

SITE INVESTIGATION PLAN



Arapahoe Unit 151 (43-21) API# 05-017-06737

NESE, Section 21, T14S R42W

Cheyenne County, Colorado

Prepared for:
Citation Oil & Gas Corp.
14077 Cutten Rd.
Houston, TX 77069

Prepared by:
Absaroka Energy and
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112 High St.
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CIT.CO.0650.01



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1 INTRODUCTION

Citation Oil & Gas Corp. (Citation) contracted Absaroka Energy and Environmental Solutions, LLC (AE₂), to prepare a Site Investigation Plan (Plan) for the Arapahoe Unit 151 (43-21) well. A COGCC inspection, document number 700600389, identified an area of vegetative subsidence in an agricultural field adjacent to the well location (Site).

The following Plan provides an overview and detailed description of the activities to be performed as part of the site investigation, as well as Site background, hydrogeology, and surface and groundwater receptors. This Plan also details the soil sampling to be conducted. Maps and other reference materials are also included.

1.1 Site Description and Location

The Arapahoe Unit 151 (43-21) well is located approximately 4.07 miles southeast of the town of Arapahoe, Colorado in Cheyenne County (**Appendix A**).

The well location may be accessed from Arapahoe by turning east onto CO highway 40, and travelling east approximately 4.70 miles to Cheyenne County Road 50. Turn south onto Cheyenne County Road 58 and travel 2.60 miles south to Cheyenne County Road Q. Turn west onto Cheyenne County Road Q and travel 1.00 miles. Turn north onto an unnamed road and travel 0.36 miles. The well is located on the west side of the road (**Appendix A**).

1.2 Contact Information

Pertinent contact information regarding the site investigation is shown in Table 1.

Table 1: Contact Information.

Contact	Person	Address	Phone No.
Responsible Party	Citation Oil & Gas Corp.	14077 Cutten Rd. Houston, TX 77069	281-891-1000
EHS & Regulatory Director	Bob Redweik	14077 Cutten Rd. Houston, TX 77069	281-891-1550
Environmental Contractor	Ben Shoup Absaroka Energy and Environmental Solutions, LLC	112 High Street Buffalo, WY 82834	307-299-5950
Landowner	Levi Mitchek	14543 Co. Rd 48 Cheyenne Wells, CO 80810	620-640-4096

1.3 Historic Land Use

The Site is located in a rural setting within the Great Plains physiographic province. Historic land use for the area includes agriculture and grazing of pastureland by livestock. In addition, the land is currently being used for oil and gas production operations. Prior to oil and gas operations, the area had few uses aside from agriculture.

1.4 High Priority Habitat Review

The Colorado Parks and Wildlife High Priority Habitat map overlay was reviewed, and the location is not within a designated wildlife high priority habitat.

2 HYDROGEOLOGICAL CONDITIONS

2.1 Geology

The surface geology of the area is composed of Quaternary eolian deposits. These deposits overlie the Tertiary Pliocene and Upper Miocene Ogallala Formation which unconformably overlies the Late Cretaceous Pierre Shale. The Ogallala Formation is a semi-consolidated deposit of sand, silt, clay, gravel, chert and caliche. This formation consists of poorly sorted beds of cemented sandy silt, sand and gravel. The thickness of the formation ranges from 0 to 400 feet near the Kansas border with varying thicknesses due to changing topography within the formation. The Pierre Shale is described as a dark-gray and brownish clay shale containing calcareous and ferruginous concretions throughout, with some thick bentonite beds. (Arnold and Boettcher, 1964).

2.2 Soil

Surface soil texture at the Site is primarily silty loam. Soil characteristics and type were referenced from the Natural Resources Conservation Service's Web Soil Survey. Soils within the site consist of one primary soil series: Keith-Richfield silt loams. These soils occur in an area with mean annual precipitation of 15 to 24 inches, mean annual air temperature of 50 to 57 degrees, and a frost-free period of 140 to 190 days.

The Keith-Richfield soils occur in plains and are silty loam, well drained, with a depth to groundwater that is typically greater than 80 inches. They are considered non-saline to very slightly saline (0.0 to 2.0 mmhos/cm). The Keith-Richfield has a very high available water supply (about 12.6 inches) from 0 to 60 inches. These soils have a typical depth to restrictive features more than 80 inches below surface.

2.3 Hydrogeology

2.3.1 Potential Groundwater Receptors

According to data on water wells from the Colorado Division of Water Resources, no water wells are present within one-quarter mile of the Site. An abandoned well, permit number 153388, was drilled to a

depth of 300 feet BGS and abandoned in 1989. The gradient of the local bedrock aquifer system is unknown, although most aquifers in this region tend to trend with topography, which is generally to the south. A map illustrating the location of groundwater wells and other hydrologic resources is provided in **Appendix CB**. Based on the small size of the site and no major facilities having ever been present, and groundwater wells being greater than 50 feet deep, the potential for groundwater impact is not considered a concern for this investigation.

2.3.2 Potential Surface Water Receptors

Surface water in the vicinity of the well site is only present during certain times of year. The closest surface water feature to the Site is Ladder Creek, an ephemeral drainage 0.40 miles north of the Site. The closest perennial body of water is the Neenoshe Reservoir located approximately 50 miles southeast of the Site.

3 SITE CHARACTERIZATION SAMPLING METHODS

3.1 General Sampling Methods

3.1.1 Site Soil Sampling

Field screening will be conducted prior to collection of soil samples. This will be accomplished with olfactory and visual observations and probing using an electrical conductivity (EC) meter. Soil sampling will follow industry accepted sampling procedures. Soil samples will be collected with a soil bucket auger. Three (3) boreholes will be installed in the area of suspected impacts (**Appendix C**). Screening points are to be collected in one (1) foot intervals from one (1) to six (6) feet below ground surface (BGS). Screening points that identify the highest indication of anomalies will be submitted for analysis. A minimum of one (1) sample from each borehole will be submitted for laboratory analysis.

Soil will be transferred directly into soil sample containers provided by the laboratory. Each sample will be transferred immediately to a cooler and preserved with ice for transport to the laboratory. Sampling personnel will don nitrile gloves during the sampling activities; donning new gloves between each sample location to prevent cross-contamination. Each soil sample will be analyzed for the following agronomic soil parameters:

- pH
- EC
- SAR
- Boron
- Organic Matter
- Nitrate
- Ammonium Nitrogen
- Phosphorus
- Potassium
- Zinc

- Iron
- Manganese
- Copper Chloride
- Lime and Texture estimates
- Percent Calcium Carbonate Equivalency
- Texture
- Selenium

3.1.2 Groundwater Sampling

No shallow groundwater is anticipated to be present at this site based on local water well data, and therefore no groundwater sampling is planned. If groundwater is encountered during the sampling event, provisions will be made to collect groundwater samples accordingly.

3.1.3 Background Reference Samples

Two (2) background samples will be collected for baseline comparative and reference purposes. The sample will be collected from an adjacent, upgradient or cross-gradient, unaffected area (approximate location identified on the Sampling Map – **Appendix B**). The background sample will be analyzed for the following constituents:

- pH
- EC
- SAR
- Boron
- Organic Matter
- Nitrate
- Ammonium Nitrogen
- Phosphorus
- Potassium
- Zinc
- Iron
- Manganese
- Copper Chloride
- Lime and Texture estimates
- Percent Calcium Carbonate Equivalency
- Texture
- Selenium

3.2 Decontamination

All sampling equipment will be decontaminated between each sample by first removing any remaining soil, then washing with an Alconox solution, then rinsing with distilled water. Equipment will be allowed to air dry prior to subsequent sampling. Sampling personnel will don nitrile gloves during the sampling activities, donning new gloves between each sample location.

3.3 Chain of Custody

Chain of Custody (COC) protocol will follow generally accepted methods. Sample containers will be sealed and placed on ice in coolers for shipment. Prior to shipping, the COC will be signed and dated by the sampler. The COC will be sealed in a Ziploc bag and taped to the inside of the cooler lid. The cooler is sealed and taped shut for shipment. Lab personnel, upon receipt of the coolers, removes the tape, breaks the cooler seal, retrieves the COC, and then fills in the appropriate lab receipt information and signs the document. Documentation of the completed COC is sent to AE₂ via email.

3.4 Documentation

Each sample location will be fully documented. At minimum, documentation includes the following items:

- Collector name
- Sample name
- Sample date/time
- Sample type (discreet, composite)
- EC reading
- Coordinates
- Photographs
- Visual/olfactory observations
- Soil description
- Other notes

To assist with the documentation effort, a GPS enabled digital device, sample log forms, and sample log table will be utilized to track and record data. Sample locations will be photo documented.

4 QUALITY ASSURANCE / QUALITY CONTROL

All sampling documentation will be reviewed for any errors or omissions prior to completing the field activities for each sampling location.

4.1 Data

Data collected for each sample will be documented by several methods. Each sample location will be documented using a digital device equipped with a GPS receiver. In addition, each sample will be documented on a sample log form. Finally, a sampling log table will be completed as samples are collected ensuring that all the required samples and attribute data are collected and recorded. Each sample location will also be photo-documented, and a photographic log will be prepared.

Sample log forms, log tables, and GPS waypoint data will be cross-checked daily to ensure accurate data.

4.2 Cross-contamination

To eliminate the possibility of cross-contamination of samples during the sampling activities, all sampling equipment will be decontaminated between each sample location. The decontamination procedures are discussed above in Section 3. In addition, sampling personnel will don new nitrile gloves for each sample to be collected.

5 SAMPLING DEVIATIONS

Additional sampling containers will be available in the event that additional sampling is warranted. Conditions that may warrant additional sampling include discovery of potentially contaminated soil areas, discovery of contamination at depths greater than anticipated, or discovery of significant differences in soil type/texture in areas across the site. Although not anticipated to be necessary, sampling containers for water samples will be available for collecting groundwater, if encountered.

6 IMPLEMENTATION AND REPORTING SCHEDULE

The site investigation will begin as soon as this plan has been approved by the COGCC. A follow-up report with the results of the site investigation will be submitted as soon as possible after activities have concluded. If determined necessary based on the site investigation results, a remediation design will be developed and implemented to address any confirmed contamination.

7 POTENTIAL REMEDIATION ACTIVITIES

Remediation activities for substantial impacts, if required, will likely involve excavation of impaired soils for transport to an approved disposal facility. Following excavation and removal of any impaired soils, confirmation sampling will be conducted to confirm successful remediation. Excavated areas will then be backfilled with clean soil as necessary and seeding of the remediated area to re-establish a proper seedbed will be conducted.

Remediation activities for minor impacts may include *in situ* treatment methods to reduce contaminants of concern below regulatory limits and to foster successful reclamation. *In situ* treatment may include scarification of the soil and addition of amendments to modify soil geochemistry. Amendments may include manure, straw, gypsum, or fertilizers. Application rates would be based on need to treat the affected area. Following *in situ* treatment, the site will be monitored to ensure successful reclamation.

The results of this Site Investigation will be summarized in a report along with soil sample data and submitted to the COGCC.

References

- Arnold and Boettcher, 1964. Geology and Ground-Water Resources in Eastern Cheyenne and Kiowa Counties, Colorado. Colorado Water Conservation Board, Department of the Interior. <https://pubs.usgs.gov/wsp/1779n/report.pdf>.
- NRCS, 2022. Soil Survey of Cheyenne County, Colorado. Version 8, Web Soil Survey, Natural Resources Conservation Service, U.S. Dept. of Agriculture, <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>. Retrieved June 2022.
- USGS, 1979. Geologic Map of Colorado: U.S. Geological Survey Special Geologic Map, scale 1:500,000, by Tweto and Ogden, <https://mrdata.usgs.gov/geology/state/sgmc2-unit.php?unit=COKpu;0>. Retrieved June 2022.
- CODWR, 2021, Well Permit Search, Colorado Division of Water Resources, <https://dwr.state.co.us/Tools/WellPermits/>. Retrieved June 2022.

APPENDICES

Appendix A – Project Location Map



Map Key

Name



Arapahoe Unit #151 (43-21)



Township Boundaries



Section Boundaries



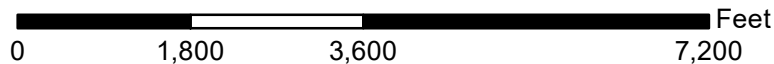
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**Arapahoe Unit 151 Soil Investigation
Overview Map**

Cheyenne County, State of Colorado



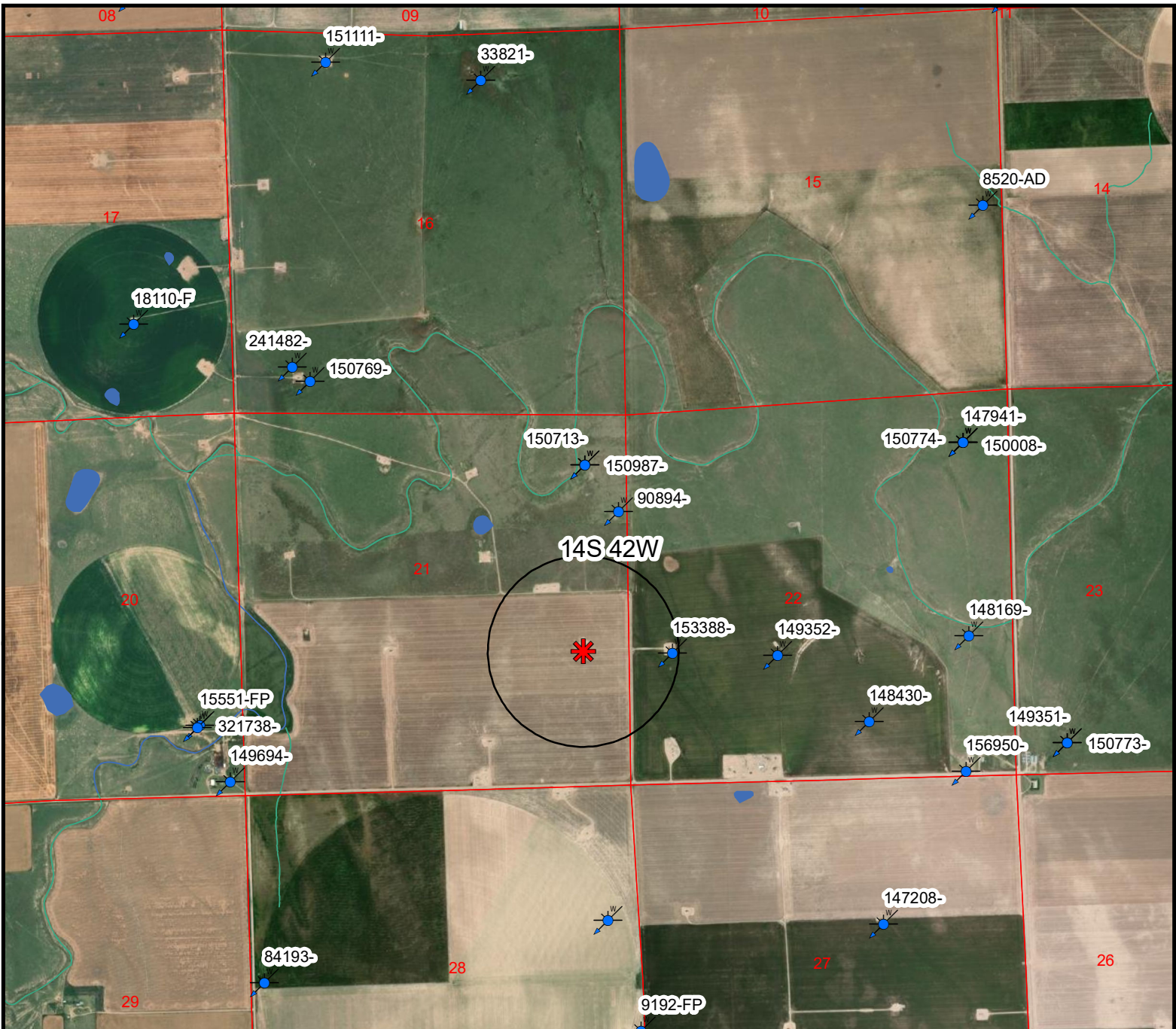
Coordinate System: WGS 1984 UTM Zone 13N











Scale: 1:24,000

Date: 6/15/2022

Appendix B – Hydrologic Data



Map Key

- | | |
|---|---|
|  Water Wells | NWI Wetlands |
|  Arapahoe Unit #151 (43-21) |  Freshwater Emergent Wetland |
|  0.25 Mile Buffer |  Freshwater Pond |
|  Township Boundaries |  Riverine |
|  Section Boundaries | |



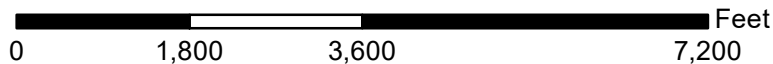
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**Arapahoe Unit 151 Soil Investigation
Hydrologic Data Map**

Cheyenne County, State of Colorado



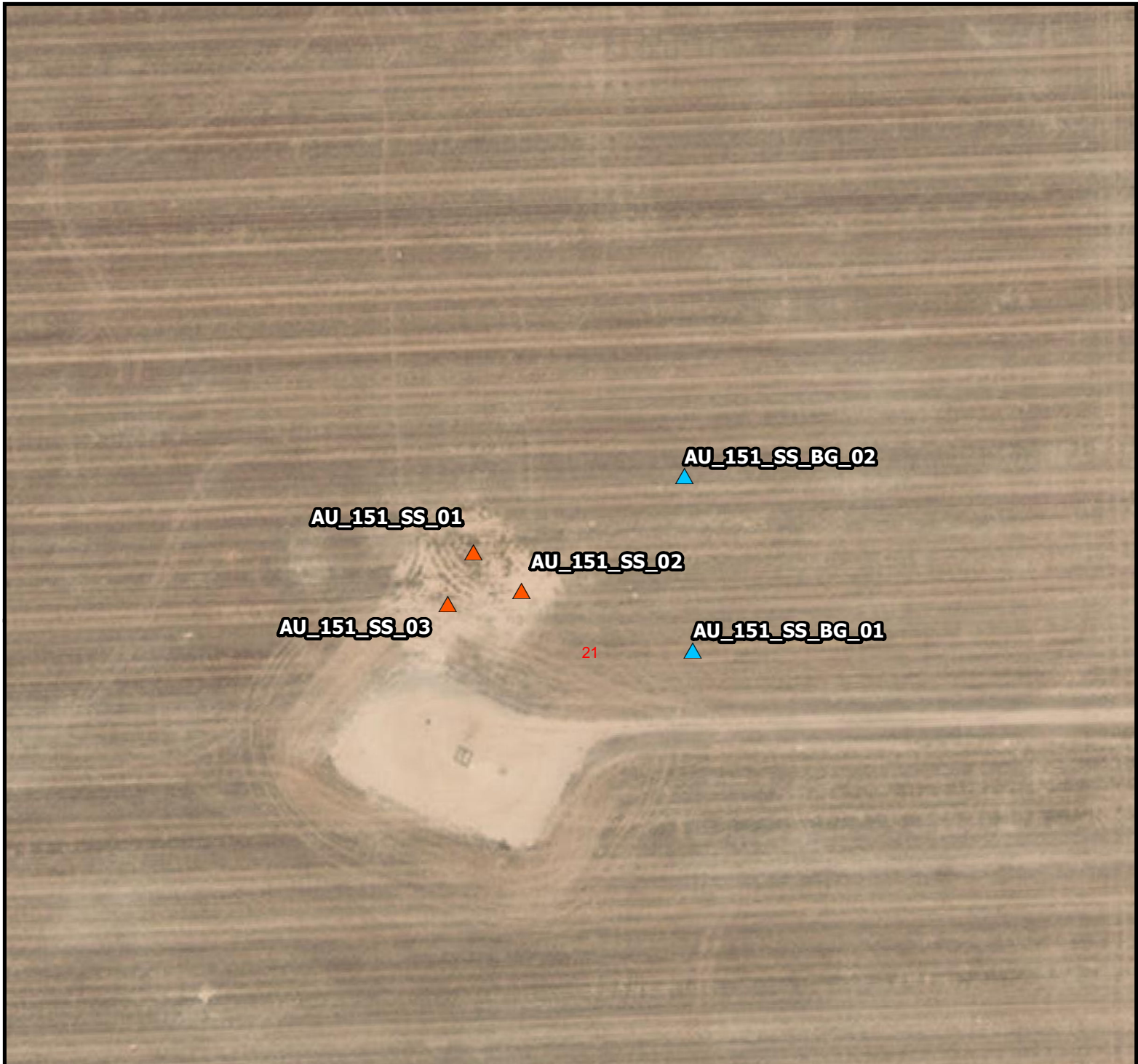
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Scale: 1:24,000

Date: 6/15/2022

Appendix C – Proposed Sampling Map



Map Key

-  Background Samples
-  Soil Investigation Samples
-  Section Boundaries




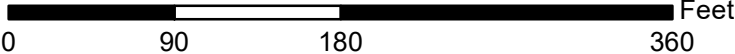
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**Arapahoe Unit 151 Soil Investigation
Proposed Soil Sampling Map**

Cheyenne County, State of Colorado

Coordinate System: WGS 1984 UTM Zone 13N



Scale: 1:1,250

Date: 6/15/2022

