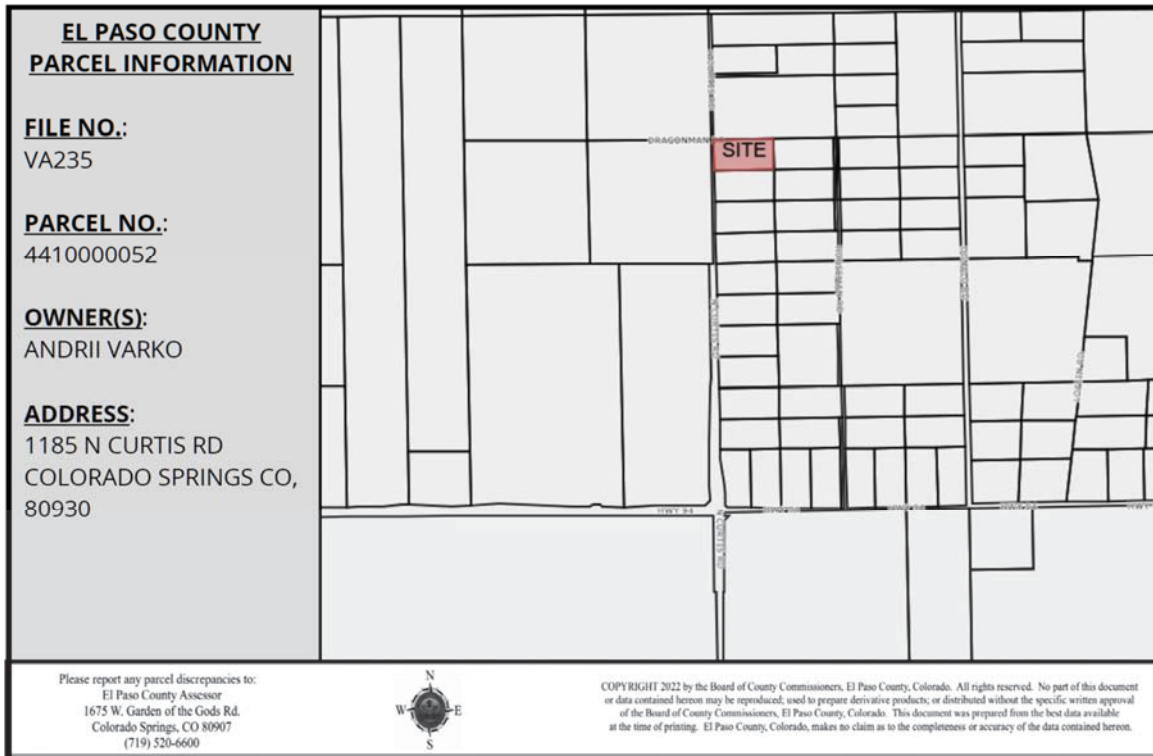
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Attachments:

- APPENDIX A – EROSION CONTROL PLANS
- APPENDIX B – ESQCP STORMWATER PERMIT FORM
- APPENDIX C – USDA SOIL REPORT
- APPENDIX D – INSPECTION CHECKLIST
- APPENDIX E – OPERATION AND MAINTENANCE MANUAL

Vicinity Map

The proposed RV and mixed storage development (herein known as the Site) is located at 1185 North Curtis Road, at the intersection of Dragonman Drive and North Curtis Road. (Parcel No. 4410000052, Commissioner District No. 2). The legal description of the property is the north one-half of the northwest quarter of the southwest quarter of the northwest quarter of section 10, township 14 south, range 64 west of the 6th principal meridian, excepting therefrom the westerly 30 feet for Curtis Road, in El Paso County, Colorado.



Vicinity Map

Description of Stormwater Management Plan (SWMP) General Requirements

The Federal Clean Water Act and the Colorado Water Quality Control Act require stormwater discharge permits during construction at development sites that disturb one or more acres of land. This development is less than 5 acres and the project will disturb 2 acres of land.

A. Colorado Department of Public Health and Environment (CDPHE) General Requirements

Per CDPHE General Permit Stormwater Discharges Associated with Construction Activity (Construction Stormwater Permit) and Authorization to Discharge Under the Colorado Discharge Permit System (CDPS),

1. A stormwater management plan (SWMP) shall be developed for each construction site covered by the Construction Stormwater Permit prior to commencement of

construction activities. For public emergency related a site plan shall be created no later than days after the commencement of construction activities.

2. The SWMP shall be prepared in accordance with good engineering, hydrologic and pollution control practices.
3. The permittee need only submit the SWMP to the CDPHE upon request, it is not required with the application for the Construction Stormwater Permit.
4. The permittee must implement the provisions of the SWMP as written and updated, from commencement of construction activity until final stabilization is complete.
5. A copy of the SWMP must be retained onsite or be onsite when construction activities are occurring at the site unless the permittee specifies another location and obtains approval from the CDPHE.

B. Signatory Requirements for Documents Submitted to the CDPHE

Documents required for submittal to the CDPHE in accordance with the Construction Stormwater Permit, including applications for permit coverage and other documents as requested by the CDPHE, 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.

“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.”

Applicant/Owner
Andrii Varko

Operator

C. Consistency with Other Plans

The permittee may incorporate, by reference, applicable portions of plans prepared for other purposes at their facility. Plans or portions of plans incorporated by reference must be available along with the SWMP, the Erosion Control Plans are located under **Appendix A**.

D. Required SWMP Modifications

At nearly every site, the implemented control measures will have to be modified to adapt to changing site conditions, or to ensure that potential pollutants are consistently and properly managed. The pollutant sources and management practices at a site must be reviewed on an ongoing basis. When control measures or other site conditions change, the SWMP must be modified to accurately reflect the actual field conditions. Examples include, but are not limited to, removal of control measures, identification of new potential pollutant sources, addition of control measures, modification of control measure installation and implementation criteria or maintenance procedures, and changes in items included in the site map and/or description. The plan should be viewed as a living document that is continuously being reviewed and modified as part of the overall process of assessing and managing stormwater quality issues at the site.

The SWMP must be amended when the following occurs:

- A change in design, construction, operation, or maintenance of the site requiring implementation of new or revised control measures;
- The plan proves ineffective in controlling pollutants in stormwater runoff in compliance with the permit conditions;
- Control measures identified in the SWMP are no longer necessary and are removed; and
- Corrective actions are taken onsite that result in a change to the SWMP.

For SWMP revisions made prior to or following a change(s) onsite, including revisions to sections addressing site conditions and control measures, a notation must be included in the plan that identifies:

- The date of the site change, the control measure removed, or modified,
- The location(s) of those control measures, and
- Any changes to the control measures(s).

The permittee must ensure the site changes are reflected in the SWMP. The permittee is noncompliant with the Construction Stormwater Permit until the plan revisions have been made.

II. Stormwater Management Plan Requirements

A. Qualified Stormwater Manager

An individual knowledgeable in the principles and practices of erosion and sediment control and pollution prevention, and with the skills to assess conditions at construction sites that could impact stormwater quality and to assess the effectiveness of stormwater controls implemented to meet the requirements of this permit.

B. Spill Prevention and Response Plan

Procedures for preventing, responding to and reporting spills and leaks.

1. Stored soils shall be kept in a designated area on the SWMP away from drainage areas.
 - a. Soil Storage will not be occurring on this site; all soil shall be hauled away or compacted in fill areas immediately.
2. Vehicle Tracking of Sediment
 - a. A vehicle tracking control pad shall be installed at all entrances to the staging areas.
3. Management of Contaminated soils
 - a. Contaminated soil shall be removed from the site and treated as required.
 - b. Soil shall be contained by earth dike during removal.
4. Loading and unloading operations
 - a. All loading and unloading activities shall be in the stabilized staging area as designated on the SWMP
5. Outdoor storage area
 - a. Chemical storage shall be in the area designated on the SWMP.
 - b. Storage area shall have a covered enclosure to protect area.
 - c. Any and all hazardous materials used will be contained in an area specified by the contractor, and Material Safety Data Sheets (MSDS) will be available for inspection at any point during construction.
6. On-site waste management
 - a. All waste piles, dumpster, etc. shall be contained in the chemical storage area designated on the SWMP.
7. Concrete truck/equipment washing
 - a. A concrete washout area will be constructed at the staging area and constructed according to the Mile-Hi Flood District.
8. Vehicle Equipment
 - a. Fueling and vehicular maintenance will be performed on the jobsite as needed, but there will be limited storage of vehicles on site.
 - b. A secondary berm area shall be constructed to contain any spills that may occur.
9. Significant dust or particulate generating processes
 - a. Potable water shall be used to prevent airborne particulate matter.
10. Routine maintenance activities involving fertilizers, pesticides, detergents, fuel, solvents, oils, etc.
 - a. Routine maintenance activities shall be conducted in the chemical storage area if possible
 - b. If conducted outside of the chemical storage area, then care should be taken to minimize the potential pollutant with the use of ground cover over dirt areas, such as tarps
11. Wastes from geo-technical testing
 - a. All testing waste shall be removed from the site and/or disposed of in appropriate waste disposal containers.
12. Non-industrial waste sources – worker trash, portable toilets, etc.
 - a. Worker trash shall be placed in appropriate trash receptacles.

- b. Daily site inspection should be conducted to ensure site is free from trash.
- c. All portable toilets shall be secured to the ground to insure against tip over.

Should any spills occur, the SWMP administrator must take appropriate measures to assure complete, proper and legal cleanup.

1. For non-hazardous materials such as gasoline, paint, or oil that may be spilled in small quantities, the following measures shall be implemented:
 - a. Personal safety is the primary importance
 - b. Use absorbent materials to contain spills and clean the area of residuals.
 - c. Dispose of the absorbent material, soil, and/or rotomill properly.
 - d. Do not hose down spill area with water.
2. For non-hazardous materials that qualify as a significant spill, the following measures shall be implemented:
 - a. Contact the Colorado Department of Public Health and Environment (CDPHE) 24-hour Environmental Emergency Spill Reporting Line (1-877-518-5608) within 24 hours of the spill event. A written notification to CDPHE is necessary within 5 days.
 - b. Contact the Qualified Stormwater Manager.
 - c. Clean up spills immediately. Use absorbent materials if the spill is on an impermeable surface. Construct a slightly compacted earth dike to contain a spill on dirt areas. If rainfall is present at the time of the spill, cover the spill with a tarp to prevent contaminating runoff.
3. For spills involving hazardous materials, the following measures shall be implemented:
 - a. Personal safety is the primary importance. Stay upwind and at a safe distance/secure the area from anyone being harmed.
 - b. Contact the local emergency response team by dialing 911.
 - c. Contact the Colorado Department of Public Health and Environment (CDPHE) 24-hour Environmental Emergency Spill Reporting Line (1-877-518-5608) within 24 hours of the spill event. A written notification to CDPHE is necessary within 5 days.
 - d. Contact the Qualified Stormwater Manager.
 - e. A licensed contractor or a Hazmat team shall be used to properly clean up spills

C. Materials Handling

Control measures implemented at the site to minimize impacts from handling significant materials that could contribute pollutants to runoff:

1. Stabilized Staging Area – clearly designated area on the main project site, where construction equipment and vehicles, and other materials are stored.

D. Potential Sources of Pollution

Potential pollutant sources for this site include the following:

1. All disturbed and stored soils – to be mitigated by the use of silt fence, seeding and mulching, and erosion control blankets;

2. Vehicle tracking of sediments - to be mitigated by vehicle tracking control measures at the entrances to the main project site;
3. Management of contaminated soils – not anticipated for this site;
4. Loading and unloading operations – to be mitigated by use of a designated stabilized staging area;
5. Outdoor storage activities (building materials, fertilizers, chemicals, etc.) – to be mitigated by use of designated stabilized staging area;
6. Vehicle and equipment maintenance and fueling – to be mitigated by use of a designated stabilized staging area;
7. Significant dust or particulate generating processes – to be mitigated by watering as needed;
8. Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc. – to be mitigated by limiting use and proper storage within the stabilized staging area;
9. Onsite waste management practices (waste piles, liquid wastes, dumpsters, etc.) – to be mitigated by having a designated location for waste;
10. Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment – Concrete Washout Pit;
11. Dedicated asphalt and concrete batch plants – not anticipated for this site;
12. Non-industrial waste sources such as worker trash and portable toilets – to be mitigated by having a designated location for each;
13. Other areas or procedures where potential spills can occur – to be mitigated by having a spill procedure in place and containment provided by silt fencing around the site.

The ESQCP Stormwater Permit Form is show in **Appendix B** of this report.

E. Implementation of Control Measures

1. Structural Practices for Erosion and Sediment Control:
 - a. Sediment Control Log (SCL) – a sediment barrier designed to intercept sheet flow runoff from disturbed areas.
 - b. Silt Fence (SF) – a temporary sediment control practice consisting of a geotextile fabric attached to wooden or steel posts, used along the downslope perimeter of disturbed areas. The silt fence allows stormwater to pass through while capturing suspended soil particles and preventing offsite sediment transport. Installed with the bottom edge trenched into the soil, silt fences are designed for sheet flow areas and require regular inspection and maintenance during construction activities.
 - c. Sediment Basin (SB) – A temporary basin to collect runoff and allow for sedimentation removal from runoff.
2. Non-Structural Practices for Erosion and Sediment Control:
 - a. Limiting disturbance of vegetated and stabilized existing site area.
 - b. Phased construction plan to limit exposed, non-stabilized land to smaller portions at a time. Grading will begin from the east property line and move

west. Geogrid and gravel surfacing will follow immediately to stabilize the disturbed land quickly.

3. Phased Implementation

- a. Pre-disturbance and Site Access Phase (Initial Phase) include SCL and vehicle tracking control (VTC) at site entrances, concrete washout, stabilized staging area, sediment basins, and silt fence. Follow the sequence:
 - i. Site Fencing Phase – Install permanent site fence on the property line with minimum land disturbance with stabilized staging area and vehicle tracking control in place. (Start: 04/01/26, Completion: 05/01/26)
 - ii. Grading Phase – Sediment control log, silt fence, and sediment basins must be in place prior to any grading activities. The vehicle tracking control and stabilized staging area shall remain in place during grading. Grading to be performed per the grading plans. (Start: 05/01/26, Completion: 06/01/26)
 - iii. Infiltration Area – construct infiltration areas S, N, and N2 per plans. Infiltration areas S and N replace the temporary sediment basins. All other control measures to this point to remain in place including, vehicle tracking control, stabilized staging area, sediment control log, and silt fence. (Start: 06/01/26, Completion: 07/01/26)
 - iv. Landscaping – Install all perimeter landscaping and landscape cover per the landscaping plans. All control measures to this point to remain in place including, vehicle tracking control, stabilized staging area, sediment control log, and silt fence. (Start: 07/01/26, Completion: 07/15/26)
 - v. Lot Cover – Install geotextile and geogrid, and place road base cover on interior storage area and drive aisles, per the site development and landscaping plans. All control measures to this point to remain in place including, vehicle tracking control, stabilized staging area, sediment control log, and silt fence. (Start: 07/15/26, Completion: 08/01/26)
 - vi. Concrete Driveway – Concrete washout area shall be in place in addition to all previous BMPs prior to start of concrete driveway construction. (Start: 08/01/26, Completion: 08/15/26)
 - vii. Site Entrance Gate – Construct the site access gate. VTC and concrete washout area can be removed. All other control measures to this point to remain in place including, stabilized staging area, sediment control log, and silt fence. (Start: 08/15/26, Completion: 09/01/26)
 - b. Final Stabilization Phase (Final Phase) includes road base or gravel over some of the disturbed area, seeding and mulching disturbed areas not covered by gravel, and removing all temporary control measures (SF, VTC, SCL, CWA) when site has reached final stabilization. (Final Stabilization: 09/01/2027)
4. Vehicle Tracking Control will be implemented during the initial phase at the site entrance to help remove sediment from vehicles, reducing tracking onto paved surfaces.

5. Wind Erosion / Dust Control – site watering will be utilized throughout construction to keep soil particles from entering the air.
6. Groundwater and Stormwater Dewatering - dewatering is not anticipated for this site.
7. No allowable non-stormwater discharges are anticipated for this site during or after construction.

F. Site Description

The subject property, located at 1185 N Curtis Road in Colorado Springs, El Paso County, Colorado, is situated within the Black Squirrel Creek watershed, a major tributary of Chico Creek, which ultimately flows southward into the Arkansas River. Black Squirrel Creek originated in the rolling terrain east of Colorado Springs and conveys stormwater through a combination of natural channels and constructed conveyance systems before joining Fountain Creek near the city of Fountain. The overall watershed is characterized by a mix of rural residential development, agricultural lands, open prairie, and localized commercial development along transportation corridors.

Topographically, the project exhibits a gentle slope descending from the northwest to the southeast. Site elevations range from 6408 ft on the northwest corner of the site to a low point of 6388 ft at the northeast and southeast ends, where all site flows drain out off of the property. This topography facilitates overland sheet flow toward the southeast. This sub-basin is generally characterized by gentle slopes, permeable soils with moderate infiltration capacity, and limited storm sewer infrastructure. As a result, localized stormwater runoff is primarily managed through open channel and roadside conveyance features. Downstream facilities are designed to accept stormwater from surrounding low-density development and convey flows safely toward Black Squirrel Creek without causing adverse impacts.

The site design incorporates low-impact development (LID) strategies, including areas of pervious crushed granite surfacing, landscaping, and infiltration facilities sized to capture stormwater. These measures are intended to reduce peak flow rates, promote infiltration, and mitigate potential downstream impacts to the Black Squirrel Creek watershed

- Site Acreage
 - Total Site Area = 4.79 ac
 - Total Proposed Disturbed Area = 2.2 ac
- Existing Site Condition
 - The existing site consists of a single-family residential house and vegetated grassy prairie. Existing ground cover consists of grass and a road base gravel approach driveway. Stormwater discharges to the north and south property lines.
 - There are no known significant geologic features within the project area.
 - Stormwater runoff from the site ultimately discharges via Black Squirrel Creek to Chico Creek, a tributary of the Arkansas River, the ultimate receiving state water.

- Site Cover:
 - The site is located within a rural residential meadow characterized by native shortgrass prairie vegetation on sandy loam soils (USDA Hydrologic Soil Group B). Existing vegetative cover consists primarily of blue grama, western wheatgrass, and native meadow grasses, with intermittent areas of exposed soil typical of semi-arid grasslands.
 - Based on field observation and aerial imagery review, the site exhibits approximately 75% native vegetative cover and 25% bare soil, which is consistent with undisturbed shortgrass prairie conditions in eastern El Paso County.
 - Percent cover was determined through visual site assessment of representative areas within the parcel and confirmation using scaled aerial imagery to estimate the ratio of vegetated surface area to exposed soil.
- Proposed Site Cover
 - Lot Coverage: 48% vegetation, 49.5% gravel, 1.25% paved, 1.25% roof
 - Percent Impervious: 48%
 - Percent impervious for the site was determined by calculating the ratio of impervious and pervious surface areas within the project limits. Surface areas were obtained directly from the CAD site plan drawings using closed polylines representing building footprints, paved drive aisles, parking areas, sidewalks, and other hardscape features classified as impervious cover. Landscaped areas, native vegetation, infiltration areas, and other undeveloped surfaces were classified as pervious cover.
 - The CAD-derived areas were summed and percent cover was calculated by dividing the total impervious area by the total site area. Percent cover values presented in the SWMP are consistent with the approved Site Development Plan and associated civil plan sheets.
- Soil Characteristics
 - The site contains sandy loams and loamy sands. The sandy loam on the site surface classifies as USDA Hydrologic Soil Group B soil. Group A and B soils are similar; they have a high to moderate infiltration rate when thoroughly wet according to USDA NRCS Web Soil Survey (**See Appendix C**). The field soil conductivity value is 0.409 inches per hour. Both soils are largely sands and silts and do not restrict downward movement of water very well, meaning these soils are pervious. Sandy loam soils generally exhibit moderate erodibility; the relatively high sand content and moderate infiltration capacity help reduce prolonged surface runoff compared to finer-textured Group C or D clays, but the limited cohesion still allows soil particles to be detached and transported under concentrated flow, especially on unprotected slopes. Under undisturbed, vegetated conditions, the erosion potential is typically low; however, during construction, when vegetation is removed and soils are exposed and trafficked, the risk of sheet, rill, and gully erosion increases significantly. For this site, the erosion potential will be

managed as low to moderate due to low slopes, and the SWMP incorporates BMPs such as minimizing disturbed areas, stabilizing exposed soils, using sedimentation basins, and using perimeter controls and check structures as needed to limit flow velocities and prevent transport of sandy loam particles off-site.

G. Site Map

See **Appendix A** for map of site and proposed BMP locations.

H. Final Stabilization and Long-term Stormwater Management

Final stabilization for the site will be achieved through the combination of gravel surfacing parking and storage area, native grass, and landscaped areas mulched with crushed rock and wood mulch. All disturbed areas will be stabilized through permanent surfacing or revegetation. After final stabilization, all temporary control measures will be removed.

The proposed design increases imperviousness of the site due to the creation of storage and parking areas. The additional runoff is captured and infiltrated in two main infiltration basins that provide water quality through acting as a settlement basin for sediment, provides some detention to allow for biological breakdown of any contaminants in the water, and it filters a portion of outflow through the soil and gabion structure. An auxiliary third infiltration basin is also proposed next to the north infiltration basin to fully capture all of the required runoff in this area. The infiltration basins infiltrate almost all of the runoff generated; hence the outflow is less than the historic runoff condition.

Long-term stormwater quality will be maintained by routing all surface flows over the previous crushed granite and mulched landscaping areas prior to exiting the site. These areas function as vegetated and mechanical filter strips, providing infiltration and filtration of sediment and pollutants. Runoff is treated through distributed low-impact development (LID) features that promote infiltration and mimic natural hydrology.

All stormwater from impervious surfaces is directed through pervious areas, allowing for passive treatment and flow attenuation. These pervious zones are expected to maintain long-term permeability and function due to their composition and grading. Periodic inspection and maintenance of the pervious surfaces, including checking for clogging and regrading mulch as needed, will be the responsibility of the property owner.

All disturbed areas not covered with gravel or mulch are to be revegetated with the same native seed mix of the existing vegetation (grass/prairie), be evenly distributed, perennial, and equal or exceed 70% coverage of what would have been provided by native vegetation (undisturbed areas). The required seed mix is provided in the table below and on the landscape plan.

Native Seed Mix: El Paso County Native Grass Mix - Sandy Loam / HSG B Sites

Species	% by Weight	PLS Rate (lbs/acre)
Western Wheatgrass (<i>Pascopyrum smithii</i>)	25%	4.0
Blue Grama (<i>Bouteloua gracilis</i>)	20%	1.5
Sideoats Grama (<i>Bouteloua curtipendula</i>)	20%	3.0
Sand Dropseed (<i>Sporobolus cryptandrus</i>)	15%	0.5
Thickspike Wheatgrass (<i>Elymus lanceolatus</i>)	10%	3.0
Indian Ricegrass (<i>Achnatherum hymenoides</i>)	10%	2.0

Application Method:

- Drill seed into a depth of ¼ to ½ inch on flat and gently sloping areas using a rangeland drill.
- Broadcast seeding is permitted only on slopes steeper than 3:1 or inaccessible areas; increase rate by 25% when broadcasting.
- Lightly drag, rake, or cultipack to improve seed-to-soil contact immediately after seeding.
- Seed immediately following final grading and prior to mulching.

Timing of Seeding:

- Spring: March 15th – June 15th
- Fall/Dormant: September 15th – February 28th
- Avoid seeding during prolonged freezing conditions or heavy precipitation.

Soil Preparation & Amendments:

- Prepare a seedbed free of clods >2 inches, uniformly firm, and lightly scarified.
- Add compost (Class I or II) at a rate of 5-10 tons/acre on areas with significant soil disturbance, cut/fill slopes, or where organic content is <2%.
- Fertilizer is not required for native dryland grasses and shall be avoided.

Mulching Specifications:

- Mulch Material 100% wood-fiber hydromulch, biodegradable, with approved tackifier.
 - Application Rate:
 - Hydromulch: 2,000 – 3,000 lbs/acre
 - Tackifier: 80 – 120 lbs/acre (guar-based or equivalent)
 - Application Method:
 - Apply immediately after seeding using a hydro-mulch machine.
 - Ensure uniform distribution and coverage.
 - Avoid application during strong winds.
- Alternative Mulch Type – Straw Mulch
 - Straw Type: Certified weed-free native grass or wheat straw.
 - Rate: 1.5 – 2 tons/acre
 - Anchoring:
 - Mechanically crimp to 2 – 3 inches depth where accessible
 - Apply tackifier at 80 – 120 lbs/acre when mechanical crimping is not feasible.

Stabilization is considered achieved when:

- Vegetation cover reaches 70% of adjacent undisturbed native areas
- Surface is fully stabilized with not visible erosion, rilling, or sediment migration
- All disturbed soils are permanently protected against erosion.

Reseed and re-mulch areas failing to establish adequate cover.

The site requires a total of three infiltration basins due to the increased imperviousness in the proposed RV and mixed storage area. This approach meets the requirements for final stabilization and post-construction stormwater management under CDPHE and El Paso County standards.

I. Site Inspection Reports

Inspection and maintenance should be performed on all control measures periodically and after every significant storm event. The minimum inspection schedule of the stormwater management system must be performed and documented at least every seven (7) days, and within twenty-four (24) hours of any precipitation or snowmelt event. If more frequent inspections are required to ensure that control measures are properly maintained and operated, the inspection schedule shall be modified accordingly.

A Site Inspection Report shall be completed for each inspection and shall include the printed name, signature, and date of signature of the Qualified Stormwater Manager (QSM) responsible for the inspection. Site Inspection Report forms are included in **Appendix D** of this report.

All stormwater records, including the approved SWMP, inspection reports, and corrective action documentation, shall be maintained on-site at the project location in a designated site office or construction trailer. Alternatively, records may be maintained electronically, provided they are immediately accessible on-site upon request by El Paso County or CDPHE inspectors. The Operation and Maintenance Manual is in **Appendix E** of this report.

Sincerely,



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References

1. Drainage Criteria Manual, Volumes 1-3, Urban Drainage and Flood Control District, Volumes 1 –August 2018; Volume 2 – September 2017; Volume 3 – April 2018.
2. Stormwater Management Plan Preparation Guidance, Colorado Department of Public Health and Environment, 2018.
3. NRCS. (June 2020). Web Soil Survey
4. <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>. – June, 2020
5. Mile High Flood District. (2021) October 27) Retrieved December, 4, 2023
6. United States Department of Agriculture, Natural Resources Conservation Service, Custom Soil Resource Report for Jefferson County, Colorado, May, 2021.
7. USGS Quad Map, Jefferson County, Colorado, 2022.

APPENDIX A – EROSION CONTROL PLANS

EROSION CONTROL PLAN – INITIAL CONDITION

1185 N Curtis Rd, Colorado Springs, CO 80930

THE NORTH ONE-HALF OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 10,
TOWNSHIP 14 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN,
EXCEPTING THEREFROM THE WESTERLY 30 FEET FOR CURTIS ROAD, IN EL PASO COUNTY, COLORADO.

Property tax schedule number: 4410000052

CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES.



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DESIGNED BY:
Milos Sheng

FILE NUMBER:
2319
JOB NUMBER:
2025-6-10-Var
PRINTED DATE:
02/10/2026

Revision No.	Date	Revised By	City Comments
1	10/16/25	TEL PASO	M.Lamido & E. Schindler

CLIENT:
ANDRII VARKO
1185 N CURTIS RD,
COLORADO SPRINGS, CO 80930
(786) 394-0094
ANDRIVARKO@GMAIL.COM

TITLE:
EROSION CONTROL PLAN

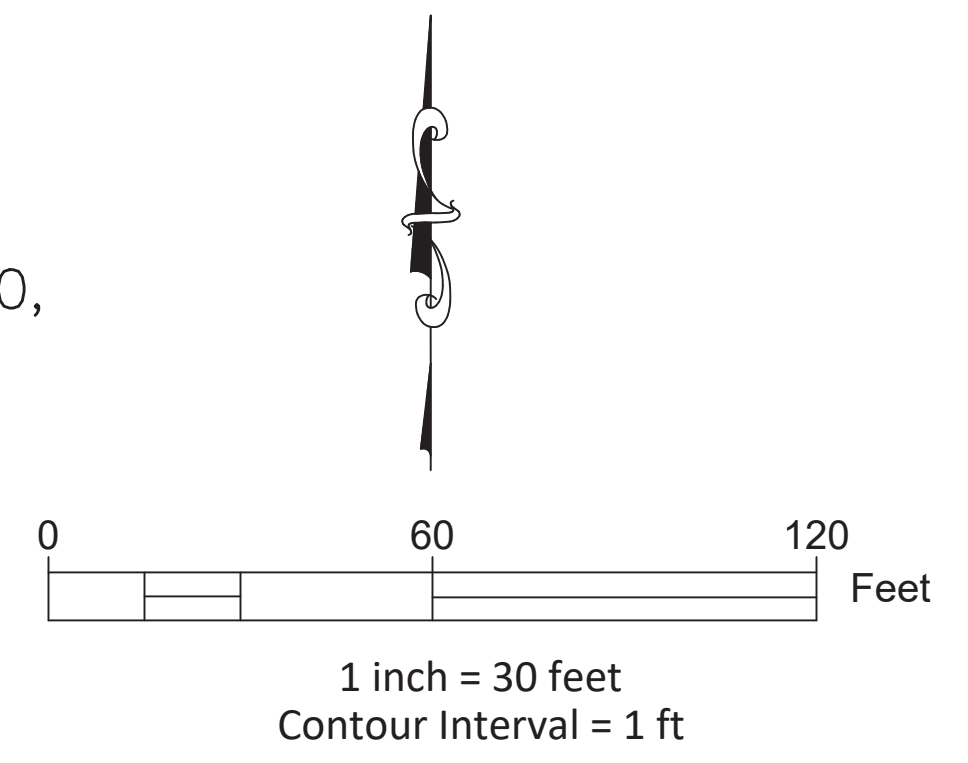
INITIAL CONDITION

PROJECT NAME:
SITE DEVELOPMENT PLAN

PROJECT ADDRESS:
1185 N Curtis Rd,
Colorado Springs,
CO 80930

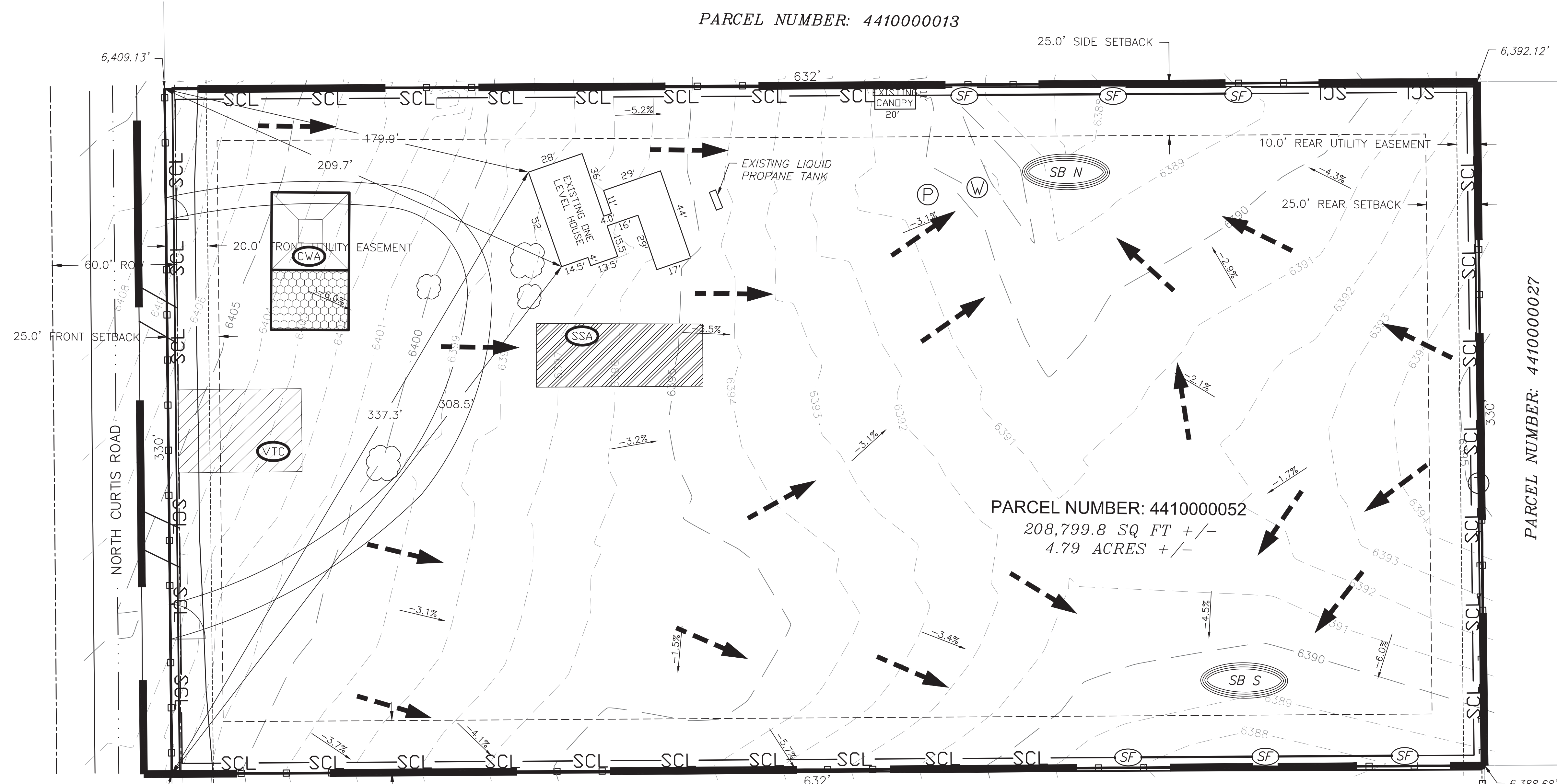
PARCEL NUMBER:
4410000052

SHEET NUMBER:
E-1



LEGEND

- PROPERTY LINE
- NEIGHBORING PROPERTY LINE
- SETBACK
- UTILITY EASEMENT
- EXISTING FENCE
- EXISTING GATE
- EXISTING FIBER OPTIC LINE
- EXISTING OVERHEAD ELECTRIC LINE
- EXISTING ELECTRIC TRANSFORMER
- EXISTING LIQUID PROPANE TANK
- EXISTING WATER WELL
- EXISTING MANHOLE TO WATER PRESSURE TANK
- EXISTING TREE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING SLOPE
- STABILIZED STAGING AREA (SSA)
- VEHICLE TRACKING CONTROL (VTC)
- CONCRETE WASHOUT AREA (CWA)
- SEDIMENT CONTROL LOG (SCL)
- PROPOSED SILT FENCE (SF)
- LIMITS OF CONSTRUCTION/DISTURBANCE (LOC)
- PROPOSED DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- SEDIMENT BASIN (SB)



PARCEL NUMBER: 4410000052
208,799.8 SQ FT +/-
4.79 ACRES +/-

SCHEDULE:

1. INSTALL ALL BMP AS SHOWN ON INITIAL EROSION CONTROL PLAN.
2. PERFORM SITE GRADING AND EXCAVATION.
3. CONSTRUCT DETENTION POND AND GRAVEL LOT SURFACING.
4. CONSTRUCT FENCE AROUND PROPERTY.
5. STABILIZE ALL BARE AREAS WITH LANDSCAPING AND NATIVE SEED MIX.
6. REMOVE VTC AND POUR CONCRETE DRIVEWAY.

OWNER STATEMENTS:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE EROSION AND STORMWATER QUALITY CONTROL PLAN.

[Signature] 2/22/2026
Andrii Varko Date

I ACKNOWLEDGE THE RESPONSIBILITY TO DETERMINE WHETHER THE CONSTRUCTION ACTIVITIES ON THESE PLANS REQUIRE COLORADO DISCHARGE PERMIT SYSTEM (CDPS) PERMITTING FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY.

[Signature] 2/22/2026
Andrii Varko Date

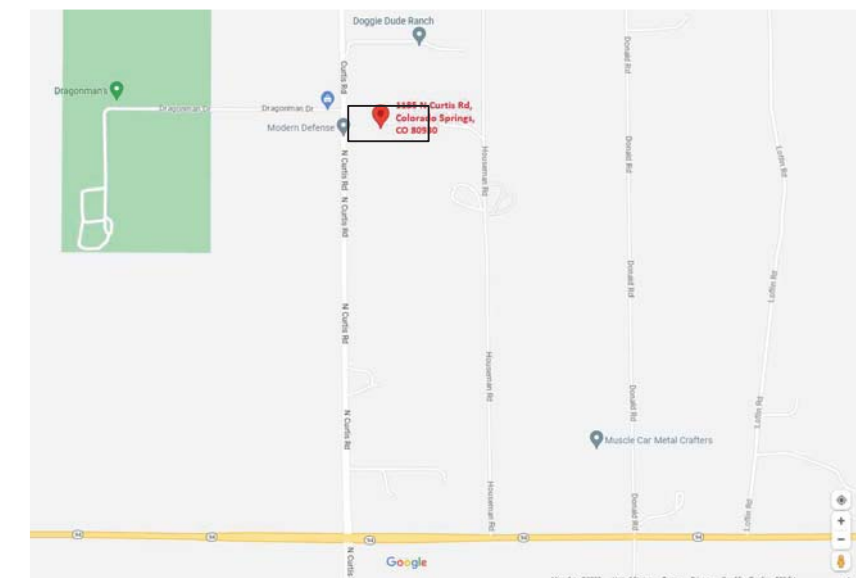
CAUTION - NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING IMPROVEMENTS AND UTILITIES AND SHALL REPAIR ANY DAMAGE AT HIS EXPENSE.

EX AND PR UTILITY LOCATIONS:

THE PLAN SHALL NOT SUBSTANTIALLY CHANGE THE DEPTH OF COVER, OR ACCESS TO UTILITY FACILITIES. ADDITIONALLY, THE PLAN SHALL NOT INCREASE OR DIVERT WATER TOWARDS UTILITY FACILITIES. ANY CHANGES TO UTILITY FACILITIES TO ACCOMMODATE THE PLAN, MUST BE DISCUSSED AND AGREED TO BY THE AFFECTED UTILITY PRIOR TO IMPLEMENTING THE PLAN. THE RESULTING COST TO RELOCATE OR PROTECT UTILITIES, OR PROVIDE INTERIM ACCESS IS AT THE EXPENSE OF THE PLAN APPLICANT.



LOCATION MAP

EROSION CONTROL PLAN – FINAL CONDITION

1185 N Curtis Rd, Colorado Springs, CO 80930

THE NORTH ONE-HALF OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 10,
TOWNSHIP 14 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN,
EXCEPTING THEREFROM THE WESTERLY 30 FEET FOR CURTIS ROAD, IN EL PASO COUNTY, COLORADO.

Property tax schedule number: 441000052

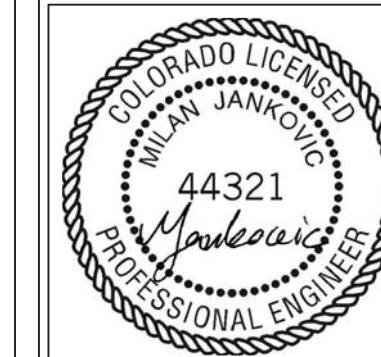
PARCEL NUMBER: 4410000013

PARCEL NUMBER: 4410000052

PARCEL NUMBER: 4410000027

PARCEL NUMBER: 4410000053

CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES.



MILOSHENG
engineering, s.c.
9235 W EUCLID AVE
LITTLETON, CO 80123
(720) 325-6876
MI@MILOSHENG.COM

DESIGNED BY:
MILOSHENG

FILE NUMBER:
2319

JOB NUMBER:
2025-6-10-Var

PRINTED DATE:
02/10/2026

No.	Date	Revised By	City Comments
1	10/16/25	TEL PASO	MI, Lamdo & E. Spohnhelli

CLIENT:
ANDRII VARKO
1185 N CURTIS RD,
COLORADO SPRINGS, CO 80930
(786) 394-0094
ANDRIVARKO@GMAIL.COM

TITLE:
EROSION CONTROL PLAN

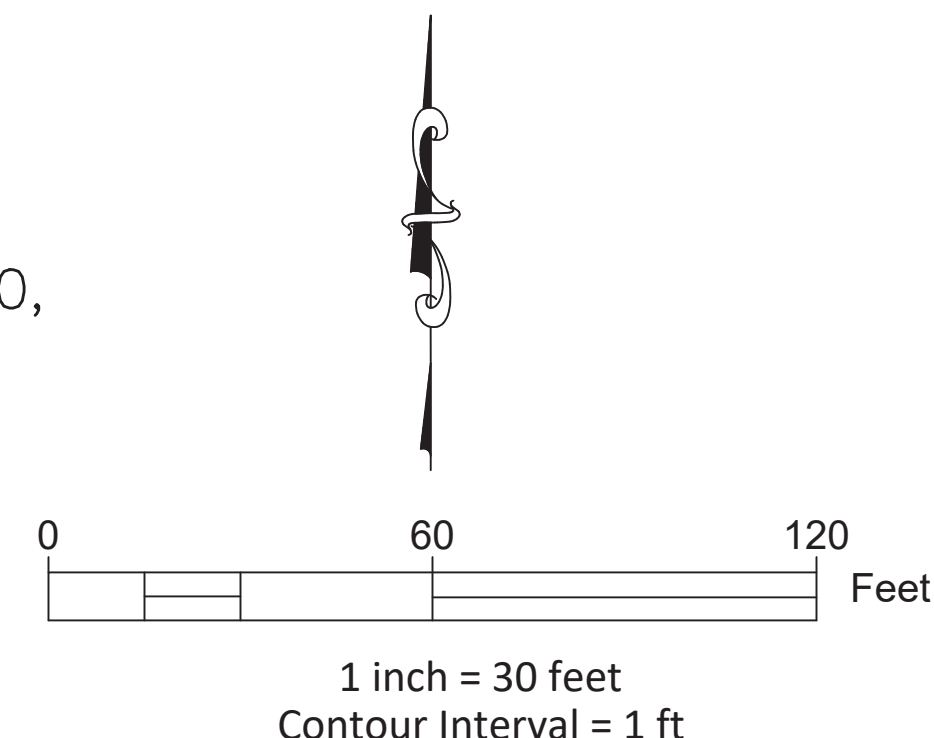
FINAL CONDITION

PROJECT NAME:
SITE DEVELOPMENT PLAN

PROJECT ADDRESS:
1185 N Curtis Rd,
Colorado Springs,
CO 80930

PARCEL NUMBER:
4410000052

SHEET NUMBER:
E-2

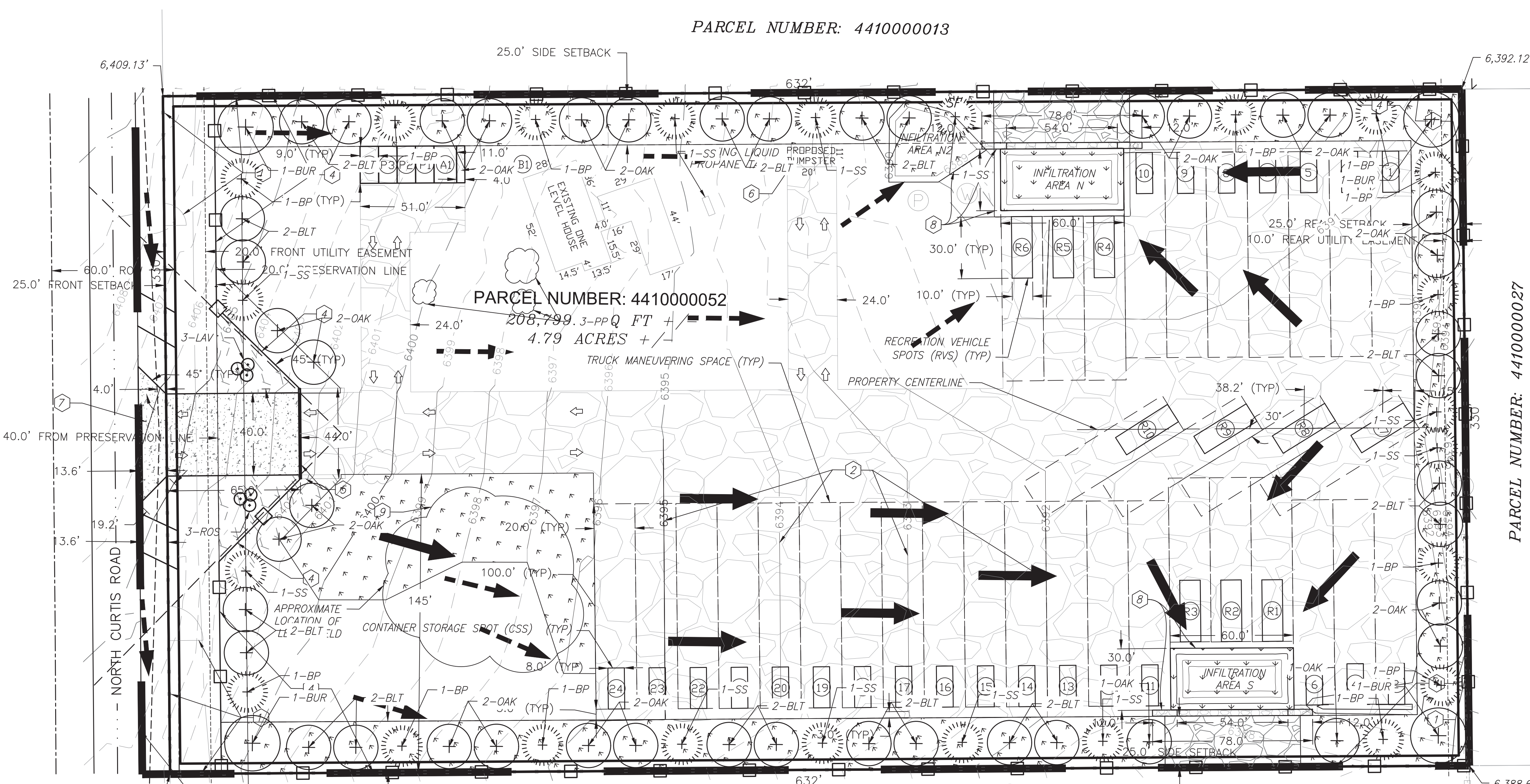


LEGEND

- PROPERTY LINE
- NEIGHBORING PROPERTY LINE
- SETBACK
- UTILITY EASEMENT
- EXISTING FENCE
- EXISTING GATE
- EXISTING FIBER OPTIC LINE
- EXISTING OVERHEAD ELECTRIC LINE
- EXISTING ELECTRIC TRANSFORMER
- EXISTING LIQUID PROPANE TANK
- EXISTING WATER WELL
- EXISTING MANHOLE TO WATER PRESSURE TANK
- EXISTING TREE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED FENCE
- PROPOSED GATE
- PROPOSED GRAVEL COVER (ROAD BASE)
- PROPOSED GABION RETAINING WALL
- PROPOSED SEEDED AREA
- PROPOSED CONCRETE OR ASPHALT DRIVEWAY

QTY.	SYM.	COMMON NAME	BOTANICAL NAME	SIZE / CONDITION
DECIDUOUS CANOPY TREES				
4	BUR	BUR OAK	QUERCUS MACROCARPA	2 1/2" CAL. SPECIMEN
EVERGREEN TREES				
13	BP	BOSNIAN PINE	PINUS HELDREICHII	6' HT. SPECIMEN
11	SS	SERBIAN SPRUCE	PICEA OMORICA	6' HT. SPECIMEN
TREES				
22	BLT	BLACK LOCUST TREE	ROBINIA PSEUDOACACIA	2 1/2" CAL. SPECIMEN
22	OAK	OAK	QUERCUS	2 1/2" CAL. SPECIMEN
SHRUBS				
3	ROS	ROSEMARY	SALVIA ROSMARINUS	#5 CONT.
3	LAV	LAVENDER	LAVANDULA	#5 CONT.
EXISTING TREES				
3	PP	PONDEROSA PINE	PINUS PONDEROSA	

- PROPOSED DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- LIMITS OF CONSTRUCTION/DISTURBANCE (LOC)



SCHEDULE:

- INSTALL ALL LANDSCAPING INCLUDING NATIVE SEEDING, TREE AND SHRUB PLANTING, AND COBBLE AND MULCH COVER.
- ENSURE ALL SEEDED AREAS ARE ESTABLISHED AS STABILIZED
- REMOVE ALL TEMPORARY BMPs INCLUDING SILT FENCE, SEDIMENT CONTROL LOG, CONCRETE WASHOUT, STAGING AREA, AND VTC.

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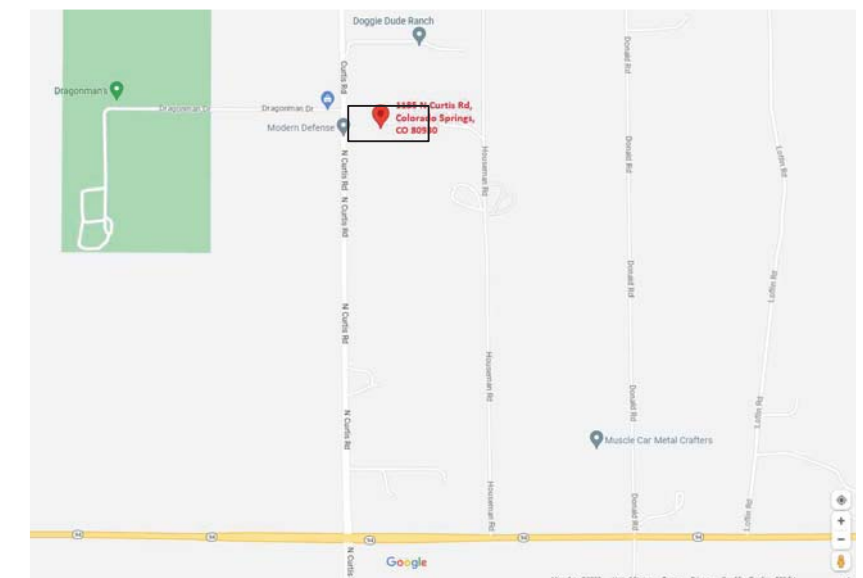
OWNER STATEMENTS:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE EROSION AND STORMWATER QUALITY CONTROL PLAN.

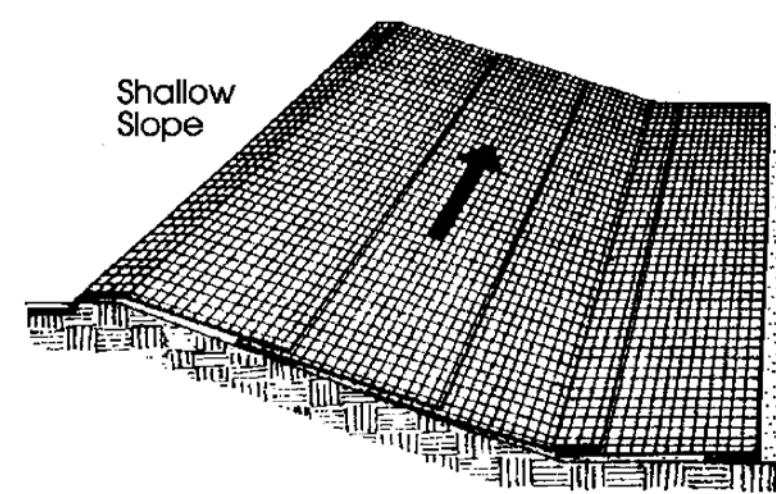
Andrii Varko
Date: 2/22/2026

I ACKNOWLEDGE THE RESPONSIBILITY TO DETERMINE WHETHER THE CONSTRUCTION ACTIVITIES ON THESE PLANS REQUIRE COLORADO DISCHARGE PERMIT SYSTEM (CDPS) PERMITTING FOR STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY.

Andrii Varko
Date: 2/22/2026

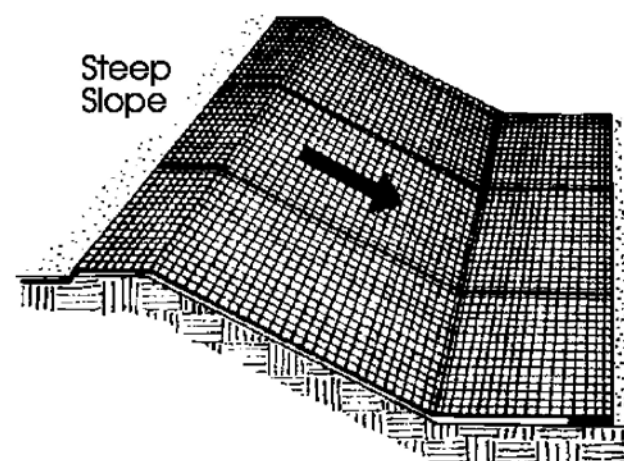


LOCATION MAP



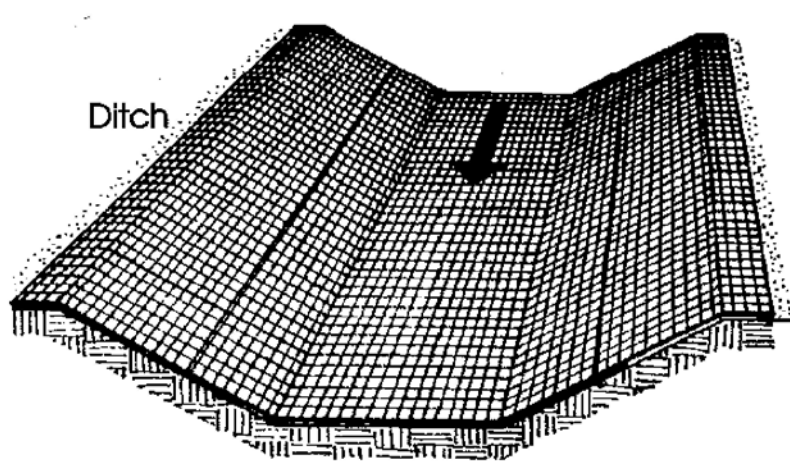
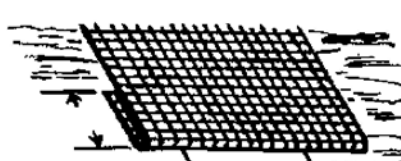
On shallow slopes, strips of netting may be applied across the slope.

Where there is a berm at the top of the slope, bring the netting over the berm and anchor it behind the berm.



On steep slopes, apply strips of netting parallel to the direction of flow and anchor securely.

Bring netting down to a level area before terminating the installation. Turn the end under 6" and staple at 12" intervals.



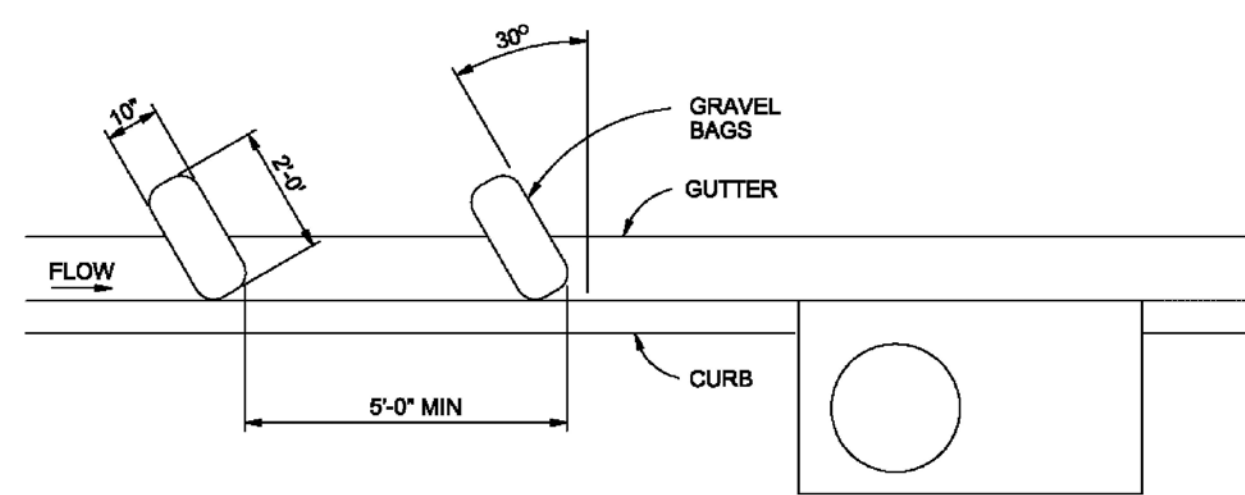
In ditches, apply netting parallel to the direction of flow. Use check slots every 15 feet. Do not join strips in the center of the ditch.

City of Colorado Springs
Storm Water Quality

Figure ECB-1
Erosion Control Blanket
Application Examples

From: Virginia Soil and Water Conservation Commission, 1985

DENM153722.CS.CDFigECB-16-49



CURB SOCK INLET PROTECTION

NTS

CURB SOCK INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.
2. SOCK IS TO BE MADE OF 1/4 INCH WIRE MESH (USED WITH GRAVEL ONLY) OR GEOTEXTILE.
3. WASHED SAND OR GRAVEL 3/4 INCH TO 4 INCHES IN DIAMETER IS PLACED INSIDE THE SOCK.
4. PLACEMENT OF THE SOCK IS TO BE 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.
5. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED AT A MINIMUM 5 FEET APART.
6. AT LEAST 2 CURB SOCKS IN SERIES IS REQUIRED.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL AND WEEKLY DURING PERIODS NO RAINFALL.
2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED OR REPLACED.
3. SEDIMENT SHALL BE REMOVED FROM BEHIND THE SOCK WHEN GUTTER WIDTH IS FILLED.
4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.

City of Colorado Springs
Stormwater Quality

Figure IP-4
Curb Sock Inlet Protection
Construction Detail and Maintenance
Requirements

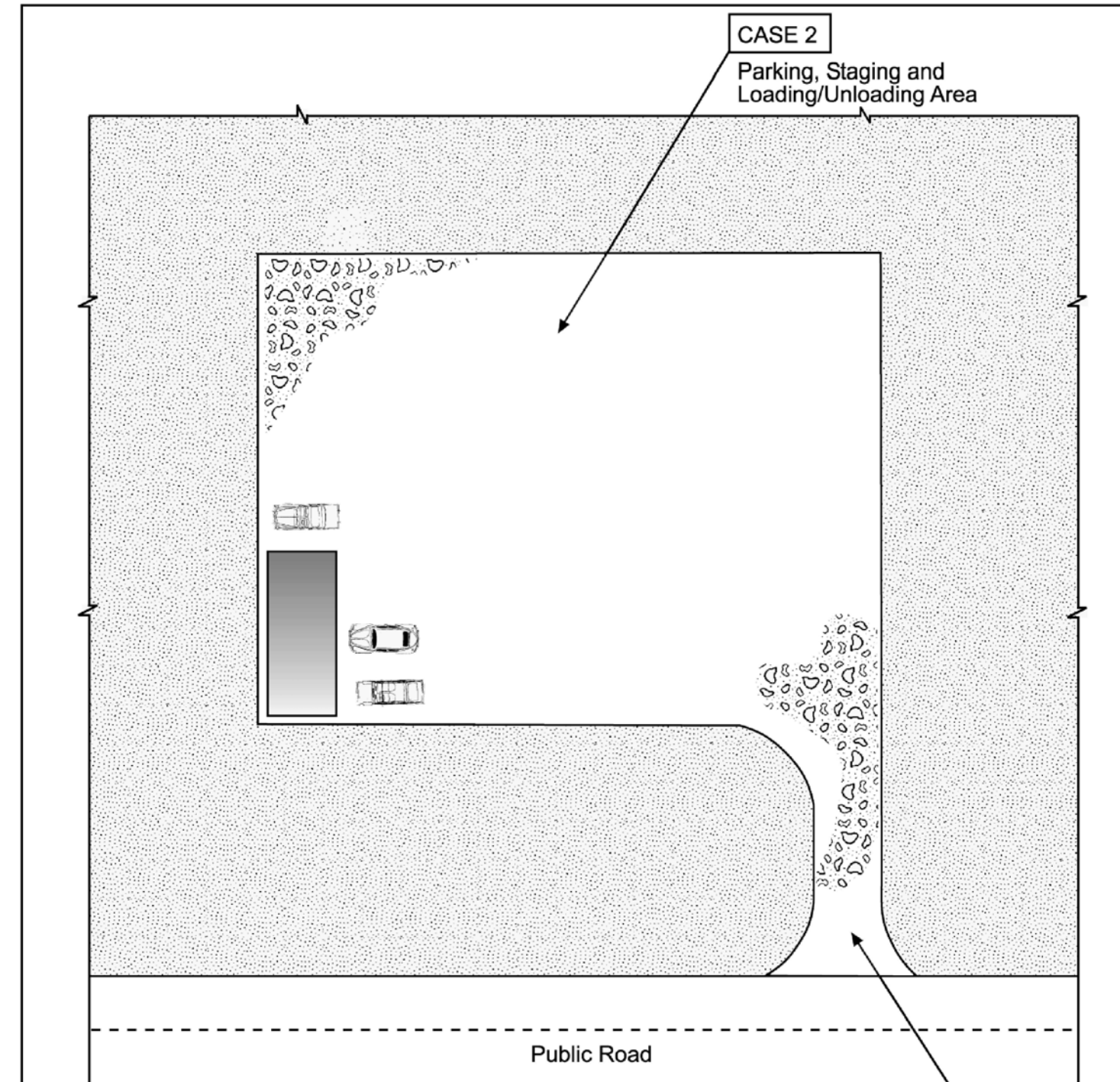


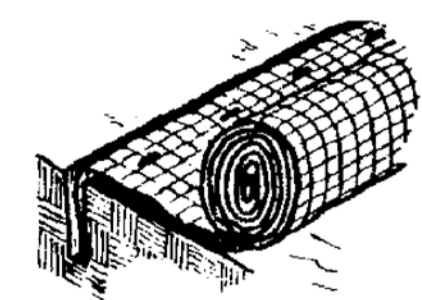
Table VT-1

	Case 1	Case 2
Gravel Thickness	9"	3"
Filter Fabric	YES	NO

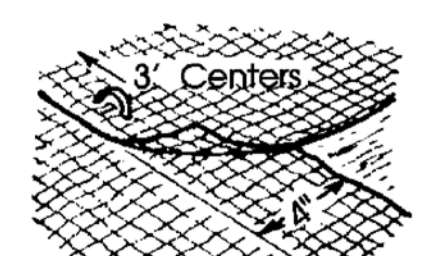
City of Colorado Springs
Storm Water Quality

Figure VT-1
Vehicle Tracking
Application Examples

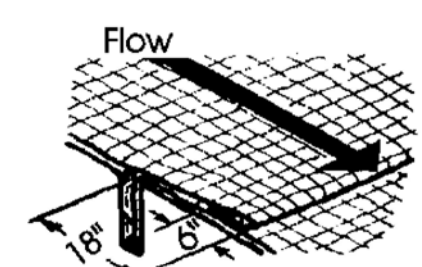
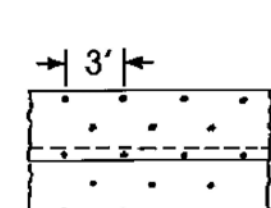
DENM153722.CS.CDFigVT-19-49



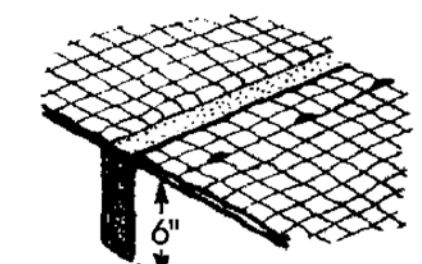
Anchor Slot: Bury the up-channel end of the net in a 6" deep trench. Tamp the soil firmly. Staple at 12" intervals across the net.



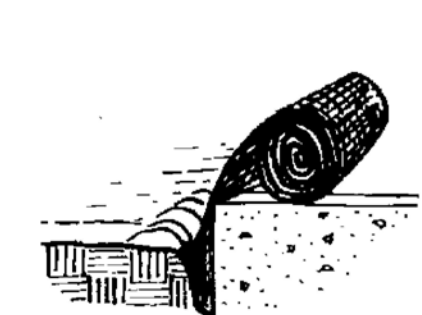
Overlap: Overlap edges of the strips at least 4". Staple every 3 feet down the center of the strip.



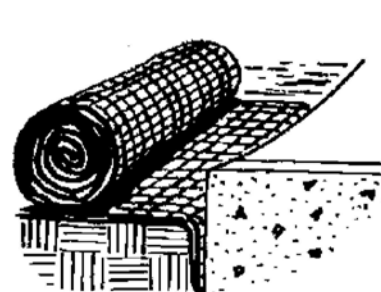
Joining Strips: Insert the new roll of net in a trench, as with the Anchor Slot. Overlap the up-channel side of the previous roll 18" and turn the end under 6". Staple the end of the previous roll just below the anchor slot and at the end at 12" intervals.



Check Slots: On erodible soils or steep slopes, check slots should be made every 15 feet. Insert a fold of the net into a 6" trench and tamp firmly. Staple at 12" intervals across the net. Lay the net smoothly on the surface of the soil - do not stretch the net, and do not allow wrinkles.



Anchoring Ends At Structures: Place the end of the net in a 6" slot on the up-channel side of the structure. Fill the trench and tamp firmly. Roll the net up the channel. Place staples at 12" intervals along the anchor end of the net.

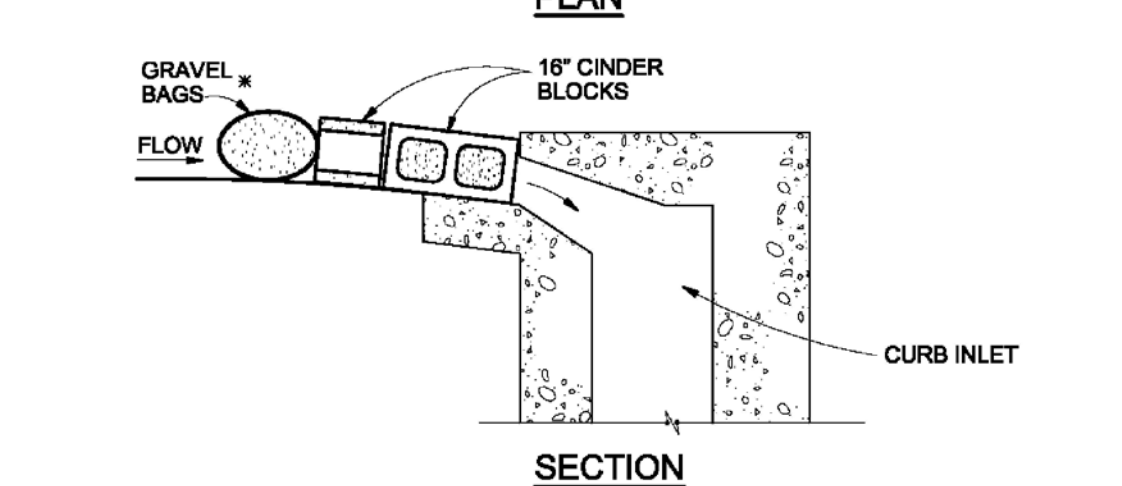
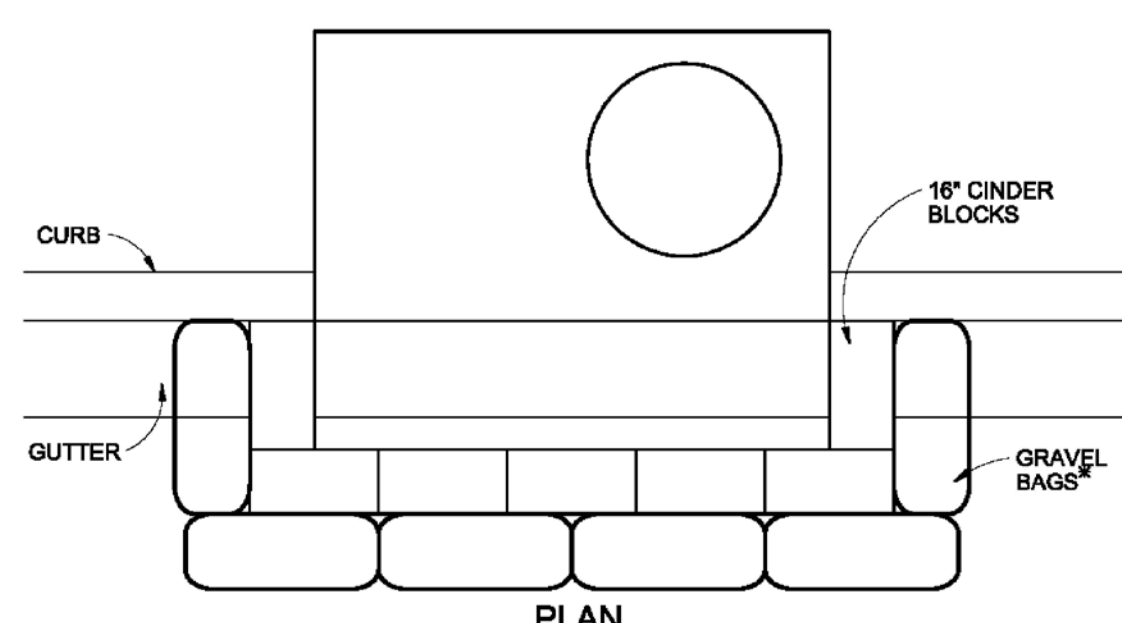


City of Colorado Springs
Storm Water Quality

Figure ECB-2
Erosion Control Blanket
Installation Requirements

From: Virginia Soil and Water Conservation Commission, 1985

DENM153722.CS.CDFigECB-26-49



BLOCK AND GRAVEL BAG*CURB INLET PROTECTION

NTS

BLOCK AND GRAVEL BAG*CURB INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.
2. CONCRETE BLOCKS ARE TO BE LAID AROUND THE INLET IN A SINGLE ROW ON THEIR SIDES, ABUTTING ONE ANOTHER WITH THE OPEN ENDS OF THE BLOCK FACING OUTWARD.
3. GRAVEL BAGS ARE TO BE PLACED AROUND THE CONCRETE BLOCKS CLOSELY ABUTTING ONE ANOTHER SO THERE ARE NO GAPS.
4. GRAVEL BAGS ARE TO CONTAIN WASHED SAND OR GRAVEL APPROXIMATELY 3/4 INCH IN DIAMETER.
5. BAGS ARE TO BE MADE OF 1/4" INCH WIRE MESH (USED WITH GRAVEL ONLY) OR GEOTEXTILE.

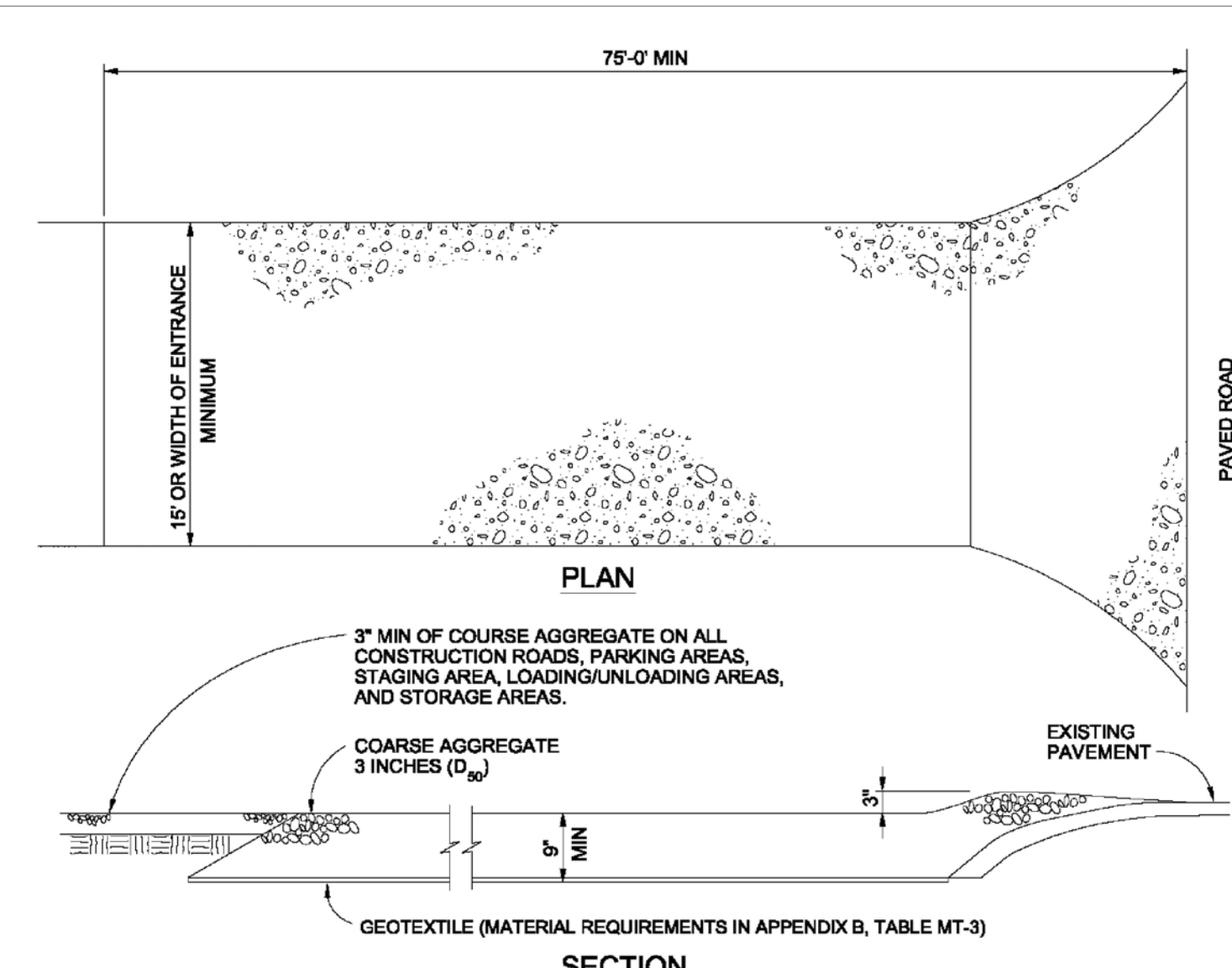
MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED OR REPLACED.
3. SEDIMENT SHALL BE REMOVED WHEN SEDIMENT HAS ACCUMULATED TO APPROXIMATELY 1/2 THE DESIGN DEPTH OF THE TRAP.
4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.

* AN ALTERNATE 3/4" TO 1" GRAVEL FILTER OVER A WIRE SCREEN MAY BE USED IN PLACE OF GRAVEL BAGS. THE WIRE MESH SHALL EXTEND ABOVE THE TOP OF THE CONCRETE BLOCKS AND THE GRAVEL PLACED OVER THE WIRE SCREEN TO THE TOP OF THE CONCRETE BLOCKS.

City of Colorado Springs
Stormwater Quality

Figure IP-3
Block & Gravel Bag Curb Inlet Protection
Construction Detail and Maintenance
Requirements



VEHICLE TRACKING

NTS

VEHICLE TRACKING NOTES

INSTALLATION REQUIREMENTS

1. ALL ENTRANCES TO THE CONSTRUCTION SITE ARE TO BE STABILIZED PRIOR TO CONSTRUCTION BEGINNING.
2. CONSTRUCTION ENTRANCES ARE TO BE BUILT WITH AN APRON TO ALLOW FOR TURNING TRAFFIC, BUT SHOULD NOT BE BUILT OVER EXISTING PAVEMENT EXCEPT FOR A SLIGHT OVERLAP.
3. AREAS TO BE STABILIZED ARE TO BE PROPERLY GRADED AND COMPACTED PRIOR TO LAYING DOWN GEOTEXTILE AND STONE.
4. CONSTRUCTION ROADS, PARKING AREAS, LOADING/UNLOADING ZONES, STORAGE AREAS, AND STAGING AREAS ARE TO BE STABILIZED.
5. CONSTRUCTION ROADS ARE TO BE BUILT TO CONFORM TO SITE GRADES, BUT SHOULD NOT HAVE SIDE SLOPES OR ROAD GRADES THAT ARE EXCESSIVELY STEEP.

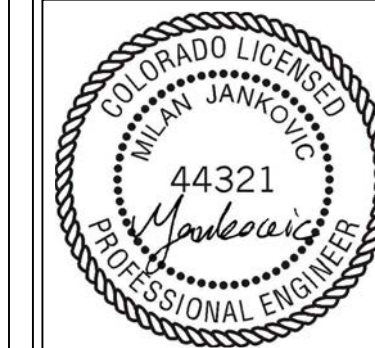
MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL STABILIZED AREAS, ESPECIALLY AFTER STORM EVENTS.
2. STONES ARE TO BE REAPPLIED PERIODICALLY AND WHEN REPAIR IS NECESSARY.
3. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED DAILY BY SHOVELING OR SWEEPING. SEDIMENT IS NOT TO BE WASHED DOWN STORM SEWER DRAINS.
4. STORM SEWER INLET PROTECTION IS TO BE IN PLACE, INSPECTED, AND CLEANED IF NECESSARY.
5. OTHER ASSOCIATED SEDIMENT CONTROL MEASURES ARE TO BE INSPECTED TO ENSURE GOOD WORKING CONDITION.

City of Colorado Springs
Stormwater Quality

Figure VT-2
Vehicle Tracking
Application Examples

PCD File # PPR2527



DESIGNED BY:
Milos Sheng, P.E.
eng@milosheng.com
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(720) 325-6876
M@MILOSHENG.COM

FILE NUMBER:

2319

JOB NUMBER:

2025-6-10-Var

PRINTED DATE:

02/10/2026

Revision Table	Revised By	City Comments
No.	Date	
1	10/16/25	M.Lamido & E. Schindler

CLIENT:
ANDRII VARKO
1185 N CURTIS RD,
COLORADO SPRINGS, CO 80930
(786) 394-0094
ANDRIVARKO@GMAIL.COM

**EROSION CONTROL
DETAILS**

PROJECT NAME:

**SITE
DEVELOPMENT
PLAN**

PROJECT ADDRESS:

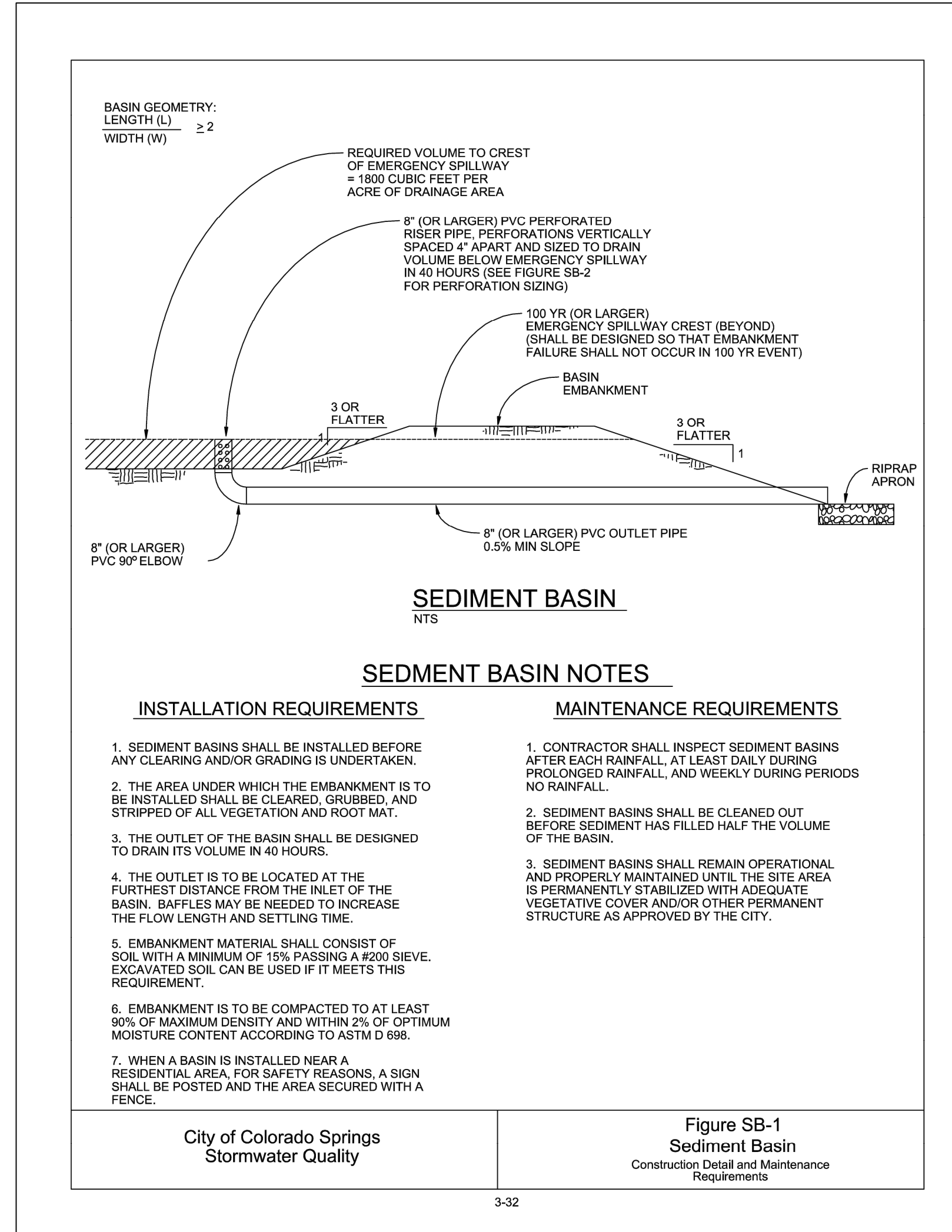
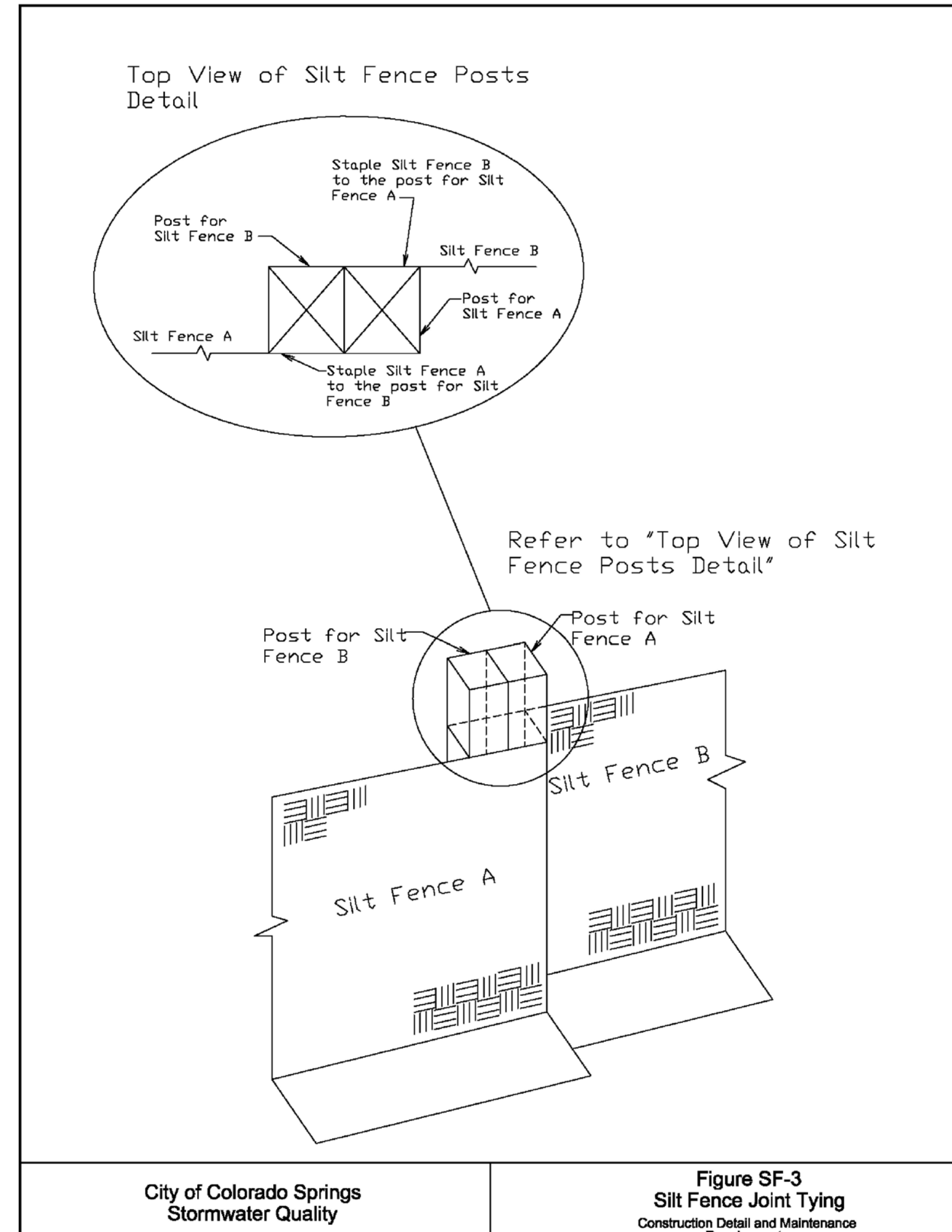
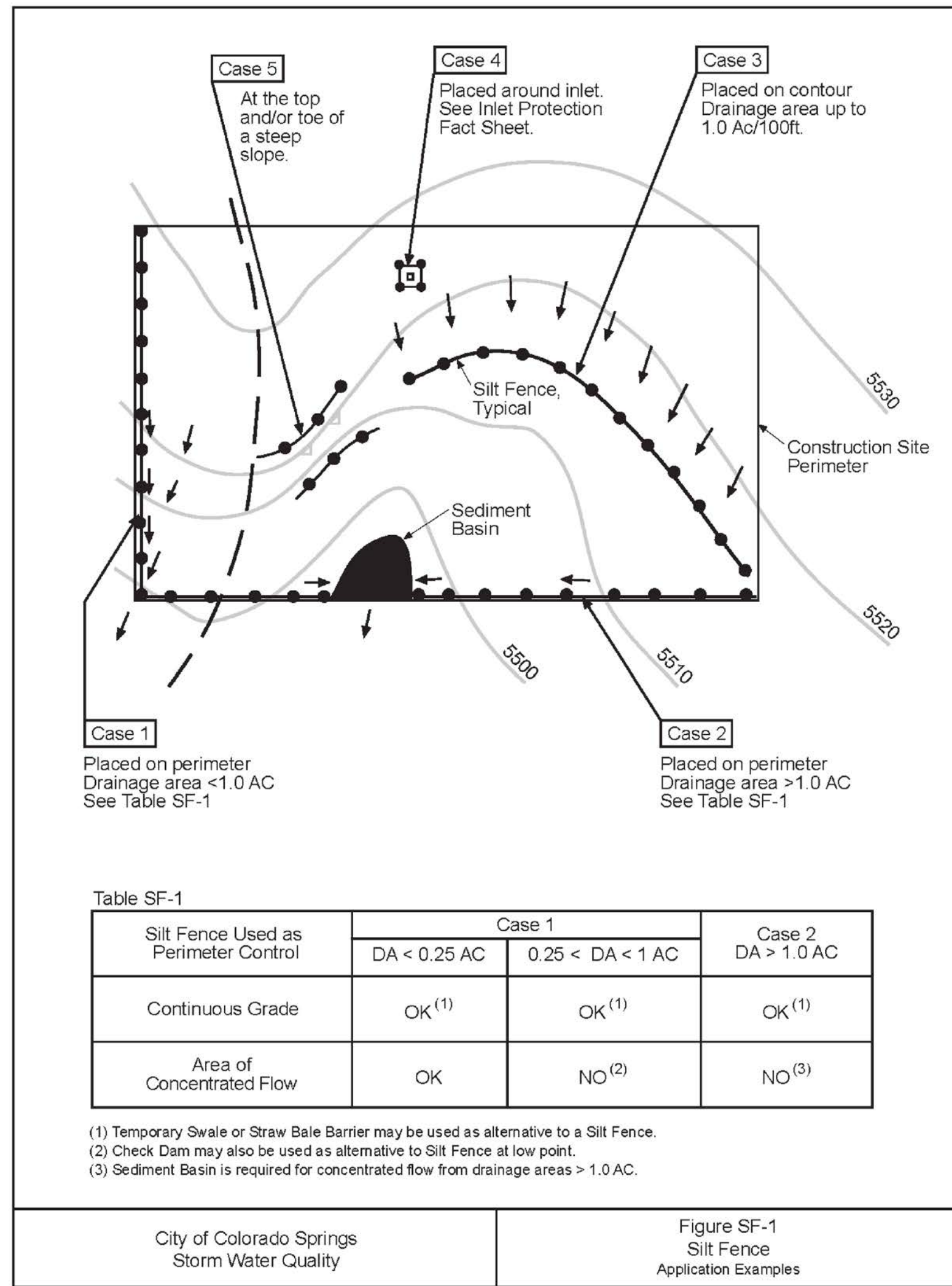
1185 N Curtis Rd,
Colorado Springs, CO
80930

PARCEL NUMBER:

441000052

SHEET NUMBER:

E-3



Sediment Basin North Calculations

Sedimentation Basin (SB N) Required WQCV			
SB N	F	D	Total
	0.8	0.5	1.3
			1800
			ft ³ /ac

Sedimentation Basin Sizing			
Depth (ft)	Length (ft)	Width (ft)	Volume (ft ³)
Overall	2	30	60
Slopes		6	1008
Inside	2	18	48
			1728

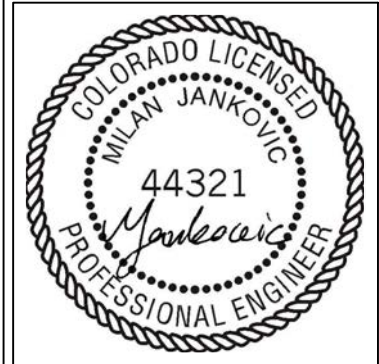
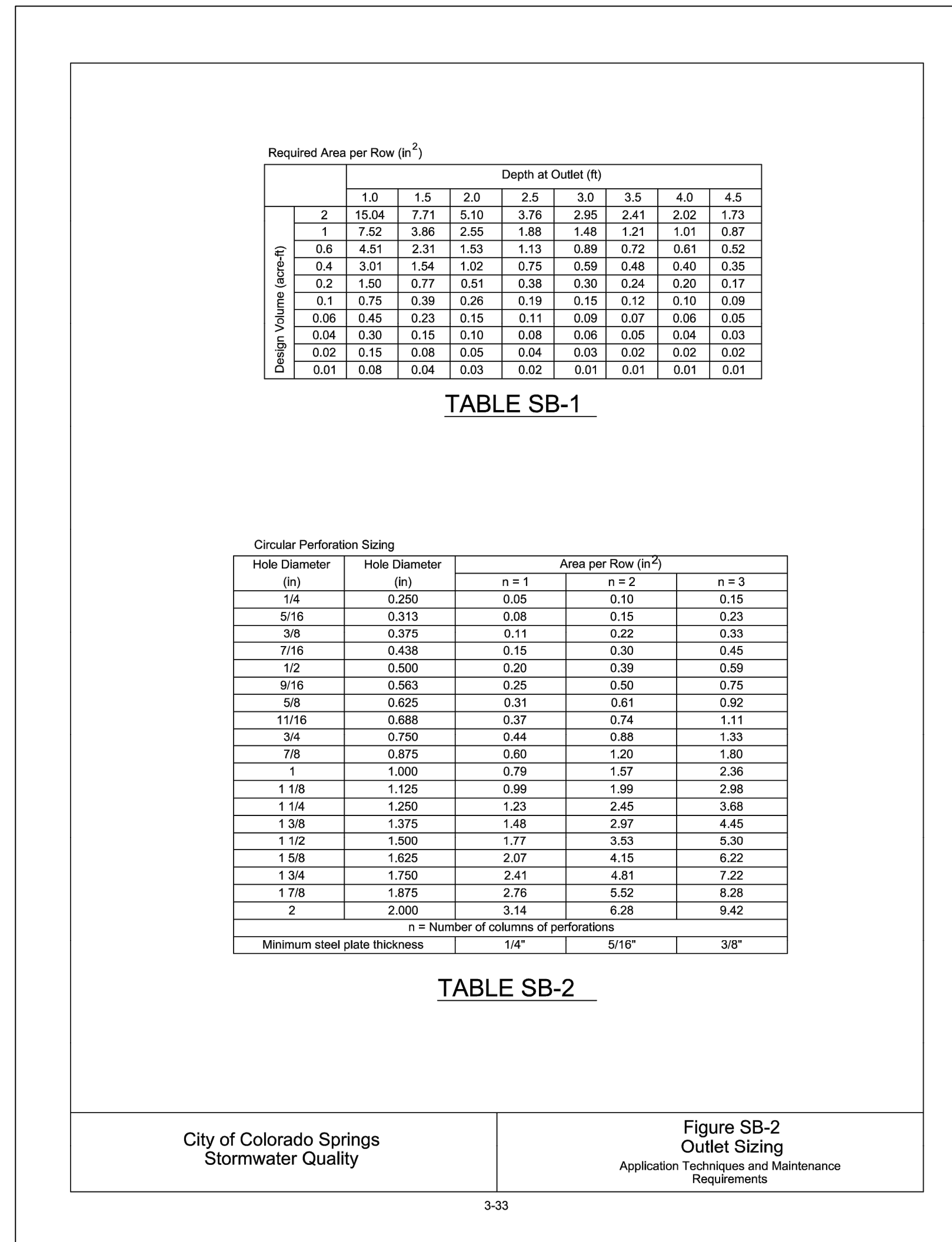
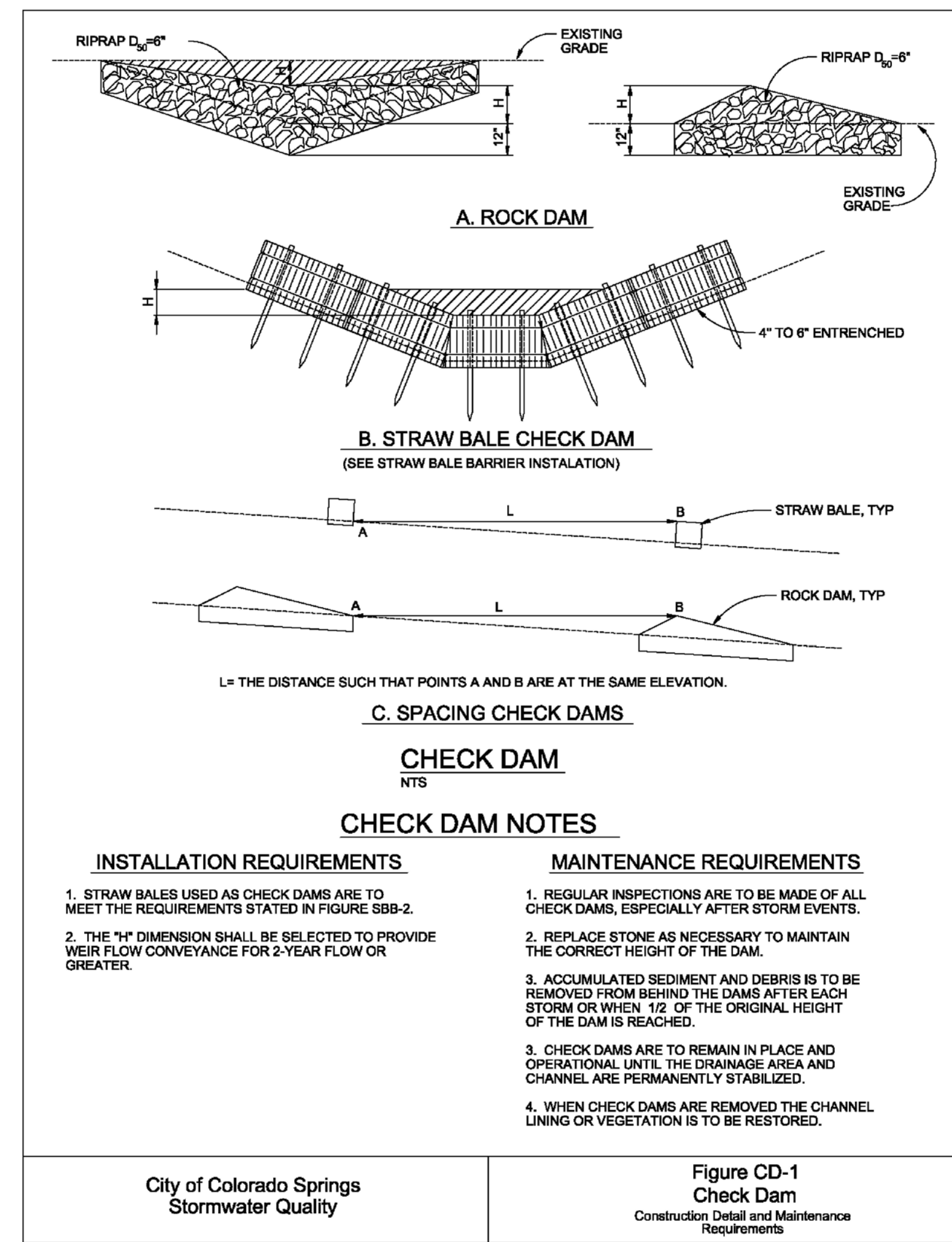
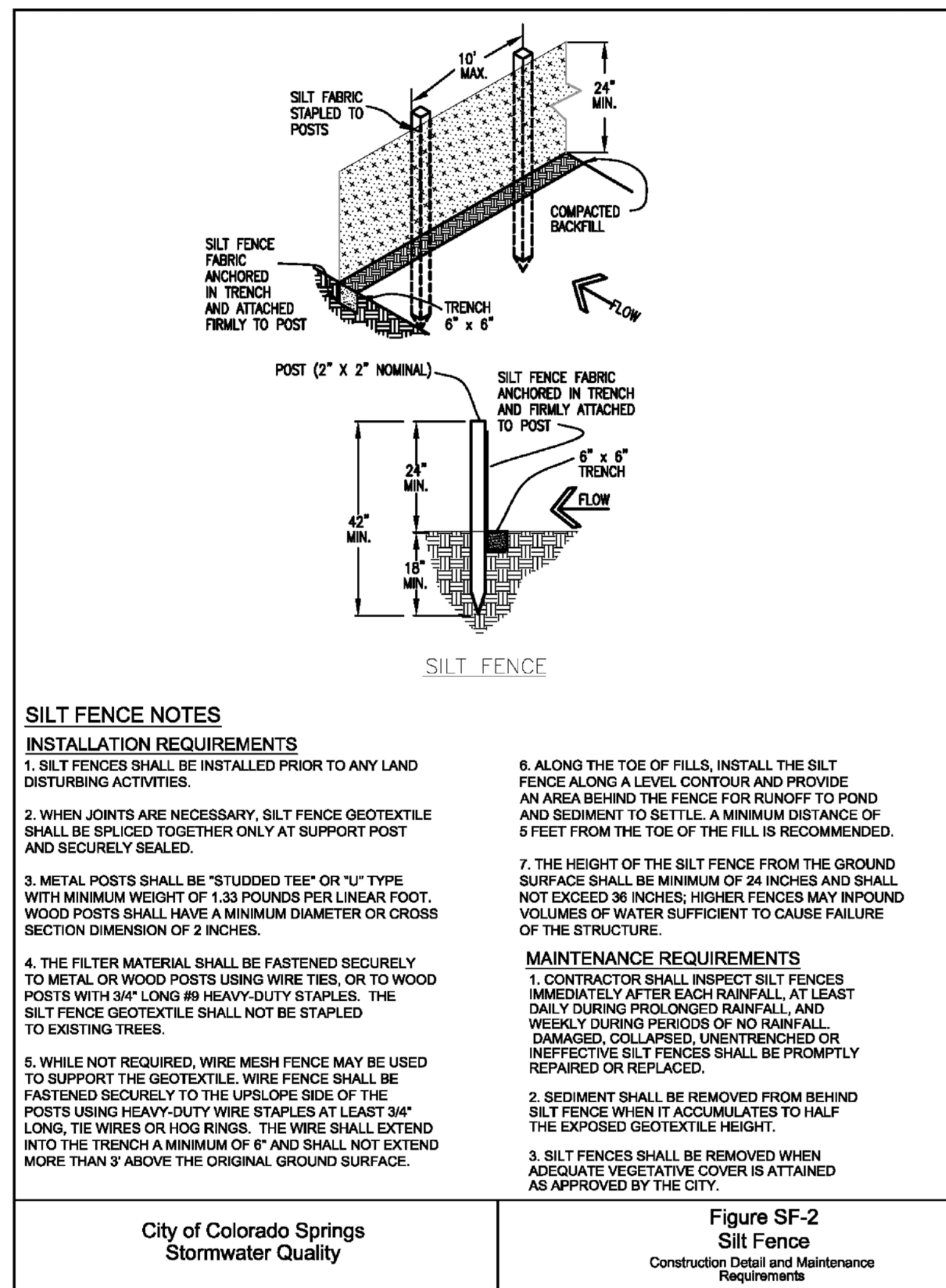
SB Outlet Pipe Design	
Depth at Outlet (ft)	2
Design Volume (acre-ft)	0.06
Required Area per Row (in ²)	0.15
Hole Diameter (in)	5/16
Number of columns of perforations (n)	2
Provided Area per Row (in ²)	0.15
PVC Pipe Diameter (in)	8

Sediment Basin South Calculations

Sedimentation Basin (SB S) Required WQCV			
SB S	C	A	Total
	1.27	0.4	1.67
			1800
			ft ³ /ac

Sedimentation Basin Sizing			
Depth (ft)	Length (ft)	Width (ft)	Volume (ft ³)
Overall	3	30	60
Slopes		6	6
Inside	3	18	48
			2592

SB Outlet Pipe Design	
Depth at Outlet (ft)	3
Design Volume (acre-ft)	0.1
Required Area per Row (in ²)	0.15
Hole Diameter (in)	5/16
Number of columns of perforations (n)	2
Provided Area per Row (in ²)	0.15
PVC Pipe Diameter (in)	8



DESIGNED BY:
Andrii Varko
 LICENSED PROFESSIONAL ENGINEER
 9235 W EUCLID AVE
 LITTLETON, CO 80123
 (720) 325-6876
 MJ@MILOSHENG.COM

FILE NUMBER:
2319

JOB NUMBER:
2025-6-10-Var

PRINTED DATE:
02/10/2026

No.	Date	Revision Table	City Comments
1	10/16/25	EL PASSO	M.Lanico & E.Schmitt

CLIENT:
ANDRII VARKO
 1185 N CURTIS RD,
 COLORADO SPRINGS, CO 80930
 (786) 394-0094
 ANDRIIVARKO@GMAIL.COM

TITLE:
EROSION CONTROL DETAILS

PROJECT NAME:
SITE DEVELOPMENT PLAN

PROJECT ADDRESS:
 1185 N Curtis Rd,
 Colorado Springs, CO 80930

PARCEL NUMBER:
441000052

SHEET NUMBER:
E-4

APPENDIX B – ESQCP STORMWATER PERMIT FORM



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: PPR2527

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	Andrii Varko
Name or Name of Representative	Andrii Varko
Title	Owner
Physical Address (not PO Box)	
Street Number and Street Name	1189 N Curtis Rd
City, State, Zip Code	Colorado Springs, CO, 80930
Mailing Address (if differs from above)	
Street Number and Street Name	265 Harris Dr
City, State, Zip Code	Idaho Springs, CO, 80452
Phone Number - Office	786-394-0094
Phone Number - Cell	786-394-0094
Email Address	andriivarko@gmail.com

Part II. Contractor/Operator (Co-Permit Holder)*	
Company/Organization	Milosh LLC
Name or Name of Representative	Milos Jankovic
Title	President/Owner
Physical Address (not PO Box)	
Street Number and Street Name	1038 S Union Blvd
City, State, Zip Code	Lakewood, CO 80228
Mailing Address (if differs from above)	
Street Number and Street Name	
City, State, Zip Code	
Phone Number - Office	(720) 938-4170
Phone Number - Cell	(720) 325-6876
Email Address	mj@milosheng.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
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 Email: Stormwater@elpasoco.com
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EL PASO COUNTY
STORMWATER PERMIT FORM
Erosion and Stormwater Quality Control Permit (ESQCP)

EPC Project Number: PPR2527

Part III. Qualified Stormwater Manager (QSM)*	
Company/Organization	Milosh LLC
Name	Milos Jankovic
Phone Number - Office	(720) 938-4170
Phone Number - Cell	(720) 325-6876
Email Address	mj@milosheng.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	1185 N CURTIS RD - RV/Mixed Storage Park SDP
Address (or nearest major cross streets)	1185 N CURTIS RD, Colorado Springs, CO, 80930
Acreage	Total: 4.79 acres Proposed Disturbance: 2.2 acres
Description of Project	RV/ Mixed Storage SDP. VA235 approved. Gravel surfaced parking area for RV and Mixed Storage.
Schedule (input estimated month or season)	Start of Construction: Spring 2026 Completion of Construction: Fall 2026 Final Stabilization: Summer 2027



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Stormwater Permit Number: ESQ

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

EPC Project Number: PPR2527

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).



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

EPC Project Number: PPR2527

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.

 Signature of Owner or Representative

12/23/2025

 Date

Andrii Varko

 Print Name of Owner or Representative

 Signature of Contractor/Operator or Representative*

*If signed by a Rep, an Affidavit of Signature Authority must be included

12/23/2025

 Date

Milos Jankovic

 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

APPENDIX C – USDA SOIL SURVEY REPORT



United States
Department of
Agriculture

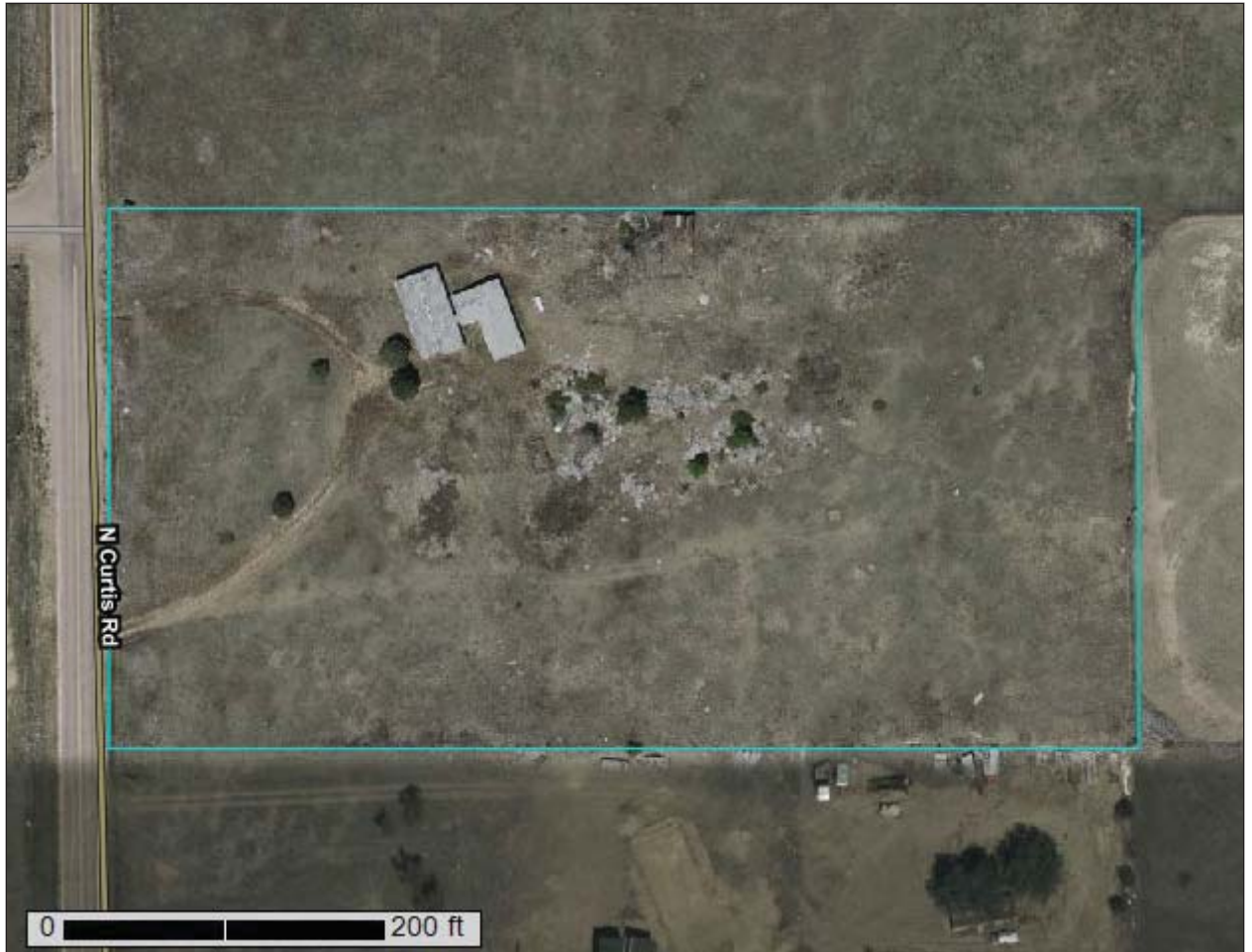
NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for El Paso County Area, Colorado

1185 N Curtis Rd



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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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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

Custom Soil Resource Report

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

Custom Soil Resource Report

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 (SOilt Type)


















Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

Area of Interest (AOI)	 Area of Interest (AOI)	 Spoil Area
Soils	 Soil Map Unit Polygons	 Stony Spot
	 Soil Map Unit Lines	 Very Stony Spot
	 Soil Map Unit Points	 Wet Spot
Special Point Features	 Blowout	 Other
	 Borrow Pit	 Special Line Features
	 Clay Spot	Water Features
	 Closed Depression	 Streams and Canals
	 Gravel Pit	Transportation
	 Gravelly Spot	 Rails
	 Landfill	 Interstate Highways
	 Lava Flow	 US Routes
	 Marsh or swamp	 Major Roads
	 Mine or Quarry	 Local Roads
	 Miscellaneous Water	Background
	 Perennial Water	 Aerial Photography
	 Rock Outcrop	
	 Saline Spot	
	 Sandy Spot	
	 Severely Eroded Spot	
	 Sinkhole	
	 Slide or Slip	
	 Sodic Spot	

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Sep 11, 2018—Aug 4, 2024

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 (SOilt Type)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13	Bresser sandy loam, cool, 5 to 9 percent slopes	5.0	99.9%
89	Tassel fine sandy loam, 3 to 18 percent slopes	0.0	0.1%
Totals for Area of Interest		5.0	100.0%

Map Unit Descriptions (SOilt Type)

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,

Custom Soil Resource Report

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

13—Bresser sandy loam, cool, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2t1pk
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

89—Tassel fine sandy loam, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 36b5
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 51 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Tassel and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: sandy loam

Custom Soil Resource Report

Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent

Depth to restrictive feature: 6 to 20 inches to paralithic bedrock

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: 10 percent

Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: R067BY024CO - Sandy Plains

Other vegetative classification: SANDY PLAINS (069AY026CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 5 percent

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 Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat) (Conductivity)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat) (Conductivity)



Soil Map may not be valid at this scale.

Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

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



Soils

Soil Rating Polygons

<= 25.0492



> 25.0492 and <= 28.0000



Not rated or not available



Soil Rating Lines

<= 25.0492



> 25.0492 and <= 28.0000



Not rated or not available



Soil Rating Points

<= 25.0492



> 25.0492 and <= 28.0000



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.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Sep 11, 2018—Aug 4, 2024

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—Saturated Hydraulic Conductivity (Ksat) (Conductivity)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
13	Bresser sandy loam, cool, 5 to 9 percent slopes	25.0492	5.0	99.9%
89	Tassel fine sandy loam, 3 to 18 percent slopes	28.0000	0.0	0.1%
Totals for Area of Interest			5.0	100.0%

Rating Options—Saturated Hydraulic Conductivity (Ksat) (Conductivity)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie. The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Fastest

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

For an attribute of a soil horizon, a depth qualification must be specified. In most cases it is probably most appropriate to specify a fixed depth range, either in centimeters or inches. The Bottom Depth must be greater than the Top Depth, and the Top Depth can be greater than zero. The choice of "inches" or "centimeters" only applies to the depth of soil to be evaluated. It has no influence on the units of measure the data are presented in.

When "Surface Layer" is specified as the depth qualifier, only the surface layer or horizon is considered when deriving a value for a component, but keep in mind that the thickness of the surface layer varies from component to component.

When "All Layers" is specified as the depth qualifier, all layers recorded for a component are considered when deriving the value for that component.

Whenever more than one layer or horizon is considered when deriving a value for a component, and the attribute being aggregated is a numeric attribute, a weighted average value is returned, where the weighting factor is the layer or horizon thickness.

Top Depth: 0

Bottom Depth: 24

Units of Measure: Centimeters

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 (Conductivity)

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.

Custom Soil Resource Report

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.

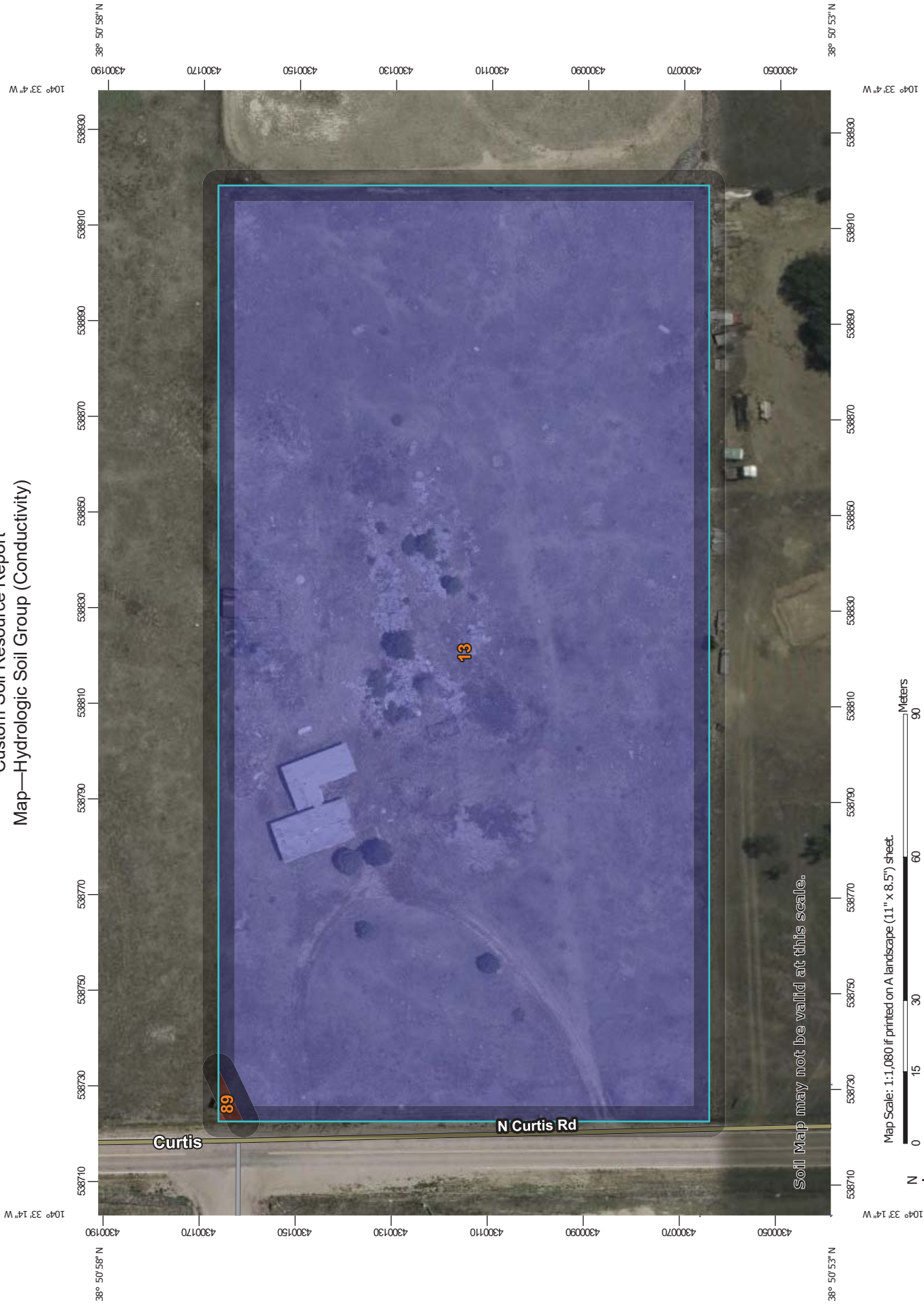
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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 (Conductivity)



Soil Map may not be valid at this scale.



MAP LEGEND



MAP INFORMATION

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

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

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

Date(s) aerial images were photographed: Sep 11, 2018—Aug 4, 2024

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 (Conductivity)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
13	Bresser sandy loam, cool, 5 to 9 percent slopes	B	5.0	99.9%
89	Tassel fine sandy loam, 3 to 18 percent slopes	D	0.0	0.1%
Totals for Area of Interest			5.0	100.0%

Rating Options—Hydrologic Soil Group (Conductivity)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Water Features

Water Features include ponding frequency, flooding frequency, and depth to water table.

Flooding Frequency Class (Conductivity)

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent.

"None" means that flooding is not probable. The chance of flooding is nearly 0 percent in any year. Flooding occurs less than once in 500 years.

"Very rare" means that flooding is very unlikely but possible under extremely unusual weather conditions. The chance of flooding is less than 1 percent in any year.

"Rare" means that flooding is unlikely but possible under unusual weather conditions. The chance of flooding is 1 to 5 percent in any year.

"Occasional" means that flooding occurs infrequently under normal weather conditions. The chance of flooding is 5 to 50 percent in any year.

"Frequent" means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year.

"Very frequent" means that flooding is likely to occur very often under normal weather conditions. The chance of flooding is more than 50 percent in all months of any year.

Custom Soil Resource Report
Map—Flooding Frequency Class (Conductivity)



Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.



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
 None
 Very Rare
 Rare
 Occasional
 Common
 Frequent
 Very Frequent
 Not rated or not available
- Soil Rating Lines**
 None
 Very Rare
 Rare
 Occasional
 Common
 Frequent
 Very Frequent
 Not rated or not available
- Soil Rating Points**
 None
 Very Rare
 Rare
 Occasional

MAP INFORMATION

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

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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)

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Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Sep 11, 2018—Aug 4, 2024

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—Flooding Frequency Class (Conductivity)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
13	Bresser sandy loam, cool, 5 to 9 percent slopes	None	5.0	99.9%
89	Tassel fine sandy loam, 3 to 18 percent slopes	None	0.0	0.1%
Totals for Area of Interest			5.0	100.0%

Rating Options—Flooding Frequency Class (Conductivity)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: More Frequent

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The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Beginning Month: January

Ending Month: December

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Conductivity)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

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.

Custom Soil Resource Report

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.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves,

Custom Soil Resource Report

numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007 (<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—El Paso County Area, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments			Percentage passing sieve number—			Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>					L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H
13—Bresser sandy loam, cool, 5 to 9 percent slopes														
Bresser, cool	85	B	0-5	Sandy loam	SM	A-4	0-0-0	0-0-0	100-100-100	74-77-80	37-39-44	23-31-35	4-8-10	
			5-8	Sandy loam, sandy clay loam	SC	A-6	0-0-0	0-0-0	100-100-100	73-76-82	42-47-54	24-30-36	7-11-15	
			8-27	Sandy clay loam, sandy loam	SC	A-6	0-0-0	0-0-0	100-100-100	72-86-88	38-48-50	29-38-41	12-17-19	
			27-36	Sandy loam, coarse sandy loam	SC-SM	A-4	0-0-0	0-0-0	100-100-100	68-76-81	31-37-42	19-22-28	3-5-9	
			36-80	Loamy coarse sand, loamy sand, coarse sandy loam	SC-SM	A-2-4	0-0-0	0-0-0	100-100-100	85-97-100	13-20-25	16-22-26	2-7-10	
89—Tassel fine sandy loam, 3 to 18 percent slopes														
Tassel	95	D	0-4	Fine sandy loam	ML, SM	A-4	0-0-0	0-0-0	85-93-100	55-70-85	35-45-55	20-23-25	NP-3-5	
			4-10	Fine sandy loam, sandy loam	SM	A-2-4, A-4	0-0-0	0-0-0	85-93-100	55-63-70	25-33-40	20-23-25	NP-3-5	
			10-14	Weathered bedrock	—	—	—	—	—	—	—	—	—	

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (*K_{sat}*), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (K_{sat}) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (*K_{sat}*) is considered in the design of soil drainage systems and septic tank absorption fields.

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Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (K_w and K_f) and the T factor. 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 K_{sat} . 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 K_w indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor K_f indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up 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. The groups are described in the "National Soil Survey Handbook."

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Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service.
National soil survey handbook, title 430-VI. (<http://soils.usda.gov>)

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Physical Soil Properties—El Paso County Area, Colorado														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/in	Pct	Pct					
13—Bresser sandy loam, cool, 5 to 9 percent slopes														
Bresser, cool	0-5	53-67-67	19-19-33	8-14-16	1.48-1.56	14.11-42.34	0.10-0.12	0.8-1.7	2.0-4.0	.15	.15	3	3	86
	5-8	52-58-63	15-25-36	12-17-22	1.47-1.57	4.23-42.34	0.10-0.12	1.2-2.8	0.5-2.0	.28	.28			
	8-27	52-57-63	12-18-23	18-25-27	1.41-1.61	4.23-42.34	0.10-0.13	1.8-3.7	0.5-2.0	.20	.20			
	27-36	66-70-75	10-20-27	7-10-15	1.59-1.62	14.11-42.34	0.09-0.13	0.6-1.6	0.5-1.0	.24	.24			
	36-80	74-82-85	0-7-21	5-11-15	1.60-1.75	14.11-141.14	0.05-0.11	0.4-1.5	0.0-0.5	.10	.10			
89—Tassel fine sandy loam, 3 to 18 percent slopes														
Tassel	0-4	-63-	-26-	5-12-18	1.35-1.50	14.11-42.33	0.12-0.14	0.0-2.9	0.5-1.0	.28	.28	2	3	86
	4-10	-68-	-24-	5-9-12	1.35-1.50	14.11-42.33	0.09-0.13	0.0-2.9	0.5-1.0	.28	.28			
	10-14	—	—	—	—	1.41-4.23	—	—	—					

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: "[National Soil Survey Handbook](#)."

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low: 0 to 3

Low: 3 to 6

Moderate: 6 to 9

High: 9 to 12

Very high: More than 12

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology)

from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

Clay

As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left

behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

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O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

R layer: Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

- Very low:* Less than 0.2
- Low:* 0.2 to 0.4
- Moderately low:* 0.4 to 0.75
- Moderate:* 0.75 to 1.25
- Moderately high:* 1.25 to 1.75
- High:* 1.75 to 2.5
- Very high:* More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $1/3$ - or $1/10$ -bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can

occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

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Very low: Less than 0.5 percent

Low: 0.5 to 1.0 percent

Moderately low: 1.0 to 2.0 percent

Moderate: 2.0 to 4.0 percent

High: 4.0 to 8.0 percent

Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and

promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid: Less than 3.5

Extremely acid: 3.5 to 4.4

Very strongly acid: 4.5 to 5.0

Strongly acid: 5.1 to 5.5

Moderately acid: 5.6 to 6.0

Slightly acid: 6.1 to 6.5

Neutral: 6.6 to 7.3

Slightly alkaline: 7.4 to 7.8

Moderately alkaline: 7.9 to 8.4

Strongly alkaline: 8.5 to 9.0

Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

Custom Soil Resource Report

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
 - A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
 - B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
 - C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
 - A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
 - B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where "Rock outcrop" is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which "severely eroded," "very severely eroded," or "gullied" is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $\text{Ca}^{++} + \text{Mg}^{++}$. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1

Moderate: 13-30:1

Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand: 2.0 to 1.0

Coarse sand: 1.0 to 0.5

Medium sand: 0.5 to 0.25

Fine sand: 0.25 to 0.10

Very fine sand: 0.10 to 0.05

Silt: 0.05 to 0.002

Clay: Less than 0.002

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated

Prismatic: Vertically elongated and having flat tops

Columnar: Vertically elongated and having rounded tops

Angular blocky: Having faces that intersect at sharp angles (planes)

Subangular blocky: Having subrounded and planar faces (no sharp angles)

Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand

Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field

generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variiegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

APPENDIX D – EROSION CONTROL INSPECTION CHECKLIST

CONSTRUCTION STORMWATER SITE INSPECTION REPORT

Facility Name		Permittee					
Date of Inspection		Weather Conditions					
Permit Certification #		Disturbed Acreage					
Phase of Construction		Inspector Title					
Inspector Name							
Is the above inspector a qualified stormwater manager? (permittee is responsible for ensuring that the inspector is a qualified stormwater manager)			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">YES</td> <td style="width: 50%; text-align: center;">NO</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	YES	NO	<input type="checkbox"/>	<input type="checkbox"/>
YES	NO						
<input type="checkbox"/>	<input type="checkbox"/>						

INSPECTION FREQUENCY					
Check the box that describes the minimum inspection frequency utilized when conducting each inspection					
At least one inspection every 7 calendar days	<input type="checkbox"/>				
At least one inspection every 14 calendar days, with post-storm event inspections conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosions	<input type="checkbox"/>				
<ul style="list-style-type: none"> • This is this a post-storm event inspection. Event Date: _____ 	<input type="checkbox"/>				
Reduced inspection frequency - Include site conditions that warrant reduced inspection frequency	<input type="checkbox"/>				
<ul style="list-style-type: none"> • Post-storm inspections at temporarily idle sites 	<input type="checkbox"/>				
<ul style="list-style-type: none"> • Inspections at completed sites/area 	<input type="checkbox"/>				
<ul style="list-style-type: none"> • Winter conditions exclusion 	<input type="checkbox"/>				
Have there been any deviations from the minimum inspection schedule? If yes, describe below.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">YES</td> <td style="width: 50%; text-align: center;">NO</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	YES	NO	<input type="checkbox"/>	<input type="checkbox"/>
YES	NO				
<input type="checkbox"/>	<input type="checkbox"/>				

INSPECTION REQUIREMENTS*
i. Visually verify all implemented control measures are in effective operational condition and are working as designed in the specifications
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
*Use the attached Control Measures Requiring Routine Maintenance and Inadequate Control Measures Requiring Corrective Action forms to document results of this assessment that trigger either maintenance or corrective actions

AREAS TO BE INSPECTED			
Is there evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system or discharging to state waters at the following locations?			
	NO	YES	If "YES" describe discharge or potential for discharge below. Document related maintenance, inadequate control measures and corrective actions Inadequate Control Measures Requiring Corrective Action form
Construction site perimeter	<input type="checkbox"/>	<input type="checkbox"/>	
All disturbed areas	<input type="checkbox"/>	<input type="checkbox"/>	
Designated haul routes	<input type="checkbox"/>	<input type="checkbox"/>	
Material and waste storage areas exposed to precipitation	<input type="checkbox"/>	<input type="checkbox"/>	
Locations where stormwater has the potential to discharge offsite	<input type="checkbox"/>	<input type="checkbox"/>	
Locations where vehicles exit the site	<input type="checkbox"/>	<input type="checkbox"/>	
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	

REPORTING REQUIREMENTS

The permittee shall report the following circumstances orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances, and shall mail to the division a written report containing the information requested within five (5) working days after becoming aware of the following circumstances. The division may waive the written report required if the oral report has been received within 24 hours.

<p>All Noncompliance Requiring 24-Hour Notification per Part II.L.6 of the Permit</p> <p>a. Endangerment to Health or the Environment Circumstances leading to any noncompliance which may endanger health or the environment regardless of the cause of the incident (See Part II.L.6.a of the Permit) This category would primarily result from the discharge of pollutants in violation of the permit</p> <p>b. Numeric Effluent Limit Violations</p> <ul style="list-style-type: none"> o Circumstances leading to any unanticipated bypass which exceeds any effluent limitations (See Part II.L.6.b of the Permit) o Circumstances leading to any upset which causes an exceedance of any effluent limitation (See Part II.L.6.c of the Permit) o Daily maximum violations (See Part II.L.6.d of the Permit) <p>Numeric effluent limits are very uncommon in certifications under the COR400000 general permit. This category of noncompliance only applies if numeric effluent limits are included in a permit certification.</p>
--

<p>Has there been an incident of noncompliance requiring 24-hour notification?</p>	NO	YES	<p>If "YES" document below</p>
	<input type="checkbox"/>	<input type="checkbox"/>	

Date and Time of Incident	Location	Description of Noncompliance	Description of Corrective Action	Date and Time of 24 Hour Oral Notification	Date of 5 Day Written Notification *

* Attach copy of 5 day written notification to report. Indicate if written notification was waived, including the name of the division personnel who granted waiver.

After adequate corrective action(s) and maintenance have been taken, or where a report does not identify any incidents requiring corrective action or maintenance, the individual(s) designated as the Qualified Stormwater Manager, shall sign and certify the below statement:

"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."

Name of Qualified Stormwater Manager

Title of Qualified Stormwater Manager

Signature of Qualified Stormwater Manager

Date

Notes/Comments

Description

Describe the control measure and what pollutant sources it will provide effective treatment for (part I.C.2.a.iv of the permit). Include the mechanism used for treatment of the pollutant source.

Implementation

Describe how the control measure will be implemented in accordance with good engineering, hydrologic and pollution control practices. Include the phase(s) of construction the control measure will be implemented for.

Installation Procedures

Describe the process required to install the control measure and have it adequately treat the intended pollutant source. Include specific depths, lengths, materials, and any other applicable information necessary to properly install the control measure.

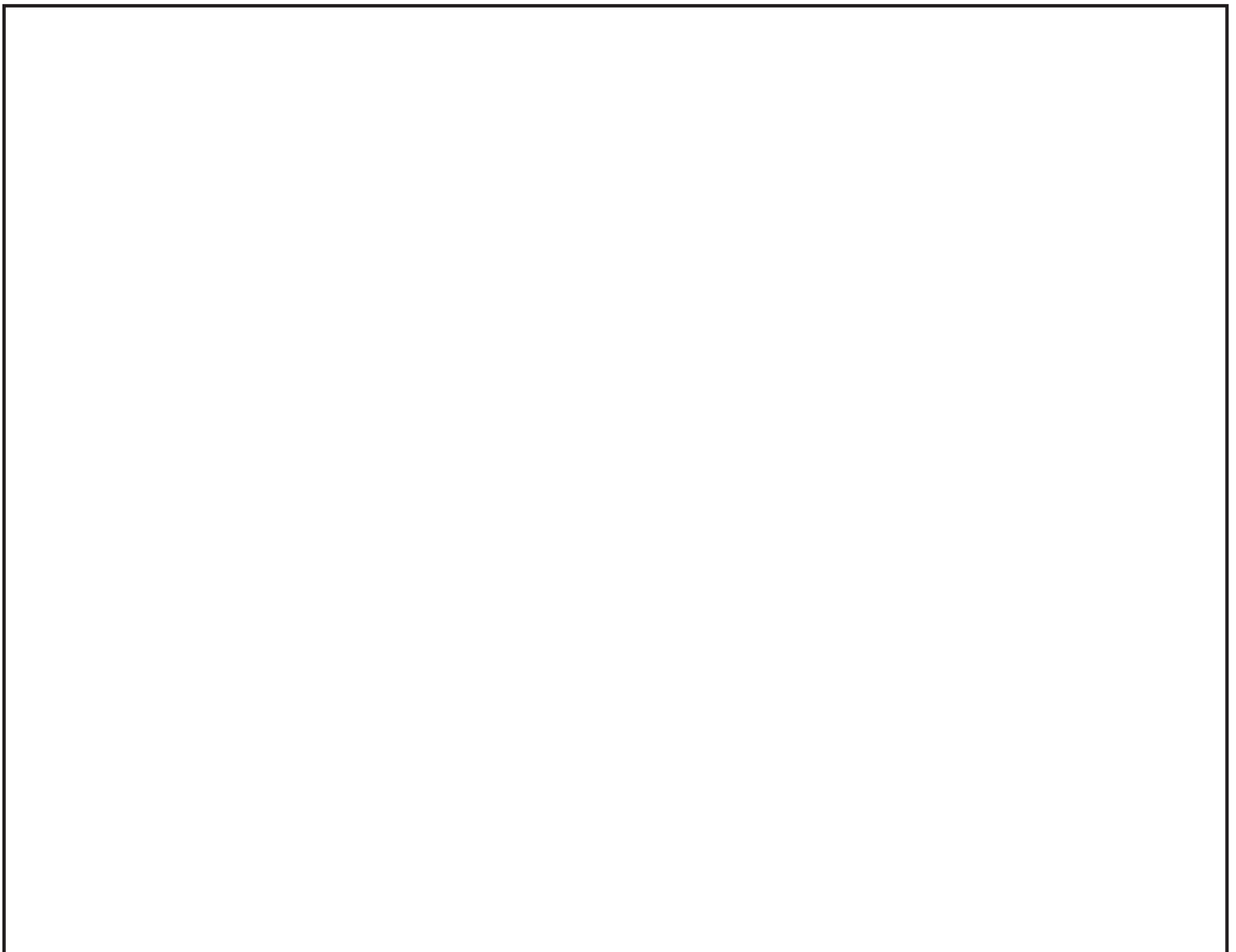
Inspection Expectations

Describe how often the control measure will be inspected and what key features should be checked during each inspection (is the silt fence tail entrenched, are the straw wattles staked ever 4 feet, etc.)

Maintenance Requirements

Describe maintenance requirements, such as how to repair damaged sections, what qualifies as a failed control measure and when it needs to be replaced. Also include criteria that would trigger maintenance (i.e. 50% capacity of the control measure has been reached).

Control Measure Diagram



APPENDIX E – OPERATION AND MAINTENANCE MANUAL

Standard Operation Procedures
for
Inspection and Maintenance
of
Infiltration Area Basin(s)

1185 N CURTIS RD - RV/Mixed Storage
Park SDP

(Adapted from the El Paso County EDB O&M manual template)

Owner:
ANDRII VARKO

El Paso County Department of Public Works
3275 Akers Drive
Colorado Springs, CO 80922

dotweb@elpasoco.com 719-
520-6900

Introduction

This plan addresses operation and maintenance of public detention / water quality facilities (**Infiltration Area S, Infiltration Area N, and Infiltration Area N2**) constructed as part of the **RV & Mixed Storage** development project to the east of N Curtis Rd (**EPC PCD projects number(s): 2319**). **The plat number of the RV/Mixed Storage Park is 441000052.**

Background

The State of Colorado Department of Public Health and Environment, Water Quality Control Division (CDPHE), has implemented federal regulations within the State of Colorado through permitting, and has included El Paso County as one of numerous Municipal Separate Storm Sewer Systems (MS4s) required to be permitted in compliance with National Pollutant Discharge Elimination System (NPDES) Phase 2 Regulations, as defined within Colorado's Phase 2 Municipal Guidance.

NPDES Phase 2 MS4s stormwater discharges are covered under a general permit under the Colorado Discharge Permit System (CDPS) under Regulation 61, and as a minimum require the MS4's operator (e.g., El Paso County) to develop, implement, and enforce a stormwater management program to reduce the discharge of pollutants to the maximum extent practicable to protect water quality requirements of the Colorado Water Quality Control Act, Colorado Code of Regulations [CCR] 61.8(11)(a)(i).

This Stormwater Facilities Operation and Maintenance Plan (O&M Plan) is for public subregional infiltration facilities (**Infiltration Area S, Infiltration Area N, and Infiltration Area N2**) constructed as part of the development project referenced above.

Associated Agreements

The Subdivision Improvements Agreement (SIA) for the development (recorded at Reception No. 441000052) required the developer to complete Infiltration Areas N, N2 and S public improvements as itemized in the associated Financial Assurance Estimate (FAE).

The SIA indemnifies the County from any losses or damages caused by overtopping or spillage from the detention ponds located within the subdivision.

The SIA allowed the developer to defer payment of drainage basin fees because the construction costs of Infiltration Areas N, N2 and S would exceed the drainage basin fees due, and to recover the construction costs exceeding the drainage basin fees due from the basin fund.

The SIA and FAE require as-built plans and certification of completion of the detention facilities in general conformance with the approved construction drawings.

Prior to final County acceptance of the Infiltration Areas N, N2 and S facilities, approval of a Letter of Map Revision (LOMR) by FEMA is required.

Funding for and Organization of Facility Operation and Maintenance

Andrii Varko or active property owner will be responsible for operations and maintenance of the Infiltration Areas N, N2 and S infiltration facilities upon acceptance of the facilities.

Site and Facilities Description

- 1) The infiltration areas are located on the north and south property line at the low points of the property.

- 2) The Infiltration Areas N, N2 and S are built of 3:1 native grass vegetated slopes and a gabion structure retaining wall and must be maintained from sediment build up that reduces its volume.
- 3) Outflow also occurs at the infiltration areas from percolation through the soil slope and through the gabion wall along the entire length of the wall.
- 4) Infiltration Area S is 3 feet deep while Infiltration Area N is 2 feet deep and N2 is 1 foot deep.

Infiltration Area Basin (IAB) Description

The subsections below describe general IAB operations and maintenance.

IAB-1 GENERAL IAB CONCEPT

Infiltration Area Basins (IABs) are a common type of permanent stormwater control measure utilized within the Front Range of Colorado. The stormwater facilities within this development function as infiltration basins designed to detain runoff and promote infiltration into underlying soils. The basins are shallow, with typical depths ranging from 2 to 3 feet, and are designed to fully drain through infiltration and controlled seepage within the required drain time.

Side slopes are constructed at 3H:1V and are stabilized with grassed soil cover to minimize erosion and facilitate infiltration and maintenance access. One basin side includes a gabion retaining wall, which provides structural support for the slope while also allowing stormwater seepage through the soil slope and void spaces within the gabion baskets.

The basins are intended to remain dry between storm events, with no permanent pool of water.

IAB-2 INSPECTING INFILTRATION AREA BASINS (IABs)

IAB-2.1 Access and Easements

Inspection and maintenance personnel may utilize the stormwater facility map in the FDR or Drainage Plan containing the location(s) of the access points and maintenance easements of the IAB(s) within this development. The IAB can be accessed from any side (3:1 slope) with excavator or track loader or by foot.

IAB-2.2 Stormwater Management Facilities Locations

Inspection and maintenance personnel may utilize the attached stormwater facility map in the FDR or Drainage Plan containing the location(s) of the access points and maintenance easements of the IAB(s) within this development.

IAB-2.3 Infiltration Area Basin (IAB) Features

IABs have a number of features that are designed to serve a particular function. Many times, the proper function of one feature depends on another. For example, if the grass cover of the area is not properly maintained, it could negatively affect the performance of the infiltration capacity, slope stability, and percolation.

Therefore, it is critical that each feature of the IAB is properly inspected and maintained to ensure that the overall facility functions as it was intended. Below is a list and description of the most common features within an IAB and the corresponding maintenance inspection items that can be anticipated:

Table IAB-1: Typical Inspection & Maintenance Requirements Matrix

IAB Features	Sediment Removal	Mowing/ Weed Control	Trash & Debris Removal	Erosion	Over-grown Vegetation Removal	Standing Water (mosquito/ algae control)	Structure Repair
Inflow Points (outfalls)	X		X	X			X
Perimeter	X		X				
Slopes	X	X	X	X	X		X
Bottom Stage	X	X	X	X	X	X	
Micropool	X		X		X	X	X
Gabion Wall				X			X
Wall Base	X		X	X	X		X
Gabion Wire							X
Embankment		X		X	X		

IAB-2.3.1 Inflow Points

Inflow points or outfalls into Infiltration Areas/Basins (IABs) are the locations where stormwater runoff enters the facility. Inflow points are typically storm sewer pipes with flared end sections that discharge into the basin. In some cases, inflow may occur from a stabilized drainage swale, channel, or overland flow path designed to convey runoff into the infiltration basin.

Energy dissipation measures, such as riprap aprons or other hard armor protection, are provided immediately downstream of inflow points to reduce flow velocities and prevent erosion of basin soils. In some instances, the storm sewer outfall may include a toe wall or cut-off wall beneath the structure to prevent undercutting and maintain long-term structural stability.

Because infiltration basins rely on permeable soils and controlled surface conditions, proper maintenance of inflow points is critical to preventing erosion, sediment transport, and clogging of basin soils.

Typical inspection and maintenance items associated with inflow points include the following:

a. Riprap Displaced – Many times, because the repeated impact/force of water, the riprap can shift and settle. If any portion of the riprap apron appears to have settled, soil is present between the riprap, or the riprap has shifted, maintenance may be required to ensure future erosion is prevented.

b. Erosion Present/Outfall Undercut – In some situations, the energy dissipater may not have been sized, constructed, or maintained appropriately and erosion has occurred. Any erosion within the vicinity of the inflow point will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.

c. Sediment Accumulation – Because of the turbulence in the water created by the energy dissipater, sediment often deposits immediately downstream of the inflow point. To prevent a loss in hydraulic performance of the upstream infrastructure, sediment that accumulates in this area must be removed in a timely manner.

d. Structural Damage – Structural damage can occur at any time during the life of the facility. Structural damage can lead to additional operating problems with the

facility, including loss of hydraulic performance.

- e. *Woody Growth/Weeds Present* – Undesirable vegetation can grow in and around the inflow area to an IAB that can significantly affect the performance of the drainage facilities discharging into the facility. This type of vegetation includes trees (typically cottonwoods) and dense areas of shrubs (willows). If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, resulting in blockage of the infiltration. Also, tree roots can cause damage to the structural components of the inflow. Routine maintenance is essential for trees (removing a small tree/sapling is much cheaper and “quieter” than a mature tree). In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.

IAB-2.3.2 Gabion Basket Walls (Infiltration and Stabilization Feature)

Gabion basket walls are incorporated within the infiltration basins to provide slope stabilization, erosion control, and controlled stormwater conveyance while allowing infiltration through the void spaces between the stone fill. The gabion baskets are designed to be permeable structures that dissipate energy, support soil slopes, and promote infiltration without creating a hard, impervious barrier.

Routine inspection and maintenance of gabion baskets are critical to ensure both structural integrity and continued infiltration performance of the basin.

Typical inspection and maintenance items associated with gabion basket walls include the following:

- a. *Basket Deformation or Bulging* – Gabion baskets shall be inspected for bulging, sagging, or distortion of the wire mesh, which may indicate internal stone migration, foundation settlement, or excessive loading. Minor deformation shall be monitored, while significant deformation shall be evaluated and repaired to prevent structural failure.
- b. *Wire Mesh Damage or Corrosion* – Inspect baskets for broken wires, torn mesh, corrosion, or loosening of connections. Damaged wire mesh may allow stone loss and reduce structural stability. Any compromised sections shall be repaired or replaced in accordance with the original design specifications.
- c. *Stone Loss or Voids* – Gabion baskets shall be inspected for missing stone, excessive voids, or uneven stone distribution. Stone loss can reduce the effectiveness of the wall and create preferential flow paths that may cause localized erosion. Missing or displaced stone shall be replaced with appropriately sized material.
- d. *Sediment Clogging of Voids* – Because gabion baskets are intended to allow stormwater seepage, accumulation of fine sediments within the void spaces may reduce infiltration capacity. Inspect the face and interior of the gabions for sediment buildup. If clogging is observed, sediment shall be removed using hand tools or low-pressure washing methods that do not damage the baskets or underlying soils.
- e. *Vegetation Growth Within Baskets* – Vegetation may establish within gabion voids over time. While limited shallow-rooted vegetation may be acceptable, woody vegetation or deep-rooted plants shall be removed to prevent displacement of stone, deformation of baskets, and blockage of infiltration pathways.
- f. *Toe Undermining or Settlement* – Inspect the base of the gabion wall for evidence of undermining, scour, or settlement. Loss of support at the toe may compromise wall stability and shall be repaired promptly by restoring grade, replacing stone, and stabilizing adjacent soils.
- g. *Adjacent Soil Erosion* – Areas immediately upstream and downstream of

gabion baskets shall be inspected for erosion, rilling, or washout. Erosion adjacent to the gabion wall may indicate concentrated flows or inadequate energy dissipation and shall be corrected to protect both the wall and basin soils.

IAB-2.3.3 Basin Bottom and Sides (Infiltration Zone)

The basin bottom within the infiltration area functions as the primary infiltration surface and temporary storage zone for stormwater runoff. Basin depths are shallow, typically ranging from 2 to 3 feet, and are designed to detain runoff long enough to allow infiltration into underlying soils without creating a permanent pool of water. The basin bottom is generally graded to promote uniform ponding and infiltration and is stabilized with vegetated or amended soil surfaces.

The infiltration basin is intended to fully drain between storm events, and prolonged standing water is not anticipated under normal operating conditions.

The typical maintenance items that are found with the basin bottom are as follows:

- a. *Sediment and Debris Accumulation* – Fine sediments and debris may accumulate on the basin bottom over time, potentially reducing infiltration capacity by sealing soil pores. Accumulated sediment shall be removed when it begins to form a visible surface layer or when infiltration performance is noticeably reduced.
- b. *Surface Sealing or Soil Compaction* – Repeated storm events or maintenance activities may compact soils or create a hardened surface crust that inhibits infiltration. Indicators include prolonged ponding, hardened soil surfaces, or sparse vegetation. Corrective actions may include scarification, soil amendment, or partial replacement of the basin bottom soils.
- c. *Vegetation Condition and Weed Growth* – Vegetation shall be inspected for vigor, uniform coverage, and suitability. Woody vegetation and deep-rooted plants shall be removed to prevent interference with infiltration and potential damage to adjacent structures. Noxious weeds shall be controlled to preserve desirable ground cover and maintain basin function.
- d. *Localized Erosion or Rilling* – Minor erosion, rills, or depressions may occur due to concentrated inflows or uneven drainage patterns. Any erosion shall be repaired promptly to maintain uniform infiltration and prevent sediment transport to lower portions of the basin.
- e. *Prolonged Ponding* – Standing water persisting longer than 72 hours after a storm event may indicate reduced infiltration capacity or clogged soils. If prolonged ponding is observed, the basin bottom shall be evaluated and maintenance actions implemented to restore infiltration performance.

IAB-2.3.4 Miscellaneous

There are a variety of inspection/maintenance issues that may not be attributed to a single feature within the IAB. This category on the inspection form is for maintenance items that are commonly found in the IAB but may not be attributed to an individual feature.

a. Encroachment in Easement Area – Private lots/property can sometimes be located very close to the IABs, even though they are required to be located in tracts with drainage easements. Property owners may place landscaping, trash, fencing, or other items within the easement area that may affect maintenance or the operation of the facility.

b. Graffiti/Vandalism – Damage to the IAB infrastructure can be caused by vandals. If criminal mischief is evident, the inspector should forward this information to the local Sheriff's Office.

c. Public Hazards – Public hazards include items such as vertical drops of greater than 4-feet, containers of unknown/suspicious substances, exposed metal/jagged concrete on structures. If any hazard is found within the facility area that poses an immediate threat to public safety, contact the Sheriff at 911 immediately!

d. Burrowing Animals/Pests – Prairie dogs and other burrowing rodents may cause damage to the IAB features and negatively affect the vegetation within the IAB. Consult EPC Environmental Division if this becomes an issue.

e. Other – Any miscellaneous inspection/maintenance items not contained on the form should be entered here.

IAB-3 MAINTAINING INFILTRATION AREA BASINS (IABS)

IAB-3.1 Maintenance Personnel

Maintenance personnel must be qualified to properly maintain IABs. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

IAB-3.2 Equipment

It is imperative that the appropriate equipment and tools are taken to the field with the operations crew. The types of equipment/tools will vary depending on the task at hand. Below is a list of tools, equipment, and material(s) that may be necessary to perform maintenance on an IAB:

- 1.) Loppers/Tree Trimming Tools
- 2.) Mowing Tractors

- 3.) Trimmers (extra string)
- 4.) Shovels
- 5.) Rakes
- 6.) All Surface Vehicle (ASVs)
- 7.) Skid Steer
- 8.) Backhoe
- 9.) Track Hoe/Long Reach Excavator
- 10.) Dump Truck
- 11.) Jet-Vac Machine
- 12.) Engineers Level (laser)
- 13.) Riprap (Minimum - Type M)
- 14.) Filter Fabric
- 15.) Erosion Control Blanket(s)
- 16.) Seed Mix (Native)
- 17.) Illicit Discharge Cleanup Kits
- 18.) Trash Bags
- 19.) Tools (wrenches, screw drivers, hammers, etc.)
- 20.) Chain Saw
- 21.) Confined Space Entry Equipment
- 22.) Approved Stormwater Facility Operation and Maintenance Manual

Some of the items identified above may not be needed for every maintenance operation. However, this equipment should be available to the maintenance operations crews should the need arise.

IAB-3.3 Safety

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the IAB that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

IAB-3.4 Maintenance Categories and Activities

A typical IAB Maintenance Program will consist of three broad categories of work: routine, minor, and major maintenance activities. Within each category of work, a variety of maintenance activities can be performed on an IAB. A maintenance activity can be specific to each feature within the IAB, or general to the overall facility. A variety of maintenance activities are typical of IABs. The maintenance activities range in magnitude from routine trash pickup to the reconstruction of drainage infrastructure. The following three sub-sections (3.5, 3.6, and 3.7) explain each of the categories and briefly describes the typical maintenance activities for an IAB, including the objectives and frequency of actions.

IAB-3.5 Routine Maintenance Activities

The majority of this work consists of regularly scheduled mowing and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging structure. It also includes activities such as weed control, mosquito treatment, and algae treatment. These activities will normally be performed numerous times during the year. These items can be completed without any prior correspondence with the EPC Stormwater; however, completed

inspection and maintenance forms shall be retained for each inspection and maintenance activity.

The Maintenance Activities are summarized below, and further described in the following sub-sections.

TABLE – IAB-2 Summary of Routine Maintenance Activities

MAINTENANCE ACTIVITY	MINIMUM FREQUENCY	LOOK FOR	MAINTENANCE ACTION
Mowing	Twice annually	Excessive grass height/aesthetics	Mow grass to a height of 4” to 6”
Trash/Debris Removal	Twice annually	Trash & debris in IAB	Remove and dispose of trash and debris
Gabion Wall Inspection	As needed – after significant rain events – twice annually at a minimum	Structural Damage, Rusting, Erosion	Remove and dispose of debris/trash/sediment and correct any structural issues
Weed control	Minimum twice annually	Noxious weeds; Unwanted vegetation	Treat w/ herbicide or hand pull; Consult the local weed specialist
Mosquito Treatment	As needed	Standing water/ mosquito habitat	Treat w/ EPA approved chemicals
Algae Treatment	As needed	Standing water/ Algal growth/green color	Treat w/ EPA approved chemicals

IAB-3.5.1 Mowing

Occasional mowing is necessary to limit unwanted vegetation and to improve the overall appearance of the IAB. Native vegetation should be mowed to a height of 4-to-6 inches tall. Grass clippings should be collected and disposed of properly.

Frequency – Routine - Minimum of twice annually or depending on aesthetics.

IAB-3.5.2 Trash/Debris Removal

Trash and debris must be removed from the entire IAB area to minimize clogging and to improve aesthetics. This activity must be performed prior to mowing operations.

Frequency – Routine – Prior to mowing operations and minimum of twice annually.

IAB-3.5.3 Gabion Wall Inspection

Inspection activities shall include removal of trash, sediment, and excessive vegetation from gabion faces and voids, and verification that baskets remain properly aligned, intact, and free of displacement or undermining. Any observed damage, deformation, or clogging that may impair infiltration or structural stability shall be addressed promptly.

Frequency – Routine – After significant rainfall events and concurrently with other scheduled maintenance activities.

IAB-3.5.4 Weed Control

Noxious weeds and other unwanted vegetation must be treated as needed throughout the IAB. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with the Environmental Division at 719-520-7878 is highly recommended prior to the use of herbicide.

Frequency – Routine – As needed based on inspections.

IAB-3.5.5 Mosquito/Algae Treatment

Treatment of permanent pools is necessary to control mosquitoes and undesirable aquatic vegetation that can create nuisances. Only EPA approved chemicals/materials can be used in areas that are warranted.

Frequency – As needed.

IAB- 3.6 Minor Maintenance Activities

This work consists of a variety of isolated or small-scale maintenance or operational problems. Most of this work can be completed by a small crew, tools, and small equipment. These items may require prior correspondence with EPC Stormwater and require completed inspection and maintenance forms to be submitted to EPC upon request for each inspection and maintenance activity.

Table – IAB-3 Summary of Minor Maintenance Activities

MAINTENANCE ACTIVITY	MINIMUM FREQUENCY	LOOK FOR	MAINTENANCE ACTION
Sediment Removal	As needed; typically, every 1–2 years	Sediment build-up; decrease in pond volume	Remove and dispose of sediment
Erosion Repair	As needed, based upon inspection	Rills/gullies forming on side slopes, trickle channel, other areas	Repair eroded areas Revegetate; address source of erosion
Vegetation Removal/Tree Thinning	As needed, based upon inspection	Large trees/wood vegetation in lower stage of pond	Remove vegetation; restore grade and surface
Gabion Cleaning (Jet/Vac)	As needed, based upon inspection	Sediment build-up/ non draining system	Clean rocks; Jet Vac if needed

IAB-3.6.1 Sediment Removal

Sediment removal is necessary to maintain the original design volume of the IAB and to ensure proper function of the infrastructure. Regular sediment removal (minor) from the forebay, inflow(s), and trickle channel can significantly reduce the frequency of major sediment removal activities (dredging) in the upper and lower stages. The minor sediment removal activities can typically be addressed with shovels and smaller equipment. Major sediment removal activities will require larger and more specialized equipment. The major sediment activities will also require surveying with an engineer’s level, and consultation with EPC Stormwater Staff to ensure design volumes/grades are achieved.

Stormwater sediments removed from IABs do not meet the criteria of “hazardous waste”. However, these sediments are contaminated with a wide array of organic and inorganic pollutants and handling must be done with care. Sediments from permanent pools must be carefully removed to minimize turbidity, further sedimentation, or other adverse water quality impacts. Sediments should be transported by motor vehicle only after they are dewatered. All sediments must be taken to a landfill for proper disposal. Prompt and thorough cleanup is important should a spill occur during transportation.

Frequency – Nonroutine – As necessary based upon inspections. Sediment removal in the

forebay and trickle channel may be necessary as frequently as every 1-2 years.

IAB-3.6.2 Erosion Repair

The repair of eroded areas is necessary to ensure the proper function of the IAB, minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor repairs to trickle channels, energy dissipaters, and rilling to major gullies in the embankments and spillways. The repair of eroded areas may require the use of excavators, earthmoving equipment, riprap, concrete, erosion control blankets, and turf reinforcement mats. Major erosion repair to the basin embankments, and adjacent to structures will require consultation with EPC Stormwater Staff.

Frequency – Nonroutine – As necessary based upon inspections.

IAB-3.6.3 Vegetation Removal/Tree Thinning

Dense stands of woody vegetation (willows, shrubs, etc) or trees can create maintenance problems for the infrastructure within an IAB. Tree roots can damage structures and invade pipes/channels thereby blocking flows. Also, trees growing in the upper and lower stages of the IAB will most likely have to be removed when sediment/dredging operations occur. A small tree is easier to remove than a large tree, therefore, regular removal/thinning is preferred. All trees and woody vegetation that is growing in the bottom of the IAB or near structures (gabion wall) should be removed. Any trees or woody vegetation in the IAB should be limited to the upper portions of the pond banks.

Frequency – Nonroutine – As necessary based upon inspections.

IAB-3.6.4 Clearing Jet-Vac

An IAB contains gabion structures that can be clogged with debris. These blockages can result in a decrease of hydraulic capacity and create standing water in areas outside of the micropool. Often the blockage to this infrastructure can be difficult to access and/or clean. Specialized equipment (jet-vac machines) may be necessary to clear debris from these difficult areas.

Frequency – Nonroutine – As necessary based upon inspections.

IAB-3.7 Major Maintenance Activities

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires consultation with EPC Stormwater Staff to ensure the proper maintenance is performed. This work requires that the staff review the original design and construction drawings to assess the situation and assign the necessary maintenance. **An ESQCP permit may be required for major maintenance activities.** This work may also require more specialized maintenance equipment, design/details, surveying, or assistance through private contractors and consultants.

Table – IAB-4 Summary of Major Maintenance Activities

MAINTENANCE ACTIVITY	MINIMUM FREQUENCY	LOOK FOR	MAINTENANCE ACTION
Major Sediment Removal	As needed – based upon scheduled inspections	Large quantities of sediment; reduced basin capacity	Remove and dispose of sediment. Repair vegetation as needed
Major Erosion Repair	As needed – based upon scheduled inspections	Severe erosion including gullies, excessive soil displacement, areas of settlement, holes	Repair erosion – find cause of problem and address to avoid future erosion
Structural Repair	As needed – based upon scheduled inspections	Deterioration and/or damage to structural components – gabion wall	Structural repair to restore the structure to its original design

IAB-3.7.1 Major Sediment Removal

Major sediment removal consists of removal of large quantities of sediment or removal of sediment from vegetated areas. Care shall be given when removing large quantities of sediment and sediment deposited in vegetated areas. Large quantities of sediment need to be carefully removed, transported and disposed of. Vegetated areas need special care to ensure design volumes and grades are preserved.

Frequency – Nonroutine – Repair as needed based upon inspections.

IAB-3.7.2 Major Erosion Repair

Major erosion repair consists of filling and revegetating areas of severe erosion. Determining the cause of the erosion as well as correcting the condition that caused the erosion should also be part of the erosion repair. Care should be given to ensure design grades and volumes are preserved.

Frequency – Nonroutine – Repair as needed based upon inspections.

IAB-3.7.3 Structural Repair

An IAB includes gabion structures that can deteriorate or be damaged during the course of routine maintenance. These structures are constructed of steel wire and rocks that can degrade or be damaged and may need to be repaired or re-constructed from time to time.

In-house operations staff can perform some of the minor structural repairs. Major repairs to structures may require input from a structural engineer and specialized contractors. Consultation with EPC Stormwater Staff should take place prior to all structural repairs.

Frequency – Nonroutine – Repair as needed based upon inspections.

Reference:

This manual is adapted from SEMSWA and the Town of Parker, Colorado, STORMWATER PERMANENT BEST MANAGEMENT PRACTICES (PBMP) LONG-TERM OPERATION AND MAINTENANCE MANUAL, October 2004

For additional resources and contact info, visit the EPC Stormwater website:

<https://publicworks.elpasoco.com/stormwater/>