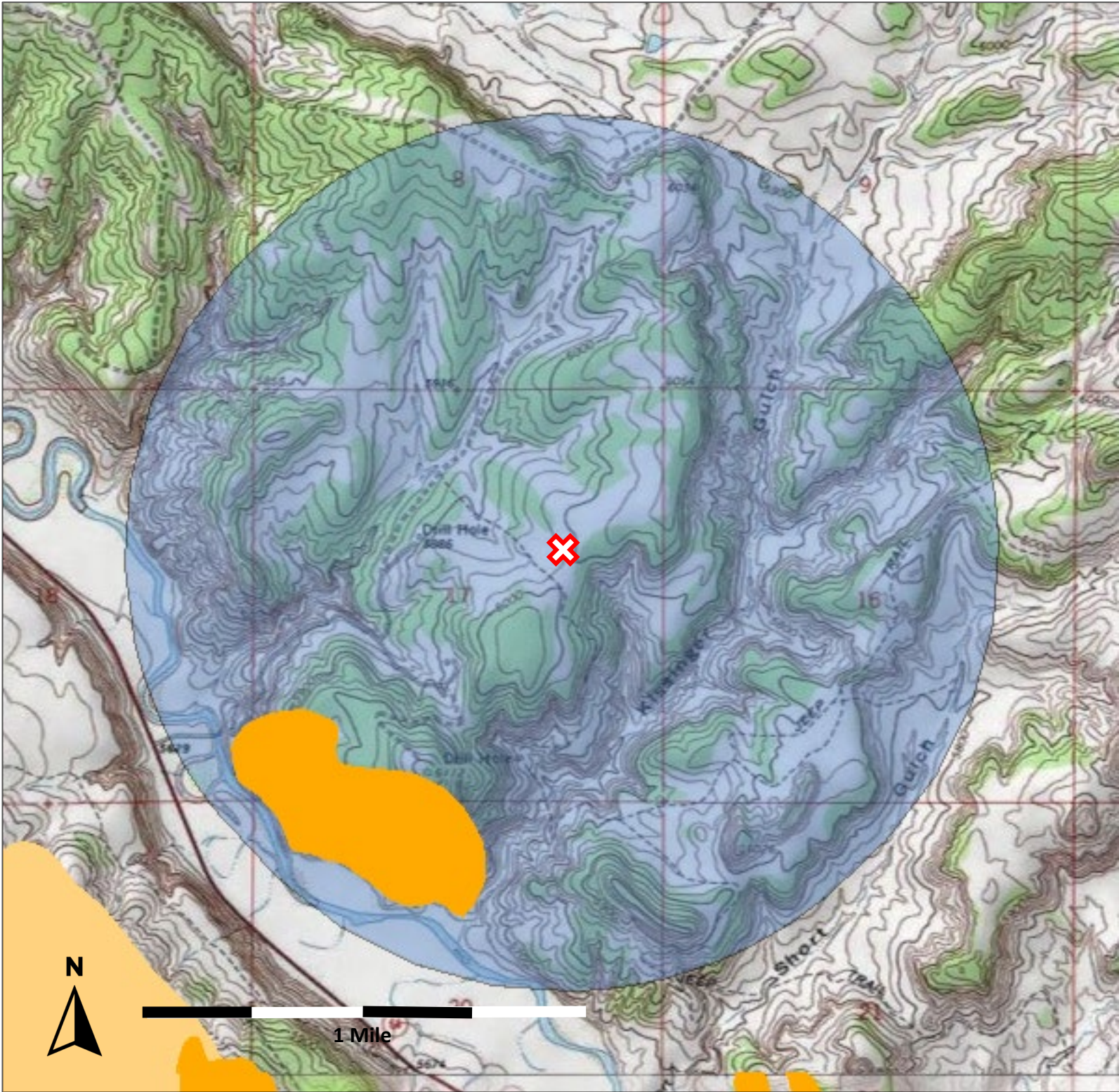


ANSCHUTZ MOHEE FED 0297-17  
GEOLOGIC HAZARDS MAP



| SUMMARY OF GEOLOGIC HAZARDS:<br>(AS MEASURED FROM THE PROPOSED WORKING PAD SITE) |                          |  |
|--|--------------------------|--|
| HAZARD TYPE  | DISTANCE (N/A IF >5280') | SOURCE   |
| RADIOACTIVITY  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| SEISMIC  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| GROUND SUBSIDENCE  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| LANDSLIDES   | ±3750' SW                | COGCC GIS, CO GEOLOGIC SURVEY MAPS, USGS U.S. LANDSLIDE INVENTORY                        |
| AVALANCHE  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| ROCKFALL   | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| FLOOD  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS, COLORADO WATER CONSERVATION BOARD, FEMA GIS DATA     |
| MUDFLOW AND DEBRIS FANS  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS, COLORADO WATER CONSERVATION BOARD                    |
| EXPANSIVE SOILS AND ROCK   | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS, NRCS GIS DATA  |
| UNSTABLE SLOPES  | N/A                      | COGCC GIS, CO GEOLOGIC SURVEY MAPS   |
| MINE EXTENT  | N/A                      | COGCC GIS; CO GEOLOGIC SURVEY MAPS; COLORADO DIVISION OF RECLAMATION, MINING, AND SAFETY |

The landslide areas identified hereon have been determined to pose minimal to no risk to the proposed Oil and Gas location.

I certify that I am a Professional Geologist, having met the educational requirements and professional work experience required by C.R.S. § 23-41-208(b). I have reviewed information pertaining to this Oil and Gas Location and the surrounding area and have identified no Geologic Hazards within a one-mile radius.

Jessica Davey  
Professional Geologist  
AIPG MEM-3242  
4585 Zuni Street  
Denver, CO 80211

  
SIGNATURE



01/15/2024  
DATE


THE FOLLOWING SOURCES HAVE BEEN CONSULTED TO DETERMINE IF ANY HAZARDS EXIST AND TO ASCERTAIN THE BOUNDARIES OF ANY IDENTIFIED HAZARDS:


COGCC GIS: [https://cogccmap.state.co.us/cogcc\\_gis\\_online/](https://cogccmap.state.co.us/cogcc_gis_online/)  
Colorado Geological Survey: <https://coloradogeologicalsurvey.org/gis-data-map-portal/>  
US Landslide Inventory: <https://www.usgs.gov/tools/us-landslide-inventory>  
Colorado Water Conservation Board: <https://coloradohazardmapping.com/>  
FEMA Floodplain GIS Data: <https://www.fema.gov/flood-maps/national-flood-hazard-layer>  
CLIENT-PROVIDED DATA MAY ALSO BE UTILIZED BEYOND THESE SOURCES

MAP DATA SOURCE:  
COGCC GIS  
US Landslide Inventory

LEGEND:

 = Well Pad Location  
 = 1-Mile Buffer from Well Pad

 = US Landslide Inventory  
Probable Landslide

 = US Landslide Inventory  
Possible Landslide

SITE NAME:  
MOHEE FED 0297-17

SURFACE LOCATION:  
SWNE SECTION 17, TOWNSHIP 2 NORTH, RANGE 97  
WEST, RIO BLANCO COUNTY, COLORADO

# **GEOLOGIC HAZARDS REPORT FOR THE ANSCHUTZ MOHEE FED 0297-17 LOCATION**

## **INTRODUCTION**

This report was prepared to address the requirements of Sections 304.b.(7).I. and 304.c.(21), of the Colorado Energy and Carbon Management Commissions (ECMC) rules, effective January 15, 2021. Anschutz is proposing the Mohee Fed 0297-17.

ECMC Rule 304.b.(7).I. requires the Operator to submit a map identifying any geologic hazards within a 1-mile radius of the proposed working pad surface. For any identified geologic hazard that extends beyond the 1-mile radius, a second map scaled to show the extent of that hazard in relation to the proposed oil and gas location shall be submitted. If the Operator identifies any Geologic Hazards pursuant to Rule 304.b.(7).I, the Operator will submit a Geologic Hazard plan per Rule 304.c.(21) describing proposed mitigation measures.

## **LOCATION OVERVIEW**

The Mohee Fed 0297-07 is located in the SWNE of Section 17, Township 2 North, Range 97 West, Rio Blanco County, Colorado.

Figure 1, below, shows the location of the existing well pad, the proposed well location at the center of the pad, which is enclosed within the Area of Disturbance shown in the red polygon, along with the 1-mile buffer (dashed black circle) used for the geologic hazard analysis. Existing roadway access is noted in black, with an additional proposed roadway to be constructed to the well pad in dark blue. A proposed pipeline route will run along the proposed roadway, which is noted in gray.





**Figure 1: Mohee Fed 0297-17 location in Rio Blanco County, Colorado**

## GEOLOGY

Appendix A contains a Geologic Map of the Mohee Fed 0297-17 site. There are two primary geologic units within the 1-mile radius of the site:

- Tw, Wasatch Formation, Tertiary aged claystone, shale, and sandstone
- Qa, Quaternary Alluvium, alluvial deposits, primarily salt, sand, and gravel in floodplains, fans, and low terraces

The Mohee Fed 0297-17 site sits on the Wasatch Formation, which covers approximately 6% of the surface in Rio Blanco County (U.S. Department of the Interior, n.d.).

## GEOLOGIC HAZARDS

GEOLOGIC HAZARD is defined in § 24-65.1-103(8), C.R.S.: “Geologic Hazard means a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant Hazard to public health, safety, or to property. The term includes, but is not limited to: avalanches, landslides, rockfalls, mudflows, and unstable or potentially unstable slopes; seismic effects; radioactivity; and ground subsidence.”

A General Regional Geohazards Map, Appendix B, from the ECMC GIS Online database, shows the following geohazards as not affecting the Mohee Fed 0297-17 site:

### **Seismic**

The Mohee Fed 0297-17 site is not within a one-mile radius of any recorded seismic events.

### **Mine Extent**

According to both the Colorado Division of Reclamation, Mining, and Safety (DRMS) and the Colorado Geological Survey (CGS), there are no mine sites within the 1-mile radius of the Mohee Fed 0297-17 site.

### **Flood**

The Mohee Fed 0297-17 site is not within a one-mile radius of a 100-year flood zone.

This General Regional Geohazards Map is a zoomed-out regional view created using the ECMC GIS Database to illustrate there are no recorded instances of the above-mentioned potential geologic hazards affecting the 1-mile radius around the Mohee Fed 0297-17 site.

### **Radioactivity**

**Definition from CDPHE:** Radon is a naturally occurring radioactive gas that comes from the breakdown of uranium in the soil.

Per the EPA, much of Colorado is in the Zone 1 category, meaning the average house will exceed the EPA's action level for indoor radon. However, since there are no permanent dwellings, especially dwellings with basements susceptible to radon, at the pad site, the potential presence of radon at the Mohee Fed 0297-17 site is not expected to represent a geologic or health hazard that would affect the design or operations of the site.

### **Ground Subsidence**

**Definition from CGS:** H.B. 1041, 106-7-103(10): Ground subsidence means a process characterized by downward displacement of surface material caused by natural phenomena such as removal of underground fluids, natural consolidation, or dissolution of underground minerals, or by man-made phenomena such as underground mining.

The Ground Subsidence Map, Appendix C, shows no known instances of ground subsidence within the area surrounding the Mohee Fed 0297-17 site (Colorado Geological Survey, 2022).

## **Landslides, Unstable Slopes, Avalanche, and Rockfall**

**Definition from CGS:** A landslide is a sudden mass movement of soil, artificial fill, and/or rock down a slope. Landslides include many different kinds of mass movements, including falls, topples, slides, spreads, flows, or a combination of one or more of these movements. Slopes of almost any angle, from slight hills to steep mountains, can fail in a sudden landslide. Landslides can be small or very large, up to thousands of cubic feet, can travel incredibly quickly (faster than a person can run), and may recur multiple times in virtually the same location.

The Landslide Map, Appendix D, does show one recorded landslide, southwest of the well pad, within a 1-mile radius from the well pad. The landslide is fully enclosed within the 1-mile radius. The U.S. Landslide Inventory has this landslide classified as a confidence level 2 on a scale from 1 to 5, which means there is evidence of landslide activity in the area (U.S. Department of the Interior, 2022). The landslides in this region are typically present along the White River, which runs southeast to northwest along the southwest edge of the 1-mile buffer from the Mohee Fed 0297-17. The movement of the documented landslides most likely occurred when the climate was wetter during the last glacial period, early to mid-Pleistocene, and future movement is unlikely in the current dry Continental Subarctic climate; however, future movement may be triggered by heavy rainfall in gullied areas (Hail, Jr., 1990).

According to the Colorado Avalanche Information Center, the Mohee Fed 0297-17 site is not located within a known avalanche region and there are no records for the past five years of avalanche activity in the region (Colorado Department of Natural Resources, 2022).

## **Mudflow and Debris Fans**

The Colorado Geological Survey has not targeted this region of the state as a current high-risk area for mudflows and debris fans. Mudflows typically occur in burn scar areas after major wildfire activity, and there has not been such an occurrence in this area for the CGS to initiate a study (Colorado Geological Survey, 2022).

## **Expansive Soils and Rock**

**Definition from CGS:** H.B. 1041, 106-7-106 (6): “Expansive soil and rock” means soil and rock which contains clay, and which expands to a significant degree upon wetting and shrinks upon drying.

There are three soil types within the Mohee Fed 0297-17 location Forelle loam, Rentsac channery loam, and Rentsac-Moyerson-Rock outcrop complex.

Table 1 below lists the soil types, drainage class, hydrologic soil group, frequencies of flooding and ponding, land capability classifications (non-irrigated), depth to restrictive feature, and hydric ratings for each soil type found within the 1-mile radius from the well pad. The codes listed in the left column are referenced on the Soils Map, Appendix E.

**Table 1: Types and characteristics of soils found within a 1-mile radius of the well pad.**

| Code | Soil Name   | Drainage Class          | Hydrologic Soil Group | Frequency of Flooding/Ponding | Land Capability (non-irrigated) | Depth to Restrictive Feature | Hydric Rating |
|------|---|-------------------------|-----------------------|-------------------------------|---------------------------------|------------------------------|---------------|
| 1    | Abor clay loam, 5 to 30 percent slopes                        | Well-drained            | D                     | None/None                     | 6e                              | 20"-40"                      | No            |
| 5    | Badland   | *                       | D                     | *                             | 8e                              | 0"-6"                        | No            |
| 13   | Bulkley channery silty clay loam, 5 to 30 percent slopes      | Well-drained            | C                     | None/None                     | 6e                              | 40"-60"                      | No            |
| 33   | Forelle loam, 3 to 8 percent slopes                           | Well-drained            | B                     | None/None                     | 4e                              | >80"                         | No            |
| 48   | Kobase silty clay loam, moist, 3 to 8 percent slopes          | Well-drained            | C                     | None/None                     | 3e                              | >80"                         | No            |
| 49   | Kobase silty clay loam, moist, 8 to 15 percent slopes         | Well-drained            | C                     | None/None                     | 4e                              | >80"                         | No            |
| 53   | Moyerson stony clay loam, 15 to 65 percent slopes             | Well-drained            | D                     | None/None                     | 7e                              | 10"-20"                      | No            |
| 71   | Redrob loam   | Somewhat poorly drained | C                     | None Rare/None                | 5w                              | >80"                         | No            |
| 73   | Rentsac channery loam, 5 to 50 percent slopes                 | Well-drained            | D                     | None/None                     | 7e                              | 10"-20"                      | No            |
| 74   | Rentsac-Moyerson-Rock outcrop complex, 5 to 65 percent slopes | Well-drained            | D                     | None/None                     | 7e                              | 10"-20"                      | No            |
| 89   | Tisworth fine sandy loam, 0 to 5 percent slopes               | Well-drained            | C                     | None/None                     | 7s                              | >80"                         | No            |
| 90   | Torrifluvents, gullied  | Well-drained            | A                     | None Occasional/None          | 7e                              | >80"                         | No            |
| 91   | Torriorthents-Rock outcrop complex, 15 to 90 percent slopes   | Well-drained            | D                     | None/None                     | 7e                              | 10"-20"                      | No            |
| 92   | Trembles loam, wet  | Moderately well-drained | A                     | None Occasional/None          | 3c                              | >80"                         | No            |
| 104  | Yamacall loam, 2 to 15 percent slopes                         | Well-drained            | B                     | None/None                     | 4e                              | >80"                         | No            |
| 129  | Water   | N/A                     | N/A                   | N/A                           | N/A                             | N/A                          | Yes           |

All four hydrologic soil groups (A, B, C, and D) are found within the 1-mile radius around the Mohee Fed 0297-17.

According to the U.S. Department of Agriculture (U.S. Department of Agriculture, 2007), these soil groups are defined as:

Group A: Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group C: Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

Group D: —Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification, as described in the next section, if they can be adequately drained.

The land capability ratings (non-irrigated) for the 1-mile radius surrounding the Mohee Fed 0297-17 range from class 3 to class 8. Along with the subclasses of c, e, and w, none of these ratings affect commercial, other than agriculture, use of the land (U.S. Department of Agriculture, 2007).

None of the soils found within the 1-mile radius of the Mohee Fed 0297-17 have any limitations, including expansive soils or rock types, that should negatively affect the drilling of the well on the pad location.

## **ECMC GEOLOGIC HAZARD REQUIREMENTS**

**Rule 304.b.(7).I Geologic Hazard Map:** A map identifying any Geologic Hazards within a 1-mile radius of the proposed Working Pad Surface. For any identified Geologic Hazard that extends beyond the 1-mile radius, a second map scaled to show the extent of that Hazard in relation to the proposed Oil and Gas Location.

- Several maps have been prepared to show the pad site in relation to all Geologic hazards within a 1-mile radius.
- The landslide area located near the site of the proposed Mohee Fed 0297-17 has been inactive since the early to mid-Pleistocene.

**Rule 304.c.(21) Geologic Hazard Plan:** If the Operator identifies any Geologic Hazards pursuant to Rule 304.b.(7).I, the Operator will submit a Geologic Hazard plan describing proposed mitigation measures.

- Geologic hazards related to this existing pad location may include a historic landslide as identified using CGS data and ECMC GIS Database maps.
- The Mohee Fed 0297-17 site is within one mile of several existing oil and gas wells, all of which have not experienced any issues with landslides. In the event that a future landslide should occur, Anschutz would enlist the services of an engineering firm that would suggest Best Management Practices for landslide mitigation to minimize impacts on the Anschutz Mohee Fed 0297-17 site.

### **Best Management Practices for the Anschutz Mohee Fed 0297-17 Location:**

- Anschutz will engage an engineer, whether internal or external, to monitor any changes in identified landslides throughout the operations on the location. A plan to mitigate any

landslide action will be put in place to minimize any impacts a landslide will have on the location. Anschutz recognizes that any future landslide activity is minimal; however, in the best interest of protecting assets and lives onsite, monitoring and mitigation are necessary.

## **SUMMARY**

Based on the review of publicly available data, the only potential geologic hazard within a 1-mile radius of the Mohee Fed 0297-17 site is landslides. The landslide identified within the 1-mile radius does not pose a direct threat to the site since movement has not occurred since the early to mid-Pleistocene. It is unlikely that movement will occur in the near future with the current classification as a confidence level 2; however, Anschutz would be prudent to monitor any potential visible landslide movement in the area after major rain events and check with the U.S. Landslide Inventory for any future updates to the classification.

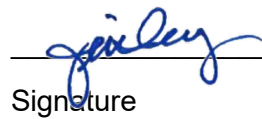
## **LIMITATIONS**

This report is intended for preliminary evaluation purposes only for geologic hazards, as contained in this report, in the Mohee Fed 0297-17 project vicinity.

## **CERTIFICATION**

I certify that I am a Professional Geologist, having met the educational requirements and professional work experience required by C.R.S. § 23-41-208(b). I have reviewed information pertaining to this Oil and Gas Location and the surrounding area, and have identified no Geologic Hazards within a one-mile radius.

Jessica Davey  
Professional Geologist  
AIPG MEM-3242  
4585 Zuni Street  
Denver, CO 80211

  
\_\_\_\_\_  
Signature

01/15/2024  
\_\_\_\_\_  
Date

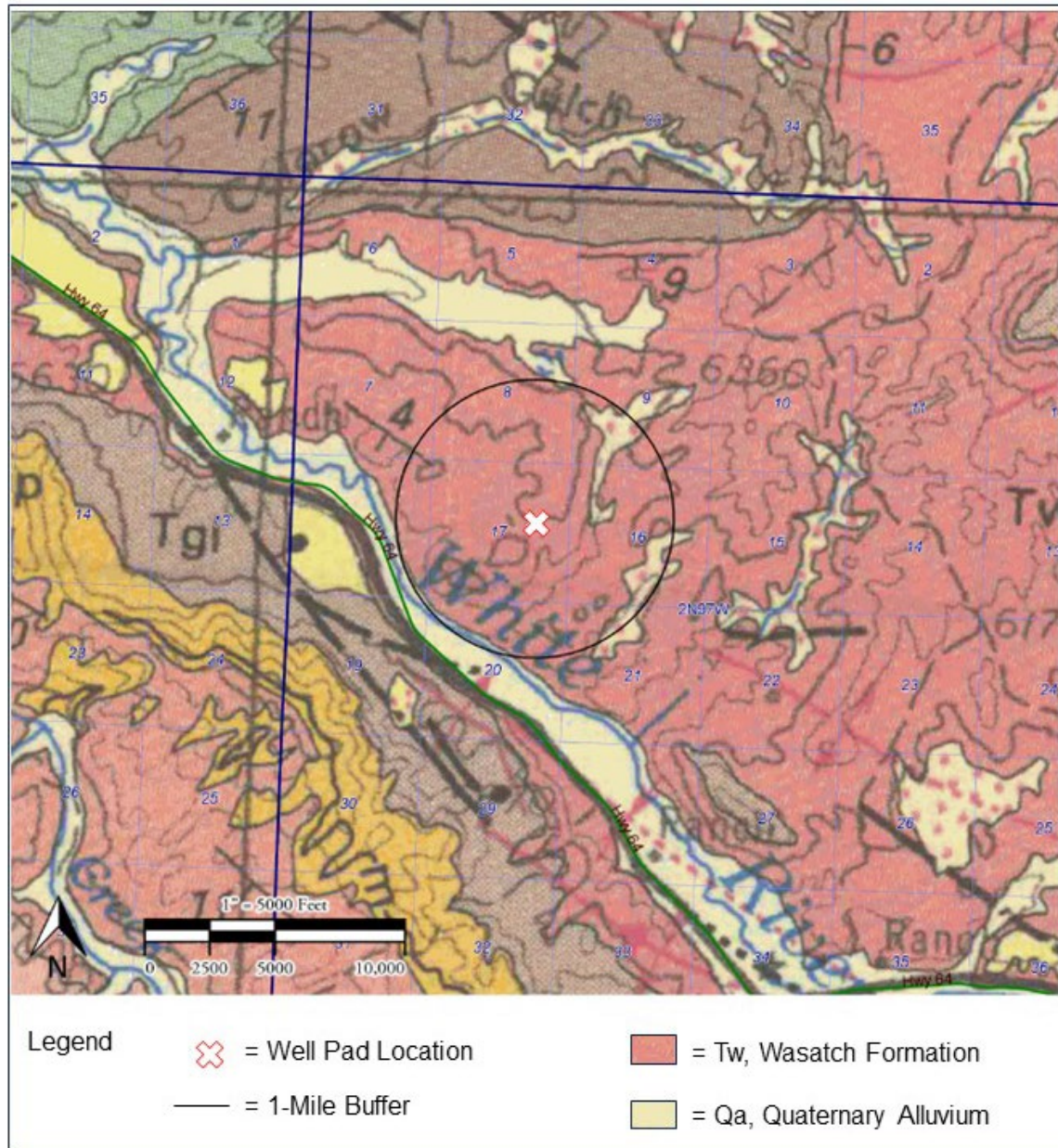


## REFERENCES

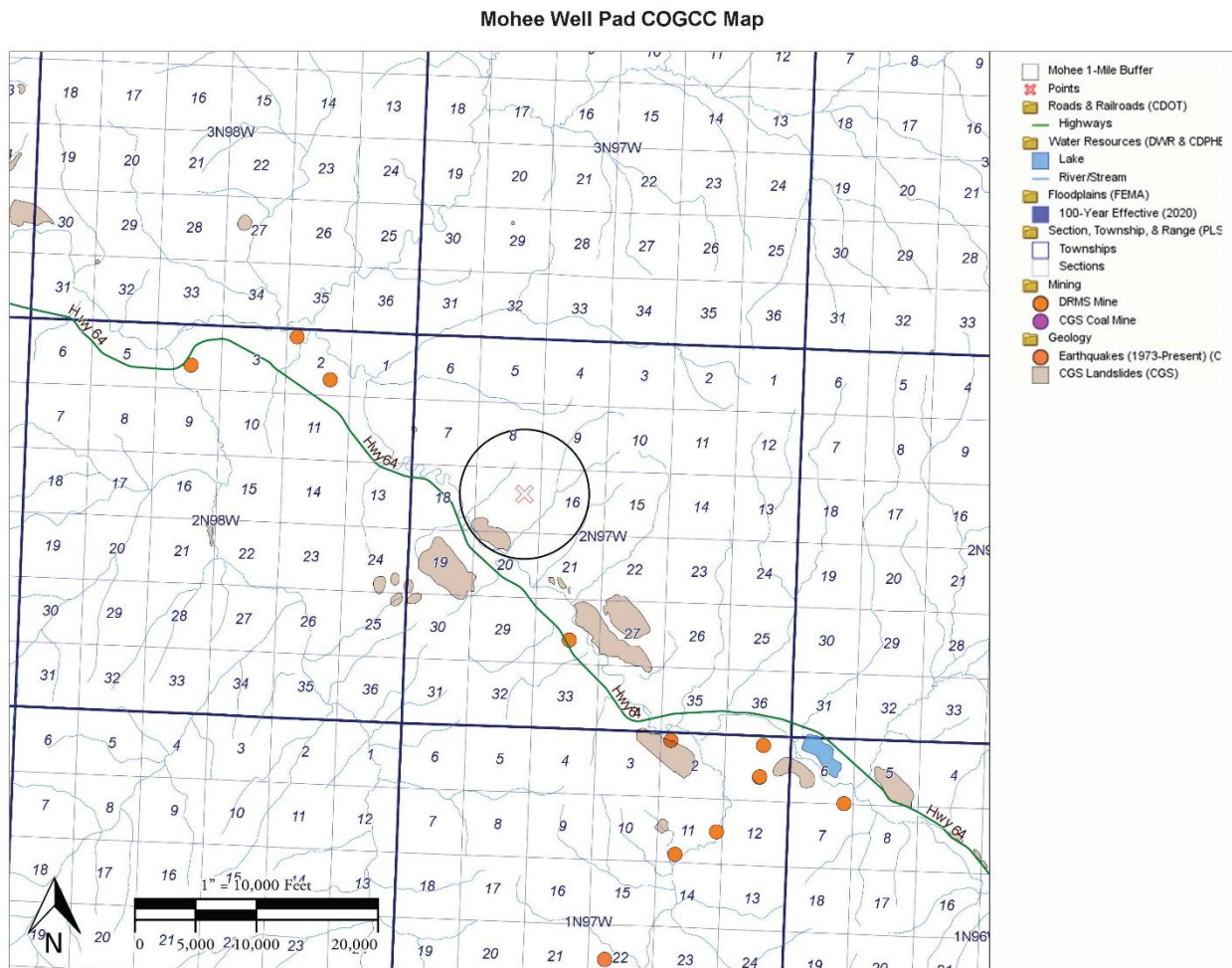
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Retrieved from Mineral Resources Data: <https://mrdata.usgs.gov/geology/state/fips-unit.php?code=f08103>

## APPENDIX A – GEOLOGIC MAP

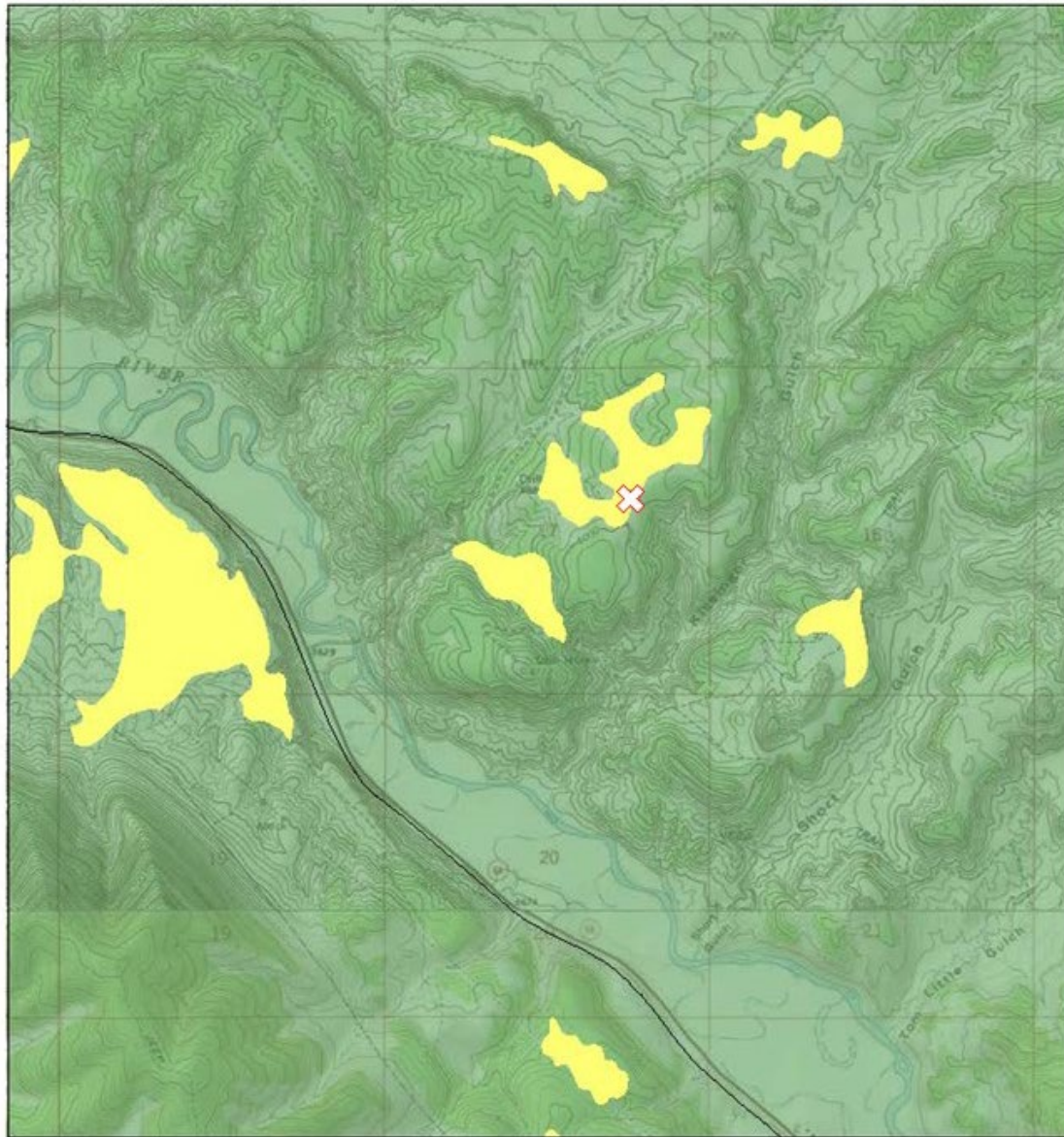


## APPENDIX B – GENERAL REGIONAL GEOHAZARDS MAP





## APPENDIX C – GROUND SUBSIDENCE MAP

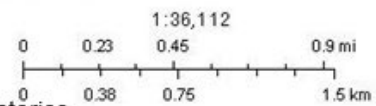


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- EG-14 Evaporite Formations
- EG-14 Cretaceous and Tertiary Formations
- EG-14 Dune and sheet sand deposits
- EG-14 Eolian (wind-blown) deposits
- MS-47 Collapsible soils Rifle area
- MS-34 Roaring Fork River Corridor collapsible soil

✕ = Well Pad Location

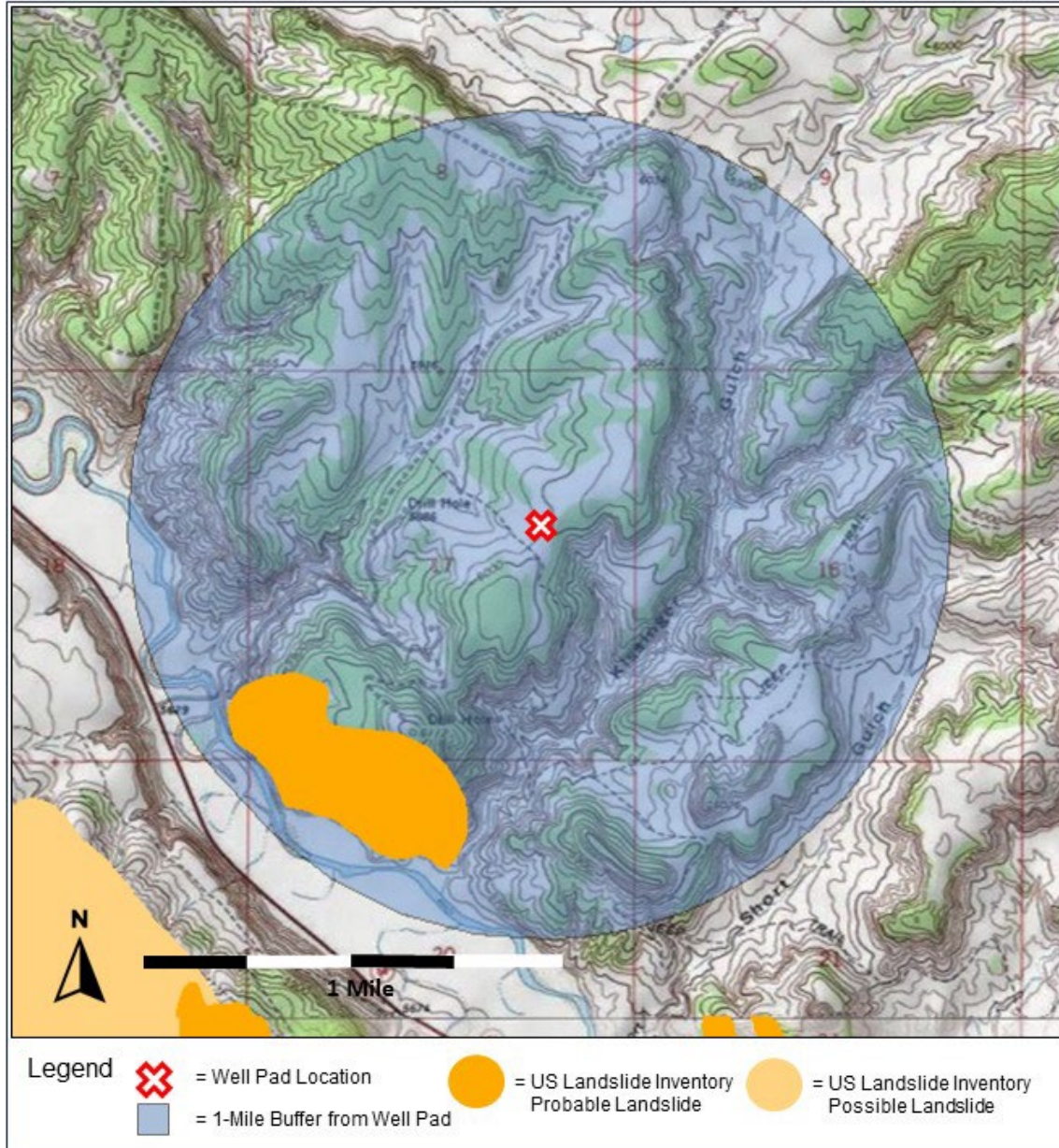
● = Collapsible soil case histories



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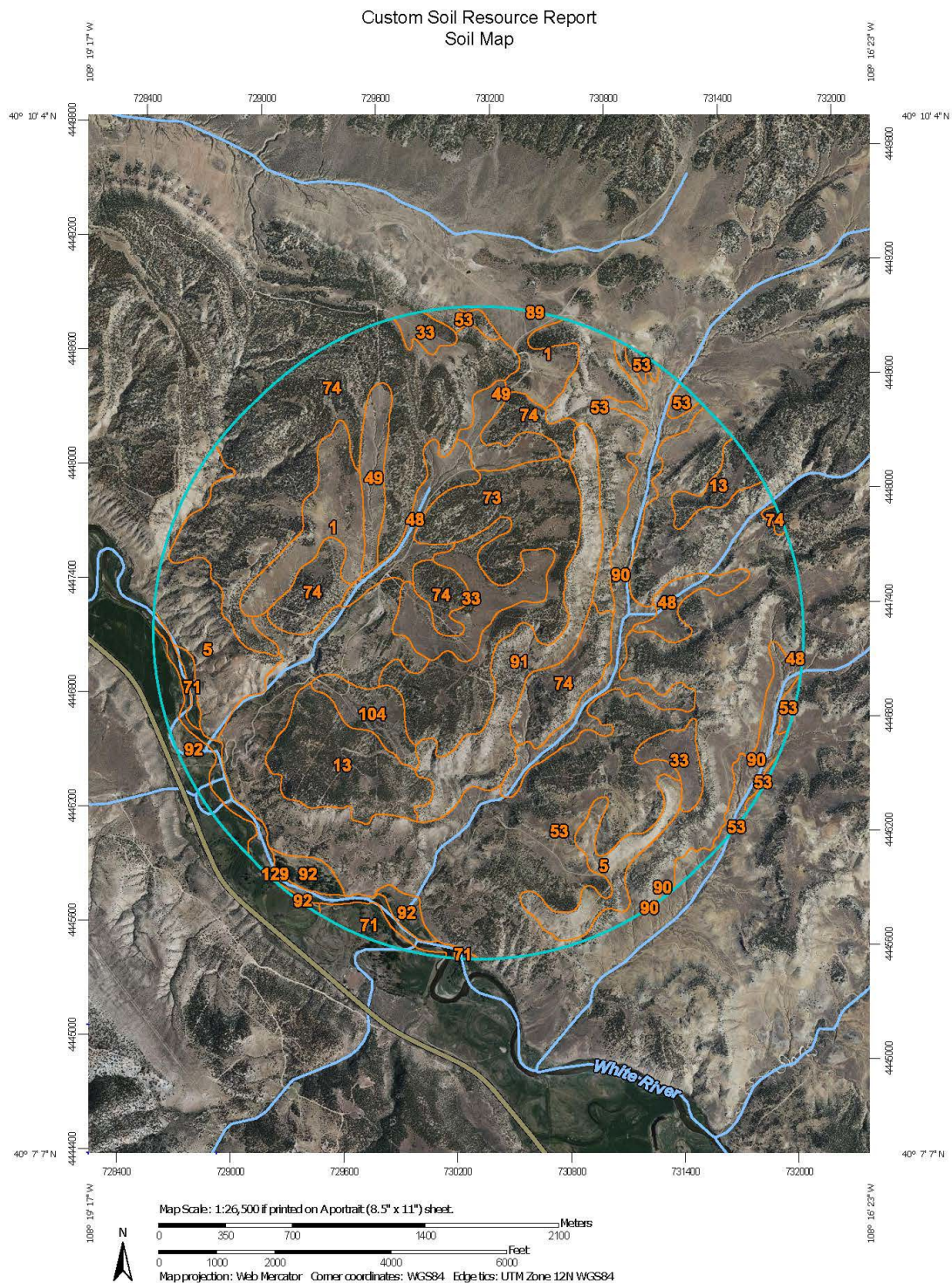
Web App Builder for ArcGIS  
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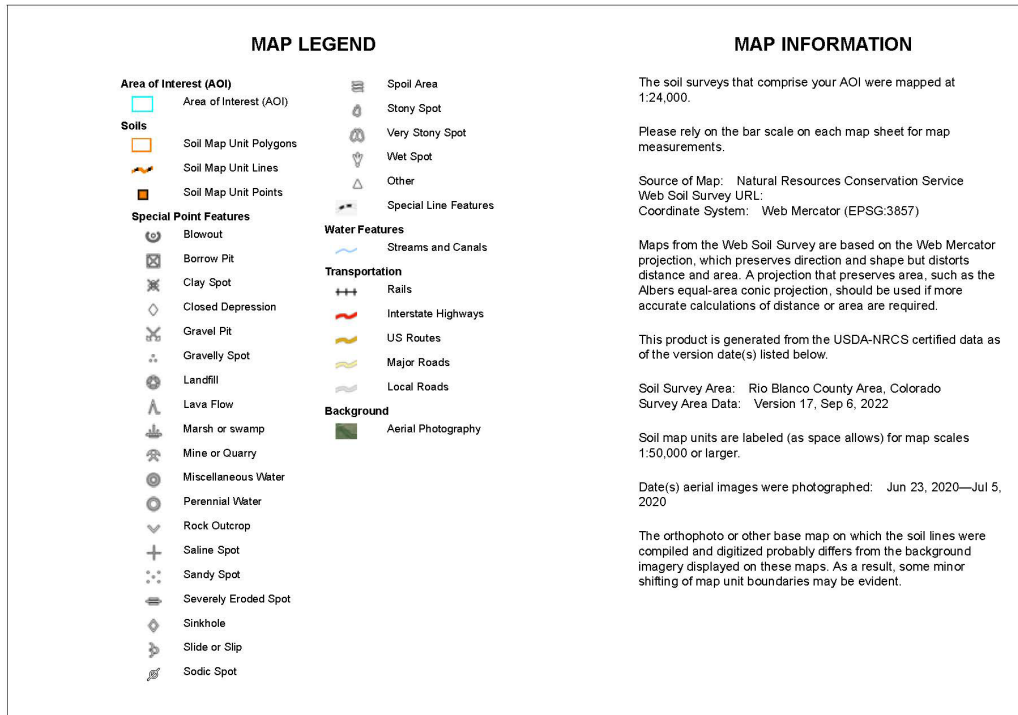
## APPENDIX D – LANDSLIDE MAP





## APPENDIX E – SOILS MAP







## Map Unit Legend

| Map Unit Symbol                    | Map Unit Name   | Acres in AOI   | Percent of AOI |
|------------------------------------|---|----------------|----------------|
| 1                                  | Abor clay loam, 5 to 30 percent slopes                        | 93.8           | 4.2%           |
| 5                                  | Badland   | 129.4          | 5.7%           |
| 13                                 | Bulkley channery silty clay loam, 5 to 30 percent slopes      | 106.1          | 4.7%           |
| 33                                 | Forelle loam, 3 to 8 percent slopes                           | 89.0           | 3.9%           |
| 48                                 | Kobase silty clay loam, moist, 3 to 8 percent slopes          | 56.1           | 2.5%           |
| 49                                 | Kobase silty clay loam, moist, 8 to 15 percent slopes         | 52.5           | 2.3%           |
| 53                                 | Moyerson stony clay loam, 15 to 65 percent slopes             | 812.8          | 36.0%          |
| 71                                 | Redrob loam   | 22.6           | 1.0%           |
| 73                                 | Rentsac channery loam, 5 to 50 percent slopes                 | 160.6          | 7.1%           |
| 74                                 | Rentsac-Moyerson-Rock outcrop complex, 5 to 65 percent slopes | 394.9          | 17.5%          |
| 89                                 | Tisworth fine sandy loam, 0 to 5 percent slopes               | 0.0            | 0.0%           |
| 90                                 | Torrifluvents, gullied  | 123.9          | 5.5%           |
| 91                                 | Torriorthents-Rock outcrop complex, 15 to 90 percent slopes   | 100.9          | 4.5%           |
| 92                                 | Trembles loam, wet  | 55.3           | 2.4%           |
| 104                                | Yamacall loam, 2 to 15 percent slopes                         | 29.3           | 1.3%           |
| 129                                | Water   | 33.5           | 1.5%           |
| <b>Totals for Area of Interest</b> |   | <b>2,260.6</b> | <b>100.0%</b>  |