LARAMIE ENERGY

CURRIER BCU 0993-16-07 WELL PAD
TOPSOIL PROTECTION PLAN

Prepared for:

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I. INTRODUCTION

Laramie Energy, LLC. requested that WestWater Engineering (WestWater) prepare a topsoil protection plan for the Currier BCU 0993-16-07 (Currier 16-07) well pad location. The proposed project would be located within Mesa County, Colorado in Section 16, Township 9 South, Range 93 West on privately owned lands. Initial disturbance associated with the well pad would be 9.0 acres. Upon interim reclamation, approximately 2.1 acres would remain as production pad surface. An estimated 1.0 acre would be disturbed for construction of the access road. An additional 0.9 acre would be disturbed within a reclaimed pipeline corridor for the installation of the adjoining pipelines to the Currier 16-07 well pad.

This topsoil protection plan applies to the areas where Laramie plans to cause surface disturbance associated with the well pad and access road and addresses the requirements of the Colorado Energy and Carbon Management Commission (ECMC) 304.c.(14), 1001.a, 1002.b and 1002.c rules for reclamation regulations. It should be noted that per the ECMC 304.c.(14) rule, in no case will topsoil be used for building the location, nor will it be left in place and covered by subsoil in a cut and fill situation.

II. PROJECT AREA DESCRIPTION

The proposed project would be located along a ridge at an elevation of approximately 7,400 feet (Figure 1). There are no prominent topographic features in the surrounding area. Buzzard Creek is located south of the project area. Drainages in the surrounding area typically flow north to south towards Buzzard Creek.

Vegetation communities within the proposed disturbance area and immediately surrounding the proposed well pad are comprised of mountain sagebrush shrublands and Gambel's oak shrublands with an understory of perennial forbs and grasses.

Soils

The well pad would be located on the sideslope of a ridge with predominant slopes ranging from 5 to 20 percent. The dominant native vegetation community in the project area and vicinity would be characterized as a montane shrubland.

The well pad would be located on two soil types as described in Table 1, and shown on Figure 2 (NRCS 2023).

Table 1. Soils occurring within the project area.

Map Unit Symbol	Soil Name	Description	Project Feature
34	Empedrado loam, 25 to 45 percent slopes	This soil type occurs on mountains at elevations from 7,400 feet to 7,900 feet. This is a well-drained soil type. The parent material is mixed rock colluvium derived from sedimentary rock.	Well Pad, Access Road, Pipelines

Map Unit Symbol	Soil Name	Description	Project Feature
47	Hesperus-Empedrado, moist-Pagoda complex 5 to 35 percent slopes	This soil type occurs on mountainsides at elevations from 6,200 feet to 8,500 feet. This is a well-drained soil. Parent material is residuum weathered from sandstone and shale.	Well Pad, Access Road, Pipelines

III. SOIL ASSESSMENT

The Currier 16-07 well pad would be newly built, disturbing approximately 9.0 acres during initial clearing and grading of the well pad and an additional 1.9 acres for the access road and pipelines for a total of 10.9 acres of initial disturbance.

Methods

Soil survey and baseline soils information were obtained from the Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture (USDA) (NRCS 2023). On-site visual and tactile soil investigations were conducted on hand-dug soil pits to evaluate macroscopic characteristics of disturbed soils from four locations for fertility testing within the proposed disturbance area as shown on Figure 2.

The soil samples were collected from within the proposed disturbance area at depths ranging from 1 to 24 inches. All soil samples were analyzed for soil chemical and physical properties to determine topsoil quality and recommendations for nutrient amendments.

Results

The well pad, access road, and adjoining pipelines would be located on two soil types according to NRCS (NRCS 2023) (Figure 2). Results of the laboratory soil analysis are provided in Appendix A. Field observations, including photographs, of the topsoil including color, texture, and other information, is also provided in Appendix A for each soil sample and pit location.

Based on field observations, the soils present in the project area appear to provide suitable topsoil to a minimum depth of 6 inches. Where topsoil appeared to be less than 6-inches deep based on laboratory analysis, the soils are still suitable to be stripped to a minimum depth of 6-inches. In some areas, topsoil availability is present to a depth of +/- 24 inches. Moderate to high organic matter was present at all sample sites. Soil texture for three of the samples was clay loam and one sample was loam. Topsoil depths were determined based on root structure, organic content, and soil color/texture changes.

Topsoil Stripping Notes – The entire well pad is suitable to be stripped for topsoil to a minimum depth of 6-inches. It is estimated that 4,469 cubic yards are available to be stripped and stockpiled at the Currier 16-07 well pad.

IV. TOPSOIL MANAGEMENT

Working Surface Preparation/Construction Activities

Topsoil protection considerations will be applied to the storage of topsoil to ensure erosion and sediment transportation are minimized, in addition to ensuring that potential contamination and compaction are also mitigated per ECMC Regulation 1002.c and e.

Topsoil Handling

Proper handling and storage of topsoil is critical to successful revegetation, especially in the case of reestablishing important native plant species on disturbed areas. The topsoil contains soil microbes (i.e., bacteria, mycorrhiza, invertebrates), and seed banks of viable seed for the native plants present on the site. Many native plant species depend upon the activity of soil microbes for germination in some instances and for establishment and survival of most seedlings.

Per Regulation 1002.b(2) and (3), the top 6-inchs or the topsoil horizon (whichever is deeper) of soil should be stockpiled and separated to prevent mixing with any other trench material. If the topsoil horizons are too rocky, or too thick, the topsoil shall be segregated to the greatest extent possible and stored. Soils that are comprised of 35% or more rock, or have soil horizons that are less than 6-inches in thickness, fit this classification. Based on the soil pits dug for this location, the soils do not contain more than 35% rock. The soils are clay loam to loam soils with very little rock or gravel in the soil horizons. Topsoil stockpile locations for the well pad are depicted on Figure 2.

During construction of access roads and pipelines, the topsoil will be stripped and windrowed along the access road and pipeline alignments. Stormwater controls will be installed to reduce sediment transport. The construction of access roads and pipelines and subsequent reclamation and re-seeding is a short-term activity, resulting in the stripped topsoil windrows being distributed over those areas of disturbance and seeded as construction is completed.

Topsoil will be protected from erosion and weed invasion. Topsoil will be stockpiled on stable slopes and will be positioned to minimize exposure to wind and water erosion. Topsoil piles that will be stored for longer than 30 days will be seeded to provide cover which will help to reduce erosion, provide competition for weed species, and to maintain viability of the soil fungi and microbe communities.

Using the recommended seed mixes on long-term storage piles helps maintain biological activity and provide a seed bank of viable seed. If long-term stockpiling or deep stockpiling cannot be avoided, application of mycorrhizal inoculants (see section below) may also be beneficial to help ensure the topsoil maintains optimal condition for reclamation purposes.

The stockpiled topsoil will be spread out along the non-working area surface after drilling and completions operations have been completed. Re-contouring of the pad surface to its original or near-original grade will occur after soils have been re-spread.

A Storm Water Management Plan (SWMP) will be prepared in accordance with ECMC Regulation 1002.f for this project which will include additional descriptions of soil stabilization methods and Best Management Practices (BMPs) that should be used during and post-construction.

Soil Preparation

Before seeding begins, the soil needs to be prepared. The objective is to have the top 12-inches of soil decompacted to allow for root growth and still be firm enough on the surface to allow for good seed to soil contact (Whisenant 2003). Compaction can reduce water infiltration and also hinder the penetration of the sprouting seed. During interim reclamation, it is recommended that the following practices are implemented to help reduce compaction and prepare the seedbed: scarification, tillage, disking, chisel plowing, cultipacking, or harrowing (Colorado Natural Areas Program et al. 1998). In the event there is significant compaction, ripping with heavy equipment should be implemented when soil moisture levels are below 35% of field capacity, to a depth of 18-inches as recommended by ECMC Regulation 1003.c.

Imprinting the soil is recommended to help reduce soil runoff. Imprinting can be done in the form of dozer tracks or furrows perpendicular to the direction of slope. When utilizing hydro-seeding followed by mulching, imprinting should be done prior to seeding unless the mulch is to be crimped into the soil surface. If broadcast seeding and harrowing, imprinting should be done as part of the harrowing. Other simple imprinting methods include deep hand raking and harrowing, always perpendicular to the direction of slope. The effectiveness of the imprinting should be reviewed during standard storm water inspections. If needed, the imprinting will undergo maintenance to ensure the topsoil conditions facilitate revegetation efforts and minimize erosion.

Soil Amendments

The addition of soil amendments in rangeland reclamation projects can create more optimal growing conditions for non-native or invasive plant species, with which native plants compete poorly. There is potential that the use of soil amendments (fertilizer) containing nitrogen will disproportionately benefit undesirable annual plants (Perry et al. 2010). If the company determines the use of soil amendments to be beneficial, the type and rate should be based on results from lab analysis of soil samples collected at the site. The bioavailability of the nutrients found in the soil is an important consideration when assessing whether or not to add particular amendments.

A potentially beneficial alternative method to enhance reclamation success, particularly where there is poor or destroyed topsoil, is the application of vesicular-arbuscular mycorrhizal fungi (AMF). These fungi, mostly of the genus *Glomus*, are symbiotic with about 80 percent of all vegetation. Endo-mycorrhizal fungi are associated mostly with grasses and forbs and could be helpful in reclamation. In symbiosis, the fungi can increase water and nutrient transfer capacity of the host root system (Barrow and McCaslin 1995). Over-the-counter commercial products are available, and the best products should contain more than one fungus species.

Compacted soils respond well to fossilized humic substances and by-products called humates. These humates, including humic and fulvic acids and humin were formed from pre-historic plant and animal deposits and can benefit reclamation efforts on compacted soils when applied as directed. The use of these humic products will also help facilitate an environment in which the beneficial microbial activity is increased while also improving the soil structure and making the nutrients in the native soils more bioavailable for plant uptake (Khaled and Fawy 2011).

Seed Mixture

Upon interim and/or final reclamation, the seed mix below (Table 2) will be used. This seed mix is adapted from the Bureau of Land Management's Colorado River Valley Field Office seed menu recommendations (BLM 2021). The seed mix is well suited for the vegetation communities present in the project area. The mix includes perennial native grasses and forbs that should establish well, protect topsoil, and provide a basis for rehabilitation of the site upon reclamation. The seed mix was included to meet the requirements of the ECMC Regulation 1003.e.(2).

Table 2. Seed Mix: Mixed Mountain Shrubland – Mesic (Gambel's Oak/Mountain Sagebrush) (16 to 22 inches precipitation)

Common Name	***Species Name***	***Variety***	***Seeds per Pound***	***PLS lbs/acre***
Plant Three of the Following Grasses (15% of Mix Each, 45% Total)				
Mountain Brome	*Bromus marginatus*	UP* Cold Springs preferred, or Bromar, Garnet	64,000	6.1
Slender Wheatgrass	*Elymus trachycaulus*	San Luis	159,000	1.6
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	Native Colorado/Utah source, or Anatone, Goldar	140,000	2.8
Rocky Mountain Fescue	*Festuca saximontana*	Colorado/Utah source preferred	1,200,000	0.3
And One of the Following Grasses (10% of Mix Each, 20% Total)				
Prairie Junegrass	*Koeleria macrantha*	Native Colorado/Utah source preferred	2,315,000	0.1
Mutton Bluegrass	*Poa fendleriana*	Native Colorado/Utah source preferred	890,000	0.3
And One of the Following Grasses (10% of Mix Each, 10% Total)				
Western Wheatgrass	*Pascopyrum smithii*	UP* variety native Colorado/Utah source, or Arriba, Recovery, Rodan, Rosana	110,000	2.4
Thickspike Wheatgrass	*Elymus lanceolatus*	Bannock, Critana, Schwendimar	154,000	1.7
And One of the Following Grasses (10% of Mix Each, 10% Total)				
Columbia Needlegrass	*Achnatherum nelsonii*	Native sources within 500 miles preferred	150,000	1.7
Letterman Needlegrass	*A. lettermanii*	Native sources within 500 miles preferred	225,000	1.2
And Five of the Following Forbs (3% of Mix Each, 15% Total) *				
Common Name	***Scientific Name***	***PLS lbs/acre***	***Common Name***	***Scientific Name***	***PLS lbs/acre***

Common Name	*Species Name*	*Variety*		*Seeds per Pound*	*PLS lbs/acre*
American Vetch	*Vicia americana*	2.4	Rocky Mountain Penstemon	*Penstemon strictus*	0.1
Bigelow's Tansy-aster	*Machaeranthera bigelovii*	0.05	Scarlet Gilia	*Ipomopsis aggregata*	0.2
Blanketflower	*Gaillardia aristata*	0.6	Showy Daisy	*Erigeron speciosus*	0.05
Great Basin Penstemon	*Penstemon subglaber*	0.19	Sticky Geranium	*Geranium viscosissimum*	1.6
Hairy Goldenaster	*Heterotheca villosa*	0.1	Sulphur Buckwheat	*Eriogonum umbellatum*	0.4
Lewis Blue Flax	*Linum lewisii*	0.5	Tailcup Lupine	*Lupinus caudatus*	4.4
Little Sunflower	*Helianthella uniflora*	1.9	Utah Sweetvetch	*Hedysarum boreale*	1.7
Mule's-ears	*Wyethia amplexicaulis*	2.8	Western Yarrow	*Achillea millefolium*	0.03

*Preferred source = Uncompahgre Project (UP), Kathy See, nativeplant@upartnership.org, 970-240-9498, 970-901- ther native Colorado/Utah source is preferred.

Seeding Methods

Seeding should be conducted no more than 24 hours following completion of final seedbed preparation (BLM 2019). For best results and success, reseeding should be done in late autumn. It is recommended that a combination of drill seeding and hydroseeding should be used for reseeding the site.

Along moderate to steep slopes, hydroseeding would be the preferred method of seeding the site at the standard seeding rate. If the site is hydroseeded, it is recommended that an erosion control mulch is applied to help with vegetation establishment. Along gentle slopes, drill seeding would be the preferred method at the standard seeding rate.

For broadcast seeding, the following two seeding methods can also be implemented to improve germination success.

- harrow with just enough soil moisture to create a rough surface, broadcast seed and re-harrow, preferably at a 90-degree angle to the first harrow; or
- hand raking and broadcast followed by re-raking at a 90-degree angle to the first raking.

These are not the only means of replanting the site. However, these methods have been observed to be effective in similar landscapes.

After two years of controlling weeds (with herbicides) and allowing the grasses to become established, woody species should be inter-seeded or hand-planted to increase the diversity and value of the reclamation plantings. Regular surveys for noxious weeds should be completed to help ensure the seedbank of undesirable species is not inadvertently increased during reclamation processes in accordance with ECMC Regulation 1003.f.

Mulching

If areas are broadcast seeded, it is recommended that an application of certified weed-free straw, mulch, erosion control netting (i.e., Jute, wood excelsior, etc.), or erosion control blankets are installed within 24 hours of seeding to help protect soil from erosion and increase soil moisture content. Potential detrimental effects of mulching include the introduction of weed species and the establishment of non-native cereal grains. Use of a certified weed-free sterile wheat hybrid straw mulch would limit these effects. Straw mulch is most effective on gentle to moderate slopes and can be hand broadcast in a uniform depth across the project site of 2-3 inches. The application rate of straw mulch is approximately 2 tons per acre (NRCS 2002). If straw mulch is used it should be crimped into the soil surface. Erosion control blankets and netting are typically used in applications where there is a steep slope, but can also be used to help maintain soil stability while seedlings establish in areas where the slope is not considered moderate to steep. The material is often biodegradable and does not need to be removed once it has been installed.

BMPs

A Storm Water Management Plan will be prepared for this project which will provide additional details for the appropriate Best Management Practices (BMPs) to be utilized during and post-construction activities. For more specific details, please refer to the respective document. BMPs such as hydromulching, installation of small earthen berms, diversion ditches, and straw wattles are common BMPs with regards to storage and reclamation of stockpiled topsoil. A summary of BMPs that will be used for topsoil protection are outlined in Appendix B.

Noxious Weeds

Increased traffic and activities in the project area may promote conditions that facilitate the spread of invasive noxious weeds from outside the project area. The application of a weed management plan for this project site is recommended to: 1) prevent the invasion and expanded range of noxious weeds; and 2) promote the establishment of desirable plant life upon rehabilitation of the proposed well pad during interim and final reclamation.

Laramie will implement the protocol specified in the Mesa County Noxious Weed Management Plan. This Noxious Weed and Vegetation Management Plan was written with respect to the Colorado Noxious Weed Act, C.R.S 35-5.5-115 (Mesa County 2020).

Subsequent to soil disturbances, vegetation communities can be susceptible to infestations of invasive or exotic weed species. Vegetation removal and soil disturbance during construction can create optimal conditions for the establishment of invasive, non-native species. Construction equipment traveling from weed-infested areas into weed-free areas could disperse noxious or invasive weed seeds and propagates, resulting in the establishment of these weeds in previously weed-free areas.

Several simple practices should be employed to prevent most weed infestations. The following practices should be adopted for any activity to reduce the costs of noxious weed control through prevention. The practices include:

- Prior to delivery to the site, equipment should be thoroughly cleaned of soils remaining from previous construction sites which may be contaminated with noxious weeds.

- If working in sites with weed-seed contaminated soil, equipment should be cleaned of potentially seed-bearing soils and vegetative debris at the infested area prior to moving to uncontaminated terrain.
- All maintenance vehicles should be regularly cleaned of soil.
- Avoid driving vehicles through areas where weed infestations exist.

V. REFERENCES

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Currier BCU 0993-16-07
Working Pad Surface

T9S R94W

T9S R93W

330

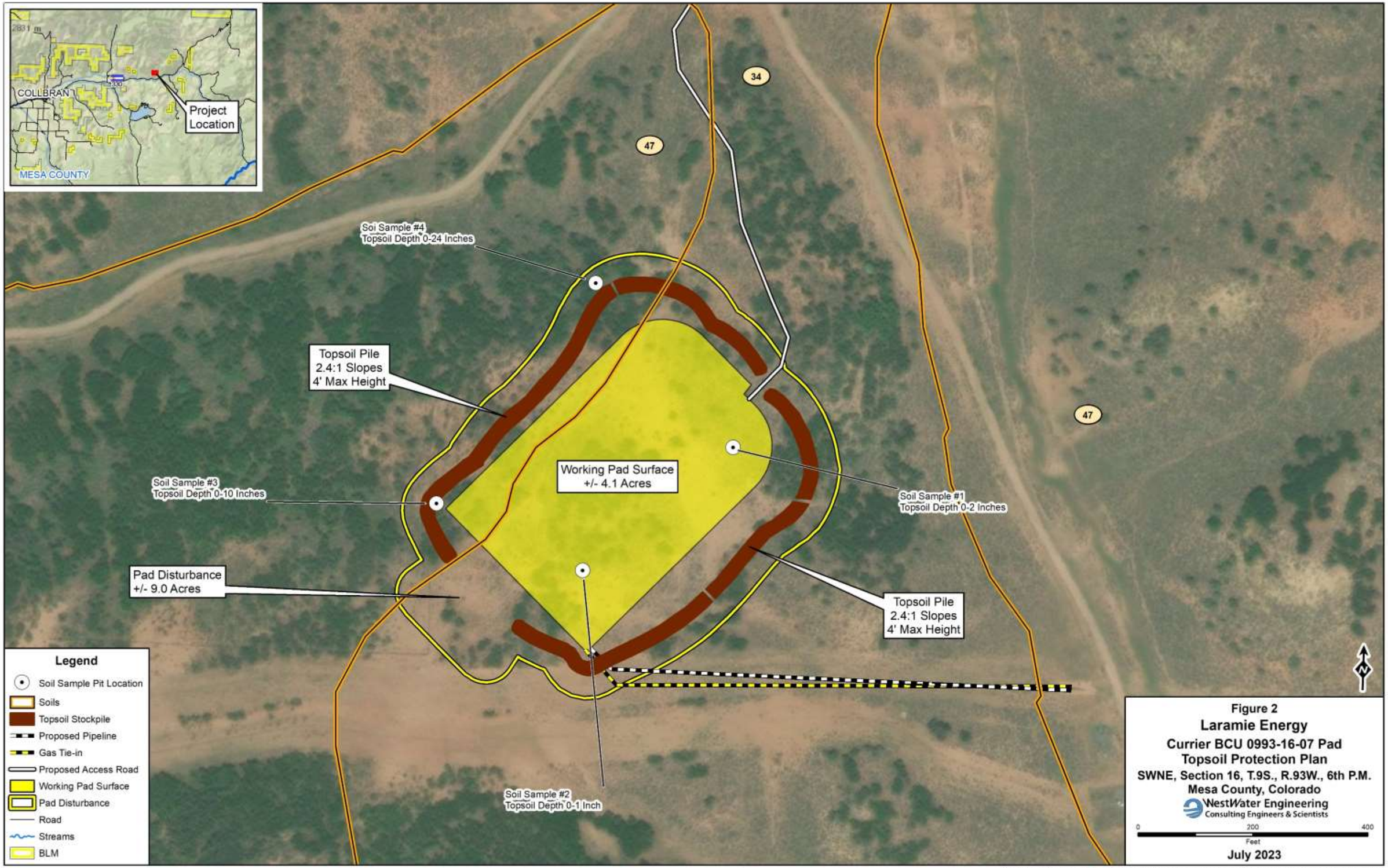
330

330

Legend
- Proposed Pipeline
- Gas Tie-in
- Proposed Access Road
- Working Pad Surface
- Pad Disturbance
- Road
- BLM

Figure 1
Laramie Energy
Currier 0993-16-07 Pad
Topsoil Protection Plan
SWNE, Section 16, T.9S., R.93W., 6th P.M.
Mesa County, Colorado
WestWater Engineering
Consulting Engineers & Scientists
0 0.5 1
Miles
July 2023

Map Source: Z:\Laramie Energy II\Currier 0993-16-07\2023\GIS\Topsoil Protection Plan Report Maps 7-10-23\TPP Figure 1.mxd 7/12/2023 rbb



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APPENDIX A

Topsoil Sample Field Observations

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Laboratory Analysis Results

SOIL SAMPLE AND PIT #1

Topsoil Depth	Munsell Color	Texture	Comments
0-2”	7.5 YR 3/3	Clay loam	Upper A horizon, roots present, crumb structure, organic content approximately 15% .
2-16”	5 YR 4/3	Silty clay loam	Subtle lightening of soil near 2-3-inch depth. A change in soil texture and reduced organic material to 5%.

Photo of Soil Sample and Pit #1

Soil Laboratory Analysis Results

Soil Sample #1 0-6 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Loam
pH	6.6
EC (Conductivity) mmhos/cm	0.17
Nitrate-N KCI, ppm N	16.5
Nitrate-N, lbs N/Acre	10
Phosphorus Olsen P, ppm P	16.3
K- Potassium NH4OAc, ppm K	293
Sulfate M-3, ppm S	10.3
Zinc DTPA, ppm Zn	2.37
Iron DTPA, ppm Fe	29.4
Manganese DTPA, ppm Mn	8.9
Copper DTPA, ppm Cu	1.01
Calcium NH4OAc, ppm Ca	2025
Magnesium NH4OAc, ppm Mg	300
Sodium NH4OAc, ppm Na	7
Soil Organic Matter LOI, %	5.8
Boron Hot Water, ppm B	0.63
SAR	0.2

SOIL SAMPLE AND PIT #2

Topsoil Depth	Munsell Color	Texture	Comments
0-1”	7.5 YR 4/4	Silty clay loam	Upper A horizon, roots present, sub-angular blocky structure, organic content 10%.
1-19”	5 YR 5/4	Silty clay loam	A change in soil color and reduced organic content to 3%.

Photo of Soil Sample and Pit #2

Soil Laboratory Analysis Results

Soil Sample #2 0-16 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Loam
pH	6.6
EC (Conductivity) mmhos/cm	0.17
Nitrate-N KCI, ppm N	16.5
Nitrate-N, lbs N/Acre	10
Phosphorus Olsen P, ppm P	16.3
K- Potassium NH4OAc, ppm K	293
Sulfate M-3, ppm S	10.3
Zinc DTPA, ppm Zn	2.37
Iron DTPA, ppm Fe	29.4
Manganese DTPA, ppm Mn	8.9
Copper DTPA, ppm Cu	1.01
Calcium NH4OAc, ppm Ca	2025
Magnesium NH4OAc, ppm Mg	300
Sodium NH4OAc, ppm Na	7
Soil Organic Matter LOI, %	5.8
Boron Hot Water, ppm B	0.63
SAR	0.2

SOIL SAMPLE AND PIT #3

Topsoil Depth	Munsell Color	Texture	Comments
0-10”	7.5 YR 4/2	Silty clay loam	Upper A horizon, roots present, sub-angular blocky structure, organic content 10%.
10-24”	5 YR 3/1	Clay loam	Subtle lightening of soil near 10-inch depth. A change in soil texture and lack of root structure.

Photo of Soil Sample and Pit #3

Soil Laboratory Analysis Results

Soil Sample #3 0-15 Inches Composite Soil Sample	
Parameter	
Texture	Clay loam
pH	6.5
EC (Conductivity) mmhos/cm	0.13
Nitrate-N KCI, ppm N	8.0
Nitrate-N, lbs N/Acre	24
Phosphorus Olsen P, ppm P	6.8
K- Potassium NH4OAc, ppm K	386
Sulfate M-3, ppm S	10.7
Zinc DTPA, ppm Zn	1.35
Iron DTPA, ppm Fe	35.8
Manganese DTPA, ppm Mn	11.7
Copper DTPA, ppm Cu	1.5
Calcium NH4OAc, ppm Ca	2871
Magnesium NH4OAc, ppm Mg	558
Sodium NH4OAc, ppm Na	7
Soil Organic Matter LOI, %	5.2
Boron Hot Water, ppm B	0.63
SAR	0.2

SOIL SAMPLE AND PIT #4

Topsoil Depth	Munsell Color	Texture	Comments
0-24”	5 YR 3/1	Clay loam	Upper A horizon, roots present, sub-angular blocky, organic content 5-10%.
24+ inches	5 YR YR 3/1	Silty clay	A change in soil texture, lack of root structure, and reduced organic content was noted.

Photo of Soil Sample and Pit #4

Soil Laboratory Analysis Results

Soil Sample #4 0-18 Inches Composite Soil Sample	
Parameter	**Results**
Texture	Clay loam
pH	6.3
EC (Conductivity) mmhos/cm	0.10
Nitrate-N KCI, ppm N	3.3
Nitrate-N, lbs N/Acre	23
Phosphorus Olsen P, ppm P	13.2
K- Potassium NH4OAc, ppm K	389
Sulfate M-3, ppm S	10.8
Zinc DTPA, ppm Zn	2.54
Iron DTPA, ppm Fe	53.4
Manganese DTPA, ppm Mn	21.8
Copper DTPA, ppm Cu	1.22
Calcium NH4OAc, ppm Ca	3349
Magnesium NH4OAc, ppm Mg	4077
Sodium NH4OAc, ppm Na	7
Soil Organic Matter LOI, %	6.1
Boron Hot Water, ppm B	0.64
SAR	0.2

APPENDIX B

TOPSOIL PROTECTION BEST MANAGEMENT PRACTICES

Topsoil Protection BMPs

- Protection from Contamination - based on changes in physical characteristics (e.g., organic content, color, texture, density, or consistency) soil horizons will be segregated and stockpiled separately; topsoil stockpiles will be separated by compacted earthen berms, sediment control logs, straw bale barriers, etc.; and stabilizing stockpile surfaces to control for erosion and sedimentation;
- Protection from Compaction - topsoil stockpiles will be indicated on site with signage; stockpiles will be placed in areas away from vehicle and equipment traffic; and when stockpiling, compaction will be minimized by limiting the number of equipment passes, limiting stockpile height, and using vegetation;
- Protection from Wind Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures;
- Protection from Water Erosion - surface roughening, applying hydro-seed/mulch, using soil tackifier, covering stockpiles with rolled erosion control products or other similar measures; and
- Weed Establishment Prevention - mechanical, biological, and chemical controls will be used to prevent the establishment of weeds.