



MGP ENTERPRISE A-4 RECLAMATION PLAN

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Prepared For
**BP America
Production Company**

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ATTACHMENTS

Attachment 1: Construction Plans

- G-01: Cover Sheet
- G-02: Existing Conditions
- C-01: Gas Well Pad Regrading Plan
- C-02: Sections
- C-02.1: Sections
- C-03: Volumes and Cut-Fill Grid
- C-04: Erosion Control Plan
- C-05: Details

Attachment 2: Site Specific Calculations

Attachment 3: Draft Standardized Methods for Well Pad Reclamation

Attachment 4: First Growing Season Field Assessment Form

Attachment 5: Qualitative Erosion Monitoring Form

1. PURPOSE AND OBJECTIVES

This Reclamation Plan (Plan) has been prepared by Woodard & Curran, Inc. on behalf of BP America Production Co (BP) to describe the design for completing the reclamation of disturbances associated with the MGP Enterprise A-4 (MGP A-4) well pad located on private land approximately 20 miles west of Trinidad, Colorado in Las Animas County. This Plan was developed in response to and based on a Colorado Oil and Gas Conservation Commission (COGCC) inspection of the MGP A-4 well pad in October 2022, a follow-up from previous inspections. This Plan includes:

- Section 2 – Site Background
- Section 3 – Reclamation Approach
- Section 4 – Anticipated Schedule and Monitoring
- Section 5 – Correction Actions Summary and Reclamation Success Criteria

The primary objective of the reclamation is to stabilize the land area disturbed during well pad construction, including restoration of the natural vegetative community, hydraulic systems, visual resources, and wildlife habitats with a design that can be safely implemented given the physical hazards posed by steep terrain. The secondary objective is to accommodate the landowner's preference to leave the approximately 0.4-mile access road from Hill Ranch Road to the well pad intact. To achieve these potentially competing objectives, the well pad will only be regraded/contoured to the extent that the primary objective can be achieved.

2. SITE BACKGROUND

2.1 Location

MGP A-4 is a former gas-producing well (API #: 05-071-06094) located in Las Animas County, Colorado in NWNE of Section 9 T34S R66W on private land owned by Hill Ranch (herein referred to as the "Site"). Attachment 1, Sheet G-01 shows the Site location.

2.2 Climate

According to the United States Environmental Protection Agency (EPA), the Site and immediate vicinity are within the Level III Ecoregion "Southern Rockies" and the Level IV Ecoregion "Sedimentary Mid-Elevation Forests." According to the Western Regional Climate Center (WRCC), for the period between February 1989 and June 2016, the annual average maximum temperature was 65.8 degrees Fahrenheit (F), the average minimum temperature was 33.4 degrees F, the average total precipitation was 17.15 inches, and the average total snowfall was 34.7 inches. According to the WRCC, the prevailing wind direction at the nearest meteorological station, located at the Trinidad Airport, is West-Southwest based on hourly data from 1992-2002.

2.3 Topography

The MGP A-4 well pad is located on a cut-out hillslope, at an elevation of approximately 6,850 feet above mean sea level (amsl). The pad itself is generally flat and approximately one acre. There are two steep slopes descending from the west and south sides of the pad. According to the topographic survey conducted in 2023 (see Section 2.7.1), the slope to the west of the well pad descends approximately 146 vertical feet over 320 horizontal feet, with slopes ranging from 2.2:1 to 1.5:1. The slope is approximately 340 feet across at its widest and 146 feet at its narrowest. The slope to the south of the well pad is smaller, descending approximately 54 vertical feet over approximately 137 horizontal feet. The width of the southern slope is approximately 80 feet.

2.4 Geology

The Site is located in the Raton Mesa region of south-central Colorado, in an area characterized by flat-topped mesa with steep slopes and separated by deep canyon formations. The Raton Basin is an Upper Cretaceous and Tertiary sedimentary basin with structural formations of rock created by tectonic warping of a previously flat-lying strata (Wood, 2021). The Site is situated on the Raton Formation, which crops out over most of the Raton Mesa region, with a maximum thickness of 1,700 feet (NMGS, 1969). This formation is comprised of yellow-white, gray, and olive-gray, very fine- to coarse-grained arkose, graywacke, and quartzose sandstone beds; gray to dark gray siltstone and silty shale beds, and numerous coal beds (NMGS, 1969).

Depth to bedrock at and around the Site varies from 0 to 17 feet below ground surface (see Section 2.10.3).

2.5 Soil

According to the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), the soil type associated with the MGP A-4 well pad is the Saruche-Rombo-Rock outcrop complex, 25 to 50 percent slopes. The typical profile of Saruche is 0 to 4 inches of channery silty clay loam, underlain by 4 to 16 inches

of parachannery silty clay loam, underlain by 16 to 30 inches of bedrock. The typical profile of Rombo is 0 to 4 inches of channery silty clay loam, underlain by 4 to 22 inches of channery silty clay loam, underlain by 22 to 34 inches of parachannery silty clay loam, underlain by 34 to 44 inches of bedrock. NRCS classifies the land capability as 7e, which means the soil has severe limitations that make it unsuitable for cultivation and restrict use mainly to grazing, forestland, or wildlife habitat. Subclass "e" indicates that the main hazard is erosion risk unless close-growing plant cover is maintained. Site soils are considered Type D Soils using the NRCS Hydrologic Soil Groups (USDA NRCS, 2022). When thoroughly saturated, Type D soils have high runoff potential, which translates to high erosion potential (USDA NRCS, 2007).

2.6 Operation and Reclamation History

The MGP A-4 well and well pad were drilled and constructed in November 1985 and the well was plugged and abandoned (P&A) in 1993. BP acquired MGP A-4 following its P&A through the acquisition of Amoco Production Company in 1998. As of the acquisition, reclamation had not been completed. On December 19, 2019, COGCC issued a Sundry Notice providing an extension for the reclamation of the well pad. In response to the Sundry Notice, BP enlisted Wood Environment & Infrastructure Solutions, Inc. (Wood) to prepare a Reclamation Plan (Wood, 2021). The Reclamation Plan called for removal of a roadway culvert, stabilization of a roadside scour area with riprap, regrading of the well pad and outslope to a maximum of 2 horizontal:1 vertical (2H:1V), hydroseeding of disturbed areas with a mixture of native grasses and grains, fiber mulching after seeding, and covering the seeded slopes with Bionet C125 erosion control blanket (ECB).

Work to implement the 2021 Reclamation Plan commenced in the spring of 2021 by ENTACT, LLC. Implementation of the 2021 Reclamation Plan was not completed reportedly due to lack of available soil to be regraded and unsafe conditions due to the difficulty of construction equipment navigating steep slopes.

On July 22, 2021, COGCC performed a post-reclamation inspection and reported that reclamation had not been completed and determined that the Site remained out of compliance with COGCC Rule 1004. Three subsequent COGCC inspections were performed, most recently on October 4, 2022. Notable findings from the latest inspection include:

- The well pad and access road had not been recontoured and reclaimed per COGCC Rule 1004 and culverts remain.
- The fill slope was not stabilized, and significant erosion was preventing vegetative establishment.
- Insufficient and inadequately maintained stormwater controls (straw wattles).
- Noxious weeds were observed in the pad access roadway.

In response to an issued Field Inspection Report #690203458 by COGCC on October 5, 2022, BP arranged for additional hydroseeding and best management practice (BMP) installation completed on November 1, 2022 and documented in a Sundry Notice submitted to COGCC on November 21, 2022.

Woodard & Curran, Inc. began managing the site following hydroseeding in November 2022. Woodard & Curran conducted its initial site visit January 2023.

2.7 Land Use

The Site is located on private land in the Raton Mesa region of southern Colorado. Both the land and the access road are owned by Hill Ranch.

2.8 Hydrology

2.8.1 Drainage Area and Soils

Wood prepared a Hydraulics Report as part of their 2021 Reclamation Plan (Wood, 2021). All hydraulic results were updated and/or confirmed for this Reclamation Plan. Updated topographic data was produced in 2023 via photogrammetry using a DJI Phantom 4 drone and processed with Pix4D, yielding a ground sampling distance of 0.96 inch and horizontal and vertical accuracy under 0.3 inch. Using the updated topographic data, Woodard & Curran determined the following local watershed areas at the Site:

- 0.66 acres contribute to the well pad.
- 2.2 acres account for western slope drainage.
- 0.3 acres account for southern slope drainage.

As described in Section 2.4, Site soils are considered Type D and therefore minimal infiltration occurs during precipitation events. The immediate receiving waters is an unnamed ditch and the ultimate receiving waters is the Puragatoire River. Except during extreme flood events, there is a low likelihood of stormwater runoff from the site reaching the unnamed ditch. This is because there is a dirt road (with no culvert) that runs north-south that provides access to another well pad and acts as an approximately 10-foot tall berm between the bottom of the western slope and ditch.

2.8.2 Design Storms

The National Oceanic and Atmospheric Administration (NOAA) provides partial duration series (PDS)-based precipitation frequency estimates for any given location with 90% confidence intervals. The latitude and longitude coordinates were input to the NOAA Atlas 14 Point Precipitation Frequency Estimates online tool. Using the design-life of the erosion control products and allowance for vegetation establishment, the 25-year return interval storm was considered with a safety factor of 1.5. Given precipitation depths at various storm durations, Intensity-Duration-Frequency (IDF) curves were developed to determine the rainfall intensity at the time to concentration (NOAA National Weather Service, 2013). See Attachment 2: Site Specific Calculations for IDF creation, hydrologic, and subsequent hydraulic calculations.

2.9 Vegetation, Wildlife, and Habitat

Woodard & Curran requested a Colorado Conservation Data Explorer (CODEX) report via the Colorado Natural Heritage Program to identify sensitive plant and animal species and natural communities within the project area. The ecosystem in the area includes Rolling Sagebrush Steppe, Evergreen Forest, and Herbaceous habitat (CODEX, 2023). There is sparse vegetation on the well pad and slope. Similar woodland and shrubland plant communities were identified using the Southwest Regional Gap Analysis Project (SWReGAP). The well pad and slope have sparse vegetation compared to the adjacent landscape. The project area is considered high priority habitat as elk and mule deer winter range, is within an Aquatic Sportfish Management Water, and supports birds, bears, snakes, lizards, and rodents (CODEX, 2023). The Riverine systems are temporarily or seasonally flooded (CODEX, 2023).

2.10 Previous Site Investigation

Wood conducted a site investigation from July 2020 through February 2021. The results from this investigation are included in Wood's 2021 Reclamation Plan (Wood, 2021). Section 2.9 summarizes Wood's findings as they relate to the current phase of reclamation.

2.10.1 Vegetation and Topography

The well pad was constructed by cutting into the hillside and depositing the cut material on the downslope sides. The downhill slope is roughly 2H:1V and steeper. Woodard & Curran performed an aerial survey in 2023 to gather updated topographic data, which are presented in the Construction Plans (see Attachment 1, Sheet G-02). Minimal vegetation has established on the disturbed area since the last seeding event in November 2022. There are patches of grasses and herbaceous vegetation, along with sparse juniper and gamble oak shrubs (Wood, 2021). The vegetation is significantly less dense or nonexistent compared with undisturbed areas adjacent to the Site.

2.10.2 Well Head

Wood located the abandoned well head during their 2021 investigation. The top of the 18-inch diameter steel well head is located approximately 8 feet below ground surface (bgs). The well head location is indicated on the Construction Plans (see Attachment 1, Sheet G-02) and must be protected in place during any reclamation activities.

2.10.3 Geotechnical Analysis and Depth to Bedrock

Wood conducted a geotechnical investigation including digging 11 test pits to refusal using an excavator. The test pits were excavated by USA Environment, now ENTACT. The depth of the fill placed from the construction of the well pad ranged from 10 to 17 feet. Test pit excavation depths ranged from 3 to 17 ft bgs when refusal was encountered. No groundwater was encountered. Wood noted that the well pad appeared to be well compacted (Wood, 2021).

Select soil samples were sent to the laboratory for moisture content, grain size analyses and USCS classification, Atterberg limits, direct shear, and Standard Proctor tests. The native soils were weathered from the Raton Formation rocks, consisting primarily of clayey sand or clayey gravel with cobbles and boulders. The laboratory classified the soils using the USCS and identified clayey sand (SC) and clayey gravel (GC). Fine to coarse angular cobble and boulder sized sandstone rock fragments up to 5 feet in diameter were present in the soils.

Table 1: General Subsurface Profile (Wood, 2021)

Stratum	Material Description (USCS)	Depth to Bottom of Stratum (ft)
Fill	Clayey sand and gravel (SC/GC) w/ cobbles and boulders	1 to 17
Bedrock	Weathered sandstone bedrock	17+

3. RECLAMATION APPROACH

Woodard & Curran followed a systematic approach to development of this Reclamation Plan. The Draft Standardized Methods for Well Pad Reclamation Design is provided as Attachment 3. There are four major steps in the well pad reclamation design process, described below. Below is a summary of calculations, tools, and industry standards used to guide the process.

- Land Preparation
 - Includes regrading, removal of debris or noxious weeds, smoothing of surface rills, etc. Provides alternative means and methods given site-specific conditions and goals.
- Erosion Control BMP Selection
 - Determination of Design Storm.
 - Applicability evaluation and selection of filtration/slope check BMPs (e.g., straw wattles, compost filter sock), using simplified tables and design guidance based on site-specific conditions (Erosion Control Technology Council, 2023).
 - Applicability evaluation and selection of Rolled Erosion Control Product (e.g., jute mat) using simplified tables and design guidance based on site-specific conditions (Erosion Control Technology Council, 2023).
 - Creation of benches in long slopes to ensure interruption in accordance with manufacturer recommendations (see: maximum uninterrupted slope on specification sheet from erosion control product) to maximize erosion control product effectiveness.
 - Evaluation of riprap reinforcement for drainage channels using HEC-15 Shear Stress Analysis for riprap D_{50} design.
 - Consideration of alternative BMPs (e.g., erosion control mat, check dams, runoff diversion)
- Soil Health Evaluation
 - Analyze soil for: pH, Organic Matter or Total Organic Carbon, Nitrogen, Potassium, Moisture Content and perform USCS soil classification for top 3" of soil profile. See Soil Health Evaluation Fact Sheet in Attachment 3 for information regarding how to plan soil sampling and analysis.
 - Consult with an expert and/or utilize Profile Products soil testing service to determine whether amendments (organic matter, nutrients, etc.) are needed prior to seed application, and at what rate.
- Seeding, Mulching, and Stabilizer Evaluation
 - Input site-specific conditions to Profile Product's PS3 online tool. The output is a recommendation of their products and application rates that will enable soil stabilization and growth. There is also an option to request a seed mix, however, it is important to confirm the seed mix with a regional or local expert. Other products, such as those manufactured by LSC, have demonstrated high performance in revegetation projects as well.

- Consult regulator, regional vegetation expert, or contractor for seed mix recommendation.
- Utilize the Erosion Control Technology Council's guidance for selecting an appropriate hydraulic erosion control product.

3.1 Site Preparation and Controls

Site preparation activities shall be conducted prior to any other work. Subsurface utilities must be verified, including the identification of the abandoned well head. The well head will remain in place throughout construction and proper controls must be implemented to provide protection. Maintenance of all access and haul routes is the responsibility of the contractor. The contractor shall fill deep ruts and repair any damage to the existing access road during construction.

3.2 Land Preparation

Stormwater runoff is the main contributor to erosion on the well pad slopes, which causes soil and seed movement, development of rills, and development of more significant gullies. To address stormwater runoff, the following site-specific corrective actions will be implemented.

3.2.1 Surface Erosion Rill Removal

Rocky Mountain Reclamation's (Laramie, WY) proprietary slope chain and slope drag will be the primary tools used to remove rills from the western and southern slopes. This involves attaching a chain to a 4WD John Deer Tractor at the top of the slope and anchoring it to another tractor or heavy equipment at the bottom of the slope, where possible. The slope chain includes an attachment that looks like a playing jack with a disc on the bottom. The slope drag consists of two steel I-beams welded together. Both pieces of equipment function to disturb the slope and till the soil. The slope chain and slope drag will be deployed in a cross-slope fashion (i.e., parallel to contour) across the slopes.

3.2.2 Regrading

- Berm (place fill) along the western and southern edges of the well pad to limit runoff off the well pad onto the downgradient slope in accordance with the Construction Plans (see Attachment 1, Sheet C-01).
- Recontour the well pad to direct runoff to the existing larger gullies on the northwest and southeast slopes of the well pad in accordance with the Construction Plans (see Attachment 1, Sheet C-01).

3.3 Installation of Erosion Control BMPs

- Place 9" diameter sediment retention fiber rolls (e.g., compost logs, straw wattles) along the western slope on the contour at a 20-foot spacing. See plans for layout and installation details and instructions. The fiber rolls must be installed according to the manufacturer's instructions. The fiber rolls should be placed so that they extend to the edge of the disturbed area and act as check dams for flow running off the well pad. The existing drainage feature on the northern side of the western slope beyond the disturbed area is comprised of stabilized vegetation and rocky soil.
- Place 9" diameter sediment retention fiber rolls along the southern slope at a 15-foot spacing to the extent practicable. It is imperative that fiber rolls are installed properly. The fiber rolls should be

placed so that they extend to the edge of the disturbed area and act as check dams for flow running off the well pad. The existing drainage feature on the eastern side of the southern slope beyond the disturbed area is comprised of stabilized vegetation and rocky soil.

- Reinforce the existing drainage channels on northwest and southeast slopes of the well pad, and at the bottom within the proposed swale, using $D_{50}=12"$ Type M riprap. Reinforce the drainage channels on the northwest and southwest portions of the western slope using $D_{50}=24"$ Type VH riprap. Given Site constraints, only place riprap where it is safe for heavy equipment (e.g., top and bottom of drainage channels). According to hydrologic and hydraulic modeling, this size of riprap is designed to withstand a 25-year storm event with a 1.5 factor of safety (USGS, 1986). See Attachment 2: Site Specific Calculations for riprap sizing and design storm determination.
- Install a silt fence at the bottom of the western slope. The intent of the sediment logs is to maintain sheet flow to allow restoration to natural conditions. The shear induced by sheet flow will be resisted by grassy vegetation. However, a silt fence at the bottom of the slope provides an additional erosion control measure protecting the ephemeral stream in the event the previously described measures are overcome by an unusually severe storm.

3.4 Revegetation

The primary goal of revegetation is to achieve 80% cover compared to an undisturbed native/background area. By achieving this primary goal, the slope will also be stabilized, erosion reduced, and habitat improved. Woodard & Curran has monitored the slope during Spring 2023 for signs of seeded species (seedlings). As of April 2023, no significant seedling growth has been observed since hydroseeding in November 2022. The hydroseeding completed in November 2022 was amended with Promatrix and Flexterra (WSP, 2022). Per a conversation with Profile Products (makers of Promatrix and Flexterra), Promatrix and Flexterra are not typically mixed in their application because Flexterra is a more robust version of Promatrix. Additionally, the seed mix included Kentucky Bluegrass, Timothy, and Orchardgrass, which are typically found in sub-irrigated pasture, not in a pinyon-oak community.

In accordance with COGCC guidelines, reseeding will use native species consistent with the adjacent plant community. Woodard & Curran recommends reseeding the slope before mid-June (see Section 4.2.2) using the procedure described in Sections 3.4.1 and 3.4.2.

3.4.1 Soil Health and Fertilization

Three soil samples were collected in March 2023 by Woodard & Curran: one sample on the western slope, one on the southern slope, and one from an undisturbed native area north of the western slope. The samples were collected from 0-6 inches below ground surface within the soil profile and analyzed for organic matter (OM), nitrogen (N), phosphorus (P), and potassium (K). Based on the results of the analysis, fertilizer or other nutrient amendments are not required prior to seed application. The laboratory analytical results are provided in Attachment 2: Site Specific Calculations.

3.4.2 Seeding

Seed will be applied to all slopes: the western slope, the southern slope, and to select portions of the cut slope directly above and to the east of the well pad, depending on field conditions.

Hydroseeding shall be performed at a rate of 40 pounds per acre (lbs/acre) using the seed mix in Table 2 plus 7 lbs/acre using barley and 3 lbs/acre using San Luis Slender Wheatgrass. Barley and San Luis Slender Wheatgrass act as cover crops to provide slope stabilization while the slower growing vegetation germinates and establishes.

Table 2: CO Native Seed Mix

Variety/Common Name	Lbs pure live seed/Acre	Seeds/lb	Seeds/ft sq	% Seeds	% of Mix
Pastura Little bluestem	6.4	130,000	19.10	13.67	16%
Arriba Western wheatgrass	7.2	113,840	18.82	13.47	18%
Sandberg bluegrass	0.8	900,000	16.53	11.83	2%
White River Indian ricegrass	1.6	141,000	5.18	3.71	4%
Vaughn Side oats grama	4.8	190,000	20.94	14.99	12%
CO native blue grama	4.8	200,000	22.04	15.78	12%
Trailhead great basin wildrye	4.8	200,000	22.04	15.78	12%
Critana thickspike wheatgrass	4.8	156,000	17.19	12.31	12%
Total	40		139.70	100.00%	100%

3.4.3 Soil Stabilization

After seed application, the final step is to apply EarthGuard at a rate of 10 gallons per acre along with mulch. This step should be completed following other erosion control activities (erosion rill removal, seeding, and fiber roll installation) and is applicable to all slopes: the western slope, the southern slope, and seeded areas of the cut slope.

EarthGuard can still be effective when only applied from one direction, which may be the case as the contractor encounters wind and steep slopes. EarthGuard bonds with the soil using ion exchange, which makes it more effective in clayey soils, such as those found at the Site (see Section 2.4 and Attachment 2). EarthGuard does not form a hard crust, allowing the strength of germinating seed to push through the EarthGuard matrix.

3.5 Slope Progression Methodology

The order of operations for each 20-foot interval on the western slope and 15-foot interval on the southern slope is as follows:

1. Utilize slope chain and/or slope drag to smooth out surface erosion rills. Manually rake out rills where equipment is ineffective or cannot access.
2. Hydroseed
3. Cover seed using Slope Chain
4. Install sediment retention fiber roll across width of the slope on the contour
5. Apply EarthGuard to entire slope
6. Avoid disturbance of the prepared seedbed areas and commence post-construction monitoring

4. ANTICIPATED SCHEDULE AND MONITORING

4.1 Monitoring Procedures

Inspections will be performed at least monthly through the third quarter of 2023 and at least quarterly thereafter to evaluate general Site conditions, uniformity of vegetation cover, presence of bare areas, identification of noxious weed infestation, location of erosive areas, and general condition of surface water and erosion control structures. Observations will be made on the overall condition of individual components (e.g., vegetation, erosion, and BMPs) of the reclaimed area. Response action recommendations will be made based on the individual component recommendations. Inspections will be documented in field logbooks and/or electronic field forms and will include photographs. Other inspection procedures may be necessary due to ancillary regulatory agency requirements. For example, there may be additional requirements resulting from a Colorado Department of Public Health and Environment stormwater discharge permit.

4.2 Spring 2023

4.2.1 Monitoring

The Site will be monitored until mid-May for presence of seedlings from the November 2022 seed application. The assessment will be made using Attachment 4: First Growing Season – Qualitative Field Assessment Form, or equivalent. Erosion will also be monitored and documented. This assessment will be made using Attachment 5: Qualitative Erosion Monitoring or equivalent.

4.2.2 Maintenance and Response Actions

The reclamation activities described in Sections 3.1 and 3.2 should be completed by the end of June 2023 to ensure installation of BMPs prior to the monsoon season. Revegetation activities should not commence until the proper erosion control measures (regrading and installation of surface water BMPs) are implemented to limit seed vulnerability to erosion.

4.3 Post-Construction Monitoring (2023-2025)

Vegetation and erosional control BMP monitoring will be performed following construction monthly through November 2023 and at least quarterly thereafter until reclamation success criteria is achieved (see Section 5). More frequent inspections may be warranted during the growing season and/or monsoon season. Vegetation assessments will be made using Attachment 4: First Growing Season – Qualitative Field Assessment Form, or equivalent. Erosion and BMP integrity assessment will be made using Attachment 5: Qualitative Erosion Monitoring Form, or equivalent.

Once the operator believes all disturbances meet reclamation standards, COGCC will be contacted to schedule a final abandonment inspection. If self-sustaining vegetation growth has not been observed on the slopes by two years after seeding has occurred, the reclamation approach will be reassessed in coordination with COGCC.

5. CORRECTIVE ACTIONS SUMMARY AND RECLAMATION SUCCESS CRITERIA

5.1 Corrective Actions Summary

The COGCC identified the following deficiencies with the Site during inspections between 2019-2022. Field Inspection Forms are available on the [COGCC website](#).

Noncompliance Item #1: *Per rule 1004, the site should be regraded to the pre-disturbance state. The well pad and road have not been regraded.*

Corrective Action #1: The landowner has requested the pad and road grading remain in place and are not regraded back to pre-drilling state. A 502b variance request is detailed in a letter to the COGCC dated March 6, 2023. The COGCC has denied the waiver until the Site is in compliance with all other 1004 rules, pending a conference call anticipated to occur at the end of May 2023. Regrading of the access roads and well pad to pre-disturbance conditions is not anticipated at this time.

Noncompliance Item #2: *Per rule 1003.e(3) the site must be revegetated for interim reclamation to achieve 80% vegetation coverage.*

Corrective Action #2: Land preparation and seeding, as described in Sections 3.2 and 3.4, are major components of this Reclamation Plan.

Noncompliance Item #3: Per Field Inspection Report 690203458, stormwater controls and erosion BMPs are failing to comply with rule 1002.f.(2).

Corrective Action #3: BMPs will be implemented (see Section 3.3). Erosion rills on the slopes will be removed using a slope chain. Sediment retention fiber rolls will be installed on the slopes at frequencies determined by engineering modeling. Riprap will be placed in drainage channels. Site runoff will be directed to channels. EarthGuard will be applied to the slopes to improve soil stabilization during seed germination.

5.2 Regulatory (Primary) Success Criteria

In accordance with the 1000 Series Rules published by the COGCC (COGCC, 2022), the following reclamation success criteria will be used to evaluate Site stability:

"Interim reclamation of all disturbed areas no longer in use shall be considered complete when all ground surface disturbing activities at the site have been completed, and all disturbed areas have been either built on, compacted, covered, paved, or otherwise stabilized in such a way as to minimize erosion to the extent practicable, or a uniform vegetative cover has been established that reflects pre-disturbance or reference area forbs, shrubs, and grasses with total percent plant cover of at least eighty percent (80%) of pre-disturbance levels or reference areas, excluding noxious weeds. Re-seeding alone is not sufficient."

The point-intercept method, or equivalent, will be employed to verify vegetation coverage is 80% of an appropriate undisturbed reference area. Attachment 4 to this Reclamation Plan was developed for implementing the point-intercept method.

In addition, prior to closure, the Site will conform with COGCC Rule 1004, excepting any variances granted by COGCC.

5.3 Ancillary (Secondary) Success Criteria

Reclamation features supporting the success of revegetation must be functioning adequately to ensure sufficient revegetation. These features include regrading for stormwater drainage routing, riprap placement, and straw wattle (or equivalent) placement along the contour. Their integrity and function will be assessed during scheduled monitoring visits.

Success criteria for the stormwater runoff routing include:

- Minimal new rill development on the slope.
- No significant scouring of embankment or downstream conveyances.
- No significant slope sluffing or soil/seed migration.
- Routing of upstream drainage to keep off slopes.

Success criteria for the riprap placement include:

- No significant migration of riprap.
- No significant scouring of native soils under riprap.

Success criteria for sediment retention fiber roll placement include:

- No significant downhill rills forming.
- No significant scour around the sediment retention fiber rolls.
- Effective sediment capture.

6. REFERENCES

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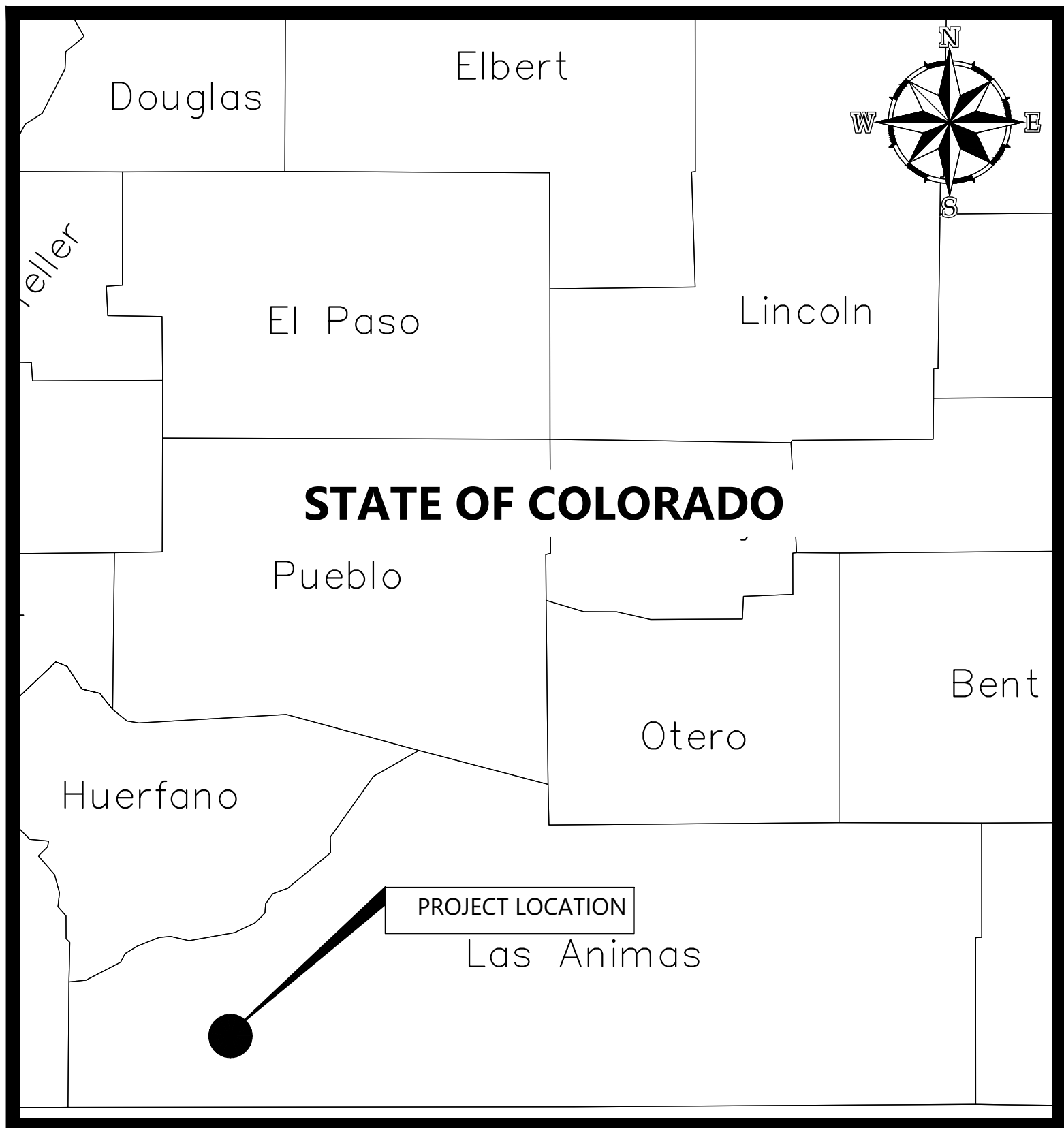
ATTACHMENTS

BP AMERICA PRODUCTION COMPANY (10000) HOUSTON, TEXAS

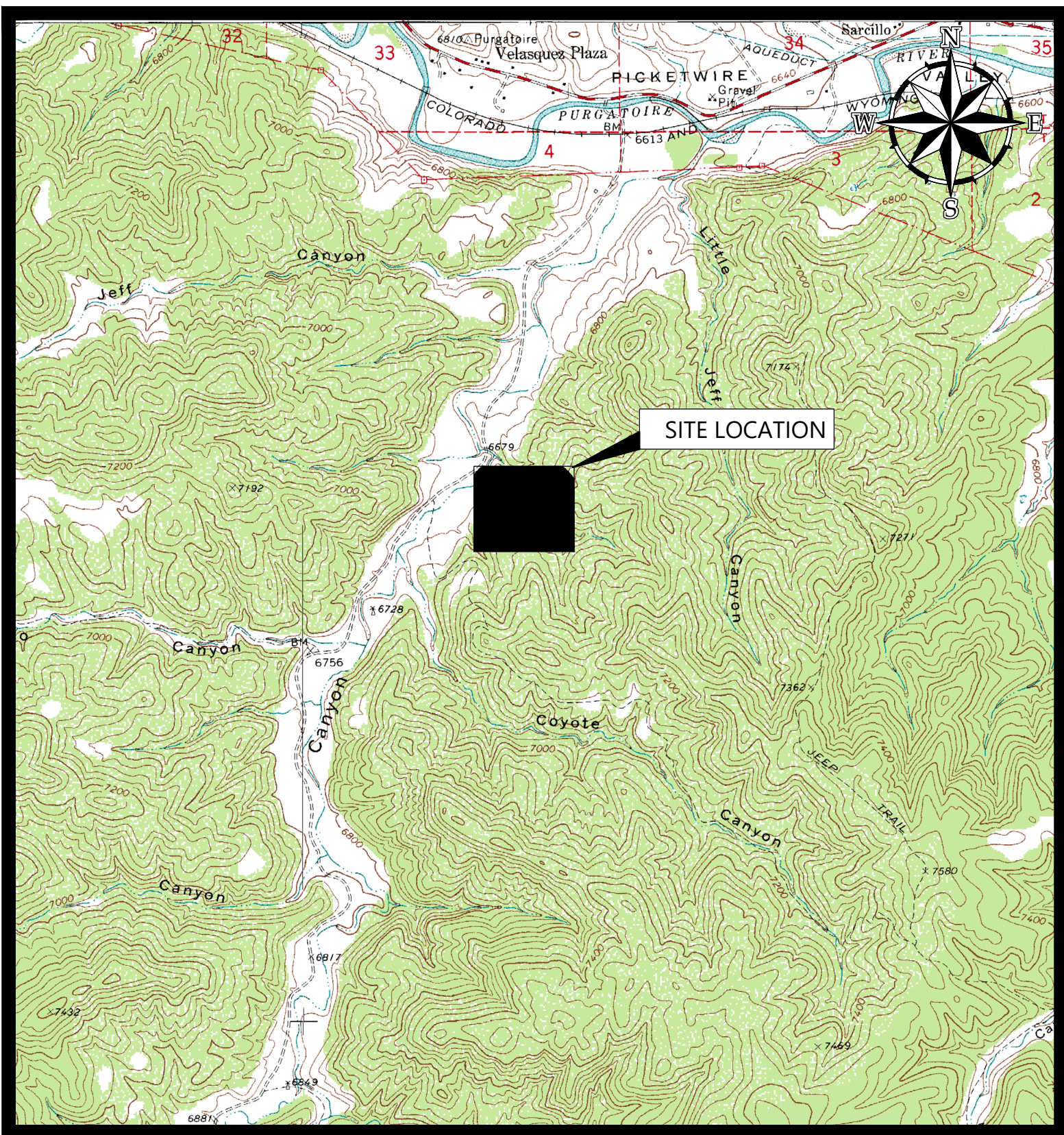
RECLAMATION OF MGP ENTERPRISE A-4 WELL PAD

ISSUED FOR CONSTRUCTION

JUNE, 2023



PROJECT LOCATION MAP



SITE LOCATION MAP

SOURCE: USGS TOPO QUADRANGLE



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RECLAMATION OF MGP
ENTERPRISE A-4 WELL PAD

REV	MM/DD/YY	DESCRIPTION
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JOB NO:	0234949
DATE:	JUNE, 2023
SCALE:	--
DESIGNED BY:	ES
DRAWN BY:	MM
CHECKED BY:	KS
FILENAME:	G-01.dwg

DRAWING TITLE:
GENERAL

COVER SHEET

DRAWING NO:

G-01

SHEET: 1 OF 8



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RECLAMATION OF MGP
ENTERPRISE A-4 WELL PAD

REV	MM/DD/YY	DESCRIPTION
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JOB NO: 0234949

DATE: JUNE, 2023

SCALE: AS NOTED

DESIGNED BY: ES

DRAWN BY: MM

CHECKED BY: KS

FILENAME: G-02.dwg

DRAWING TITLE:
GENERAL

EXISTING CONDITIONS

DRAWING NO:

G-02

SHEET: 2 OF 8

LEGEND:

- EXISTING CONTOURS
- SIDE SLOPE DRAINAGE SWALES
- MAIN DRAINAGE CHANNEL
- CENTERLINE MAIN DRAINAGE CHANNEL
- GRAVEL ACCESS ROAD
- GAS WELL PAD
- ABANDONED GAS WELL



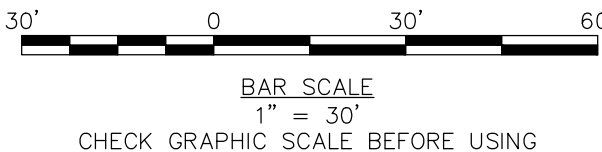
Notes: **P&A Well Location**
Latitude: 37.1050082
Longitude: -104.7803466
Northing: 1160418.55
Easting: 3209876.10

REFERENCE:
WELL LOCATION PER WOOD RECLAMATION
PLAN, DATED 4/8/21.

COORDINATE DATUM:
NAD 83 COLORADO STATE PLANES,
SOUTH ZONE, US FOOT

EXISTING AND PROPOSED PROJECT ELEVATIONS
ARE BASED ON AN ASSUMED LOCAL SITE DATUM.
ELEVATIONS ARE BASED ON A GROUND CONTROL
POINT LOCATED AT 1161045.02 N, 3209683.22 E
(PLASTIC GCP-7). THE BENCHMARK HAS AN
ELEVATION 6777.10 FEET ABOVE MEAN SEA LEVEL
(NAD 1983 [CONUS] USING GEOID18 [CONUS]).
BEARINGS AND NORTH ORIENTATION SHOWN
HEREON ARE BASED UPON THE COLORADO
SOUTH 0503 STATE PLANE COORDINATE SYSTEM.
CONTRACTOR SHALL VERIFY BENCHMARKS AND
RE-SET CONTROL AS NECESSARY PRIOR TO START
OF CONSTRUCTION.

GROUND CONTROL POINTS ARE BLACK PLASTIC
ANCHORING SPIKES.



GROUND CONTROL POINTS

Point #	Elevation	Northing	Easting	Description
2	6859.09	1161376.74	3210262.04	GCP-1
3	6995.32	1160404.53	3210175.70	GCP-2
4	6892.45	1160439.22	3209910.38	GCP-3
5	6851.67	1160291.10	3209807.76	GCP-4
6	6734.36	1160770.47	3209570.25	GCP-5
7	6704.44	1161704.65	3209683.70	GCP-6
8	6777.10	1161045.02	3209683.22	GCP-7



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RECLAMATION OF MGP
ENTERPRISE A-4 WELL PAD

REV	MM/DD/YY	DESCRIPTION
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JOB NO: 0234949

DATE: JUNE, 2023

SCALE: AS NOTED

DESIGNED BY: ES

DRAWN BY: MM

CHECKED BY: KS

FILENAME: C-01.dwg

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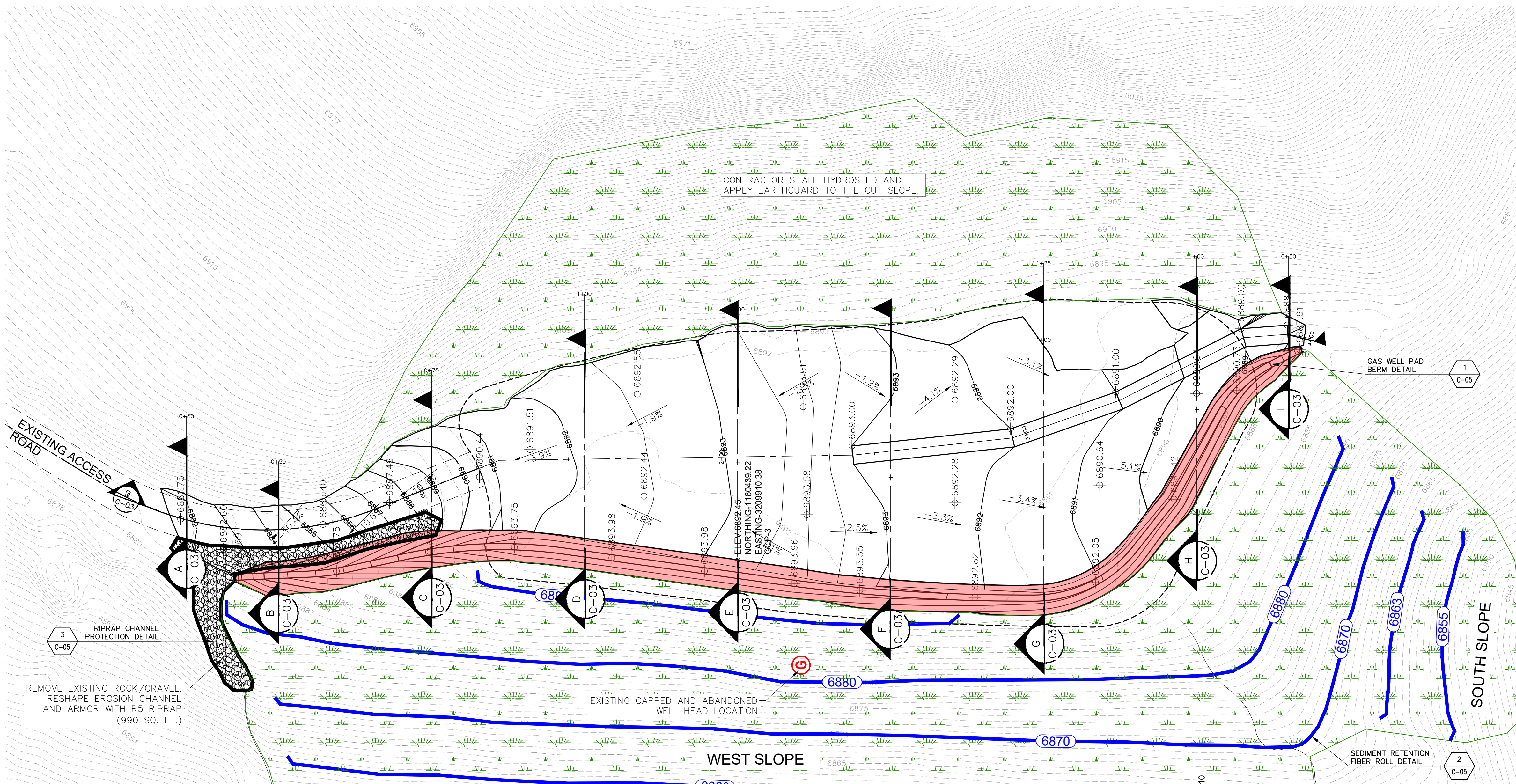
CIVIL

**GAS WELL PAD
REGRADING PLAN**

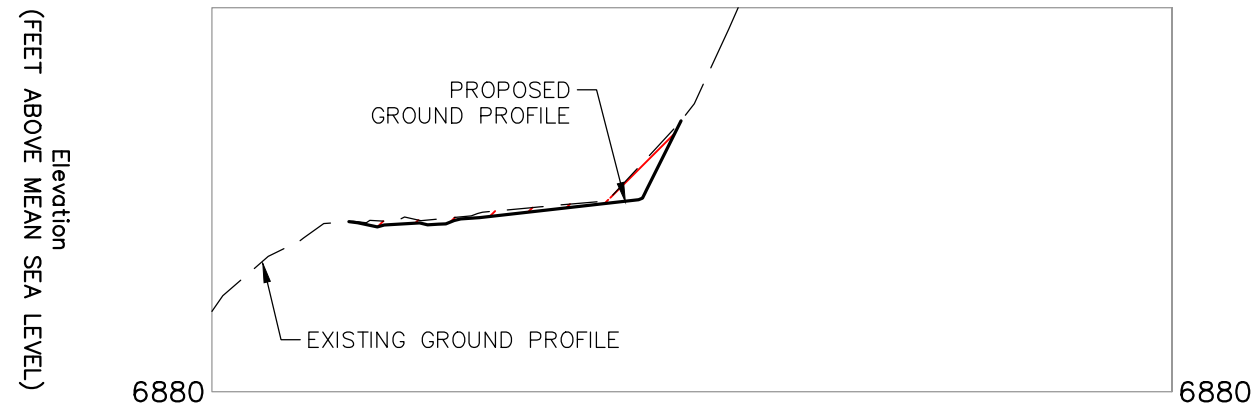
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SHEET: 3 OF 8

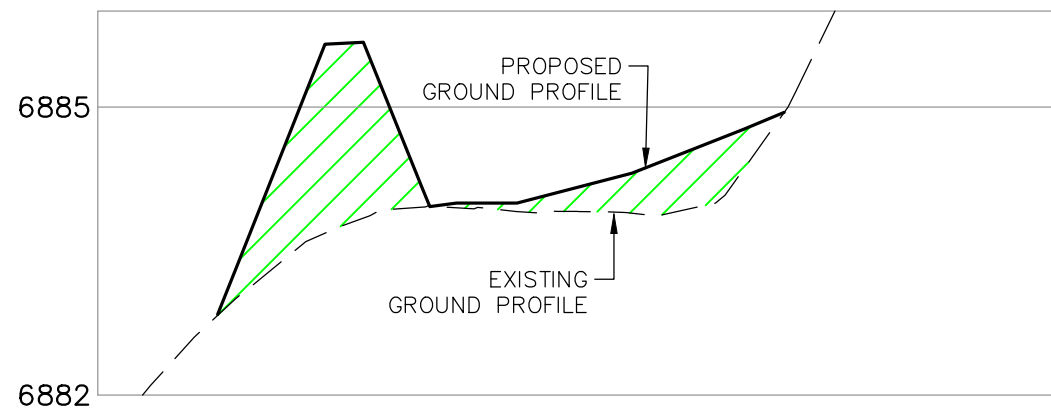


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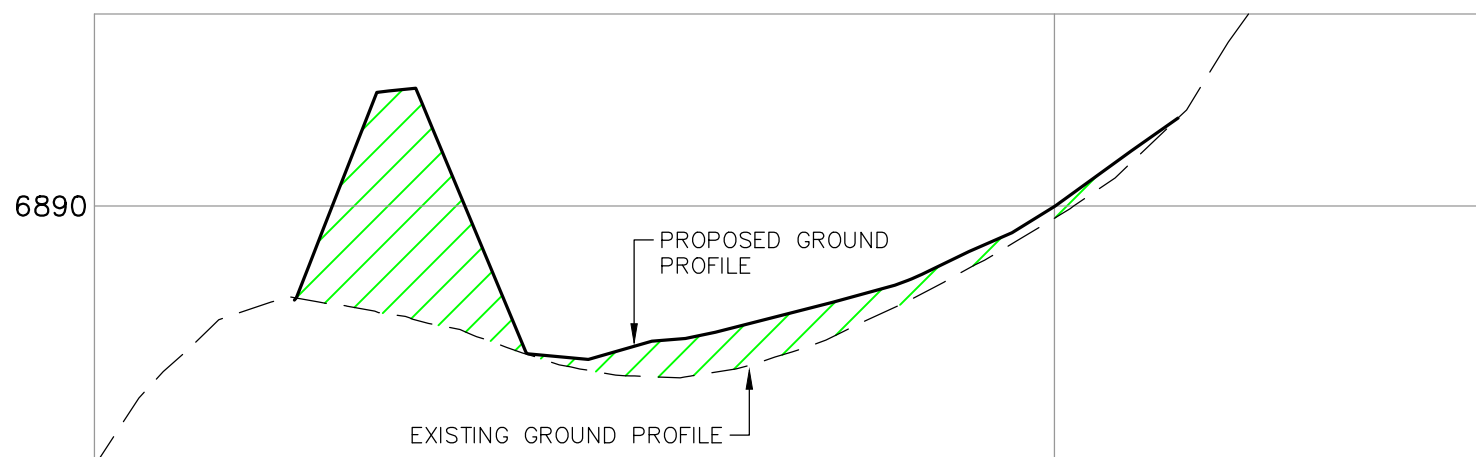
SECTION A-A-PROFILE STA. 0+00 TO STA. 0+50

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



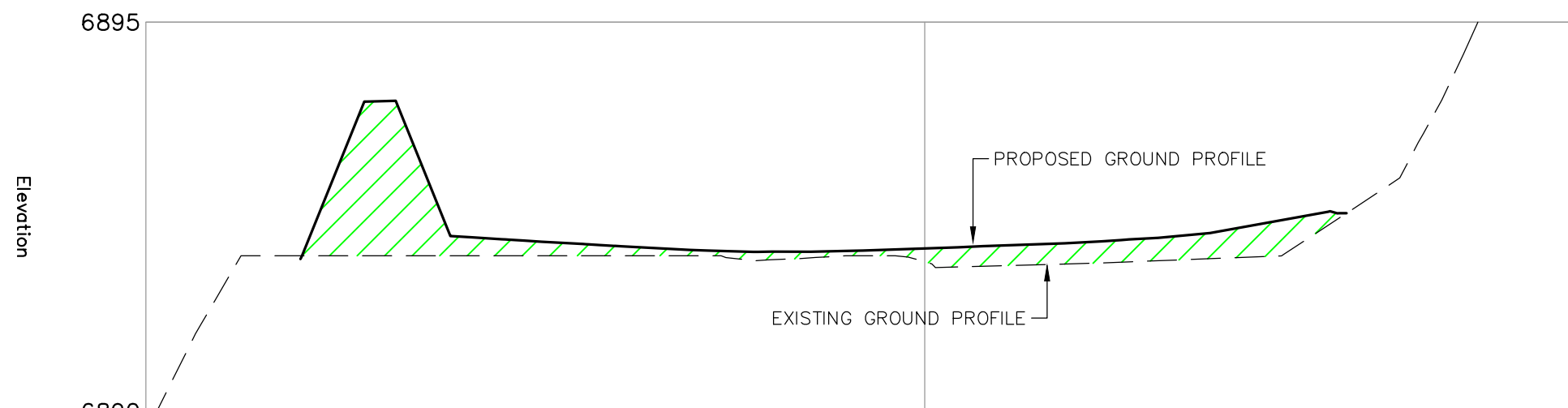
SECTION B-B-PROFILE STA. 0+00 TO STA. 0+50

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



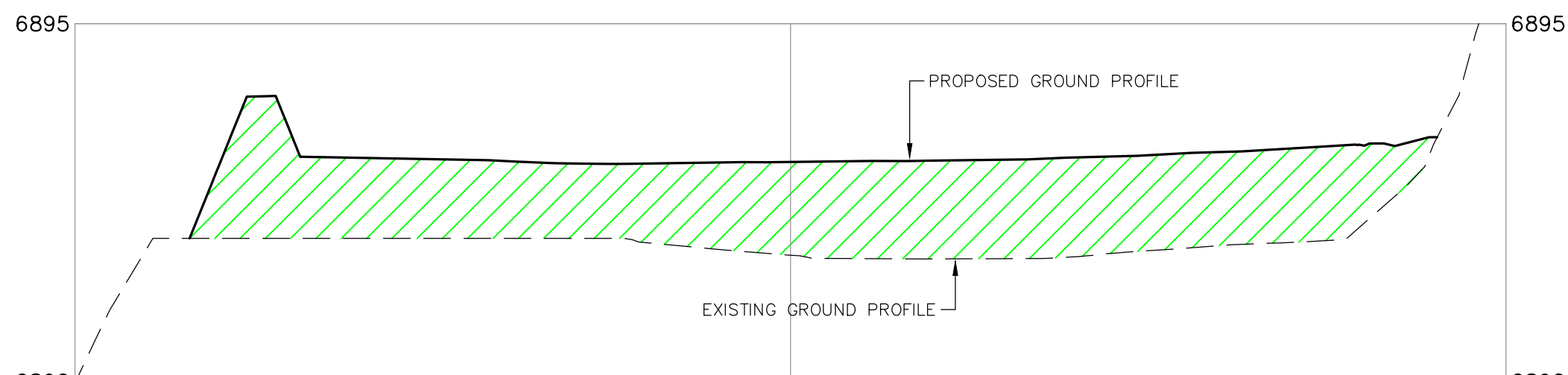
SECTION C-C-PROFILE STA. 0+00 TO STA. 0+75

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



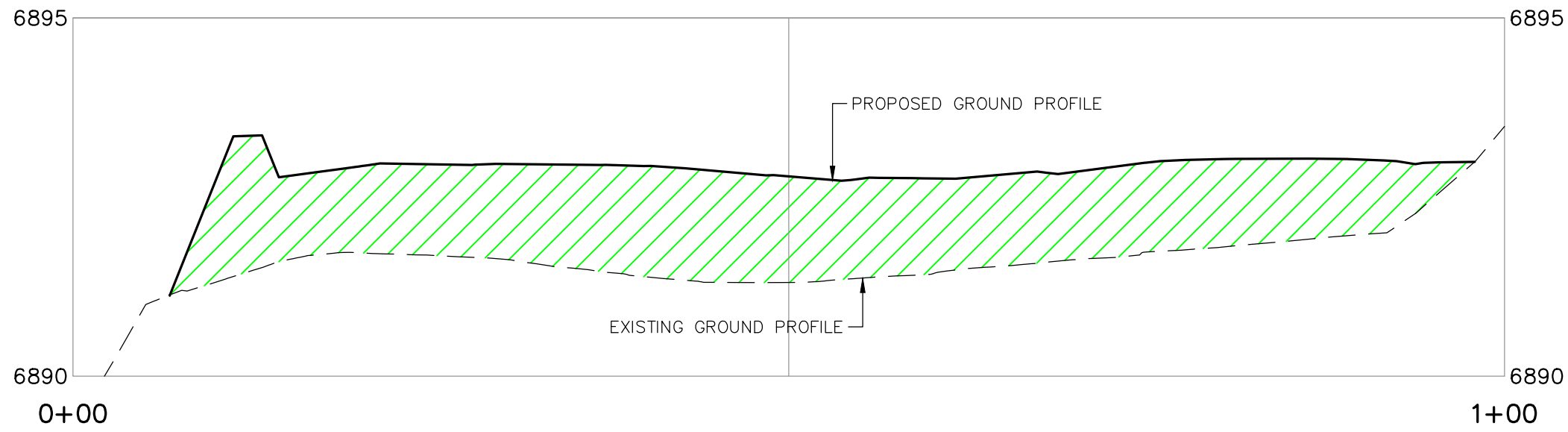
SECTION D-D-PROFILE STA. 0+00 TO STA. 1+00

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



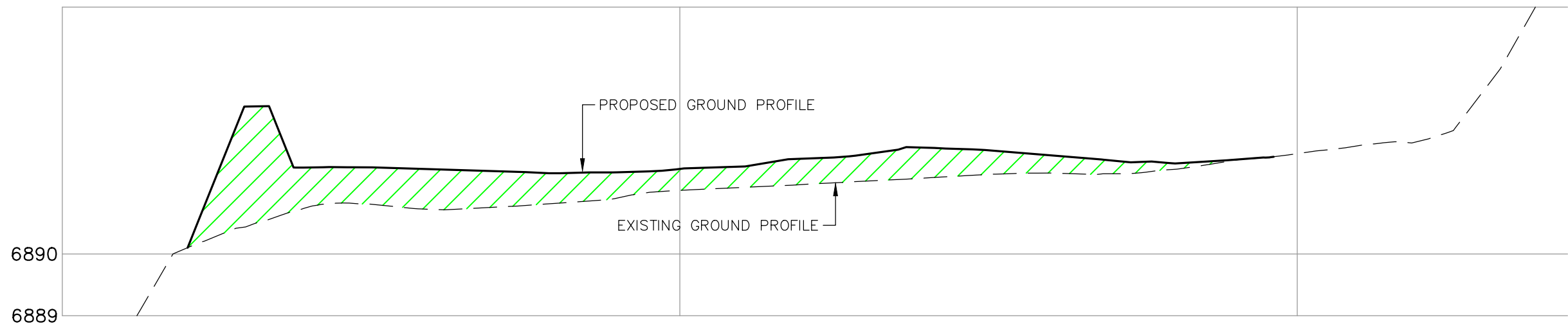
SECTION E-E-PROFILE STA. 0+00 TO STA. 1+00

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



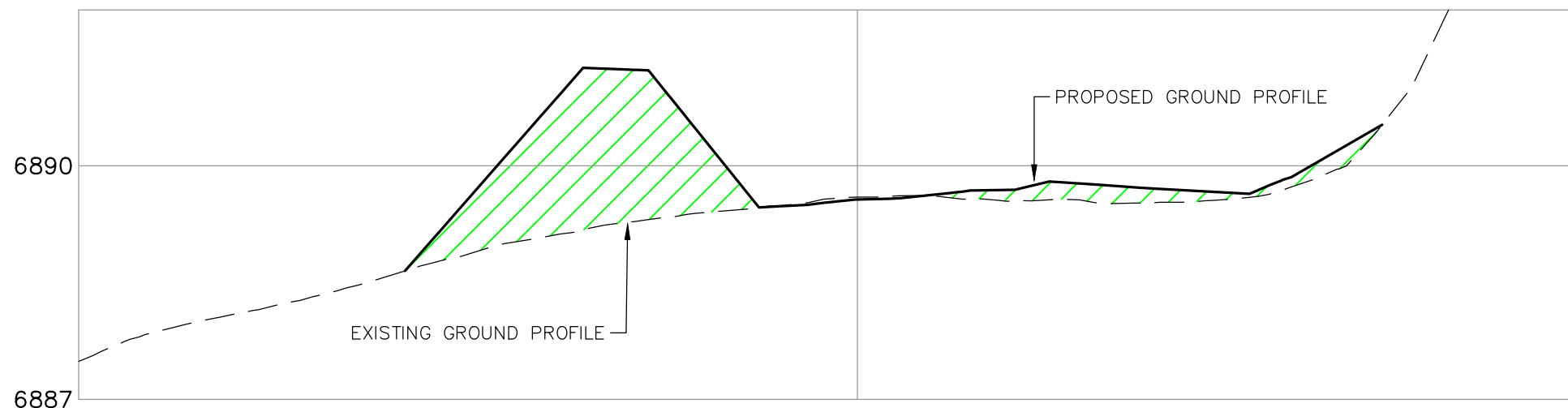
SECTION F-F-PROFILE STA. 0+00 TO STA. 1+00

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



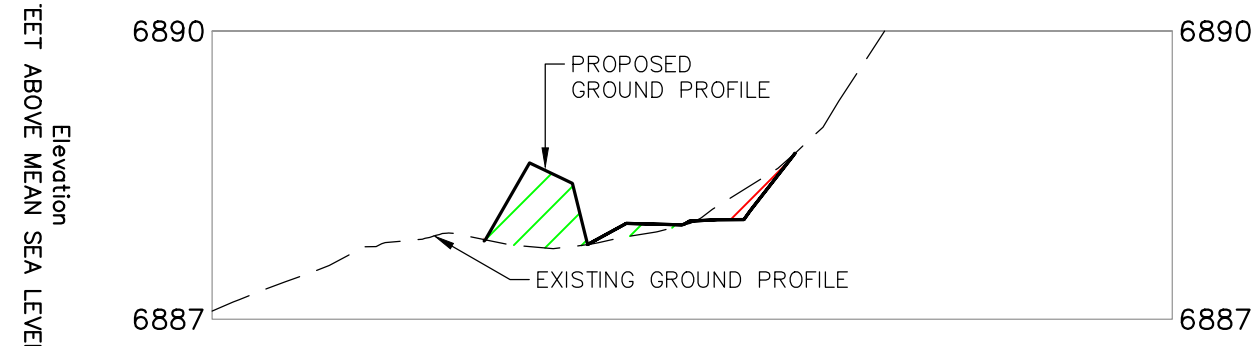
SECTION G-G-PROFILE STA. 0+00 TO STA. 1+25

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



SECTION H-H-PROFILE STA. 0+00 TO STA. 1+00

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



SECTION I-I-PROFILE STA. 0+00 TO STA. 0+50

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



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RECLAMATION OF MGP
ENTERPRISE A-4 WELL PAD

REV	MM/DD/YY	DESCRIPTION
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JOB NO:	0234949
DATE:	JUNE, 2023
SCALE:	AS NOTED
DESIGNED BY:	ES
DRAWN BY:	MM
CHECKED BY:	KS
FILENAME:	C-02.dwg

DRAWING TITLE:

CIVIL

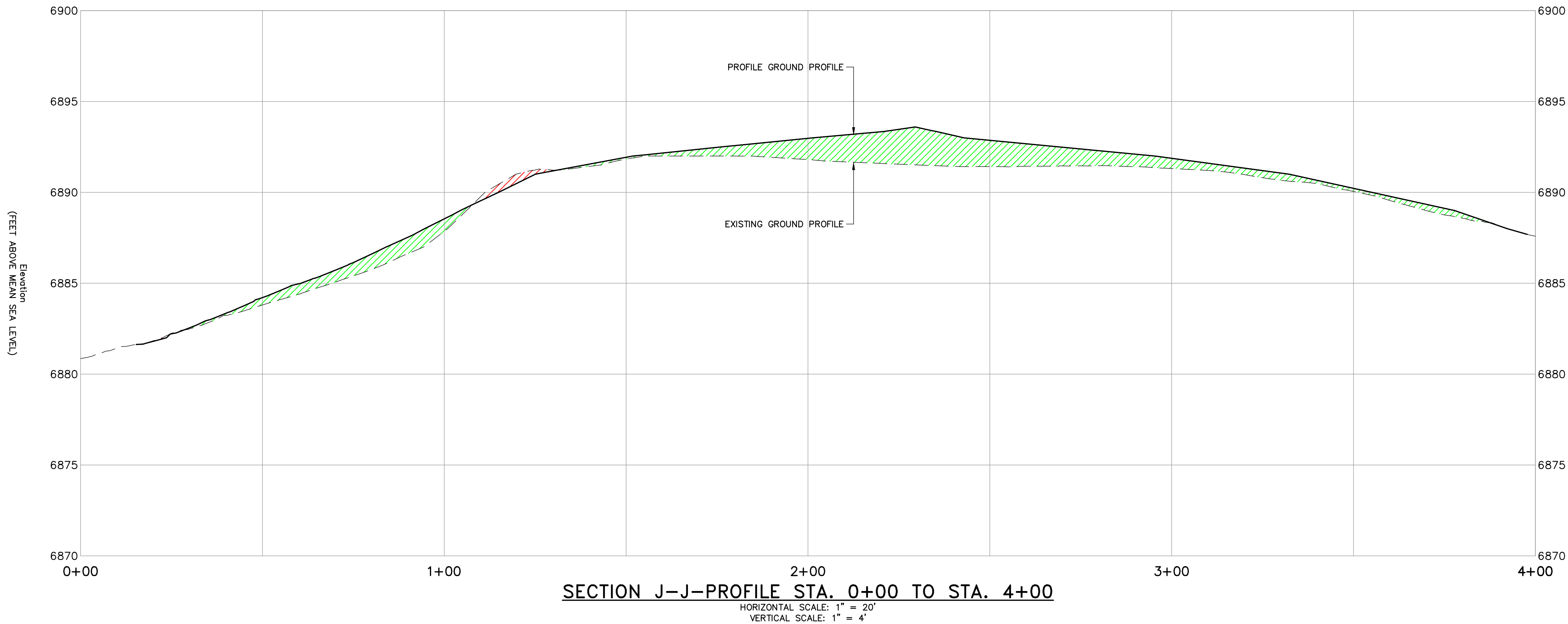
SECTIONS

DRAWING NO:

C-02

SHEET: 4 OF 8

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JOB NO:	0234949
DATE:	JUNE, 2023
SCALE:	AS NOTED
DESIGNED BY:	ES
DRAWN BY:	MM
CHECKED BY:	KS
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DRAWING TITLE:

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SECTIONS

DRAWING NO:

C-02.1

SHEET: 5 OF 8



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JOB NO: 0234949

DATE: JUNE, 2023

SCALE: AS NOTED

DESIGNED BY: ES

DRAWN BY: MM

CHECKED BY: KS

FILENAME: C-03.dwg

DRAWING TITLE:

CIVIL

VOLUMES AND CUT-FILL GRID

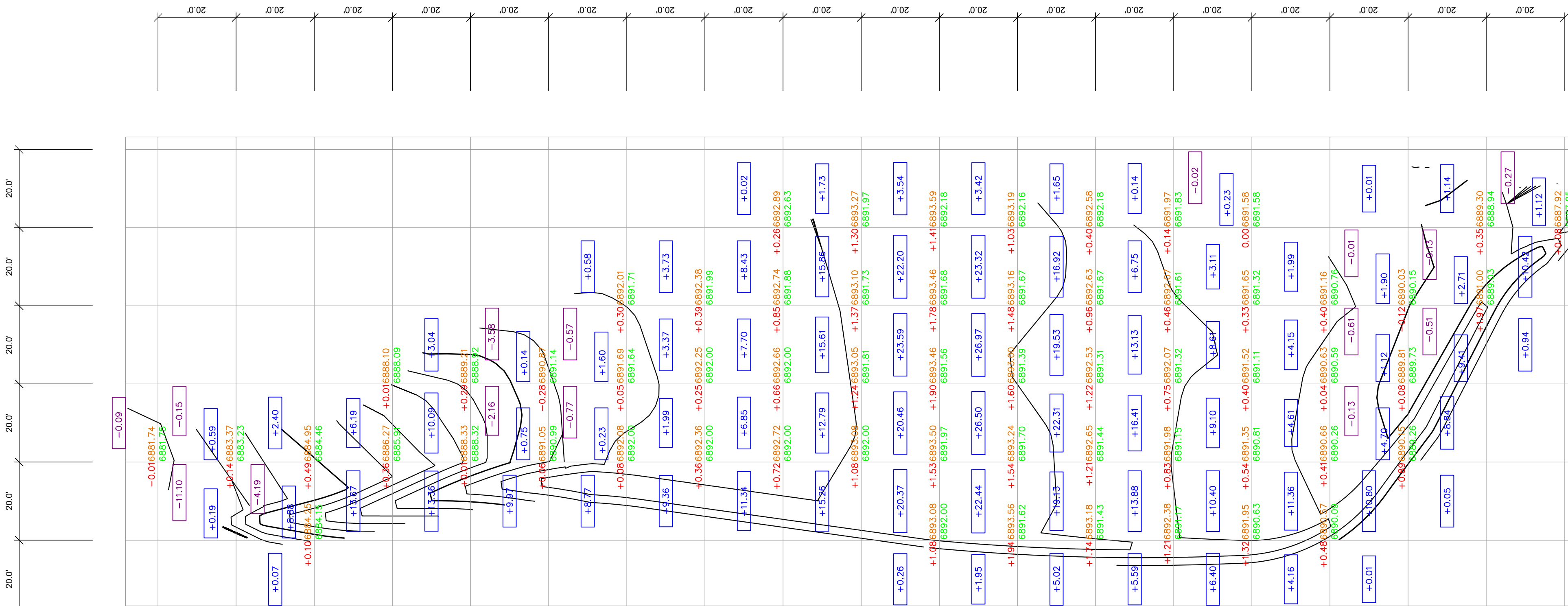
DRAWING NO:

C-03

SHEET: 6 OF 8

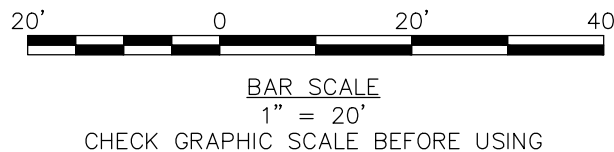
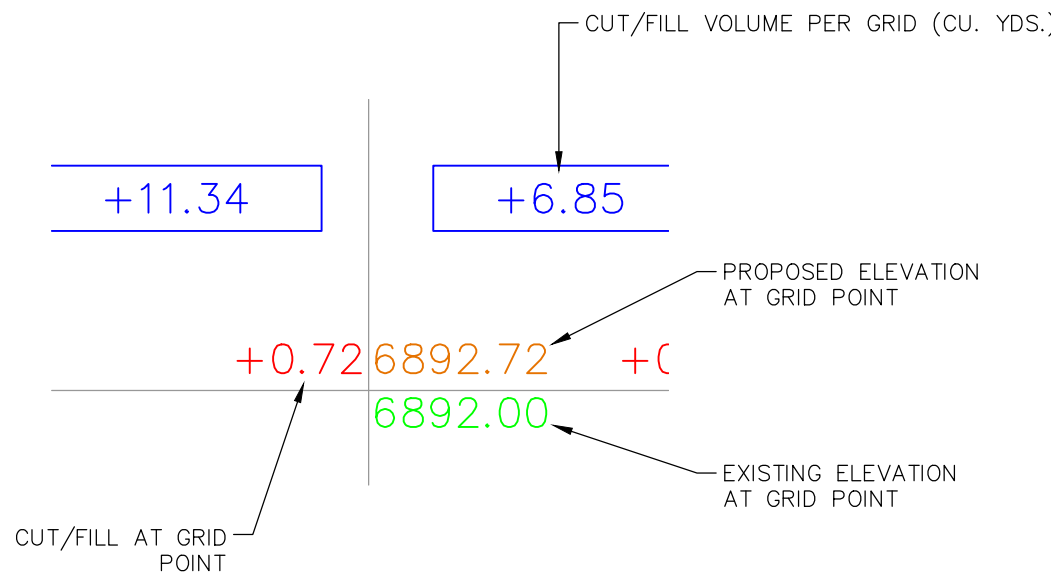
Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
VOL-EG TO FG	1.000	1.000	22990 Sq. Ft.	35 Cu. Yd.	648 Cu. Yd.	612 Cu. Yd.<Fill>
Totals			22990 Sq. Ft.	35 Cu. Yd.	648 Cu. Yd.	612 Cu. Yd.<Fill>



0.1	11.2	4.2	0.0	0.0	5.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.6	0.3	0.0	Cut
0.0	0.8	11.4	19.9	26.5	10.9	11.2	18.5	34.3	61.3	90.4	104.6	84.6	55.9	37.8	26.3	18.5	22.2	12.5	0.0	Fill

LEGEND:



647.4	0.0	0.0
Fill	13.0	0.3
Cut	117.9	0.1
	138.9	5.3
	154.8	3.3
	199.3	15.3
	23.5	0.0



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ENTERPRISE A-4 WELL PAD**

REV	MM/DD/YY	DESCRIPTION
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JOB NO:	0234949
DATE:	JUNE, 2023
SCALE:	AS NOTED
DESIGNED BY:	ES
DRAWN BY:	MM
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FILENAME:	C-04.dwg

DRAWING TITLE:

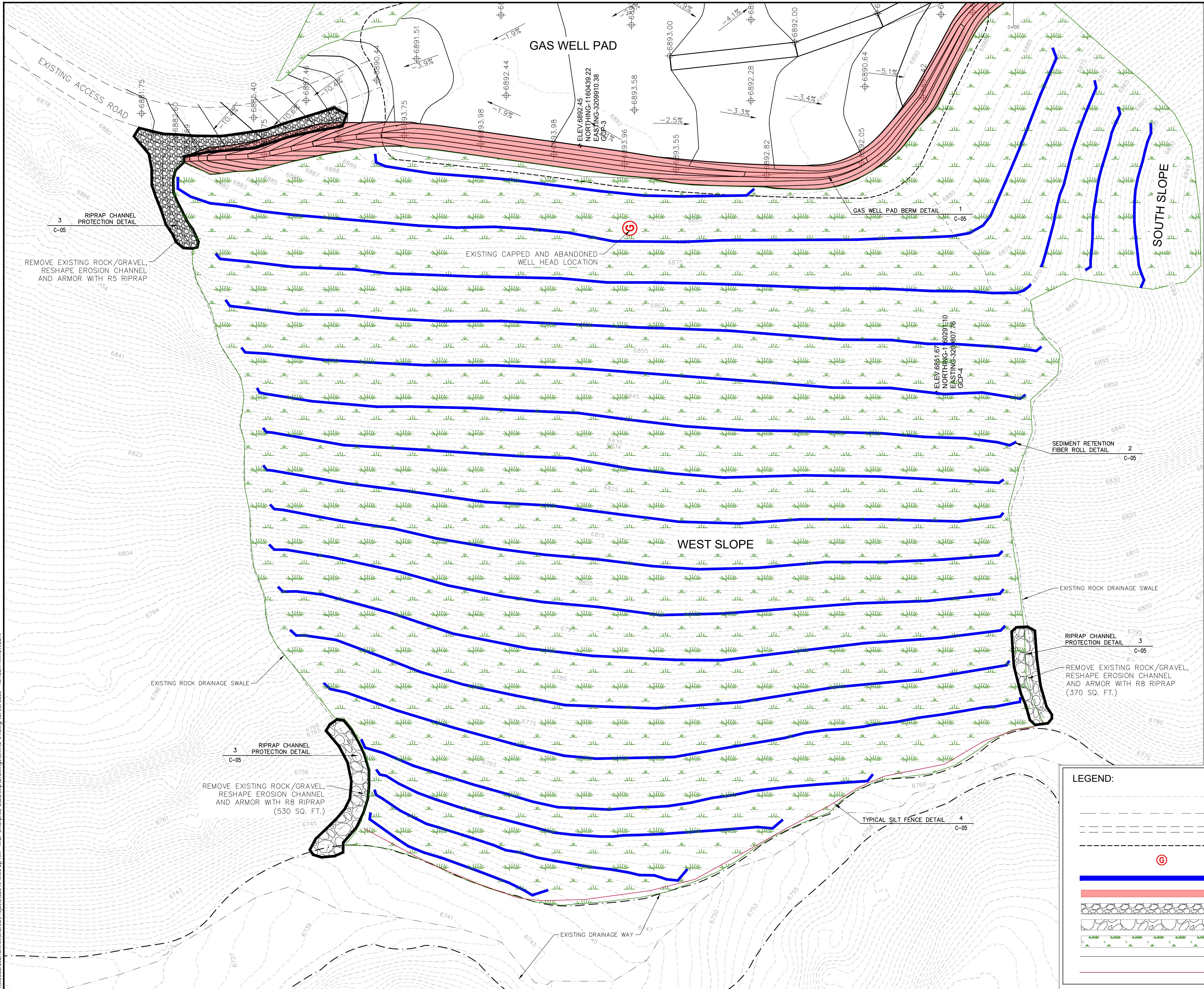
CIVIL

EROSION CONTROL PLAN

DRAWING NO:

C-04

SHEET: 7 OF 8



- NOTES:
- CONTRACTOR SHALL PREPARE SOIL PRIOR TO INSTALLATION OF ALL EROSION CONTROL BMPs.
 - SOIL PREPARATION INCLUDES: USING SLOPE CHAIN TO REMOVE EXISTING EROSION RILLS, AND SEED APPLICATION.
 - CONTRACTOR SHALL START AT THE BOTTOM OF THE SLOPE AND MOVE UP THE SLOPE IN 20-FT INTERVALS IN ORDER TO PROTECT FRESHLY TREATED AND SEED SOIL DURING SEDIMENT RETENTION FIBER ROLLS INSTALLATION.
 - EARTHGUARD SHALL BE APPLIED AT A RATE OF 10 GALLONS/ACRE AFTER ENTIRE SLOPE HAS BEEN TILLED USING THE SLOPE CHAIN, SEED, AND COMPOST FILTER SOCK/ SEDIMENT RETENTION FIBER ROLLS INSTALLED. APPLY EARTHGUARD ACCORDING TO MANUFACTURER'S INSTRUCTIONS, ENSURING NO SHADOW EFFECTS.
 - CONTRACTOR SHALL HYDROSEED AND APPLY EARTHGUARD TO THE CUT SLOPE AND THE FILL SLOPE ON THE SOUTH, EAST AND WEST SIDES OF THE GAS WELL PAD.

LEGEND:

- | | |
|--|--------------------------------|
| | EXISTING CONTOURS |
| | SIDE SLOPE DRAINAGE SWALES |
| | GRAVEL ACCESS ROAD |
| | GAS WELL PAD |
| | ABANDONED GAS WELL |
| | SEDIMENT RETENTION FIBER ROLL |
| | GAS WELL PAD CONTAINMENT BERM |
| | RIPRAP R5 |
| | RIPRAP R8 |
| | HYDROSEED AND APPLY EARTHGUARD |
| | PROPOSED CONTOURS |
| | SILT FENCE |



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REV	MM/DD/YY	DESCRIPTION
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JOB NO: 0234949

DATE: JUNE, 2023

SCALE: AS NOTED

DESIGNED BY: ES

DRAWN BY: MM

CHECKED BY: KS

FILENAME: C-05.dwg

DRAWING TITLE:

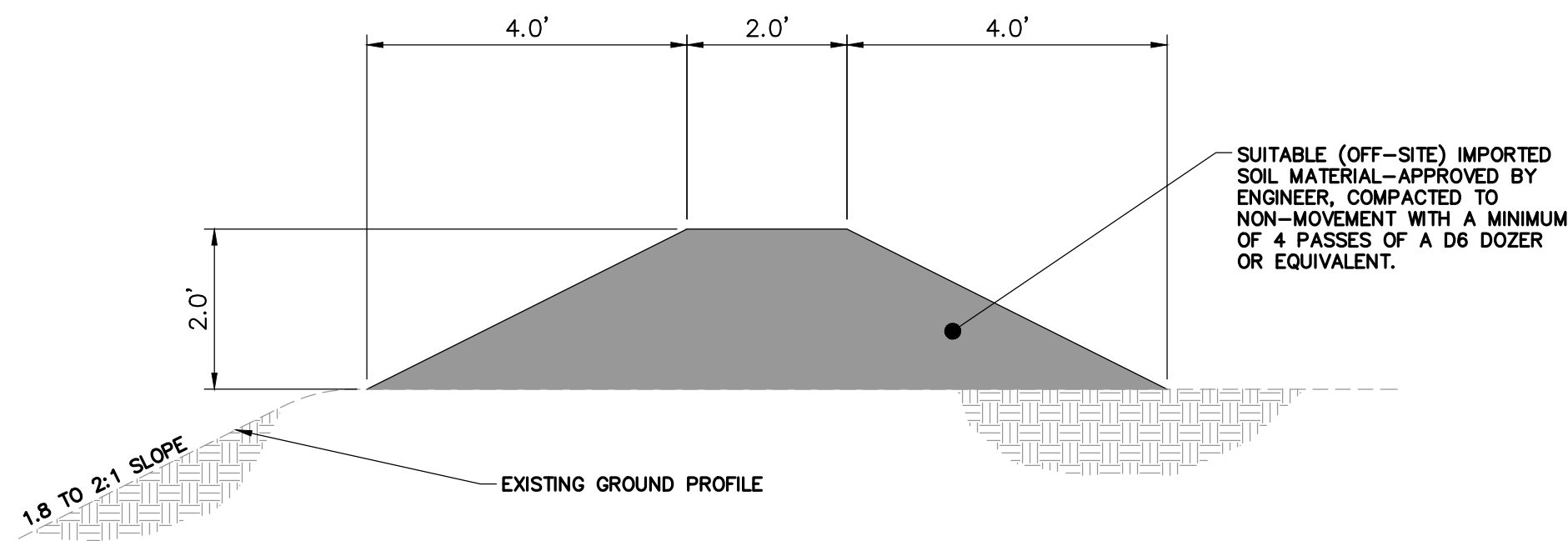
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DETAILS

DRAWING NO:

C-05

SHEET: 8 OF 8

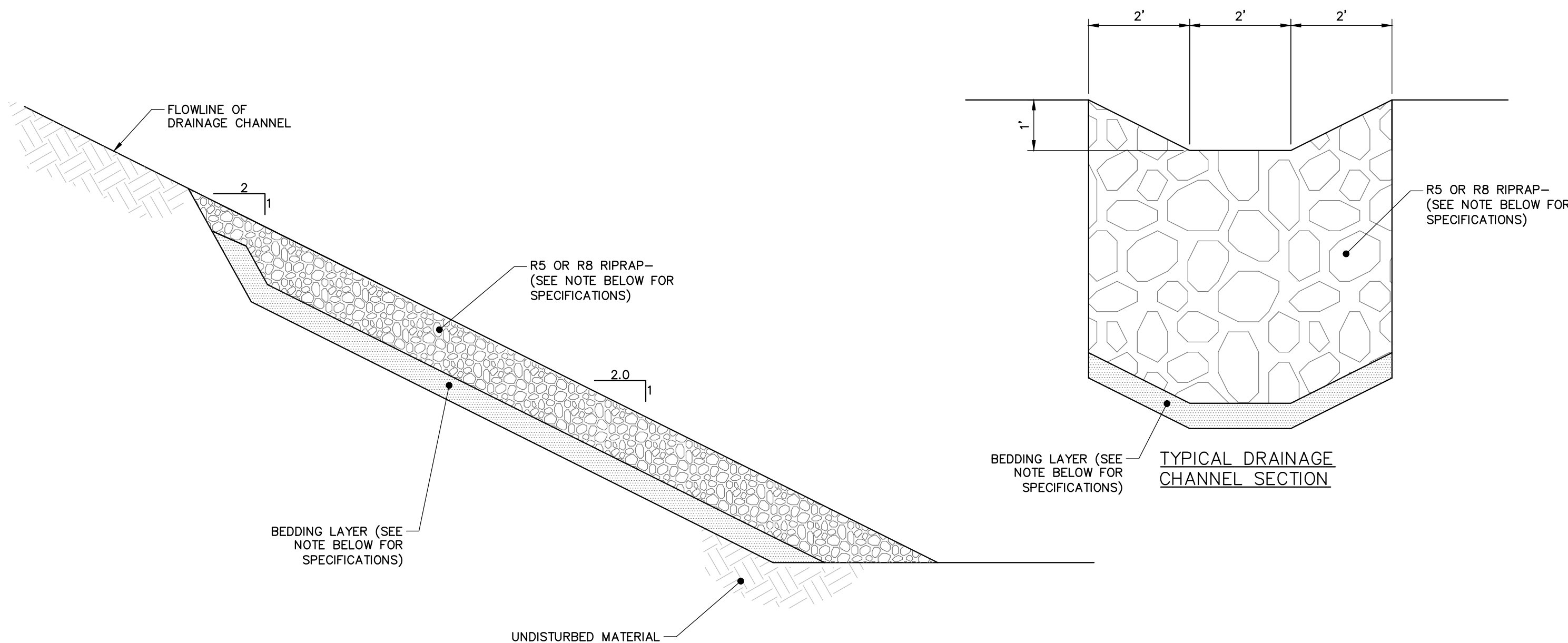


SECTION

1 GAS WELL PAD BERM DETAIL

C-05 SCALE: NOT TO SCALE

SUITABLE SOIL WILL BE IMPORTED, NOT DERIVED FROM ON SITE. SUITABLE SOIL WILL BE FREE OF ALL STICKS, ROOTS, SHARP OBJECTS, OR DEBRIS OF ANY KIND AND STONES OR OTHER HARD OBJECTS GREATER THAN 2 INCHES. THE MATERIAL SHALL HAVE AN ACCEPTABLE MOISTURE CONTENT TO ACHIEVE COMPACTION. SUITABLE SOILS WILL CLASSIFY BY THE USCS AS SC, CL, SW, SP, GM, GC, OR SM. "BORDER LINE" SOILS, AS DEFINED BY THE UNIFIED SOIL CLASSIFICATION SYSTEM (USCS), WHICH ARE A RESULT OF THE COMBINATION OF ANY SOILS CLASSIFIED AS SUITABLE, WILL BE CONSIDERED SUITABLE.



NOTE:

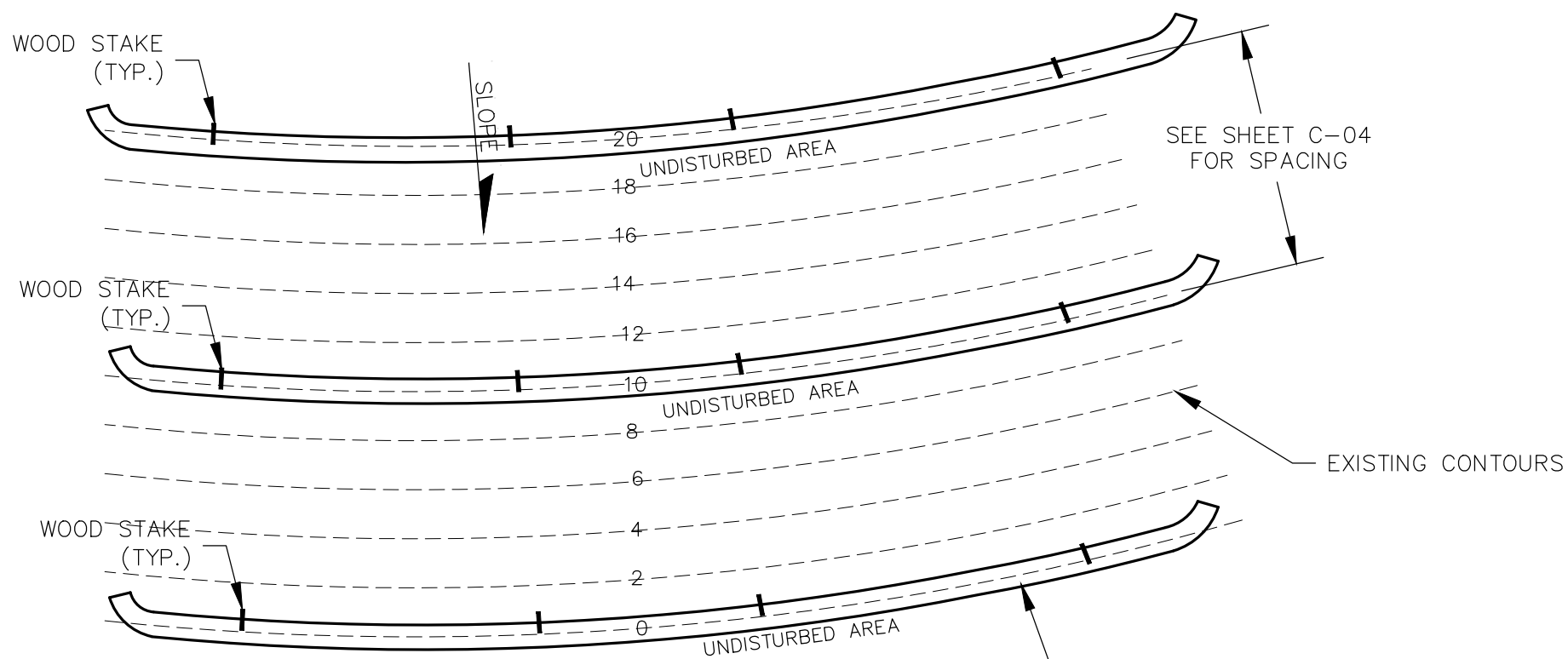
- R5 TO BE PLACED AT MIN THICKNESS OF 30" AND BEDDED ON MIN. THICKNESS OF 4" OF AASHTO NO. 3 STONE.
- R8 TO BE PLACED AT MIN. THICKNESS OF 60" AND BEDDED ON MIN. THICKNESS OF 6" AASHTO NO. 1 STONE.

3 RIPRAP CHANNEL PROTECTION DETAIL

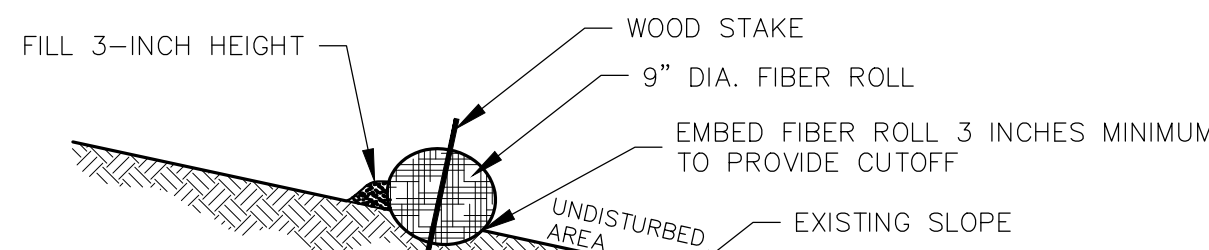
C-05 SCALE: NOT TO SCALE

D50=24"		D50=12"	
Type VH	SPECIFIED	Type M	SPECIFIED
SIZE	PERCENT SMALLER	SIZE	PERCENT SMALLER
42"	70-100	21"	70-100
33"	50-70	18"	50-70
24"	35-50	12"	35-50
9"	2-10	4"	2-10

Spec	Confirmed Equivalent	Cys	Tons
R5 (D50 - 12")	Type M	74	148
R5 Bedding	AASHTO #3	10	20
R8 (D50 - 24")	Type VH	112	224
R8 Bedding	AASHTO #1	12	24



PLAN VIEW



SECTION

1. SEDIMENT RETENTION FIBER ROLLS (SRFR) SHALL BE NINE (9") NOMINAL DIAMETER AND SHALL BE BIODEGRADABLE. SRFR WILL BE PAID FOR BY LINEAR FOOTAGE INSTALLED. TRAFFIC SHALL NOT BE PERMITTED TO CROSS SRFR'S.

2. SEDIMENT RETENTION FIBER ROLLS (SRFR) SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE BARRIER SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN BARRIER ALIGNMENT.

3. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES 1/4 THE ABOVE GROUND HEIGHT OF THE BARRIER AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN. SEDIMENT RETENTION FIBER ROLLS (SRFR) SHALL BE INSPECTED IN ACCORDANCE WITH THE WRITTEN RECLAMATION PLAN. DAMAGED SRFR'S SHALL BE REPAIRED ACCORDING TO MANUFACTURERS SPECIFICATIONS OR REPLACED. BIODEGRADABLE SRFR'S SHALL BE MAINTAINED UNTIL VEGETATIVE STABILIZATION.

4. UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SRFR, STAKES SHALL BE REMOVED. THE SRFR MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

5. EMBEDMENT DEPTH SHALL BE A MINIMUM OF 3 INCHES FOR ALL SRFR'S.

6. DRIVE STAKE THROUGH MIDDLE OF THE SRFR AT MAXIMUM 4-FT SPACINGS. DRIVE STAKE 12" TO 16" BELOW SOIL SURFACE. PLACE ADDITIONAL STAKES ON DOWNSLOPE SIDE OF THE SRFR AT 10-FT. SPACINGS.

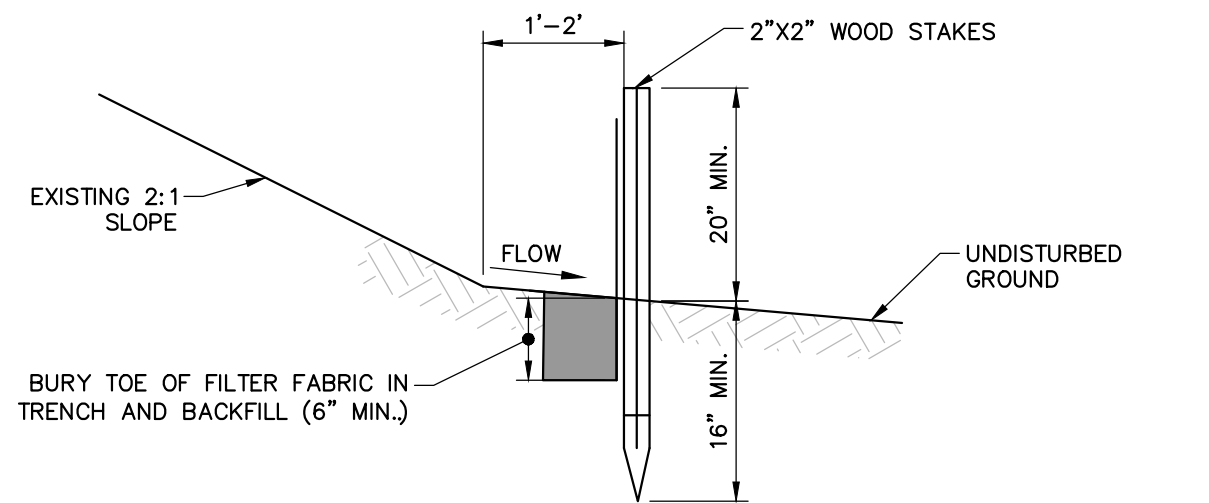
7. MINIMUM STAKE DIMENSIONS SHALL BE 2"x2".

8. SEE MANUFACTURER'S RECOMMENDATIONS FOR JOINING METHOD FOR ADJACENT SRFR UNITS. A ONE FOOT OVERLAP, DIRECTED UP-GRADIENT, IS RECOMMENDED FOR MOST PRODUCTS.

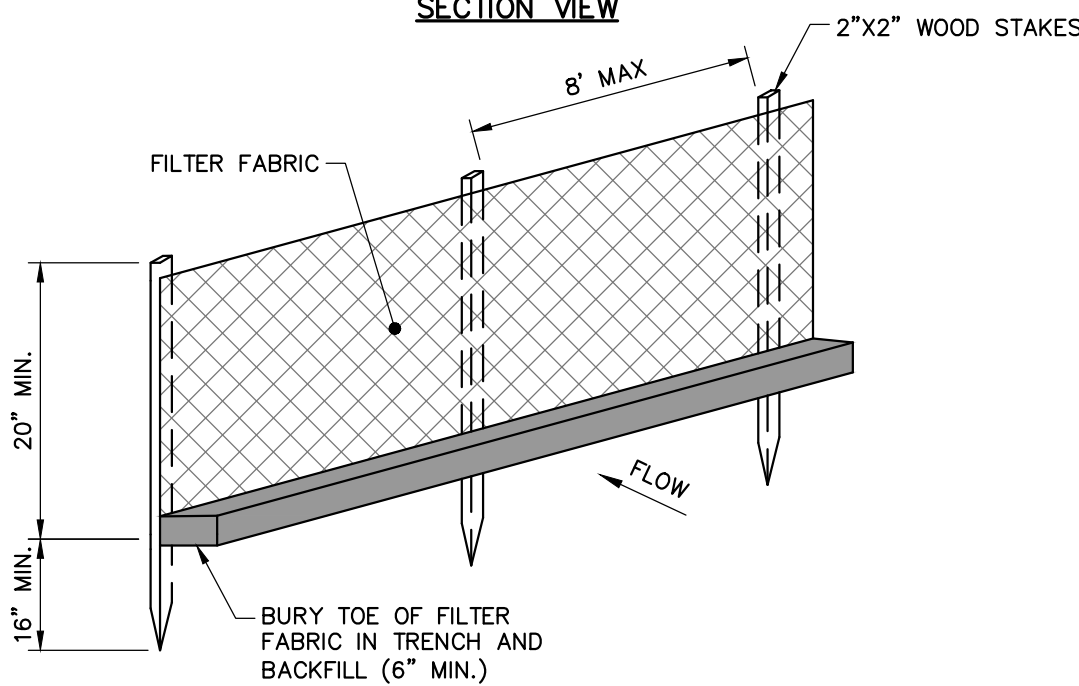
9. TO PROTECT FRESHLY SEEDED SLOPES, CONTRACTOR TO AVOID DISTURBANCE OF THE AREA BELOW THE FIBER ROLL AFTER THE INSTALLATION.

2 SEDIMENT RETENTION FIBER ROLL DETAIL

C-05 SCALE: NOT TO SCALE



SECTION VIEW



ISOMETRIC VIEW

NOTES:

- INSTALL FABRIC ON UPHILL SIDE OF WOOD STAKES.
- SPACING BETWEEN WOOD STAKES PER MANUFACTURER'S RECOMMENDATION.
- SILT FENCE WILL NOT BE USED IN DRAINAGE WAYS.
- MAINTENANCE: INSPECT FOR TEARS IN THE FABRIC OR DAMAGE TO SUPPORTS. REPAIR AS NECESSARY. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES A DEPTH OF SIX-INCHES OR MORE.
- REMOVAL: WHEN UPSLOPE AREAS ARE STABILIZED, THE STRUCTURE AND ANY ACCUMULATED SEDIMENT WILL BE REMOVED.

NOTE: THIS IS A GENERAL DETAIL AND MAY NOT REFLECT EXISTING SILT FENCE AS CONSTRUCTED IN FIELD. SILT FENCE INSTALLED PER MANUFACTURER RECOMMENDATIONS.

4 TYPICAL SILT FENCE DETAIL

C-05 SCALE: NOT TO SCALE

MGP Well Site-Specific Calculations

Hydrology & Hydraulic Calculations



NOAA Atlas 14, Volume 8, Version 2
Location name: Weston, Colorado, USA*
Latitude: 37.105°, Longitude: -104.7802°
Elevation: m/ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

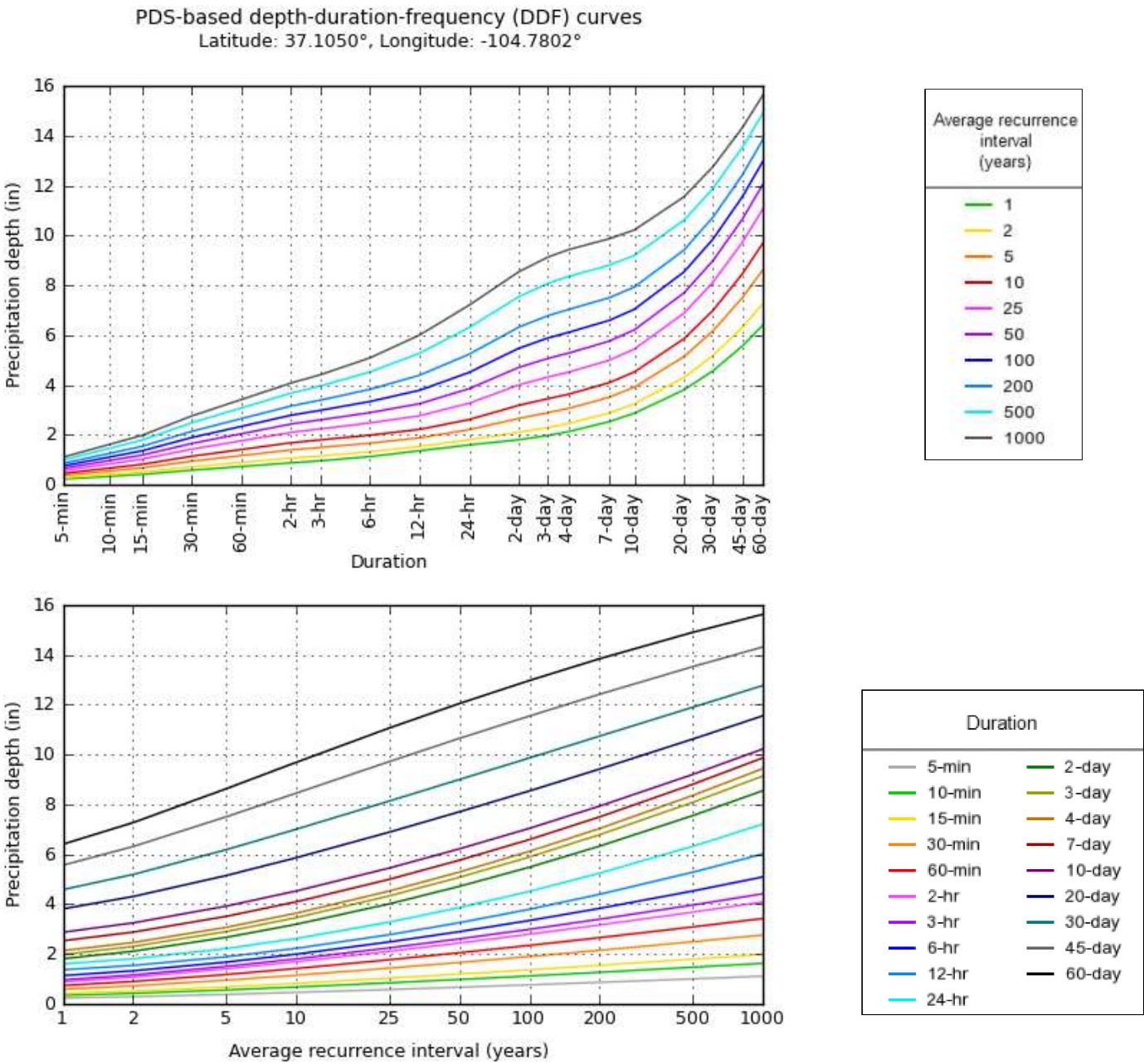
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.236 (0.188-0.296)	0.291 (0.232-0.364)	0.383 (0.304-0.482)	0.463 (0.365-0.586)	0.578 (0.440-0.767)	0.670 (0.497-0.904)	0.766 (0.547-1.07)	0.866 (0.591-1.25)	1.00 (0.656-1.50)	1.11 (0.706-1.68)
10-min	0.346 (0.276-0.433)	0.426 (0.339-0.534)	0.561 (0.445-0.706)	0.678 (0.534-0.857)	0.846 (0.644-1.12)	0.981 (0.727-1.32)	1.12 (0.800-1.56)	1.27 (0.865-1.83)	1.47 (0.961-2.19)	1.63 (1.03-2.47)
15-min	0.422 (0.337-0.529)	0.519 (0.413-0.651)	0.684 (0.543-0.860)	0.827 (0.652-1.05)	1.03 (0.786-1.37)	1.20 (0.887-1.62)	1.37 (0.976-1.90)	1.55 (1.06-2.23)	1.79 (1.17-2.67)	1.99 (1.26-3.01)
30-min	0.592 (0.472-0.741)	0.725 (0.578-0.909)	0.952 (0.756-1.20)	1.15 (0.906-1.45)	1.43 (1.09-1.90)	1.66 (1.23-2.24)	1.90 (1.36-2.64)	2.15 (1.47-3.09)	2.49 (1.63-3.71)	2.76 (1.75-4.18)
60-min	0.739 (0.589-0.925)	0.901 (0.718-1.13)	1.18 (0.935-1.48)	1.42 (1.12-1.80)	1.77 (1.35-2.35)	2.05 (1.52-2.77)	2.35 (1.68-3.27)	2.66 (1.81-3.83)	3.09 (2.02-4.60)	3.42 (2.17-5.18)
2-hr	0.886 (0.712-1.10)	1.08 (0.864-1.34)	1.41 (1.12-1.75)	1.69 (1.34-2.12)	2.11 (1.62-2.78)	2.44 (1.83-3.27)	2.79 (2.01-3.86)	3.17 (2.18-4.53)	3.68 (2.43-5.45)	4.09 (2.62-6.14)
3-hr	0.965 (0.779-1.19)	1.16 (0.937-1.44)	1.50 (1.21-1.86)	1.80 (1.44-2.25)	2.25 (1.74-2.95)	2.61 (1.97-3.49)	2.99 (2.17-4.12)	3.40 (2.36-4.85)	3.96 (2.63-5.85)	4.41 (2.84-6.61)
6-hr	1.14 (0.926-1.39)	1.33 (1.08-1.63)	1.68 (1.36-2.06)	2.00 (1.61-2.47)	2.48 (1.95-3.26)	2.90 (2.21-3.86)	3.34 (2.46-4.60)	3.83 (2.69-5.45)	4.53 (3.04-6.66)	5.09 (3.31-7.57)
12-hr	1.37 (1.12-1.66)	1.54 (1.27-1.87)	1.89 (1.54-2.30)	2.23 (1.81-2.73)	2.77 (2.21-3.64)	3.26 (2.52-4.33)	3.79 (2.82-5.21)	4.40 (3.13-6.24)	5.28 (3.60-7.74)	6.01 (3.95-8.88)
24-hr	1.60 (1.33-1.93)	1.81 (1.50-2.17)	2.22 (1.83-2.68)	2.62 (2.15-3.18)	3.28 (2.64-4.27)	3.86 (3.01-5.10)	4.51 (3.39-6.15)	5.24 (3.77-7.40)	6.32 (4.35-9.21)	7.21 (4.79-10.6)
2-day	1.81 (1.51-2.16)	2.11 (1.76-2.52)	2.67 (2.22-3.19)	3.19 (2.64-3.84)	4.01 (3.24-5.15)	4.71 (3.70-6.15)	5.48 (4.15-7.38)	6.33 (4.58-8.82)	7.55 (5.24-10.9)	8.55 (5.74-12.5)
3-day	1.98 (1.66-2.35)	2.30 (1.93-2.73)	2.90 (2.42-3.45)	3.46 (2.87-4.14)	4.33 (3.52-5.53)	5.07 (4.01-6.58)	5.89 (4.48-7.89)	6.79 (4.94-9.42)	8.08 (5.64-11.6)	9.13 (6.17-13.3)
4-day	2.14 (1.80-2.52)	2.46 (2.07-2.91)	3.07 (2.57-3.64)	3.64 (3.03-4.34)	4.52 (3.69-5.76)	5.29 (4.19-6.83)	6.12 (4.67-8.17)	7.03 (5.14-9.73)	8.35 (5.86-12.0)	9.43 (6.41-13.7)
7-day	2.53 (2.15-2.96)	2.88 (2.44-3.37)	3.51 (2.96-4.13)	4.09 (3.44-4.84)	4.99 (4.10-6.28)	5.76 (4.59-7.37)	6.59 (5.07-8.72)	7.50 (5.53-10.3)	8.80 (6.22-12.5)	9.86 (6.75-14.2)
10-day	2.87 (2.45-3.35)	3.25 (2.77-3.79)	3.92 (3.32-4.59)	4.53 (3.82-5.33)	5.44 (4.48-6.79)	6.21 (4.97-7.89)	7.04 (5.44-9.24)	7.93 (5.87-10.8)	9.20 (6.53-13.0)	10.2 (7.04-14.7)
20-day	3.81 (3.28-4.39)	4.31 (3.70-4.97)	5.14 (4.40-5.96)	5.86 (4.99-6.84)	6.88 (5.68-8.42)	7.70 (6.20-9.61)	8.54 (6.64-11.0)	9.42 (7.01-12.7)	10.6 (7.60-14.8)	11.5 (8.04-16.5)
30-day	4.58 (3.96-5.26)	5.19 (4.48-5.96)	6.18 (5.32-7.13)	7.00 (5.99-8.12)	8.13 (6.71-9.83)	8.99 (7.26-11.1)	9.86 (7.69-12.6)	10.7 (8.03-14.3)	11.9 (8.55-16.5)	12.8 (8.94-18.1)
45-day	5.56 (4.83-6.34)	6.31 (5.48-7.20)	7.50 (6.49-8.60)	8.45 (7.27-9.75)	9.71 (8.04-11.6)	10.6 (8.62-13.0)	11.5 (9.03-14.6)	12.4 (9.32-16.4)	13.5 (9.76-18.6)	14.3 (10.1-20.2)
60-day	6.40 (5.58-7.27)	7.27 (6.33-8.27)	8.62 (7.49-9.84)	9.68 (8.36-11.1)	11.1 (9.17-13.1)	12.0 (9.78-14.7)	13.0 (10.2-16.4)	13.8 (10.4-18.2)	14.9 (10.8-20.4)	15.6 (11.1-22.0)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

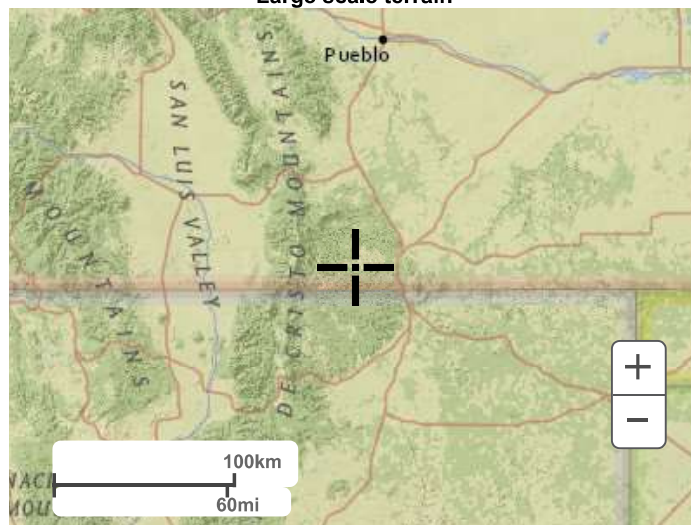
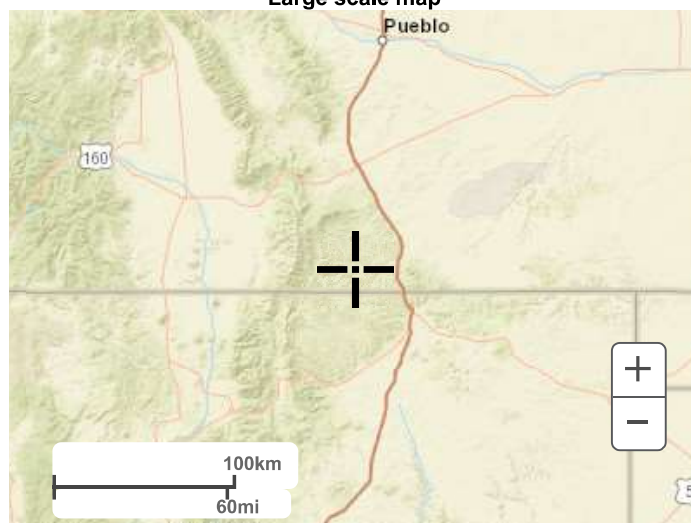
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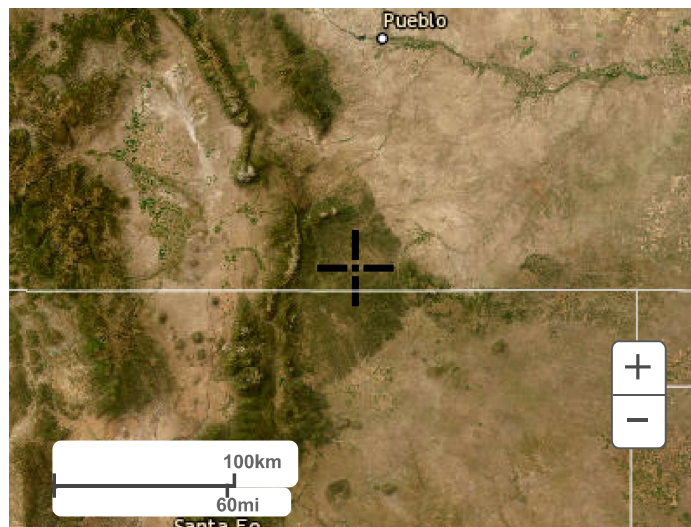
PF graphical



Maps & aerials

Small scale terrain

**Large scale terrain****Large scale map****Large scale aerial**

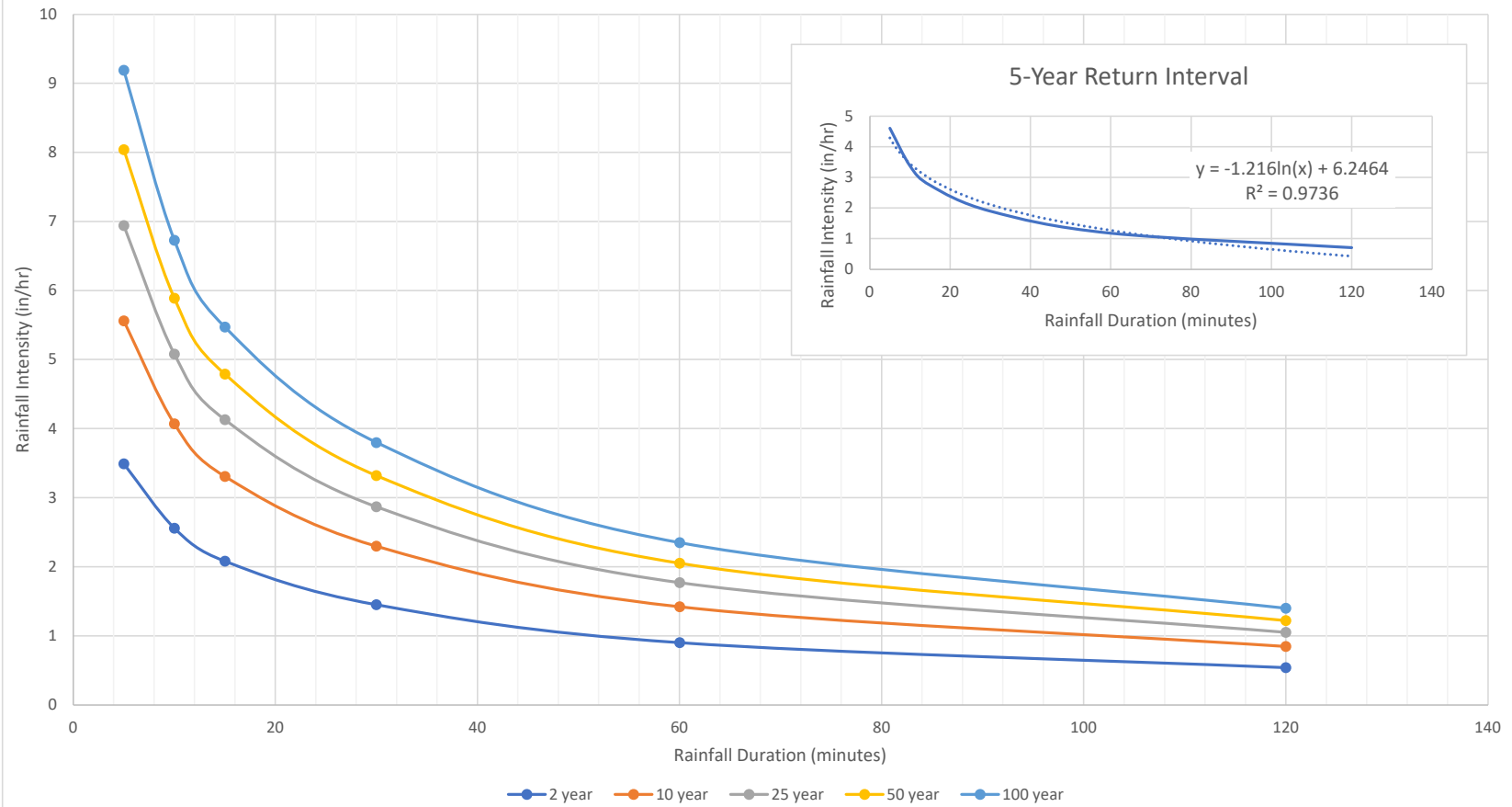


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IDF Curves



Hydraulic Calculations- Site Runoff										
Drainage Basin	Area (acres)	Runoff Coefficient	Time of Concentration (Tc) Estimation						Rational Method Peak Flow	
			Flow-Regime	Length	Slope	Storm Intensity (in/hr) (5- Year Return Interval)	Travel Time (Tt) (min)	Time of Concentration (min)	Peak Flow (cfs)	Storm Duration (Seconds)
Rehab Slope - South	0.27	0.59	Sheet Flow	145	0.50	6.37	0.7	0.72	1.0	43
Rehab Slope - West	2.2	0.59	Sheet Flow	300	0.50	6.13	1.1	1.14	7.8	68
Rehab Slope - West 20 ft wattle	0.2	0.59	Sheet Flow	20	0.50	8.19	0.2	0.20	0.87	12
Flow Reporting to Pad	0.11	0.59	Sheet Flow	100	0.06	5.84	1.1	2.89	2.2	173
	0.55	0.59	Shallow Concentrated Flow	103	0.23	5.54	1.8		3.8	
Flow to NW Drainage Channel	0.22	0.59	Sheet Flow	227	0.03	5.19	2.4	2.4	1.75	144
Flow to SE Drainage Channel	0.23	0.59	Shallow Concentrated Flow	176	0.03	3.69	8.3	8.34	1.6	500

Figure 9.7-1 Runoff Coefficients

C D soil type = 0.45(i) +.508	0.59215
-------------------------------	---------

Reference: CO DOT Design Manual

Rational Method	Q=C*i*A
Peak Flow (Q)	cfs
Runoff Coefficient (C)	dimensionless
Rainfall Intensity (I)	in/hr
Drainage Area (A)	acres

Sheet Flow (HEC-22 Chapter 3.2.2.3)

$$T_s = \frac{K_s}{6.92} \left(\frac{n L}{\sqrt{S}} \right)^{0.6} \tag{3-3}$$

where:

- T_s = Sheet flow travel time, min
- n = Roughness coefficient (see Table 3-2)
- L = Flow length, m (ft)
- I = Rainfall intensity, mm/hr (in/hr)
- S = Surface slope, m/m (ft/ft)
- K_s = Empirical coefficient equal to 6.92 (0.933 in English units)

Shallow Concentrated Flow (HEC-22 Chapter 3.2.2.3)

$$V = K_v k S_p^{0.5} \tag{3-4}$$

where:

- K_v = 1.0 (3.28 in English units)
- V = Velocity, m/s (ft/s)
- k = Intercept coefficient (Table 3-3)
- S_p = Slope, percent

Table 3-3. Intercept Coefficients for Velocity vs. Slope Relationship of Equation 3-4. ^(B)	
Land Cover/Flow Regime	k
Forest with heavy ground litter; hay meadow (overland flow)	0.076
Trash fallow or minimum tillage cultivation; contour or strip cropped; woodland (overland flow)	0.152
Short grass pasture (overland flow)	0.213
Cultivated straight row (overland flow)	0.274
Nearly bare and untilled (overland flow); alluvial fans in western mountain regions	0.305
Grassed waterway (shallow concentrated flow)	0.457
Unpaved (shallow concentrated flow)	0.491
Paved area (shallow concentrated flow); small upland gullies	0.619

MGP Well Site-Specific Calculations

Riprap Sizing Calculations

Rip Rap Design for Channel Bottom

HEC-15 Guidance

Step 1: Calculate Flow Depth

Using *Hydraflow Express*

Assumptions:

Bottom width	2	ft
Side Slopes	2:1	Z:1
Total Depth	1	ft
Slope	0.5	ft/ft
Flow Rate - 25-yr storm	2	cfs
n-value	0.07	
Flow Depth	0.2	ft

$$\tau_d = \gamma d S_o \quad (\text{HEC} - 15 \text{ Equation } 3.1)$$

Where:

τ_d = maximum shear stress on the channel bottom (lb/ft^2)

γ = unit weight of water (lb/ft^3)

d = depth of flow in channel (ft)

S_o = channel bottom slope (ft/ft)

Step 2: Calculate Shear Stress

τ_d	6.2	lb/ft ²
τ_d with 1.5 FS	9.4	lb/ft ²

$$D_{50} = \frac{\tau_p}{F^* * (\gamma_s - \gamma)} \quad (\text{HEC} - 15 \text{ Equation } 7.1)$$

Where:

D_{50} = mean riprap size (ft)

τ_p = permissible shear stress (lb/ft^2) = τ_d for main channel and τ_b for bend

F^* = Shield's parameter, dimensionless = 0.051

γ_s = unit weight of the stone = 164 lb/ft^3

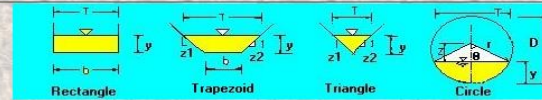
γ = unit weight of the water = 62.4 lb/ft^3

Step 3: Compute D50

D50 for τ_d =	1.2	ft
D50 for τ_d w/ 1.1 FS=	1.8	ft

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: 0.5	ft/ft	Water depth(y): 0.22	ft	Bottom width(b): 2	ft
Flow velocity: 4.578696	ft/s	LeftSlope (Z1): 2	to 1 (H:V)	RightSlope (Z2): 2	to 1 (H:V)
Flow discharge: 2.4	ft ³ /s	Input n value: 0.07	or select n		
Calculate!		Status: Calculation finished		Reset	
Wetted perimeter: 2.96	ft	Flow area: 0.52	ft ²	Top width(T): 2.86	ft
Specific energy: 0.54	ft	Froude number: 1.89		Flow status: Supercritical flow	
Critical depth: 0.32	ft	Critical slope: 0.118	ft/ft	Velocity head: 0.33	ft

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Channel Report

Typical Drainage Channel Cross Section

Triangular

Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 1.00

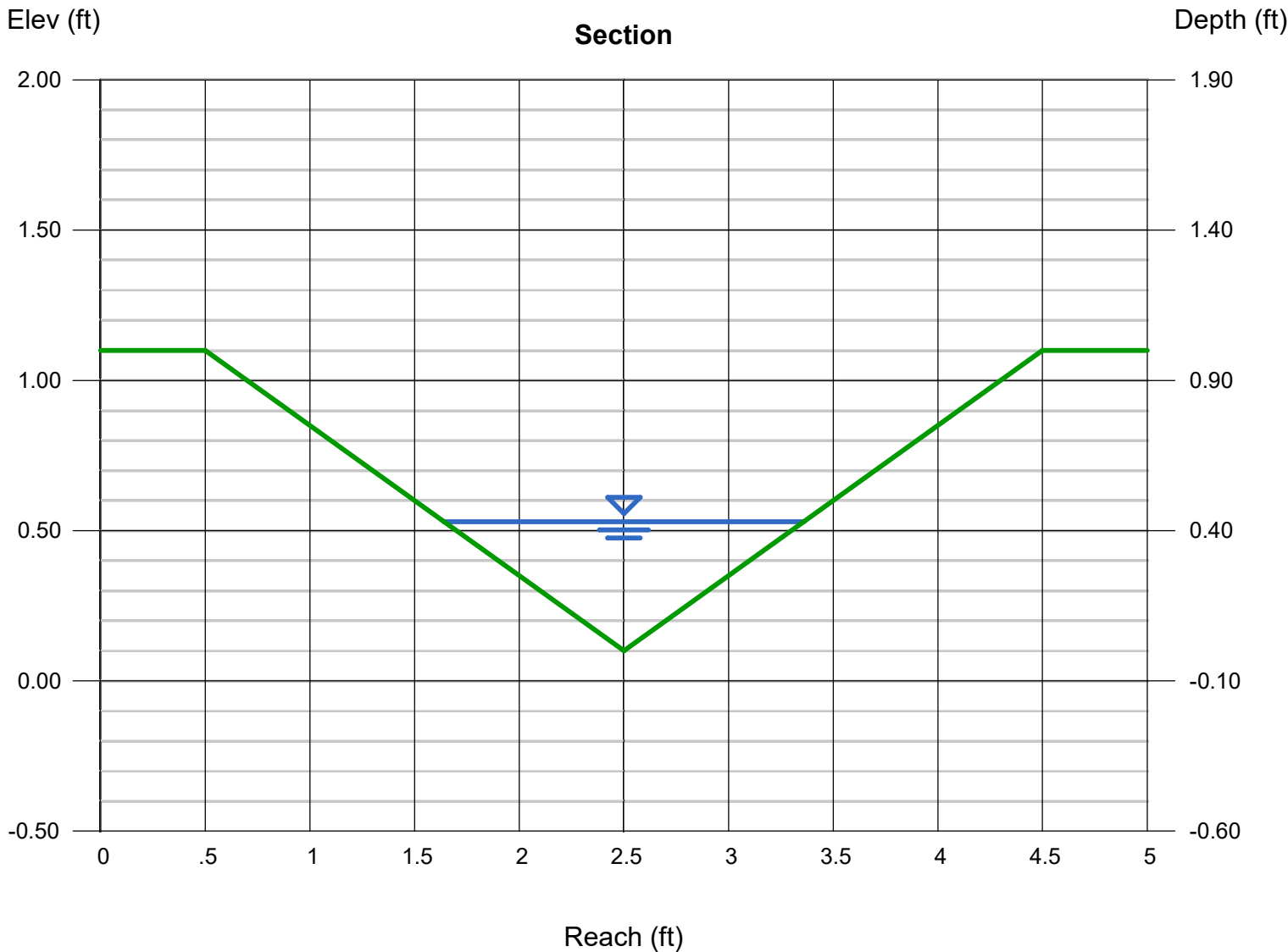
Invert Elev (ft) = 0.10
Slope (%) = 50.00
N-Value = 0.070

Calculations

Compute by: Known Q
Known Q (cfs) = 1.75

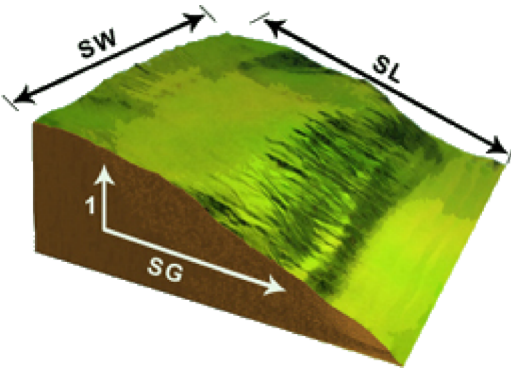
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Depth (ft) = 0.43
Q (cfs) = 1.750
Area (sqft) = 0.37
Velocity (ft/s) = 4.73
Wetted Perim (ft) = 1.92
Crit Depth, Yc (ft) = 0.55
Top Width (ft) = 1.72
EGL (ft) = 0.78



MGP Well Site-Specific Calculations

Hydraulic Erosion Control Product Selection



Project Information

Project	6538-0001
* Project Name	MGP Well Pad
Location	Pueblo, Colorado United States
Contact	Emily Stoick
Phone	4066866917
Email	estoick@woodardcurran.com
* Project Type	Others
Estimated Start Date	06/12/2023
* Estimated Project Size (Acres)	2.2
* Project Stage	In Planning

Slope Details

Slope Name	Slope West
Functional Longevity	18 - 24 months
Supporting Practices Factor (P)	Loose With Rough Surface Greater Than 12-inch Depth (0.8)
Soil Density (Y)	92 lb/ft ³

Thawing Soils?	No
Soil Loss Limit (SLL)	0.01 in
Slope Length (SL)	300 ft
Slope Gradient (SG)	1.75 H:1 V
Slope Width (SW)	250 ft
Soil Type (K Factor)	Sandy Clay Loam (0.17)
Expected Final Cover Type	Veg. Open Space - Good Cond. (cover > 75%)
Rainfall Factor (R)	34.29
ft•tons/acre•hr•year	
Desired Growth Improvement Factor (G)	800%
Tank Size	1000 gal

RUSLE Parameters and Runoff Discharge

Rainfall Factor (R)	34.29
ft•tons/acre•hr•year	
Soil Erodibility Factor (K)	0.17
Topographic Factor (LS)	19.3836
Supporting Practices Factor (P)	0.8
Runoff Discharge	3.185 ft ³ /s ₁

Product Selection

Click on a product in the list below to view application detail

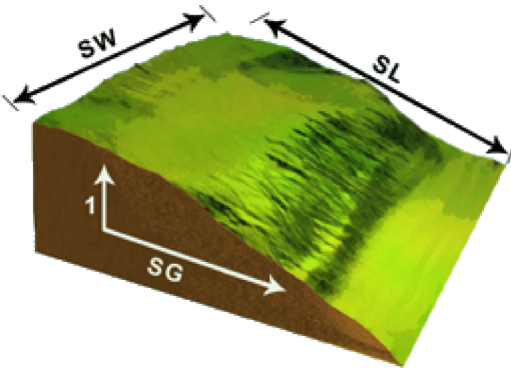
HECP Product Application
Flexterra HP-FGM

Product C-Factor	0.001	
------------------	-------	--

Factor of Safety (FS)	>10
Annual Soil Loss (with Product)	181 lb/acre, 0.0005 in
Annual Soil Loss (without Product)	180788 lb/acre , 0.5413 in

Functional Longevity	≤18 Months
Growth Establishment Factor	800%
Suggested Application Rate	4000 lb/acre
Job Size	1.722 acres
# of Tanks per Acre	10.53
Estimated # of Bags	145
# of Bags per Tank	8
Total # of Tanks	18.1

1. Runoff discharge is calculated using a 10-year, 24-hour rainfall intensity.
2. Slope interruption limits are for product applications on a 3H:1V slope. For applications on steeper slopes, slope interruptions limits may need to be decreased.
3. Large scale testing conducted at Utah Water Research Laboratory using a rainfall simulator on a 2.5H:1V slope, sandy-loam soil, at a rate of 5 inches per hour for a duration of 60 minutes (30 minutes for Base Hydraulic Mulches).



Project Information

Project	6538-0001
* Project Name	MGP Well Pad
Location	Pueblo, Colorado United States
Contact	Emily Stoick
Phone	4066866917
Email	estoick@woodardcurran.com
* Project Type	Others
Estimated Start Date	06/12/2023
* Estimated Project Size (Acres)	2.2
* Project Stage	In Planning

Slope Details

Slope Name	Slope South
Functional Longevity	18 - 24 months
Supporting Practices Factor (P)	Loose With Rough Surface Greater Than 12-inch Depth (0.8)
Soil Density (Y)	92 lb/ft ³

Thawing Soils?	No
Soil Loss Limit (SLL)	0.01 in
Slope Length (SL)	150 ft
Slope Gradient (SG)	1.75 H:1 V
Slope Width (SW)	90 ft
Soil Type (K Factor)	Clay Loam (0.23)
Expected Final Cover Type	Veg. Open Space - Good Cond. (cover > 75%)
Rainfall Factor (R) ft•tonsf•in/acre•hr•year	47.8
Desired Growth Improvement Factor (G)	400%
Tank Size	1000 gal

RUSLE Parameters and Runoff Discharge

Rainfall Factor (R) ft•tonsf•in/acre•hr•year	47.8
Soil Erodibility Factor (K)	0.23
Topographic Factor (LS)	11.8575
Supporting Practices Factor (P)	0.8
Runoff Discharge	0.62 ft ³ /s ₁

Product Selection

Click on a product in the list below to view application detail

HECP Product Application
Flexterra HP-FGM

Product C-Factor	0.001	
------------------	-------	--

Factor of Safety (FS)	>10
Annual Soil Loss (with Product)	209 lb/acre, 0.0006 in
Annual Soil Loss (without Product)	208579 lb/acre , 0.6246 in

Functional Longevity	≤18 Months
Growth Establishment Factor	800%
Suggested Application Rate	4000 lb/acre
Job Size	0.31 acres
# of Tanks per Acre	10.89
Estimated # of Bags	27
# of Bags per Tank	8
Total # of Tanks	3.4

1. Runoff discharge is calculated using a 10-year, 24-hour rainfall intensity.
2. Slope interruption limits are for product applications on a 3H:1V slope. For applications on steeper slopes, slope interruptions limits may need to be decreased.
3. Large scale testing conducted at Utah Water Research Laboratory using a rainfall simulator on a 2.5H:1V slope, sandy-loam soil, at a rate of 5 inches per hour for a duration of 60 minutes (30 minutes for Base Hydraulic Mulches).

MGP Well Site-Specific Calculations

Compost Filter Sock Size and Frequency Selection

Sediment Retention Fiber Rolls (SRFRs)

General Usage and Installation Guidelines



Sediment Retention Fiber Roll (SRFR) General Usage and Installation Guidelines



Erosion Control Technology Council

Introduction

Sediment Retention Fiber Rolls (SRFRs) are a manufactured three-dimensional device of a specified filler matrix encapsulated within a flexible containment material utilized in sediment and flow control applications. SRFRs are also known as wattles, logs, socks, tubes or fiber rolls. SRFRs are available as prefabricated units; constructed into tubular configurations comprised of rice straw, wheat straw, excelsior fiber, wood fiber, coconut fiber, compost, flax or a similar matrix material. The matrix material is encapsulated within biodegradable or photodegradable netting, yielding an approximate functional life of 1 - 3 years. Functional life will vary depending on factors such as material composition and site-specific climatic conditions. SRFRs provide economical performance and utility for numerous applications such as perimeter control, inlet protection, velocity control and slope length reduction. Finally, as with any erosion control or sediment



control measure, proper installation and maintenance is critical to the success of these products.

SRFRs offer many advantages when used in slope and channel applications. Once installed, SRFRs reduce flow velocity, intercept runoff and remove sediment from polluted waters. Sediment collects upstream of the unit and within the fibrous matrices of SRFRs. Plant material may also take hold upstream and within the SRFR matrix. When plant material is established, a vegetated buffer is formed providing permanent erosion control. In an unvegetated condition, SRFRs serve to shorten the effective slope length of the waterway or slope.

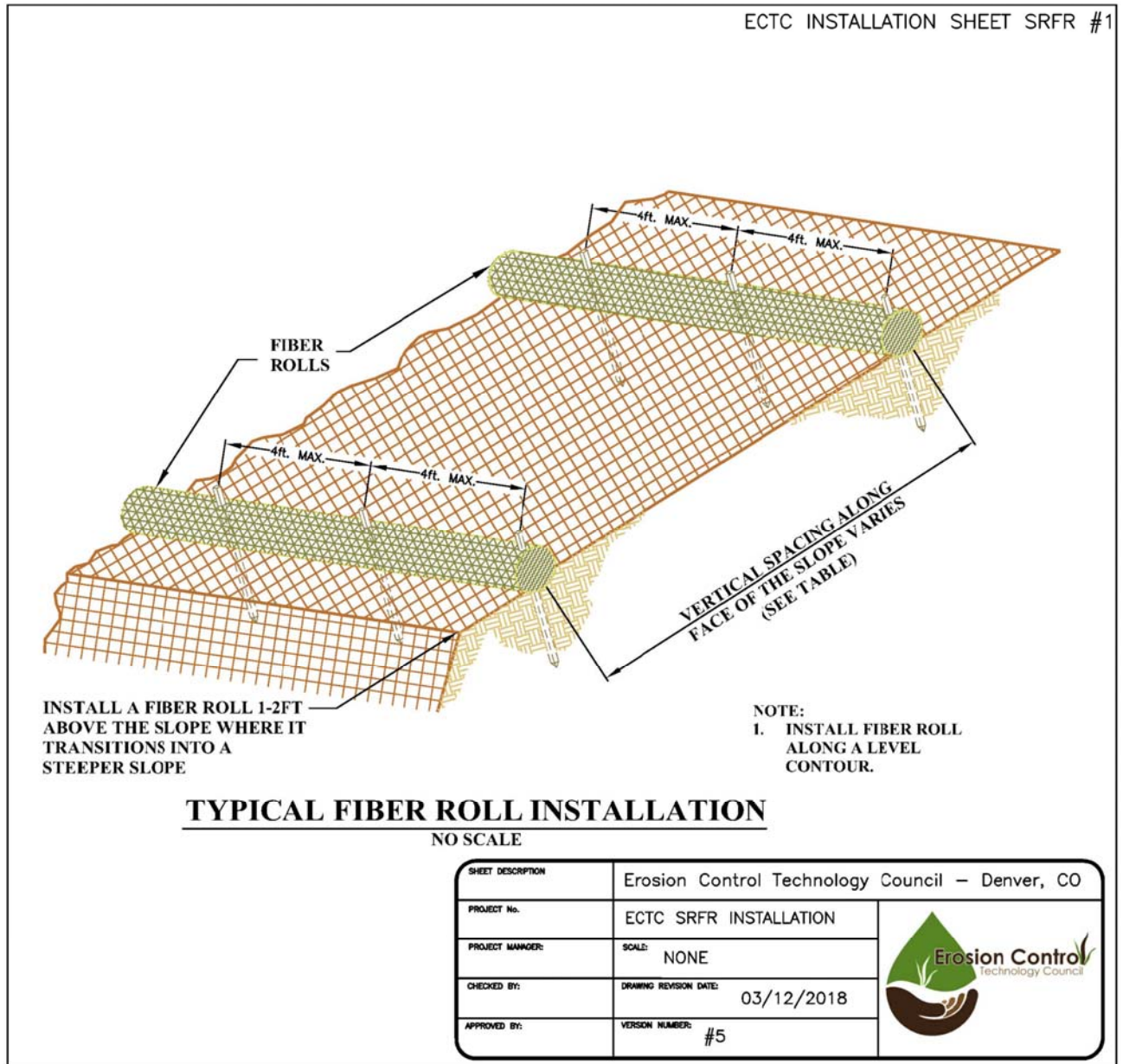
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Appropriate Applications

SRFRs are typically placed along the toe, top, face and at grade breaks of exposed and erodible slopes to shorten the slope length and spread

runoff as sheet flow. SRFRs are also frequently used for inlet protection, around temporary stockpiles and even around the perimeter of a job



NOTES:

1. Install fiber roll along a level contour.
2. Some SRFRs are anchored on the down gradient side through the netting only as compared to through the center of the SRFR as shown on this detail. (See netting only stake detail – ECTC SRFR installation sheet 5)

Figure 1. Spacing of SRFRs.

Appropriate Applications (cont.)

site for sediment containment and/or filtration. SRFRs are also used in channel applications as checks to reduce flow velocity and filter sediment laden flow. SRFRs may be used in conjunction with Rolled Erosion Control Products (RECPs) and Hydraulically Applied Erosion Control Products (HECPs). If used with HECPs, SRFRs are installed prior to application of the HECP. Once SRFRs are installed, apply the HECP per the man-

ufacturer's application rates and instructions. When used with RECPs, SRFRs are typically placed and secured after installation of the RECP. Proper installation is necessary for successful SRFR implementation. Excessive runoff and erosion may occur if SRFRs are not adequately spaced, trenched in and/or anchored. The following provides a general guide to determination of spacing and installation.

Table 1. Nominal Spacing for SRFR Slope Installations.

		Nominal Diameter Spacing (ft)			
		6" dia.	9" dia.	12" dia.	20" dia.
Slope Gradient	≤4H:1V	20	40	60	80
	3H:1V	15	30	45	60
	2H:1V	10	20	30	40
	1H:1V	5	10	15	20

Reducing Slope Length for Erosion Control

Slope length and gradient are two factors that directly affect the erodibility of a slope and introduce sediment into stormwater runoff. As many road right-of-ways are space limited, slopes along roadsides tend

to be steep, leading to accelerated erosion. SRFRs provide a reliable and economical means to reduce the effective length of slopes, thus reducing erosion and sediment discharge to receiving waters.

Suggested Spacing

Primarily, the gradient of the slope will determine the distance between SRFRs on a slope, however, the soil type and overall project risk may affect the final spacing plan of the installation. See Figure 1 for illustration of typical SRFR spacing.

Typical spacing between SRFRs for slope applications is recommended in Table 1. Contact the manufacturer of the SRFR for specific recommendations.

Typical spacing between SRFRs can be calculated as follows for channel applications:

$$\text{Spacing} = \frac{(\text{Unit Nominal Diameter} - \text{Trench Depth})}{\text{Channel Gradient}}$$

Example: Unit Nominal Diameter = 9"
Trench Depth = 2.0" (See step 3)
Channel Gradient = 0.005 ft/ft

$$\text{Spacing} = [(9'' - 2.0'') / (12'' \text{ per ft})] / 0.005 = 116.7 \text{ ft}$$

Key Elements for Successful Product Installation

Always consult with the manufacturer for specific product installation requirements and site specific recommendations.

It is critical that the SRFRs are installed perpendicular to the expected water flow (parallel to the slope contour or across the width of the channel/swale).

Lay the SRFRs onto an RECP, the pre-

pared subgrade, or into the trenches in the soil; ensuring no gaps exist between the roll and the subgrade or RECP. When using HECPs, apply them after the SRFRs have been properly installed.

Wooden stakes or metal pins may be used to secure the SRFRs. If using wooden stakes the minimum dimensions of the stake should be $\frac{3}{4}'' \times \frac{3}{4}''$ and long enough to provide anchoring

Key Elements for Successful Product Installation (cont.)

and stability for the SRFR. Typically, the stake length below the soil surface is between 12" - 16". Site-specific conditions such as compacted soil or rocky subgrade will dictate what is realistic and practical for an adequate installation. First, make pilot hole through the center of the SRFRs using a straight metal rod (i.e. rebar), then insert the wooden stakes (this step may not be necessary if using porous SRFRs or metal pins.)

SRFRs may be secured by driving stakes through the body of the unit, or by penetrating the netting of the

unit on an angle. Individual manufacturers provide product/project specific recommendations for the staking of SRFRs. For either staking method, drive the stakes or pins through the SRFR or the netting only, leaving no more than 1 to 2 inches of the stake or pin exposed. Stakes or pins should be placed according to manufacturer's recommendations. On very steep or erosive slopes, additional stakes or pins may be placed on the down-slope side of the roll. In very compacted soil shorter stakes or pins may be necessary.



Photo 1. SRFRs installed across the width of a swale.

CADD Drawings:

- The drawings shown in this document are available for download at ECTC.org
- DWG files are available for designers to import into CADD.
- Designers are welcome to modify the drawings for usage in their project specifications.

Installation Instructions on Bare (Unprotected) Soils

Step One: Prepare site by removing debris and obstructions and minimizing disturbances to yield a smooth, even ground surface. If seeding is required, place seed, as specified, prior to installation of SRFRs.

Step Two: Determine if an anchor trench is required. Verify manufacturer's recommendations based on site-specific characteristics and prod-

uct properties. Map out the placement of SRFRs to determine location and profile of the anchor trench.

Step Three: For SRFRs that require an anchor trench, excavate an anchor trench along the area where the SRFR is to be placed. The depth and width of the anchor trench is dependent upon the soil type and dimensions of the SRFR. Typically, the anchor trench

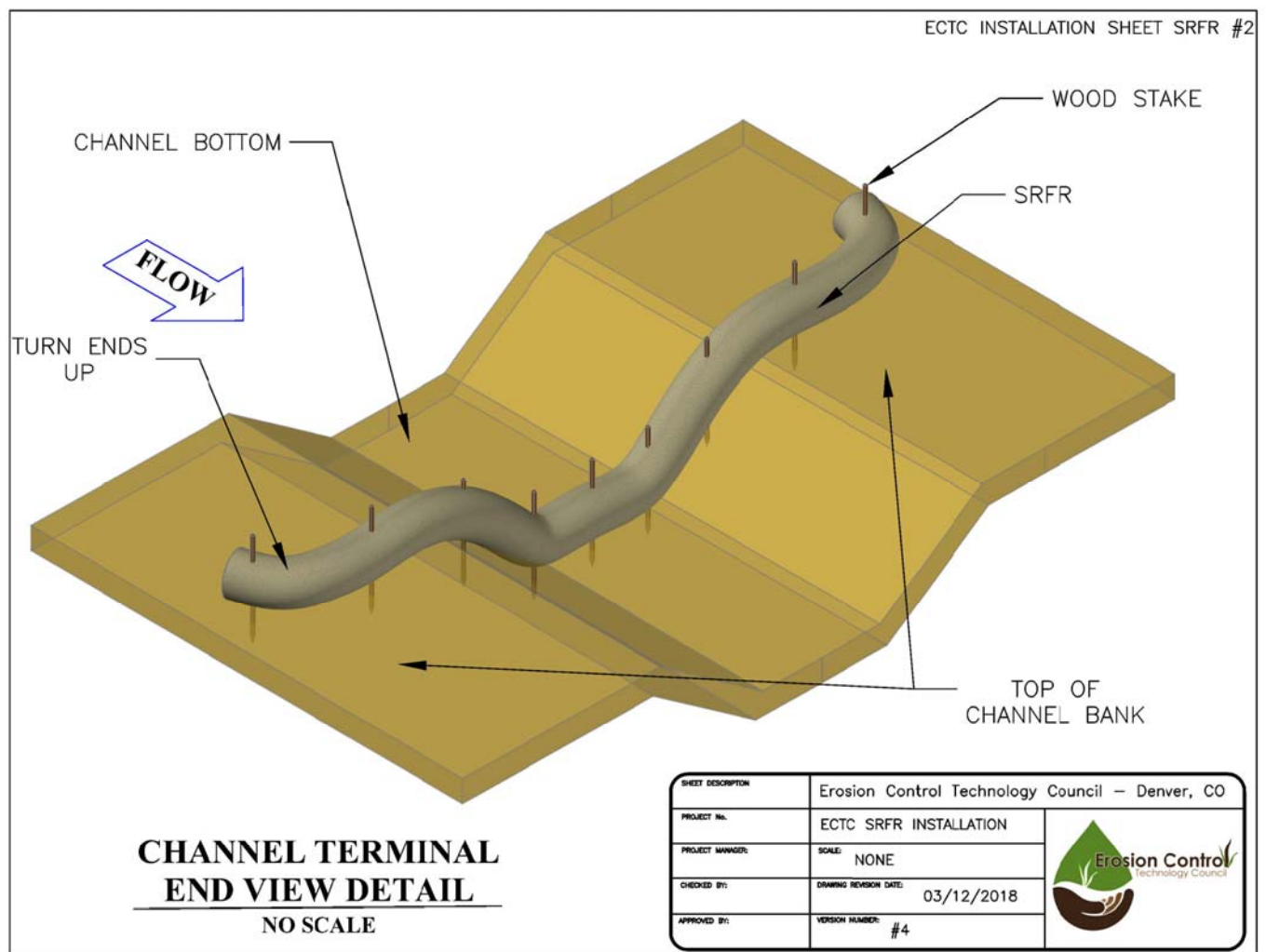


Figure 2. Terminal End Detail.

Installation Instructions on Bare (Unprotected) Soils (cont.)

should be a range of 1 to 3 inches. The anchor trench is utilized to minimize under-cutting of soil on the upstream side of the slope. The anchor trench should match the installation profile and contour of the installed device. SRFRs installed on flat surfaces as perimeter control or inlet protection may not require an anchor trench, per manufacturer's recommendation. For SRFRs that do not

require an anchor trench, secure the SRFRs directly to the ground surface, as directed by Steps 5 and 6.

Step Four: Channel Applications: The SRFR should be placed across the width of the channel and perpendicular to the centerline of the channel (direction of flow). The SRFR must be installed sufficiently up the channel banks to prevent flanking or concen-

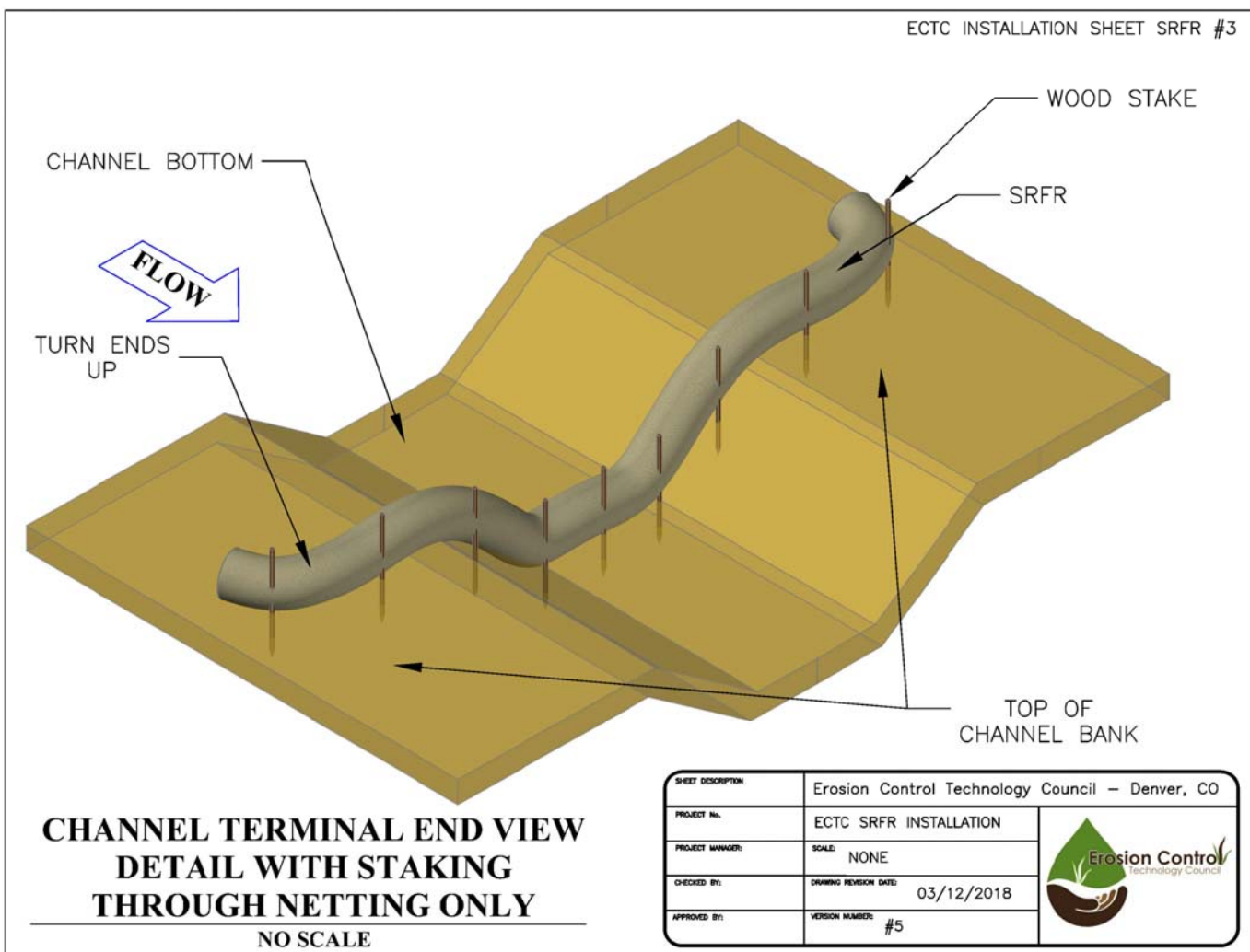


Figure 3. Terminal End Detail

Installation Instructions on Bare (Unprotected) Soils (cont.)

trated flow around the ends of the SRFR. Slope Applications: Units should be placed perpendicular to the downslope flow line. Ends of the unit should be turned upslope forty-five degrees to prohibit flanking of

the installation. **See Figures 2 and 3** for examples of slope installation terminal end.

Step Five: Place the SRFR in the anchor trench. The SRFR must be installed ensuring intimate contact with

Figures 4, 5 & 6 Entrenchment and Staking Details.

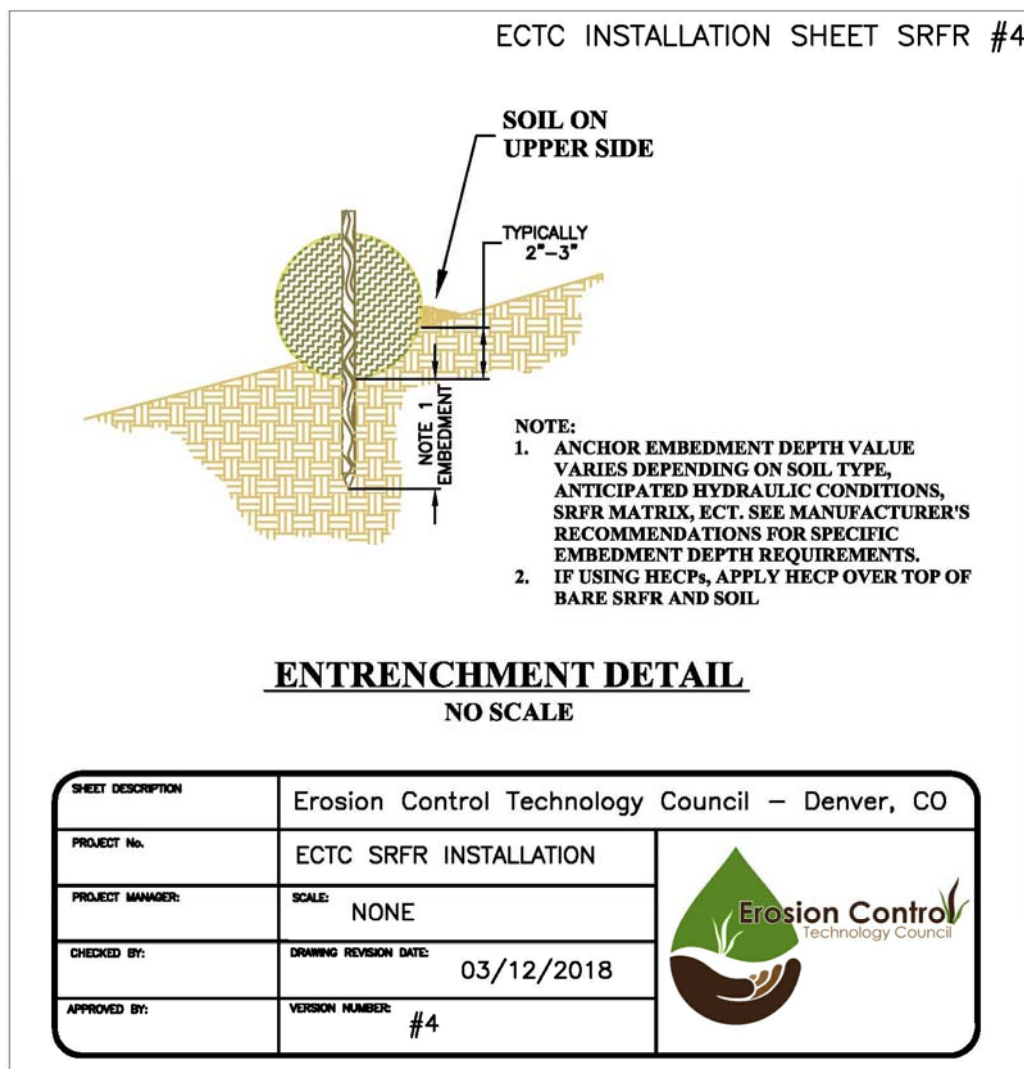


Figure 4. Stake through the middle of the SRFR.

Installation Instructions on Bare (Unprotected) Soils (cont.)

the soil surface along the entire length of the unit.

Step Six: Secure the SRFR with stakes or pins along the length of the unit. Stakes should be driven in vertically, perpendicular to a horizontal

ground plane (see **Figures 4, 5 and 6**, “Entrenchment and Staking Details”). Driving stakes perpendicular to a sloped ground surface may compromise the stability of the SRFR.

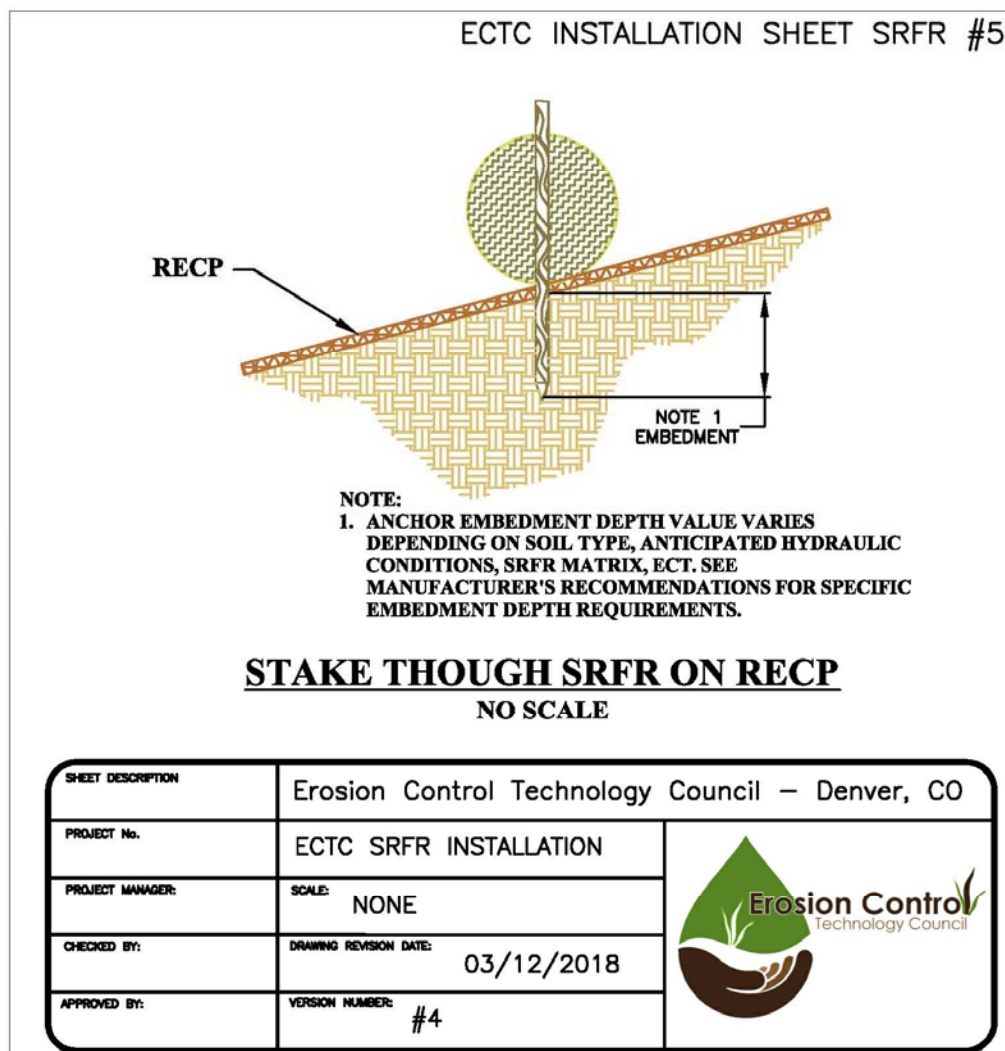


Figure 5 Stake through RECP on top of RECP/HECP.

Installation Instructions on Bare (Unprotected) Soils (cont.)

An optional method of securing the SRFR is to drive stakes on both sides of the SRFR and lace rope between the stakes securing the SRFR. After the rope is laced around the stakes, the stakes are then driven into the slope so that the rope will hold the

fiber roll tightly to the slope. If metal stakes are used the rope may be laced and knotted at the bend at the top of the metal stakes. Secure ends of each SRFR. See **Figure 7** for schematics of Stake Lacing.

Figures 4, 5 & 6 Entrenchment and Staking Details (cont.)

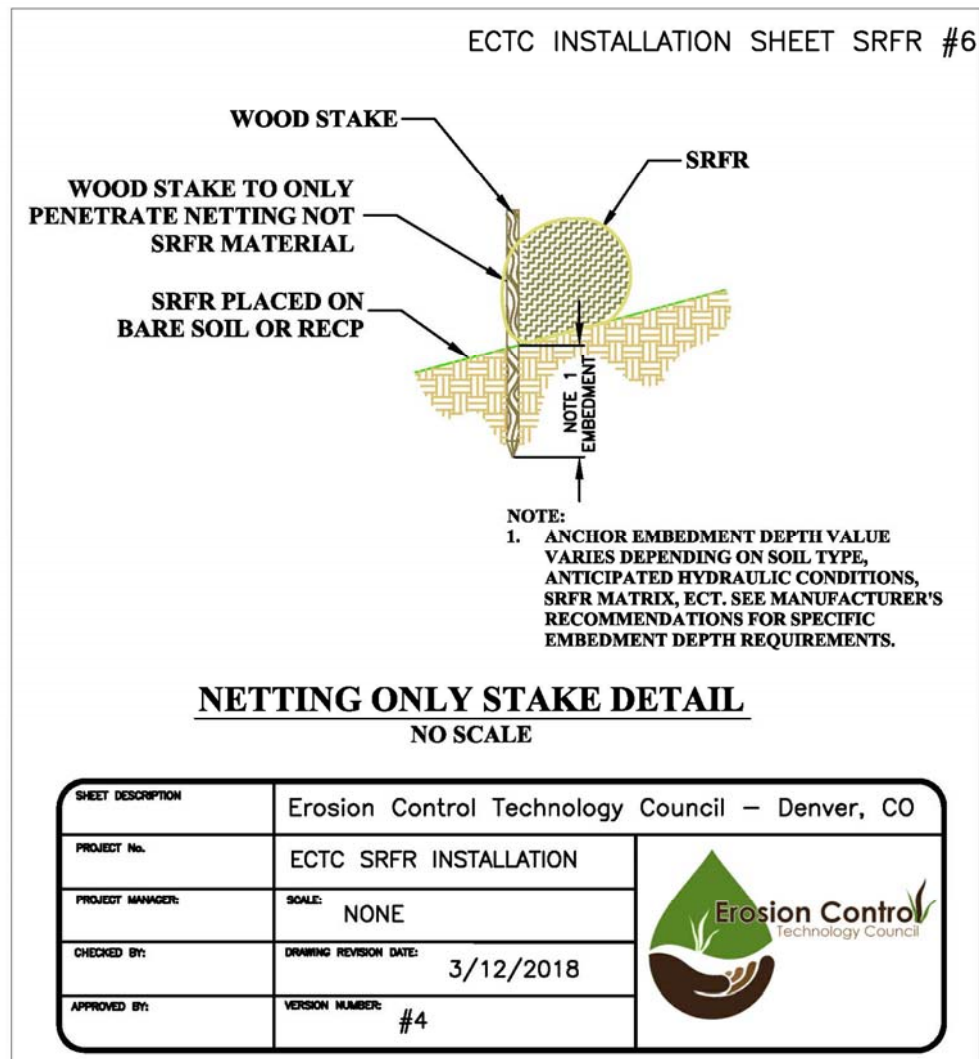


Figure 6. Stake through netting only on soil.

Installation Instructions on Bare (Unprotected) Soils (cont.)

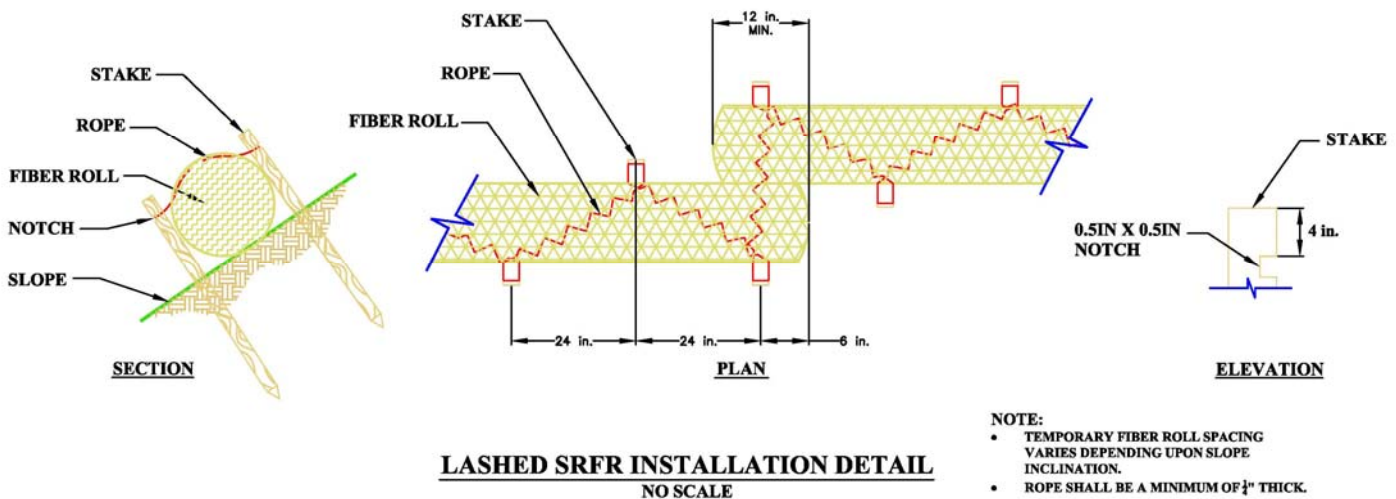
Step Seven: See manufacturer's recommendations regarding joining methods for adjacent units. A one foot overlap, directed up-gradient, is recommended for most products; however, abutting and securing with a common stake is recommended for some of the more porous SRFRs. **Figures 8, 9 & 10** show details for these methodologies.

Step Eight: For trenched SRFRs, place soil on up-slope side of the roll and compact well. The compacted up-slope soil is placed to act as a sealant

of the SRFR-soil interface in order to prevent undermining the SRFR. See Figure 4 for Entrenchment Detail.

Step Nine: For slope applications, the terminal ends of the SRFRs should be turned 45 degrees upslope and secured by stakes to prevent water flow around the terminal ends of the SRFRs. See Figure 2 for Terminal End Detail.

ECTC INSTALLATION SHEET SRFR #7



SHEET DESCRIPTION	Erosion Control Technology Council – Denver, CO	
PROJECT No.	ECTC SRFR INSTALLATION	
PROJECT MANAGER	SCALE:	NONE
CHECKED BY:	DRAWING REVISION DATE:	03/12/2018
APPROVED BY:	VERSION NUMBER:	#4



Figures 7 Schematics of Stake Lacing

Figures 8, 9 and 10 Joining Methods of Adjacent SRFRs.

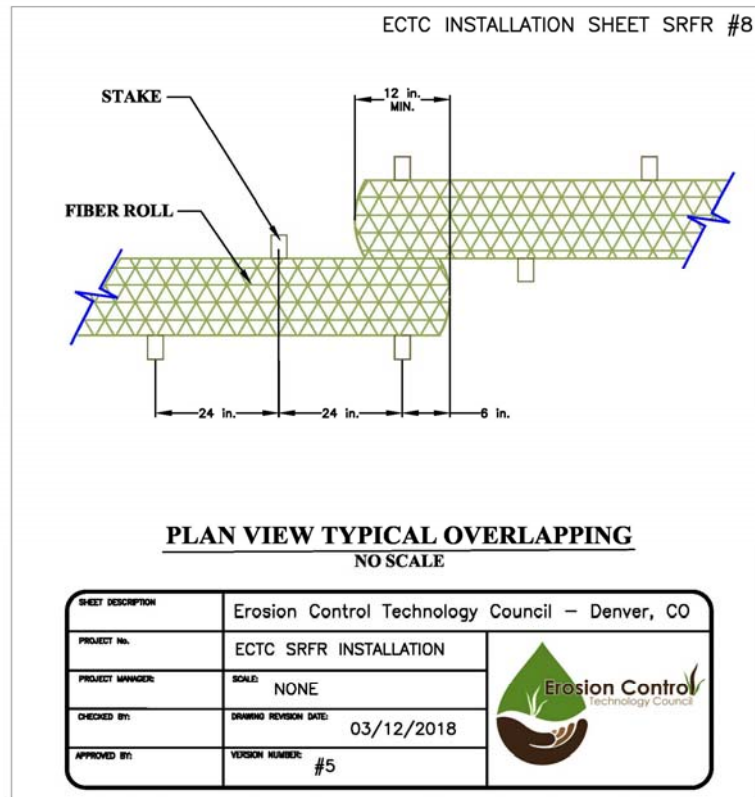


Figure 8. Overlapping SRFRs with laced stakes.

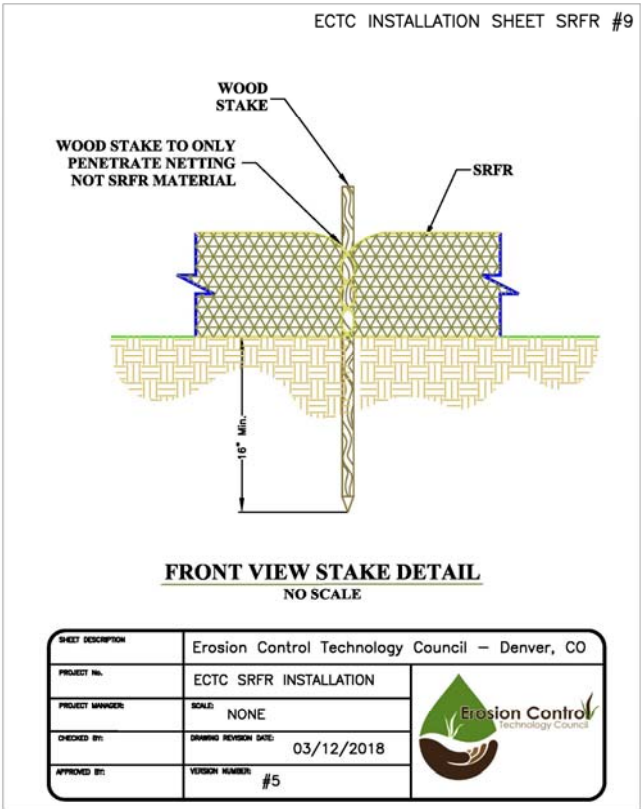


Figure 9. Abutting SRFRs with a common stake.

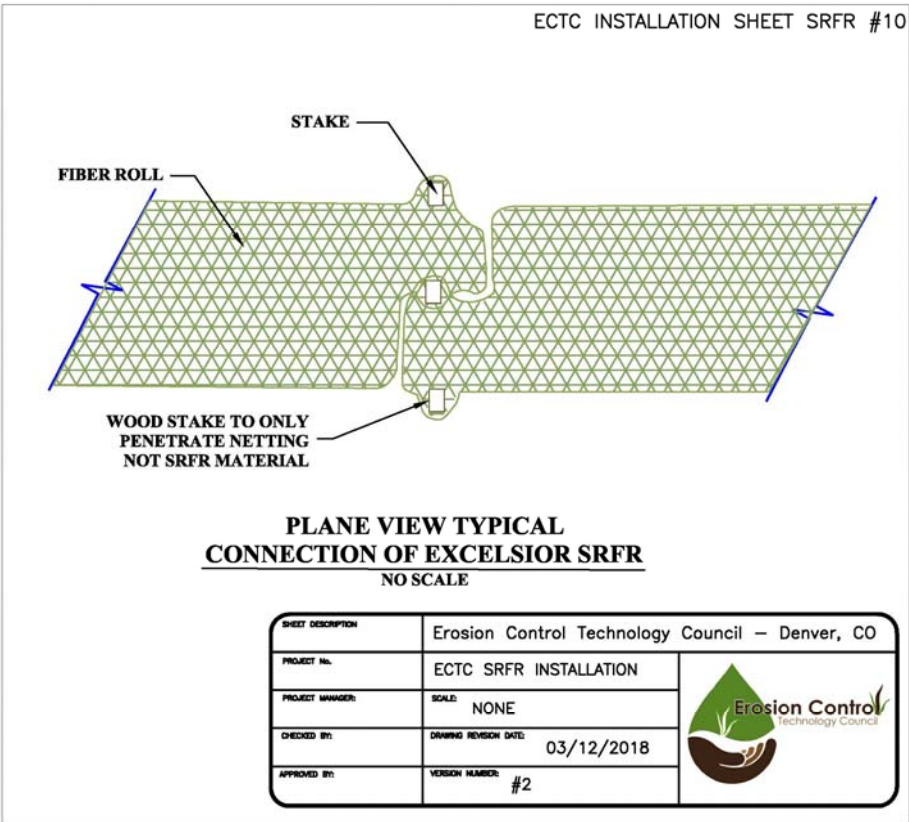


Figure 10. Typical connection of a wood SRFR.

Installation Instructions in Conjunction with RECP / HECF

For placement in conjunction with an HECF, install SRFR as directed in Step One through Step Eight above; then install the HECF as directed by manufacturer's instructions.

For placement in conjunction with RECFs, install RECFs as per manufac-

turer's instructions, then install SRFRs on top of RECF ensuring intimate contact with the RECF along the entire length of the unit. Secure SRFR(s) as directed in Steps Five through Seven.

Maintenance and Installation

Refer to the manufacturer for maintenance guidelines as this document is only intended for typical installation recommendations. For the most effective SRFR installation, use

guidelines as recommended by the manufacturer. Manufacturers may also provide site specific recommendations.

About ECTC

The Erosion Control Technology Council (ECTC) is committed to promoting cost-effective erosion and sediment control solutions through leadership, standardization and education. ECTC assists agencies, engineers, designers, contractors and other entities in the proper application, installation and specification of erosion control technologies while establishing guidelines for product quality, testing and performance.

ECTC's mission has grown even more important as new end-users look for guidance in employing RECFs, HECFs and SRFRs to comply with more stringent erosion/sediment control regulations.



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Erosion Control Technology Council



MGP Well Site-Specific Calculations

Soil Results



Date: 4/10/2023

CLIENT: Woodard & Curran-TREC
Project: 1234949.000
Lab Order: S2303317

CASE NARRATIVE
Report ID: S2303317001

Entire Report Reviewed by:

Crystal Herman

Crystal Herman, Mining Supervisor

Samples SS-Background-20230321, SS-South Slope-20230321 and SS-West Slope-20230321 were received on March 23, 2023.

Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, August 1998
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

All Quality Control parameters met the acceptance criteria defined by EPA and Pace Analytical (Formerly Inter-Mountain Laboratories) except as indicated in this case narrative.

Qualifiers by sample

Control - Soil Texture Analysis/Clay - Spike Recovery outside accepted recovery limits
Control - Soil Texture Analysis/Sand - Spike Recovery outside accepted recovery limits
S2303317-001 - Saturated Paste Cations by EPA 200.7/Calcium - RPD outside accepted recovery limits
S2303317-001 - Saturated Paste Cations by EPA 200.7/Sodium - RPD outside accepted recovery limits



Date: 4/10/2023

Definitions

RL Reporting Limit

Qualifiers

*	Value exceeds Maximum Contaminant Level
A	Check MSA specifications
B	Analyte detected in the associated Method Blank
C	Calculated Value
D	Report limit raised due to dilution
E	Value above quantitation range
G	Analyzed at Pace Gillette, WY laboratory
H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits
L	Analyzed by another laboratory
M	Value exceeds Monthly Ave or MCL or is less than LCL
ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions
R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits
U	Analyte below method detection limit
X	Matrix Effect

Soil Analysis Report

Woodard & Curran-TREC

225 Union Blvd. Ste 475

Lakewood, CO 80228

Report ID: S2303317001

Project: 1234949.000
Date Received: 3/23/2023

Date Reported: 4/10/2023
Work Order: S2303317

Lab ID	Sample ID	Depths Inches	Organic Matter		Electrical	Calcium	Magnesium	Potassium	Sodium
			LOI	pH	Conductivity	PE	PE	PE	PE
			%	s.u.	dS/m	meq/L	meq/L	meq/L	meq/L
S2303317-001	SS-Background-20230321	0-6	7.2	6.7	0.41	3.06	1.5	<0.3	<1
S2303317-002	SS-West Slope-20230321	0-6	6.7	7.0	0.69	2.95	2.7	<0.3	2
S2303317-003	SS-South Slope-20230321	0-6	4.2	7.9	0.29	1.36	0.8	<0.3	<1

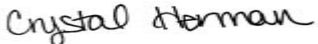
These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, TOC=Total Organic Carbon

Reviewed by:


 Crystal Herman, Mining Supervisor

Soil Analysis Report
Woodard & Curran-TREC
225 Union Blvd. Ste 475
Lakewood, CO 80228

Report ID: S2303317001

Date Reported: 4/10/2023
Work Order: S2303317

Project: 1234949.000
Date Received: 3/23/2023

Lab ID	Sample ID	Depths Inches	Sand	Silt	Clay	Texture	Available Potassium	AB-DTPA Iron	AB-DTPA Zinc	Total Phosphorus	Nitrate(as N)
			%	%	%		ppm	ppm	ppm	mg/Kg	ppm
S2303317-001	SS-Background-20230321	0-6	31.5	35.1	33.5	Clay Loam	280	22.1	0.9	280	1.2
S2303317-002	SS-West Slope-20230321	0-6	<0.1	46.5	53.5	Silty Clay	218	12.4	4.8	100	3.8
S2303317-003	SS-South Slope-20230321	0-6	<0.1	49.0	51.0	Silty Clay	217	12.9	1.5	190	<0.1

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, TOC=Total Organic Carbon

Reviewed by: Crystal Herman
Crystal Herman, Mining Supervisor

**ANALYTICAL QC SUMMARY REPORT****CLIENT:** Woodard & Curran-TREC**Date:** 4/10/2023**Work Order:** S2303317**Report ID:** S2303317001**Project:** 1234949.000**ABDTPA Metals by ICP**Sample Type **MBLK**

Units: ppm

ABDTPA BLK (04/06/23 12:16)		RunNo: 209307					
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
Iron	ND	1.5					
Zinc	ND	0.5					

ABDTPA Metals by ICPSample Type **LCS**

Units: ppm

ABDTPA QC (04/06/23 12:13)		RunNo: 209307						
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Iron	43.9	1.5	62.3		70.5	70 - 130		
Zinc	7.7	0.5	9.35		82.5	70 - 130		

ABDTPA Metals by ICPSample Type **MS**

Units: ppm

S2303317-002AS (04/06/23 12:09)		RunNo: 209307						
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Iron	16.8	2.5	5.5	12.4	79.0	70 - 130		
Zinc	10.0	0.5	5.5	4.8	94.7	70 - 130		

ABDTPA Metals by ICPSample Type **DUP**

Units: ppm

S2303317-001AD (04/06/23 12:04)		RunNo: 209307						
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Iron	19.9	2.5	22.1	10.1		20		
Zinc	0.9	0.5	0.9	5.02		20		

Available Metals - ppmSample Type **MBLK**

Units: ppm

AVA BLK (04/06/23 11:50)		RunNo: 209306					
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
Available Potassium	ND	44					

Available Metals - ppmSample Type **LCS**

Units: ppm

AVA QC (04/06/23 11:48)		RunNo: 209306					
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
Available Potassium	266	44	296		90.1	75 - 125	

Available Metals - ppmSample Type **DUP**

Units: ppm

S2303317-001AD (04/06/23 11:30)		RunNo: 209306					
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
Available Potassium	271	1	280	3.04		20	

**ANALYTICAL QC SUMMARY REPORT****CLIENT:** Woodard & Curran-TREC**Date:** 4/10/2023**Work Order:** S2303317**Report ID:** S2303317001**Project:** 1234949.000**Nitrogen - Nitrate - Calcium Chloride Extraction**Sample Type **MBLK**

Units: ppm

MBLK (04/06/23 13:09)	RunNo: 209296							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Nitrogen-Nitrate	ND	0.1						
BLANK (04/06/23 13:36)	RunNo: 209296							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Nitrogen-Nitrate	ND	0.1						

Nitrogen - Nitrate - Calcium Chloride ExtractionSample Type **LCS**

Units: ppm

LCS (04/06/23 13:12)	RunNo: 209296							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Nitrogen-Nitrate	2.6	0.1	2.5		102	80 - 120		

Nitrogen - Nitrate - Calcium Chloride ExtractionSample Type **DUP**

Units: ppm

S2303317-001AD (04/06/23 13:31)	RunNo: 209296							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Nitrogen-Nitrate	1.0	0.1	1.2	15.7		20		

Electrical Conductivity - SoilSample Type **LCS**

Units: dS/m

CONTROL (04/04/23 10:10)	RunNo: 209208							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Electrical Conductivity	3.26	0.01	3.37		96.7	80 - 120		

Electrical Conductivity - SoilSample Type **DUP**

Units: dS/m

S2303317-001A (04/04/23 10:07)	RunNo: 209208							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Electrical Conductivity	0.39	0.01	0.41	4.99		20		

Soil Texture AnalysisSample Type **LCS**

Units: %

CONTROL (04/06/23 08:19)	RunNo: 209266							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Sand	15.3	0.1	32.5		47.0	75 - 125	S	
Silt	50.0	0.1	40.2		125	75 - 125		
Clay	34.7	0.1	27.2		128	75 - 125	S	
Texture	ilty Clay Loam	0						

Soil Texture AnalysisSample Type **DUP**

Units: %

S2303317-001A (04/06/23 08:16)	RunNo: 209266							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Sand	28.4	0.1	31.4	10.2		23.9		
Silt	36.9	0.1	35.1	5.00		20		
Clay	34.7	0.1	33.5	3.67		20		
Texture	Clay Loam	0	ND			0		

**ANALYTICAL QC SUMMARY REPORT****CLIENT:** Woodard & Curran-TREC**Date:** 4/10/2023**Work Order:** S2303317**Report ID:** S2303317001**Project:** 1234949.000**Organic Matter by Loss on Ignition**Sample Type **LCS**

Units: %

CONTROL (04/04/23 08:46)	RunNo: 209290							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Organic Matter	2.4	0.1	2.16		110	75 - 125		

Organic Matter by Loss on IgnitionSample Type **DUP**

Units: %

S2303317-001A (04/04/23 08:43)	RunNo: 209290							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Organic Matter	7.2	0.1	7.2	0.133		20		

pH-SoilSample Type **LCS**

Units: s.u.

CONTROL (04/04/23 08:09)	RunNo: 209208							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
pH	7.2	0.1	7.1		102	96 - 104		

pH-SoilSample Type **DUP**

Units: s.u.

S2303317-001A (04/04/23 08:06)	RunNo: 209208							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
pH	6.9	0.1	6.7	2.06		20		

Saturated Paste Cations by EPA 200.7Sample Type **MBLK**

Units: meq/L

SAR BLK (04/06/23 14:02)	RunNo: 209309							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Calcium	ND	0.11						
Magnesium	ND	0.2						
Potassium	ND	0.3						
Sodium	ND	1						

Saturated Paste Cations by EPA 200.7Sample Type **LCS**

Units: meq/L

SAR QC (04/06/23 14:00)	RunNo: 209309							
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual	
Calcium	23.2	0.11	26		89.1	80 - 120		
Magnesium	11.8	0.2	13.4		88.3	80 - 120		
Potassium	1.5	0.3	1.51		98.8	80 - 120		
Sodium	17	1	17.2		101	80 - 120		

Saturated Paste Cations by EPA 200.7Sample Type **DUP**

Units: meq/L

S2303317-001AD (04/06/23 12:45)	RunNo: 209309							
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual	
Calcium	1.89	0.11	3.06	47.4		20	R	
Magnesium	1.2	0.2	1.5	17.0		20		
Potassium	ND	0.3	ND			20		
Sodium	1	1	ND			20	R	

**ANALYTICAL QC SUMMARY REPORT****CLIENT:** Woodard & Curran-TREC**Date:** 4/10/2023**Work Order:** S2303317**Report ID:** S2303317001**Project:** 1234949.000**Total (3050) Metals by ICP - 6010C**Sample Type **MBLK**

Units: mg/Kg

MB-20552 (04/06/23 19:23)	RunNo: 209324	PrepDate: 04/04/23 0:00	BatchID: 20552				
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual

Phosphorus

ND

10

Total (3050) Metals by ICP - 6010CSample Type **LCS**

Units: mg/Kg

LCS-20552 (04/06/23 19:25)	RunNo: 209324	PrepDate: 04/04/23 0:00	BatchID: 20552				
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual

Phosphorus

110

10

125

85.8

80 - 120

Total (3050) Metals by ICP - 6010CSample Type **MS**

Units: mg/Kg

S2303317-002AS (04/06/23 20:59)	RunNo: 209324	PrepDate: 04/04/23 0:00	BatchID: 20552				
Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual

Phosphorus

200

10

125

100

79.0

75 - 125

Total (3050) Metals by ICP - 6010CSample Type **MSD**

Units: mg/Kg

S2303317-002AMSD (04/06/23 21:02)	RunNo: 209324	PrepDate: 04/04/23 0:00	BatchID: 20552				
Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual

Phosphorus

200

10

200

0.0959

78.8

20

Total (3050) Metals by ICP - 6010CSample Type **DUP**

Units: mg/Kg

S2303317-001AD (04/06/23 20:50)	RunNo: 209324	PrepDate: 04/04/23 0:00	BatchID: 20552				
Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual

Phosphorus

250

10

280

11.0

20



Laboratory Management Program (LaMP) Chain of Custody Record
Soil, Sediment and Groundwater Samples

Page 1 of 1

BP Site Node Path:

Req Due Date (mm/dd/yy):

Rush TAT Yes

No

BP/RM Facility No:

MGP

Lab Work Order Number:

Lab Name: Pace National	BP/ARC Facility Address: MGP	Consultant/Contractor: Woodard & Curran
Lab Address: 1673 Terra Avenue, Sheridan, WY 82801	City, State, ZIP Code: Trinidad, CO	Consultant/Contractor Project No: 234949.000
Lab PM: Crystal Herman	Lead Regulatory Agency: COGCC	Address: 215 Union Blvd, Ste 275, Lakewood, CO 80228
Lab Phone: 307-672-8945	California Global ID No.:	Consultant/Contractor PM: Kirk Silver
Lab Shipping Acct:	Enfos Proposal No:	Phone: 908-930-2301 Email: ksilver@woodardcurran.com
Lab Bottle Order No:	Accounting Mode: Provision OOC-BU OOC-RM	Send/Submit EDD to: Kirk Silver & C. Michael Jackson
Other Info:	Stage Activity	Invoice To: BP-RM BP-Other

BP/RM PM: C. Michael Jackson	Requested Analyses												Report Type & QC Level				
PM Phone: 713-437-9285	Filtered (Y/N)												Limited (Standard) Package <input checked="" type="checkbox"/>				
PM Email: c.jackson@bp.com	Preservation												Limited Plus Package <input type="checkbox"/>				
Lab No.	Unique Sample ID, must follow format of SAMPLENAMEYYYYMMDD Examples: MW01_20190101; BH01_3-5_20190101	Time	Depth Unit (in)	Grab (G) or Composite (C)	Total Number of Containers	Matrix	Analysis	N, P, K	pH	Ca, Mg	Na	Fe	Zn	Organic matter	Texture	Electrical Conductivity	Comments
	SS-Background-20230321	1150	0-6 C	1	S			X	X	X	X	X	X	X	X	X	
	SS - West Slope-20230321	1200	0-6 C	1	S			X	X	X	X	X	X	X	X	X	
	SS- South Slope-20230321	1205	0-6 C	1	S			X	X	X	X	X	X	X	X	X	

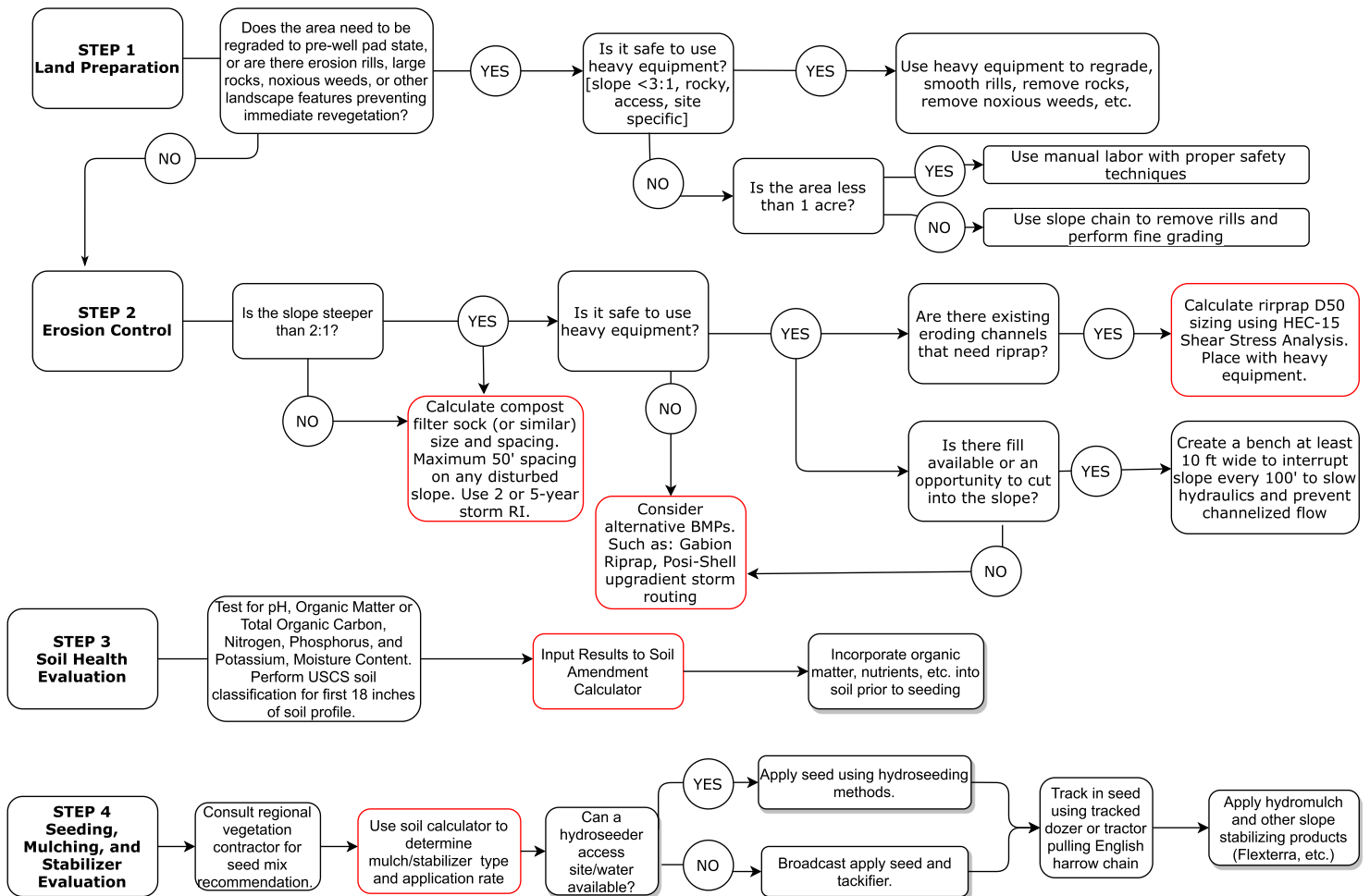
Sampler's Name: Emily Baswell	Relinquished By / Affiliation		Date	Time	Accepted By / Affiliation		Date	Time
Sampler's Company: Woodard & Curran	Emily Bell WC		3/22/23	0900	Doree Cornejo		3/22/23	0900
Ship Method: Fed Ex	Ship Date:	3/22/23 Doree Cornejo	3/22/23	1800	Daniel R. Pace		3/23/23	1108
Shipment Tracking No:								

Special Instructions: Electrical conductivity by saturated paste method

THIS LINE - LAB USE ONLY: Custody Seals In Place: Yes (No) | Temp Blank: Yes (No) | Cooler Temp on Receipt: 10.4 °F/C | Trip Blank: Yes (No) | MS/MSD Sample Submitted: Yes / No

No ice

Decision Flow Chart for Well Pad Reclamation



MONITOR 2-3 GROWING SEASONS FOR EROSION & VEGETATION ESTABLISHMENT

FIRST GROWING SEASON – QUALITATIVE FIELD ASSESSMENT FORM

MGP A-4 Well Pad

Site: _____ Evaluation Area _____ Date _____
 Seeding Date/Season _____ Seed Mix Used _____ Evaluators _____

- Mulch Species Evaluation**
- ☐ Observed Species:
 - ☐ Only a few scattered plants
 - ☐ Low-Density Un-Evenly Distributed
 - ☐ Low-Density Evenly Distributed
 - ☐ Well-Established and Common/Abundant

- Seedling Evaluation**
- ☐ Seedlings Evident and more than 40 per square meter
 - ☐ Seedlings Present, but scattered and less than 40 per square meter
 - ☐ Seedlings Present at adequate density, but appear to be desiccated/dried out (possibly dead)
 - ☐ Seedlings widely scattered and overall very few present

 - ☐ Enough Seedlings Present for a good stand of seeded species in 1-2 years
 - ☐ Enough Seedlings Present for a good stand of seeded species in 2-4 years
 - ☐ Possibly Not Enough Seedlings Present for a good stand of seeded species in 2-4 years
 - ☐ Probably Not Enough Seedlings Present for a good stand of seeded species in 2-4 years

 - ☐ Seedlings robust, well-established and some (many) with flowering heads
 - ☐ Seedlings 2-5 inches tall, well-established and only a few (or none) with flowering heads
 - ☐ Seedlings small (mostly 1-2 inches tall), but will probably survive
 - ☐ Seedlings small (mostly 1-2 inches tall), apparently stressed and not likely to survive

- Weed Abundance**
- | | | | | | | | | | | | | |
|--------------------------|-----|---|---|---|---|---|---|---|---|---|----|-------------------|
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |
| <input type="checkbox"/> | Few | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Abundant/Dominant |

- Organic Matter** ☐ Well-Integrated OR ☐ Patches of Non-integrated organic matter present on soil surface

- Mowing** ☐ Area Mowed OR ☐ Area Not Mowed

- Herbicide Application** ☐ No Evidence of Herbicide Application OR ☐ Herbicides Apparently Applied

- | | |
|---|---|
| <p>Soil Conditions</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fine, dark-colored and powdery <input type="checkbox"/> Light-colored, fine texture <input type="checkbox"/> Light-colored, mixed texture <input type="checkbox"/> Light-colored, mixed texture and rocky | <p>Erosion</p> <ul style="list-style-type: none"> <input type="checkbox"/> No apparent erosion problems <input type="checkbox"/> Some sheet-wash erosion noted <input type="checkbox"/> Rills present in places (Not a problem) <input type="checkbox"/> Rills present (Need storm water control) <input type="checkbox"/> Gullies present (Need storm water control) |
|---|---|

- Recommendations**
- ☐ Area is adequate, without issues and does not require maintenance at this time
 - ☐ Apparently no need to re-seed the area
 - ☐ Give the area one more year to develop
 - ☐ Weeds should be mowed
 - ☐ Plan to spot spray noxious weeds during the next 1-2 years
 - ☐ Re-till and re-seed the area at the next available opportunity
 - ☐ Other _____

COMMENTS:

Observed Species — Evaluation Area _____ Date _____
(m=major species; x=other species)

Present	Scientific Name	Common Name	
ACCEPTABLE SPECIES:			
<input type="checkbox"/>	<i>Achillea millefolium</i>	Common yarrow	Revegetation Mix 1
<input type="checkbox"/>	<i>Agropyron cristatum</i>	Crested wheatgrass	
<input type="checkbox"/>	<i>Agropyron intermedium</i> (= <i>Thinopyrum intermedium</i>)	Intermediate wheatgrass	
<input type="checkbox"/>	<i>Agrostis palustris</i>	Creeping bentgrass	Revegetation Mix 4
<input type="checkbox"/>	<i>Agrostis stolonifera</i>	Redtop, Spreading bent	
<input type="checkbox"/>	<i>Antennaria rosea</i>	Rose pussytoes	
<input type="checkbox"/>	<i>Arctostaphylos uva-ursi</i>	Kinnikinnick	
<input type="checkbox"/>	<i>Artemisia frigida</i>	Fringed Sagebrush	Revegetation Mix 1
<input type="checkbox"/>	<i>Artemisia ludoviciana</i>	Cudweed, Louisiana sagewort	
<input type="checkbox"/>	<i>Artemisia tridentata</i>	Big Sagebrush	
<input type="checkbox"/>	<i>Aster ascendens</i> (= <i>Symphyotrichum ascendens</i>)	Western American-aster	
<input type="checkbox"/>	<i>Astragalus vexilliflexus</i>	Milkvetch	
<input type="checkbox"/>	<i>Bromus anomalus</i>	Nodding brome	
<input type="checkbox"/>	<i>Bromus inermis</i>	Smooth brome	
<input type="checkbox"/>	<i>Bromus marginatus</i> (= <i>Bromus carinatus</i>)	Mountain brome	Reveg Mixes 1,2 & 3
<input type="checkbox"/>	<i>Calamagrostis canadensis</i>	Bluejoint	Revegetation Mix 3
<input type="checkbox"/>	<i>Carex nebrascensis</i>	Nebraska sedge	Revegetation Mix 3
<input type="checkbox"/>	<i>Deschampsia caespitosa</i>	Tufted hairgrass	Revegetation Mix 3
<input type="checkbox"/>	<i>Elymus lanceolatus</i> (= <i>Agropyron dasystachyum</i>)	Thickspike wheatgrass	Reveg Mixes 1,3 & 4
<input type="checkbox"/>	<i>Elymus repens</i> (= <i>Agropyron repens</i>)	Quackgrass, Creeping wildrye	
<input type="checkbox"/>	<i>Elymus trachycaulus</i> (= <i>Agropyron trachycaulum</i>)	Slender wheatgrass	Reveg Mixes 1,2 & 3
<input type="checkbox"/>	<i>Epilobium ciliatum</i>	Willow-herb	
<input type="checkbox"/>	<i>Festuca idahoensis</i>	Idaho or Bluebunch Fescue	Reveg Mixes 1 & 2
<input type="checkbox"/>	<i>Festuca ovina</i>	Sheep fescue	
<input type="checkbox"/>	<i>Festuca rubra</i>	Red fescue	Revegetation Mix 4
<input type="checkbox"/>	<i>Festuca scabrella</i>	Rough fescue	Reveg Mixes 1 & 2
<input type="checkbox"/>	<i>Fragaria virginiana</i>	Virginia strawberry	
<input type="checkbox"/>	<i>Heterotheca villosa</i>	Golden-aster	
<input type="checkbox"/>	<i>Juncus balticus</i>	Baltic rush	Revegetation Mix 3
<input type="checkbox"/>	<i>Juniperus communis</i>	Common juniper	
<input type="checkbox"/>	<i>Juniperus scopulorum</i>	Rocky Mountain juniper	
<input type="checkbox"/>	<i>Linum lewisii</i>	Common blue flax	Revegetation Mix 1
<input type="checkbox"/>	<i>Lotus corniculatus</i>	Bird's-foot trefoil	
<input type="checkbox"/>	<i>Melilotus officinalis</i>	Yellow sweetclover	
<input type="checkbox"/>	<i>Pascopyrum smithii</i> (= <i>Agropyron smithii</i>)	Western wheatgrass	Revegetation Mix 2
<input type="checkbox"/>	<i>Penstemon procerus</i>	Littleleaf or Pincushion beardtongue	
<input type="checkbox"/>	<i>Pentaphylloides floribunda</i> (= <i>Dasiphora fruticosa</i>)	Shrubby cinquefoil	
<input type="checkbox"/>	<i>Phacelia hastata</i>	Silverleaf scorpion-weed	
<input type="checkbox"/>	<i>Phleum pratense</i>	Common timothy	
<input type="checkbox"/>	<i>Poa ampla</i> (= <i>Poa juncifolia</i>)	Big bluegrass	Revegetation Mix 2
<input type="checkbox"/>	<i>Poa compressa</i>	Canada bluegrass	Reveg Mixes 1 & 4
<input type="checkbox"/>	<i>Poa palustris</i>	Fowl bluegrass	Revegetation Mix 3
<input type="checkbox"/>	<i>Poa pratensis</i>	Kentucky bluegrass	Revegetation Mix 4
<input type="checkbox"/>	<i>Populus balsamifera</i> (= <i>Populus trichocarpa</i>)	Black cottonwood	
<input type="checkbox"/>	<i>Potentilla pensylvanica</i>	Pennsylvania cinquefoil	

- ☐ *Prunus virginiana*
- ☐ ***Pseudoroegneria spicata* (= *Agropyron spicatum*)**
- ☐ *Rosa woodsia*
- ☐ *Salix geyeriana*
- ☐ *Shepherdia canadensis*
- ☐ *Solidago missouriensis*
- ☐ ***Stipa viridula***
- ☐ *Triticum aestivum* x *Secale cereale*

UNDESIRABLE WEEDY SPECIES:

- ☐ *Alyssum alyssoides*
- ☐ *Alyssum desertorum*
- ☐ *Bromus japonicus*
- ☐ *Bromus tectorum*
- ☐ *Camelina microcarpa*
- ☐ *Capsella bursa-pastoris*
- ☐ *Chenopodium album*
- ☐ *Cirsium vulgare*
- ☐ *Descurainia richardsonii*
- ☐ *Descurainia sophia*
- ☐ *Filago arvensis*
- ☐ *Helianthus annuus*
- ☐ *Lactuca serriola*
- ☐ *Lappula redowskii*
- ☐ *Lepidium perfoliatum*
- ☐ *Polygonum aviculare*
- ☐ *Salsola tragus*
- ☐ *Silene latifolia* (= *Lychnis alba*)
- ☐ *Sisymbrium altissimum*
- ☐ *Sisymbrium loeselii*
- ☐ *Taraxacum officinale*
- ☐ *Thlaspi arvense*
- ☐ *Tragopogon dubius*

NOXIOUS WEED SPECIES:

- ☐ *Cardaria draba*
- ☐ ***Carduus nutans***
- ☐ ***Centaurea maculosa***
- ☐ ***Cirsium arvense***
- ☐ *Convolvulus arvensis*
- ☐ *Euphorbia esula*
- ☐ *Kochia scoparia*
- ☐ *Lepidium latifolium*
- ☐ *Linaria dalmatica*
- ☐ ***Linaria vulgaris***
- ☐ *Sonchus arvensis*
- ☐ ***Verbascum thapsus***

- Chokecherry
- Bluebunch wheatgrass** Revegetation Mix 2
- Wood's rose
- Geyer's willow
- Russet or Canada buffaloberry
- Missouri goldenrod
- Green needlegrass** Revegetation Mix 2
- Triticale Revegetation Mix 2

- Pale or Yellow alyssum
- Dwarf alyssum
- Japanese brome
- Cheatgrass
- Littleseed falseflax
- Shepherd's purse
- Goosefoot, Lamb's-quarters
- Bull thistle
- Richardson tansy mustard
- Flixweed
- Fluffweed
- Annual sunflower
- Prickly lettuce
- Western stick tight or stickseed
- Clasping pepperweed
- Prostrate knotweed
- Russian thistle
- White cockle or campion
- Tumbling hedge mustard
- Hedge mustard
- Common dandelion
- Field pennycress, Fanweed
- Common salsify or Goat's-beard

- Whitetop
- Musk thistle**
- Spotted knapweed**
- Canada thistle**
- Field bindweed
- Leafy spurge
- Kochia, Summer cypress
- Perennial pepperweed, Tall whitetop
- Dalmatian toadflax
- Yellow or Common toadflax, Butter-and-eggs**
- Sowthistle
- Common mullein**

QUALITATIVE EROSION MONITORING FORM

EROSION INSPECTION	Site:	Date:																								
Average Slope (%):	Aspect:	Evaluators:																								
Evidence of Soil Movement <input type="checkbox"/> None <input type="checkbox"/> Deposition Areas infrequent and/or shallow (<3" deep)* <input type="checkbox"/> Deposition Areas common and/or (>3" deep)	Evidence of Surface Litter Movement <input type="checkbox"/> None <input type="checkbox"/> <5% of litter translocated and redeposited <input type="checkbox"/> 5 - 25% of litter translocated and redeposited <input type="checkbox"/> >25% of litter translocated and redeposited	Erosion Recommendations <input type="checkbox"/> 0 No Action – Site Complete <input type="checkbox"/> 1 Minor Action – Site Stable <input type="checkbox"/> 2 Small Areas on Site Require Action <input type="checkbox"/> 3 Significant Action Required																								
Evidence of Coarse Fragment Movement <input type="checkbox"/> None <input type="checkbox"/> <5% of coarse fragments translocated and redeposited <input type="checkbox"/> 5 - 25% of coarse fragments translocated and redeposited <input type="checkbox"/> >25% of coarse fragments translocated and redeposited	Presence of Rills <input type="checkbox"/> None <input type="checkbox"/> Infrequent and <2" in depth <input type="checkbox"/> At intervals >10 feet and 2-6" in depth <input type="checkbox"/> At intervals <10 feet and 2-6" in depth	Potential Instability (Check all that apply) <input type="checkbox"/> No signs of instability <input type="checkbox"/> Saturated areas present <input type="checkbox"/> Uplifted areas present at toe of slope <input type="checkbox"/> Significant tension cracks present <input type="checkbox"/> Signs of surface displacement <input type="checkbox"/> Significant depressions/subsidence																								
Presence of Gullies <input type="checkbox"/> None <input type="checkbox"/> Gullies present Estimated Size: Width _____ Depth _____ <input type="checkbox"/> Frequent, at intervals <10 feet <input type="checkbox"/> Infrequent, at intervals >10 feet <input type="checkbox"/> Active Erosion	Comments: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">BLM Erosion Classification Summary (Acceptable Score is equal to or <45) SCORING Item Number</th> <th style="padding: 5px;">Number of Points Awarded</th> </tr> </thead> <tbody> <tr><td style="padding: 5px;">Item 1 - Recent Soil Movement - (Maximum of 14 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 2 - Surface Litter Movement - (Maximum of 14 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 3 - Surface Rock Fragment Movement - (Maximum of 14 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 4 - Pedestalling - (Maximum of 14 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 5 - Flow patterns - (Maximum of 15 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 6A - Depth of Rills - (Maximum of 7 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 6B - Frequency of Rills - (Maximum of 7 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 7A - Depth of Gullies - (Maximum of 7 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">Item 7B - Frequency of Gullies - (Maximum of 8 points)</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px; text-align: right;">Total BLM Points</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">BLM Classification STABLE</td><td style="padding: 5px;"></td></tr> </tbody> </table>		BLM Erosion Classification Summary (Acceptable Score is equal to or <45) SCORING Item Number	Number of Points Awarded	Item 1 - Recent Soil Movement - (Maximum of 14 points)		Item 2 - Surface Litter Movement - (Maximum of 14 points)		Item 3 - Surface Rock Fragment Movement - (Maximum of 14 points)		Item 4 - Pedestalling - (Maximum of 14 points)		Item 5 - Flow patterns - (Maximum of 15 points)		Item 6A - Depth of Rills - (Maximum of 7 points)		Item 6B - Frequency of Rills - (Maximum of 7 points)		Item 7A - Depth of Gullies - (Maximum of 7 points)		Item 7B - Frequency of Gullies - (Maximum of 8 points)		Total BLM Points		BLM Classification STABLE	
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Item 7B - Frequency of Gullies - (Maximum of 8 points)																										
Total BLM Points																										
BLM Classification STABLE																										

BMP QUALITATIVE MONITORING

Site:		Date:	Evaluators:
Evidence of Check Dam Failure <input type="checkbox"/> None <input type="checkbox"/> Yes - Describe	Evidence of Sediment Accumulation in Check Dams <input type="checkbox"/> None Observed <input type="checkbox"/> Deposition areas infrequent and/or shallow (<3") <input type="checkbox"/> Deposition areas common and/or 3 inches deep		BMP Recommendations <input type="checkbox"/> 0 No Action - Site Complete <input type="checkbox"/> 1 Minor Action - Site Stable <input type="checkbox"/> 2 Small Areas on Site Require Action <input type="checkbox"/> 3 Significant Action Required
Condition of Dozer Basins <input type="checkbox"/> No Basins <input type="checkbox"/> Basins performing <input type="checkbox"/> Erosion between basins <input type="checkbox"/> Vegetation growth in basins	Condition of Grade Control Structures <input type="checkbox"/> No Structures <input type="checkbox"/> Structures controlling erosion <input type="checkbox"/> Structures not controlling erosion <input type="checkbox"/> Structures need repair	Evidence of Brush Barrier Failure or Movement <input type="checkbox"/> None observed <input type="checkbox"/> Small Amount of Movement <input type="checkbox"/> Significant Amount of Movement <input type="checkbox"/> Barrier requiring immediate repair or replacement	
Condition of Mulch <input type="checkbox"/> None Observed <input type="checkbox"/> Adequately Controlling Erosion <input type="checkbox"/> Other Erosion control measures required	Comments or Sketches Regarding Maintenance or Repairs that may be Required:		



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