September 18, 2024

Dan Peterson
Environmental Specialist
Chevron Rockies Business Unit
2115 117th Avenue
Greeley, CO 80631

Re: **Grigsby AC19-62HN Tank Battery**
Reclamation Plan
NENE, Section 30, Township 7 N, Range 63 W
Weld County, Colorado

Mr. Peterson:

Tasman, Inc. (Tasman) has prepared this Reclamation Plan (Plan) on behalf of Noble Energy, Inc. (Noble) for the Grigsby AC19-62HN Tank Battery in Weld County, Colorado (Site). The Colorado Energy and Carbon Management Commission (ECMC) has assigned this project Remediation Project No. 35368. Surface areas disturbed by remediation activities shall be reclaimed per ECMC Rules 1003 *Interim Reclamation* and 1004 *Final Reclamation of Well Sites and Associated Production Facilities*. Additional remedial activities and assessment results associated with this project were presented to and approved by the ECMC in previously submitted Form 27 reports. In anticipation of reclamation activities, Tasman completed a Site inspection on August 13, 2024; the associated field notes and photo logs are included as Attachment A.

Site Description

The Site is located in Weld County in northeastern Colorado, in the NENE Quarter-Quarter of Section 30, Township 7 North, Range 63 West near the intersection of County Road (CR) 78 and CR 63, approximately 6 miles northeast of the town of Galeton (Figure 1). There is one mapped Fish and Wildlife Service (FWS) Wetland (PEMA1: Freshwater Emergent Wetland) located within 500 feet of the Site (Figure 2). The current landowners are Robert and Renee L Grigsby.

Site Background

An unintentional release from the Grigsby AC19-62HN separator occurred in January 2024 when an oil dump line developed a leak below ground inside the separator containment berm. Following ECMC approval of the Initial Form 19 (Document No. 403668949), an initial remediation investigation was conducted by Fremont Environmental, Inc. (Fremont) in January and February 2024. During initial remediation activities, eight confirmation soil samples (Waste Characterization, SS-01 6Ft, SS-06 6Ft, SS-07 6Ft, SS-09 6Ft, SS-14 6Ft, SS-19 4Ft, and SS-22 4Ft) were collected and submitted to Summit Scientific Laboratory (Summit) for analysis of ECMC Table 915-1 Organic Compounds in Soils, total petroleum hydrocarbons (TPH) as total volatile hydrocarbons (C_6-C_{10}), total extractable hydrocarbons (C_{10}-C_{36}), Table 915-1 Metals, and Soil Suitability for Reclamation constituents. In April 2024, ten background soil samples (BKG01 3FT, BKG01 6FT, BKG02 3FT, BKG02 6FT, BKG03 3FT, BKG03 6FT, BKG04 3FT, BKG04 6FT, BKG05 3FT and BKG01 6FT) were collected and submitted to Summit for analysis of ECMC Table 915-1 Soil Suitability for Reclamation constituents and Table 915-1 Metals. Analytical results indicated that the sodium adsorption ratio (SAR) and pH values in two confirmation soil sample (SS-09 6Ft and SS-14 6Ft) were above the applicable ECMC Table 915-1 regulatory standards. Analytical results indicated that pH

values in four confirmation soil samples (SS-01 6Ft, SS-07 6Ft, SS-09 6Ft, SS-14 6Ft, and SS-22 4Ft) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. The remaining soil samples (Waste Characterization, SS-06 6Ft, and SS-19 4Ft) were in full compliance with ECMC standards and Site-specific background concentrations. The SAR and pH exceedances observed in Waste Characterization, SS-01 6Ft, SS-06 6Ft, SS-07 6Ft, SS-09 6Ft, SS-14 6Ft, SS-19 4Ft, and SS-22 4Ft were removed through excavation of impacted source material.

Following ECMC approval of Supplemental Form 27 Document No. 403763691, a supplemental Site investigation was conducted by Fremont in April 2024 to delineate the horizontal and vertical extents of the SAR and pH exceedances observed in soil samples SS-09 6Ft, SS-14 6Ft, SS-01 6Ft, SS-07 6Ft, SS-09 6Ft, SS-14 6Ft, and SS-22 4Ft. Twenty five confirmation soil samples (SS-23 6FT, SS-24 6FT, SS-25 6FT, SS-26 6FT, SS-27 6FT, SS-28 6FT, SS-29 10FT, SS-30 6FT, SS-32 10FT, SS-33 6FT, SS-34 6FT, SS-35 10FT, SS-36 6FT, SS-37 6FT, SS-38 6FT, SS39 6FT, SS40 6FT, SS41 6FT, SS42 6FT, SS43 6FT, SS44 6FT, SS45 6FT, SS47 6FT, and SS48 10FT) were collected and submitted to Summit for the analysis of ECMC Table 915-1 Soil Suitability for SAR and pH. Analytical results indicated that SAR and pH values in six confirmation soil samples (SS-27 6FT, SS-28 6FT, SS-30 6FT, SS-33 6FT, SS39 6FT, and SS40 6FT) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. Analytical results indicated that the SAR values in nine confirmation soil samples (SS-23 6FT, SS-24 6FT, SS-25 6FT, SS-29 10FT, SS-34 6FT, SS41 6FT, SS42 6FT, SS43 6FT, and SS44 6FT) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. Analytical results indicated that the pH values in three confirmation soil samples (SS-26 6FT, SS-38 6FT, and SS48 10FT) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. The remaining soil samples were in full compliance with ECMC standards and Site-specific background concentrations. The SAR and pH exceedances observed in SS-30 6FT, SS-33 6FT, and SS-34 6FT were removed following additional excavation and removal of source material. Confirmation soil sample locations are illustrated on Figure 3-A and background sample locations are illustrated on Figure 3-B. Analytical results are presented in Table 1.

Soils and Vegetation Information

The primary soil type at Site is Avar Fine Sandy Loam with a 0-5% slope (Attachment B). Avar Fine Sandy Loam soils consist of very deep, well drained soils that formed in calcareous, loamy alluvium commonly underlain by a buried horizon or buried horizons. Avar soils are found on swales and closed swales on terraces and upland plains. Native vegetation in such soils are inland saltgrass, alkai sacaton, prickly pear cactus, western wheatgrass, and blue gramma. Such soils are used for native rangeland.

Tasman completed a Site inspection on August 13, 2024, to evaluate general soil and vegetive conditions. Current land use surrounding the Site is active oil and gas production associated with the Grigsby AC19-62HN Facility. As such, background reference vegetation was collected along the northwestern boundary of the Site. Existing vegetation on-Site is a mix of noxious and invasive weeds including blue gramma, western wheatgrass, slender wheatgrass, and prickly pear cactus.

Reclamation Operations and Erosion Control

As the Site and surrounding area is an active oil and gas facility, reclamation seeding will not be completed. Excavation of the contaminated road base was completed in April 2024. Following excavation of the

contaminated soils and road base, clean fill soil and new road base were emplaced to match pre-existing conditions.

Stormwater compliance to prevent soil erosion shall be maintained by a combination of earthwork practices and placement of non-erodible surfaces. No stormwater inspections related to remediation or reclamation activities will be required. If stormwater management is required, it will be implemented.

Annual Final Reclamation Monitoring

The Site will continue to operate as an active oil and gas facility; therefore, Final Reclamation annual inspections and/or monitoring will not be completed at this time.

Conclusion

Analytical results collected during the April 2024 supplemental Site investigation indicated the SAR and pH exceedances recorded during the initial unintentional release investigation were horizontally and vertically delineated and either were removed during the excavation or located below the rooting zone. Native Avar Fine Sandy Loam is present at the Site, which are sodic or sodic and saline with SAR values ranging from 18 to 68 at depths ranging from 3 to 60 inches below ground surface (bgs) as documented in Attachment C. Based on the analytical results collected during the April 2024 supplemental Site investigation, native soil characteristics, and an understanding that the Site will remain an active oil and gas facility, there will be no long-term impacts to soil suitability at the Site and surrounding land.

If you have any questions, do not hesitate to contact me at 303.726.9642 or acook@tasman-geo.com.

Sincerely,

Alex Cook, TECS, QSM

Environmental Scientist

Figures:

1. Site Location Map
2. Site Overview Map
3. Soil Sampling and Boring Location Maps
    A. Inorganic Soil Chemistry Map
    B. Background Sample Soil Chemistry Map

Table:

1. Summary of Soil Suitability for Reclamation

Attachments:

A. Vegetation Monitoring Report

B. United States Department of Agriculture (USDA) Custom Soil Resource Report
C. USDA Official Series Description – Avar Series

FIGURE 1

Site Location Map

104°31'30"W 104°31'0"W 104°30'30"W 104°30'0"W 104°29'30"W 104°29'0"W 104°28'30"W 104°28'0"W 104°27'30"W 104°27'0"W 104°26'30"W 104°26'0"W 104°25'30"W 104°25'0"W

40°34'30"N 40°34'0"N 40°33'30"N 40°33'0"N 40°32'30"N 40°32'0"N

15 14 13 18 17

22 23 24 19 20 21 22

27 26 25 30 29 28 27

34 35 36 31 32 33

Coal Creek

Eaton Ditch

CO RD 78

CO RD 76

WELD CO RD 61

CO RD 63

CO RD 65

Long Lake

Allison Reservoir

4800 4850 4750

Grigsby AC19-62HN Tank Battery

Legend

Site Location

N

0 2,000 4,000 Feet

1 inch = 2,000 feet

1:24,000

DATE: August 2024 DESIGNED BY: B. Nelson DRAWN BY: L. Reed	**Tasman, Inc.** **6855 W. 119th Ave** **Broomfield, CO 80020**	**Noble Energy Inc. - 100322 - DJ Basin** **Grigsby AC19-62HN Tank Battery** NENE, Section 30, Township 7 North, Range 63 West Weld County, Colorado	Site Location Map	Figure 1

FIGURE 2

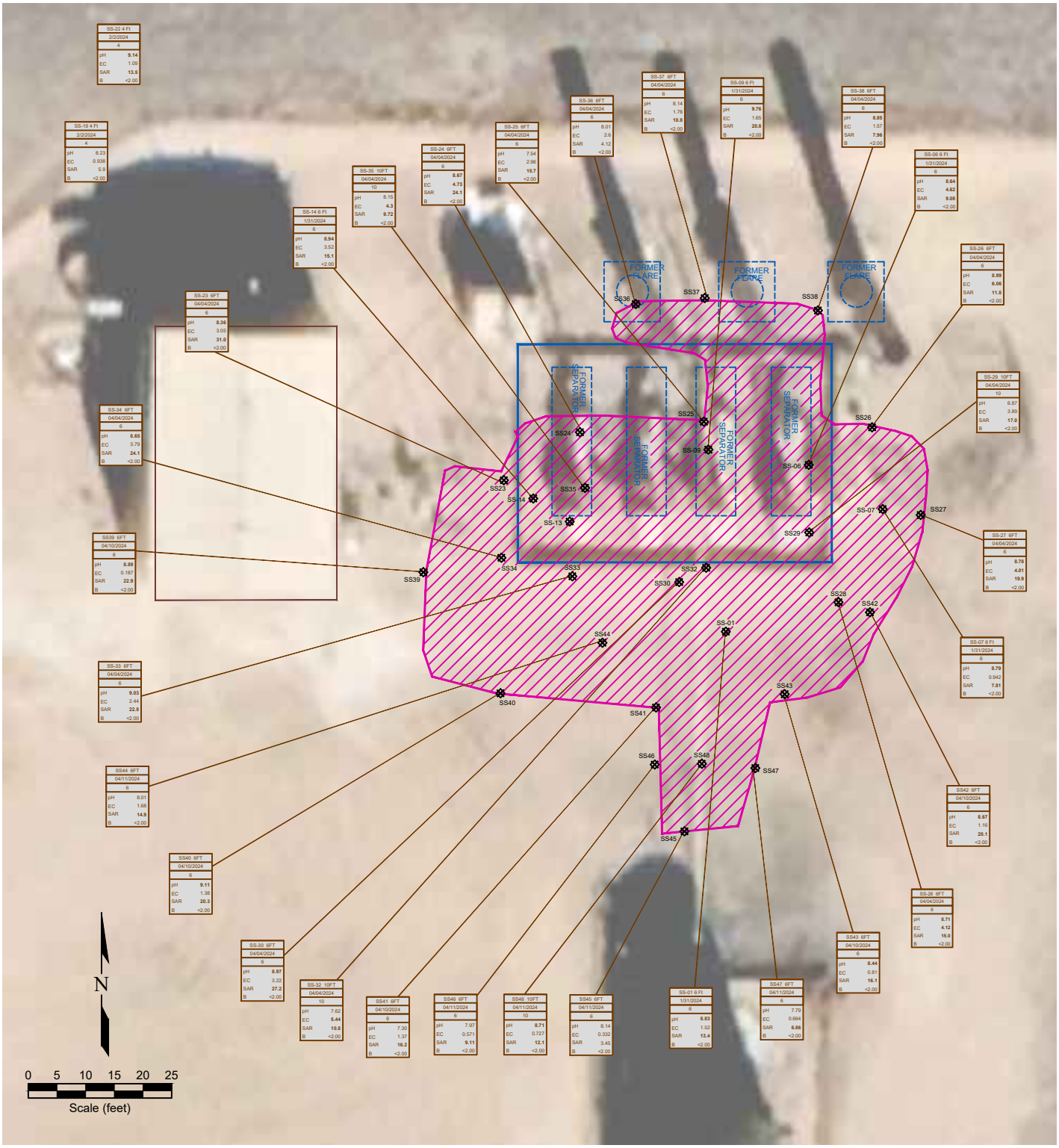
Site Overview Map

DATE: August 2024 DESIGNED BY: A. Cook DRAWN BY: L. Reed	**Tasman, Inc.** **6855 W. 119th Ave** **Broomfield, CO 80020**	**Noble Energy, Inc. – 100322 – DJ Basin** **Grigsby AC19-62HN Tank Battery** NENE, Section 30, Township 7 North, Range 63 West Weld County, Colorado	Site Overview Map	Figure 2

FIGURE 3

Figure 3-A, Inorganic Soil Chemistry Map (July 2024)

Figure 3-B, Background Sample Soil Chemistry Map (July 2024)



LEGEND

- SOIL SAMPLE LOCATION
- ABOVE GROUND STORAGE TANK
- EXCAVATED AREA
- FORMER FACILITY
- BUILDING
- FENCE LINE
- CONTAINMENT BERM
- CONTAINMENT WALL
- EXTENT OF EXCAVATION

SAMPLE — SAMPLE ID
DATE — DATE SAMPLED
DEPTH — DEPTH (ft)
pH — pH (pH units)
EC — EC (mmhos/cm)
SAR — SAR (units)
B — BORON (mg/L)

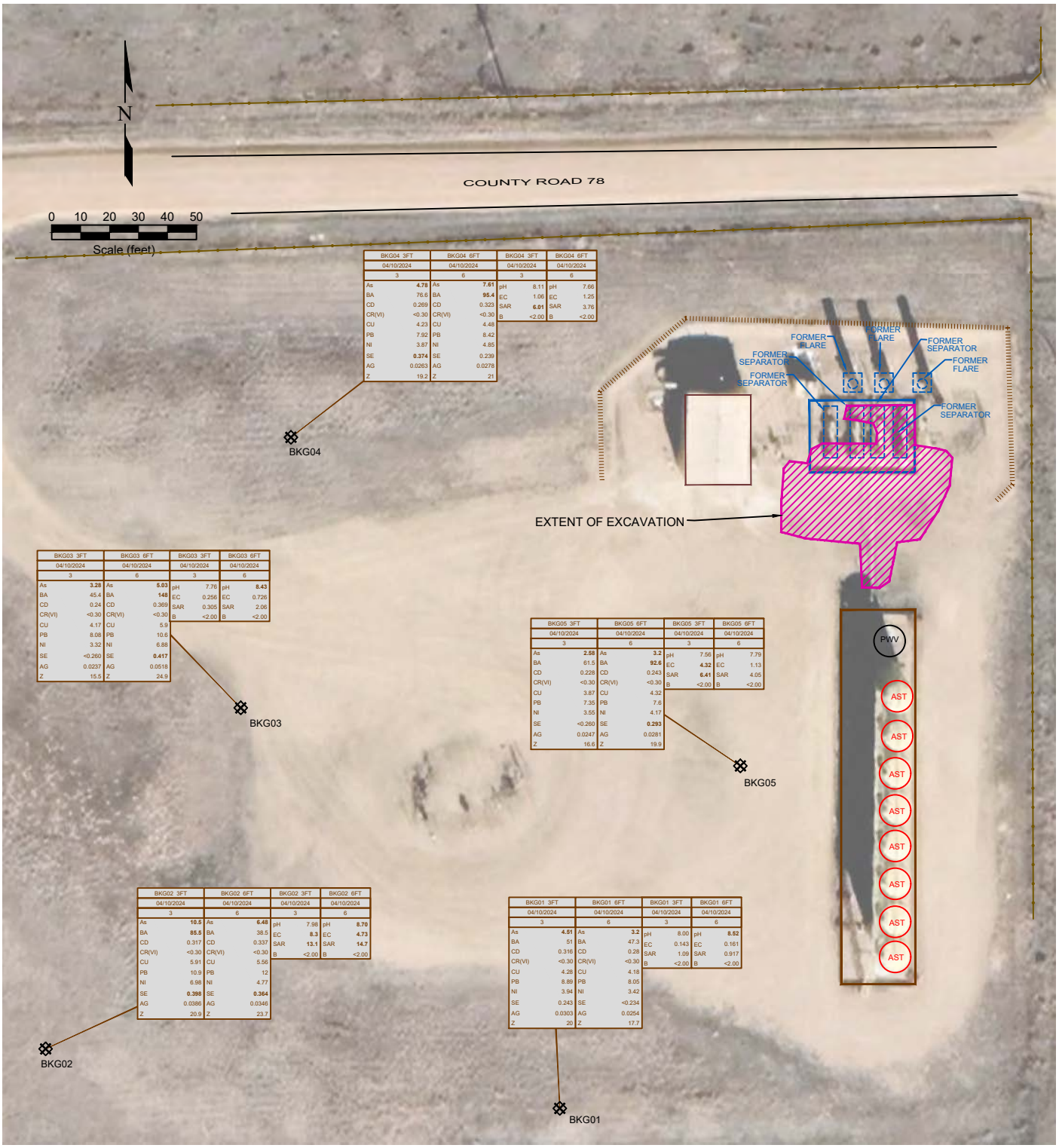
Figure 3-A

INORGANIC SOIL CHEMISTRY MAP

Noble Energy, Inc. ~ Grigsby AC19-62HN
NENE, Sec 30, T7N, R63W, 6th P.M.
Weld County, Colorado
40.551843 ° -104.470751°

Project No.	Spill #	Facility #
CO24-022	**486087**	**427074**
Date	Remediation #	Filename
7/17/24		**24022Q**

FREMONT ENVIRONMENTAL



BKG04 3FT	BKG04 6FT	BKG04 3FT	BKG04 6FT
04/10/2024	04/10/2024	04/10/2024	04/10/2024
3	6	3	6
As 4.78	As 7.61	pH 8.11	pH 7.66
BA 76.6	BA 95.4	EC 1.06	EC 1.25
CD 0.269	CD 0.323	SAR 6.01	SAR 3.76
CR(VI) <0.30	CR(VI) <0.30	B <2.00	B <2.00
CU 4.23	CU 4.48		
PB 7.92	PB 8.42		
NI 3.87	NI 4.85		
SE 0.374	SE 0.239		
AG 0.0263	AG 0.0278		
Z 19.2	Z 21		

BKG03 3FT	BKG03 6FT	BKG03 3FT	BKG03 6FT
04/10/2024	04/10/2024	04/10/2024	04/10/2024
3	6	3	6
As 3.28	As 5.03	pH 7.76	pH 8.43
BA 45.4	BA 148	EC 0.256	EC 0.726
CD 0.24	CD 0.369	SAR 0.305	SAR 2.06
CR(VI) <0.30	CR(VI) <0.30	B <2.00	B <2.00
CU 4.17	CU 5.9		
PB 8.08	PB 10.6		
NI 3.32	NI 6.88		
SE <0.260	SE 0.417		
AG 0.0237	AG 0.0518		
Z 15.5	Z 24.9		

BKG05 3FT	BKG05 6FT	BKG05 3FT	BKG05 6FT
04/10/2024	04/10/2024	04/10/2024	04/10/2024
3	6	3	6
As 2.88	As 3.2	pH 7.56	pH 7.79
BA 61.5	BA 92.6	EC 4.32	EC 1.13
CD 0.228	CD 0.243	SAR 6.41	SAR 4.05
CR(VI) <0.30	CR(VI) <0.30	B <2.00	B <2.00
CU 3.87	CU 4.32		
PB 7.35	PB 7.6		
NI 3.55	NI 4.17		
SE <0.260	SE 0.293		
AG 0.0247	AG 0.0281		
Z 16.6	Z 19.9		

BKG02 3FT	BKG02 6FT	BKG02 3FT	BKG02 6FT
04/10/2024	04/10/2024	04/10/2024	04/10/2024
3	6	3	6
As 10.5	As 6.48	pH 7.98	pH 8.70
BA 85.5	BA 38.5	EC 8.3	EC 4.73
CD 0.317	CD 0.337	SAR 13.1	SAR 14.7
CR(VI) <0.30	CR(VI) <0.30	B <2.00	B <2.00
CU 5.91	CU 5.56		
PB 10.9	PB 12		
NI 6.98	NI 4.77		
SE 0.398	SE 0.364		
AG 0.0386	AG 0.0346		
Z 20.9	Z 23.7		

BKG01 3FT	BKG01 6FT	BKG01 3FT	BKG01 6FT
04/10/2024	04/10/2024	04/10/2024	04/10/2024
3	6	3	6
As 4.51	As 3.2	pH 8.00	pH 8.52
BA 51	BA 47.3	EC 0.143	EC 0.161
CD 0.316	CD 0.28	SAR 1.09	SAR 0.917
CR(VI) <0.30	CR(VI) <0.30	B <2.00	B <2.00
CU 4.28	CU 4.18		
PB 8.89	PB 8.05		
NI 3.94	NI 3.42		
SE 0.243	SE <0.234		
AG 0.0303	AG 0.0254		
Z 20	Z 17.7		

LEGEND

- SOIL SAMPLE LOCATION
- ABOVE GROUND STORAGE TANK
- FORMER FACILITY
- FENCE LINE
- CONTAINMENT BERM
- EXCAVATED AREA
- BUILDING
- CONTAINMENT WALL
- EXTENT OF EXCAVATION

SAMPLE	SAMPLE ID
DATE	DATE SAMPLED
DEPTH	DEPTH (ft)
As <0.01	ARSENIC (mg/kg)
BA <0.01	BARIUM (mg/kg)
CD <0.01	CADMIUM (mg/kg)
CR(VI) <0.05	CHROMIUM (mg/kg)
CU <0.01	COPPER (mg/kg)
PB <0.05	LEAD (mg/kg)
NI <0.05	NICKEL (mg/kg)
SE <0.5	SELENIUM (mg/kg)
AG <0.05	SILVER (mg/kg)
Z <0.05	ZINC (mg/kg)

SAMPLE	SAMPLE ID
DATE	DATE SAMPLED
DEPTH	DEPTH (ft)
pH <500	pH (pH units)
EC 7.00	EC (mmhos/cm)
SAR <1	SAR (units)
B <5	BORON (mg/L)

Figure 3-B

BACKGROUND SAMPLE SOIL CHEMISTRY MAP

Noble Energy, Inc. ~ Grigsby AC19-62HN

NENE, Sec 30, T7N, R63W, 6th P.M.

Weld County, Colorado

40.551843 ° -104.470751°

Project No.	Spill #	Facility #
CO24-022	**486087**	**427074**
Date	Remediation #	Filename
7/17/24		**24022Q1**

FREMONT ENVIRONMENTAL

Table 1

Summary of Soil Suitability for Reclamation

TABLE 1

SUMMARY OF SOIL SUITABILITY FOR RECLAMATION

NOBLE ENERGY INC.

GRIGSBY AC19-62HN, WELD COUNTY, COLORADO

FREMONT PROJECT NO. C024-022

Sample ID	Sample Date	Depth (ft)	pH	EC (mmhos/cm)	SAR	Boron (mg/L)
ECMC Table 915-1 Soil Suitability Limits			6 - 8.3	<4	<6	2
Max. Background Concentration (or Concentration Range)			8.70	8.30	14.70	-
Waste Char.	01/29/2024	Grab	7.71	0.343	1.14	*<2.00*
SS-01 6 Ft	1/31/2024	6	**8.83**	1.52	13.4	*<2.00*
SS-06 6 Ft	1/31/2024	6	8.64	4.62	9.08	*<2.00*
SS-07 6 Ft	1/31/2024	6	**8.79**	0.942	7.81	*<2.00*
SS-09 6 Ft	1/31/2024	6	**9.76**	1.65	**20.8**	*<2.00*
SS-14 6 Ft	1/31/2024	6	**8.94**	3.52	**15.1**	*<2.00*
SS-19 4 Ft	2/2/2024	4	8.23	0.938	5.9	*<2.00*
SS-22 4 Ft	2/2/2024	4	**9.14**	1.09	13.5	*<2.00*
SS-23 6FT	04/04/2024	6	8.36	3.05	**31.0**	*<2.00*
SS-24 6FT	04/04/2024	6	8.67	4.73	**24.1**	*<2.00*
SS-25 6FT	04/04/2024	6	7.54	2.96	**15.7**	*<2.00*
SS-26 6FT	04/04/2024	6	**8.99**	6.06	11.8	*<2.00*
SS-27 6FT	04/04/2024	6	**8.78**	4.01	**19.9**	*<2.00*
SS-28 6FT	04/04/2024	6	**8.71**	4.12	**15.0**	*<2.00*
SS-29 10FT	04/04/2024	10	6.87	3.89	**17.0**	*<2.00*
SS-30 6FT	04/04/2024	6	**8.97**	3.22	**27.2**	*<2.00*
SS-32 10FT	04/04/2024	10	7.62	5.44	10.8	*<2.00*
SS-33 6FT	04/04/2024	6	**9.03**	2.44	**22.8**	*<2.00*
SS-34 6FT	04/04/2024	6	8.65	3.79	**24.1**	*<2.00*
SS-35 10FT	04/04/2024	10	8.15	4.3	9.72	*<2.00*
SS-36 6FT	04/04/2024	6	8.01	2.6	4.12	*<2.00*
SS-37 6FT	04/04/2024	6	8.14	1.76	10.8	*<2.00*
SS-38 6FT	04/04/2024	6	**8.85**	1.57	7.96	*<2.00*
SS39 6FT	04/10/2024	6	**8.89**	0.187	**22.9**	*<2.00*
SS40 6FT	04/10/2024	6	**9.11**	1.38	**20.3**	*<2.00*
SS41 6FT	04/10/2024	6	7.30	1.37	**16.2**	*<2.00*

Sample ID	Sample Date	Depth (ft)	pH	EC (mmhos/cm)	SAR	Boron (mg/L)
ECMC Table 915-1 Soil Suitability Limits			6 - 8.3	<4	<6	2
SS42 6FT	04/10/2024	6	8.67	1.16	**20.1**	*<2.00*
SS43 6FT	04/10/2024	6	8.44	0.81	**16.1**	*<2.00*
SS44 6FT	04/11/2024	6	8.01	1.68	**14.9**	*<2.00*
SS45 6FT	04/11/2024	6	8.14	0.332	3.45	*<2.00*
SS46 6FT	04/11/2024	6	7.97	0.571	9.11	*<2.00*
SS47 6FT	04/11/2024	6	7.79	0.664	6.86	*<2.00*
SS48 10FT	04/11/2024	10	**8.71**	0.727	12.1	*<2.00*
BKG01 3FT	04/10/2024	3	8.00	0.143	1.09	*<2.00*
BKG01 6FT	04/10/2024	6	**8.52**	0.161	0.917	*<2.00*
BKG02 3FT	04/10/2024	3	7.98	**8.3**	**13.1**	*<2.00*
BKG02 6FT	04/10/2024	6	**8.70**	**4.73**	**14.7**	*<2.00*
BKG03 3FT	04/10/2024	3	7.76	0.256	0.305	*<2.00*
BKG03 6FT	04/10/2024	6	**8.43**	0.726	2.06	*<2.00*
BKG04 3FT	04/10/2024	3	8.11	1.06	**6.01**	*<2.00*
BKG04 6FT	04/10/2024	6	7.66	1.25	3.76	*<2.00*
BKG05 3FT	04/10/2024	3	7.56	**4.32**	**6.41**	*<2.00*
BKG05 6FT	04/10/2024	6	7.79	1.13	4.05	*<2.00*

Bold faced, yellow highlighted values exceed the ECMC Table 915-1 concentrations

Green highlighted cells indicate soil removed via excavation

Orange highlighted cells exceed of the maximum background concentration, or concentration range

Yellow highlighted 915-1 Limits indicate the referenced soil screening level (SSL)

NA - Not analyzed

ATTACHMENT A

Vegetation Monitoring Report

Vegetation Monitoring Report

Project: Grigsby AC19-62HN Tank Battery

Date & Time: 8/13/2024 10:33

Tasman Personnel: Alex Cook

Weather: Mostly Sunny, No Wind, 78F

Client: Noble Energy, Inc.

Stormwater Issues: None Observed

Debris/Trash On-Site: None Observed

Equipment On-Site: Yes, active facility.

Observations:

Site will remain as an active Oil and Gas Facility. Equipment has been replaced following the excavation activists. Background
vegetation collected along the northern section of the Site, parallel to CR78. No weed growth observed during the Site assessment,
Background vegetation includes Blue Gramma, Western Wheatgrass, Slender Wheatgrass, and Prickly Pear.

	Site Status	Comments
Vegetation Present?	Yes	Reclamation seed mix grasses
Noxious or invasive weeds present?	No	None Observed
Have weeds been managed according to the narrative?	No	No, initial site assessment.

Photo Log (descriptions below)

P1 - Looking north across the Site, excavation completed and road base emplaced and contoured.

P2 - Looking east across the Site, the tank battery has begun production since the excavation.

P3 - Looking south across the Site, excavation completed and road base emplaced and contoured.

Photo Log Continued (descriptions below)

P4 - Looking west across the Site, excavation completed and road base emplaced and contoured.

P5 - Lease operators on-Site completing work during the Site assessment.

P6 - Looking northeast across the Site, all equipment has been replaced and operating during the Site assessment.

P7 - Looking north across the background reference area, blue gramma, western wheatgrass, and prickly pear present.

P8 - Looking east across the background reference area, blue gramma, western wheatgrass, and prickly pear present.

P9 - Looking south across the background reference area, blue gramma, western wheatgrass, and prickly pear present.

P10 - Looking west across the background reference area, blue gramma, western wheatgrass, and prickly pear present.

P11 - Vegetation growth up close, blue gramma, western wheatgrass, slender wheatgrass and prickly pear present.

P12 - Vegetation growth up close, blue gramma, western wheatgrass, slender wheatgrass and prickly pear present.

Legend

- - - - Excavation Extent (Collected via Trimble GPS)

Photo Location

Notes

1) All locations are approximate unless otherwise noted.

GPS – Global Positioning System

0 ft. 50 ft. 100 ft. N

Image Source: Google Earth; Google 2021
Projection: WGS 1984, UTM Zone 13 North

DATE:	August 15, 2024
DESIGNED BY:	A. Cook
DRAWN BY:	A. Cook

Tasman, Inc.
6855 W 119th Avenue
Broomfield, CO 80020

Noble Energy, Inc. – 100322 – DJ Basin
Grigsby AC19-62HN Tank Battery
NENE, Section 30, Township 7 North, Range 63 West
Weld County, Colorado

Reclamation Site Visist

FIGURE
1

ATTACHMENT B

UDSA Custom Soil Resources Map and Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Weld County, Colorado, Northern Part

Grigsby AC19-62HN

August 12, 2024

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

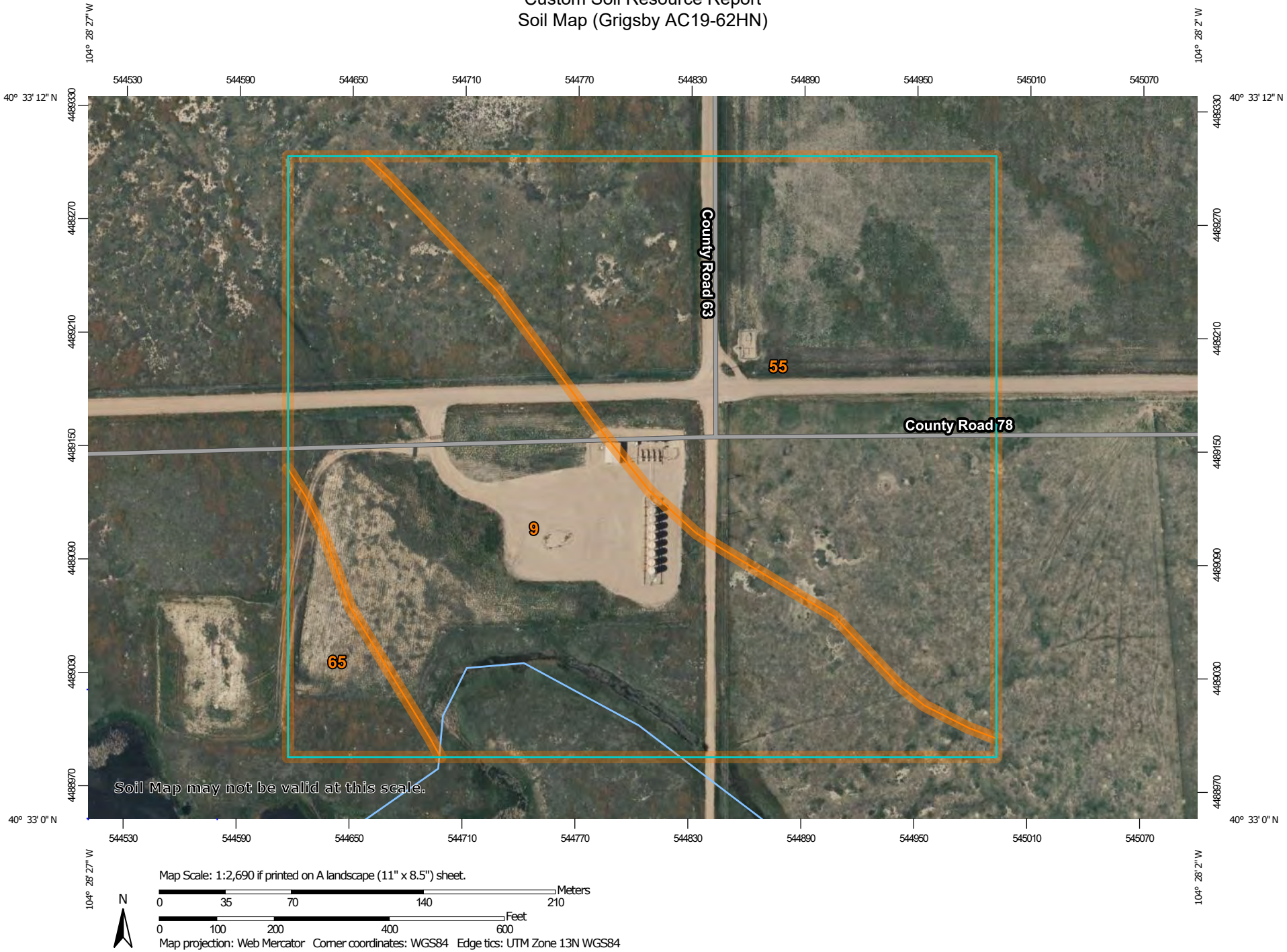
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map (Grigsby AC19-62HN)



Map Scale: 1:2,690 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Weld County, Colorado, Northern Part
Survey Area Data: Version 18, Aug 24, 2023

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

Date(s) aerial images were photographed: Jun 8, 2021—Jun 12, 2021

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

Map Unit Legend (Grigsby AC19-62HN)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9	Avar fine sandy loam	13.9	46.8%
55	Renohill fine sandy loam, 0 to 6 percent slopes	14.3	48.3%
65	Terry sandy loam, 3 to 9 percent slopes	1.5	4.9%
Totals for Area of Interest		**29.7**	**100.0%**

Map Unit Descriptions (Grigsby AC19-62HN)

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Weld County, Colorado, Northern Part

9—Avar fine sandy loam

Map Unit Setting

National map unit symbol: 3615
Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 11 to 14 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Avar and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avar

Setting

Landform: Stream terraces, swales, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

H1 - 0 to 3 inches: fine sandy loam
H2 - 3 to 8 inches: clay loam
H3 - 8 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 250.0
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: R067BY033CO - Salt Flat
Hydric soil rating: No

Minor Components

Fluvaquentic haplustolls

Percent of map unit: 6 percent

Landform: Terraces
Hydric soil rating: Yes

Ascalon
Percent of map unit: 5 percent
Hydric soil rating: No

Haverson
Percent of map unit: 4 percent
Hydric soil rating: No

Nunn
Percent of map unit: 3 percent
Hydric soil rating: No

Bankard
Percent of map unit: 2 percent
Hydric soil rating: No

55—Renohill fine sandy loam, 0 to 6 percent slopes

Map Unit Setting
National map unit symbol: 360b
Elevation: 3,600 to 6,200 feet
Mean annual precipitation: 11 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

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

Description of Renohill

Setting
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous, clayey loamy residuum weathered from shale

Typical profile
H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 18 inches: clay
H3 - 18 to 32 inches: clay loam
H4 - 32 to 36 inches: unweathered bedrock

Properties and qualities
Slope: 0 to 6 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Shingle

Percent of map unit: 5 percent
Hydric soil rating: No

Midway

Percent of map unit: 4 percent
Hydric soil rating: No

Ulm

Percent of map unit: 3 percent
Hydric soil rating: No

Other soils

Percent of map unit: 3 percent
Hydric soil rating: No

65—Terry sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 360p
Elevation: 4,000 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Terry

Setting

Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous sandy residuum weathered from sandstone

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 17 inches: fine sandy loam
H3 - 17 to 32 inches: gravelly sandy loam
H4 - 32 to 36 inches: weathered bedrock

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Tassel

Percent of map unit: 5 percent
Hydric soil rating: No

Olney

Percent of map unit: 4 percent
Hydric soil rating: No

Renohill

Percent of map unit: 3 percent
Hydric soil rating: No

Vona

Percent of map unit: 3 percent
Hydric soil rating: No

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Attachment C

USDA Official Series Description – Avar Series

LOCATION AVAR CO

Established Series
Rev. GB/JPP
7/95

AVAR SERIES

The Avar series consists of very deep, well drained soils that formed in calcareous, loamy alluvium commonly underlain by a buried horizon or buried horizons on swales and closed swales on terraces and upland plains. Slopes range from 0 to 5 percent. These soils are sodic, or sodic and saline. Mean annual temperature is about 48 degrees F, and mean annual precipitation is about 13 inches.

TAXONOMIC CLASS: Fine-loamy, mixed, mesic Ustic Natrargids

TYPICAL PEDON: Avar fine sandy loam - on a one percent slope in native range. (Colors are for dry soil unless otherwise noted.)

E--0 to 3 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 4/3) moist; moderate medium platy structure; slightly hard, very friable; strongly alkaline (pH 8.8); abrupt smooth boundary. (0 to 5 inches thick)

Btn--3 to 8 inches; brown (10YR 5/3) heavy clay loam, brown (10YR 4/3) moist; moderate medium columnar structure parting to moderate fine and medium subangular blocky; very hard, very firm; common prominent clay films on the faces of peds; slight efffervescence; SAR 18; very strongly alkaline (pH 9.5); clear smooth boundary. (3 to 9 inches thick)

Bnz1--8 to 11 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; strong effervescence; SAR 27; very strongly alkaline (pH 9.8); clear smooth boundary. (2 to 7 inches thick)

Bnz2--11 to 23 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; strong efferevescence; SAR 47; very strongly alkaline (pH 9.8); gradual smooth boundary. (7 to 17 inches thick)

Bknz--23 to 38 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; violent efferevescence; SAR 61; very strongly alkaline (pH 9.8); gradual wavy boundary. (0 to 30 inches thick)

Eknzb--38 to 50 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; violent effervescence; SAR 65; very strongly alkaline (pH 9.9); gradual wavy boundary. (0 to 13 inches thick)

Btknzb--50 to 60 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable; common distinct clay films on the faces of peds and bridging mineral grains; violent efferevescence; common medium soft masses and concretions of lime; SAR 68; very strongly alkaline. (pH 9.8)

TYPE LOCATION: Weld County, Colorado; 800 feet south and 900 feet east of the NW corner of Sec. 17, T. 9 N., R. 61 W. U.S.G.S. Grover South quad.; Lat. 40 degrees, 45 minutes, 13 seconds N., and Long. 104 degrees, 14 minutes, 09 seconds W.

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 48 to 52 degrees F. The solum ranges from 6 to 14 inches thick. Clay content in the particle-size control section ranges from 18 to 35 percent. Gravel is typically less than 5 percent by volume, but ranges from 0 to 10 percent throughout the profile. A thin A horizon is on some pedons. Depth to calcareous material typically is 0 to 5 inches, but ranges from 0 to 15 inches. Salt crystals are common below the natric horizon. Most pedons exhibit buried horizon(s), buried solums, or buried sequa.

The E horizon has hue of 7.5YR through 2.5Y, value of 5 or 6 dry, 3 or 4 moist, and chroma of 1 through 3. It has platy or granular structure. It commonly is fine sandy loam or sandy loam, but ranges from loamy sand to light clay loam. Electrical conductivity of the saturation extract ranges from .5 to 4 millimhos per centimeter. The sodium absorption ratio ranges from 1 to 3. It is slightly alkaline through strongly alkaline.

The Btn horizon has hue of 7.5YR through 2.5Y, value of 4 through 6 dry, 4 or 5 moist, and chroma of 2 through 4. It commonly has columnar structure but in some pedons it is prismatic or subangular blocky. The natric horizon commonly is clay loam or clay. Clay ranges from 35 to 50 percent, silt from 5 to 50 percent and sand from 15 to 45 percent. The base of the natric horizon is less than or equal to 10 inches. Electrical conductivity of the saturation extract ranges from 2 to 10 millimhos per centimeter but averages greater than 4. The sodium absorption ratio ranges from 13 to 90. It is strongly alkaline or very strongly alkaline.

The Bnz and Bknz horizons have hue of 7.5YR through 2.5Y, value of 5 through 7 dry, 4 to 5 moist, and chroma of 2 through 4. They commonly are sandy clay loam, sandy loam, or clay loam, but clay ranges from 15 to 35 percent, silt from 5 to 67 percent and sand from 15 to 65 percent. Strata of finer or coarser material are in some pedons. Electrical conductivity of the saturation extract ranges from 4 to 35 millimhos per centimeter. Sodium absorption ratio ranges from 20 to 250. They are strongly alkaline or very strongly alkaline.

Buried sola and sequa have hue of 10YR or 2.5Y, value of 5 through 8 dry, 3 through 7 moist, and chroma of 1 through 4. They commonly are sandy loam or sandy clay loam but clay ranges from 15 to 35 percent, silt from 5 to 67 percent and sand from 15 to 65 percent. Electrical conductivity is 4 to 35 millimhos per centimeter. Sodium absorption ratio ranges from 20 to 250. They are strongly alkaline or very strongly alkaline.

COMPETING SERIES: These are the Bunkwater (CO), Firstview (CO), and Starlake (NM) series. All have the base of the natric horizon deeper than 10 inches. In addition, Bunkwater soils lack any natric layers with more than 35 percent clay, and they lack buried horizons; Firstview soils have a lithologic discontinuity below depths of 20 to 36 inches that have clay content of over 35 percent; and Starlake soils lack buried horizons.

GEOGRAPHIC SETTING: Avar soils are on closed swales or depressions on upland plains and first terraces. Slope ranges from 0 to 5 percent. The soils formed in loamy, calcareous late Pleistocene or very early Holocene alluvium. Elevation ranges from 4,500 to 5,500 feet. Relief is flat, but microrelief includes truncated soils appearing as bare spots or slick spots and mounds of soil material stabilized around salt tolerant grasses. The average annual precipitation is 11 to 14 inches with peak periods of precipitation during the spring and early summer. Average annual temperature is 47 to 53 degrees F. The frost-free season is 130 to 160 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ascalon, Bankard, Haverson, Olney, and the competing Arvada and Mosher soils. Bankard and Haverson soils lack a natric or argillic horizon. Olney soils lack a natric horizon. Ascalon soils have a mollic epipedon and a lack of natric horizon.

DRAINAGE AND PERMEABILITY: Well drained; medium or rapid runoff; permeability is very slow or slow in the solum and moderately slow to moderately rapid in the substratum. The depth to the water table ranges from 5 to 10 feet.

USE AND VEGETATION: Used mainly as native rangeland. Natural vegetation is inland saltgrass, alkali sacaton, prickly pear, western wheatgrass, and blue grama.

DISTRIBUTION AND EXTENT: Northeastern Colorado: The soils of this series are moderately extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Denver, Colorado

SERIES ESTABLISHED: Weld County, Colorado, 2/80.

REMARKS: This series is morphologically and genetically complex. The position of the soil, i.e., being adjacent to the flood plain, is responsible for the buried horizon or horizons. The water table is the transport mechanism responsible for the sodicity and salinity condition and the fluctuating water table level is the mechanism partially responsible for the depths of the ca, sa, and natric horizon in the pedon. After considerable field and lab research, it is theorized that the source of the sodium and calcium cations is the shale of the Laramie Formation. Diagnostic horizons and features recognized are: an ochric epipedon; a natric horizon from 3 to 8 inches; accumulation of sodium, calcium carbonate, and soluble salts in layers below the natric horizon; buried horizons; an ustic aridic moisture regime; and a mesic temperature regime. This revision updates the classification from an Ustollic subgroup to an Ustic subgroup to be compatible with the 1994 Amendments to Soil Taxonomy. Last updated by the state 6/95.

National Cooperative Soil Survey
U.S.A.