CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN MINE PROJECT
MALHEUR COUNTY, OREGON

GEOLOGY AND SOILS BASELINE REPORT

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LIST OF ABBREVIATIONS AND ACRONYMS

Atlas	Atlas Precious Metals Inc.
BLM	Bureau of Land Management
Calico	Calico Resources USA Corp.
CO_2	carbon dioxide
DOGAMI	Department of Geology and Mineral Industries
IBC	International Building Code
ICC	International Code Council
IMS	IMS, Inc.
H_2S	hydrogen sulfide
Ma	million years ago
MCE	maximum considered earthquake
MPE	maximum probable earthquake
NMC	Newmont Mining Corporation
NRCS	Natural Resources Conservation Service
OSBGE	Oregon State Board of Geologist Examiners
OSSC	Oregon Structural Specialty Code
PGA	peak ground acceleration
Project	Grassy Mountain Mine Project
RQV	Red Quill Ventures, LLC
USGS	United States Geological Survey
WEG	wind erodibility group

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1 INTRODUCTION

The purpose of this geology and soils baseline report is to characterize the geology and soils in the study area prior to the start of proposed mining operations at the Grassy Mountain Mine Project (Project) near the city of Vale in Malheur County, Oregon. The Oregon Department of Geology and Mineral Industries (DOGAMI) guidelines require local and regional geologic information be collected to provide a characterization of baseline conditions. These conditions include soil, surface and groundwater, geology and potential geologic hazards, seismicity, mineralogy and pre-mining topography. Characterization of these conditions helps to identify potential impacts to the design, construction, operation, and reclamation of proposed mine features and the environment. The geologic information would be used in a number of applications, including, but not limited to: 1) identifying geotechnical conditions; 2) determining foundation stability; 3) use in characterizing hydrogeologic conditions; 4) key input to the geochemical characterization task to identify potential acid-generating rock material and potential sources of heavy metals or other constituents; and 5) input for drafting the Division 37 and potential National Environmental Policy Act-related sections of the respective documents (Oregon Administrative Rule 632-037-0055; Oregon State Board of Geologist Examiners [OSBGE] 2014a; OSBGE 2014b).

A large portion of the text and data used in this report has been taken from the February 2015 *Geology and Soils Baseline Study* prepared for the Project by Red Quill Ventures, LLC (RQV) (RQV 2015). Additional or updated information has been added where necessary to accommodate the current permit area. The additional/updated information includes: 1) expansion/description of the permit area; 2) updates to geology and soils descriptions to accommodate the revised study area; and 3) Contacts and Preparers. Figures have also been included to show the geology and soils in the additional portion of the study area. The February 2015 RQV report is included as Attachment A to this report. The August 2018 *Grassy Mountain Mine Soil Survey, Malheur County, Oregon*, prepared by Cascade Earth Sciences (CES) (CES 2018) is included as Attachment B to this report.

2 RESOURCE STUDY AREA

The Project is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (Figure 1) and consists of two areas: the Mine and Process Area and the Access Road Area (Permit Area) (Figure 2).

The Mine and Process Area is located on three patented lode mining claims and adjacent unpatented lode mining claims that cover an estimated 886 acres. These patented and unpatented lode mining claims are part of a larger land position that includes 442 unpatented mining claims on lands administered by the Bureau of Land Management (BLM) (Figure 2). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

Figure 1: Location Map

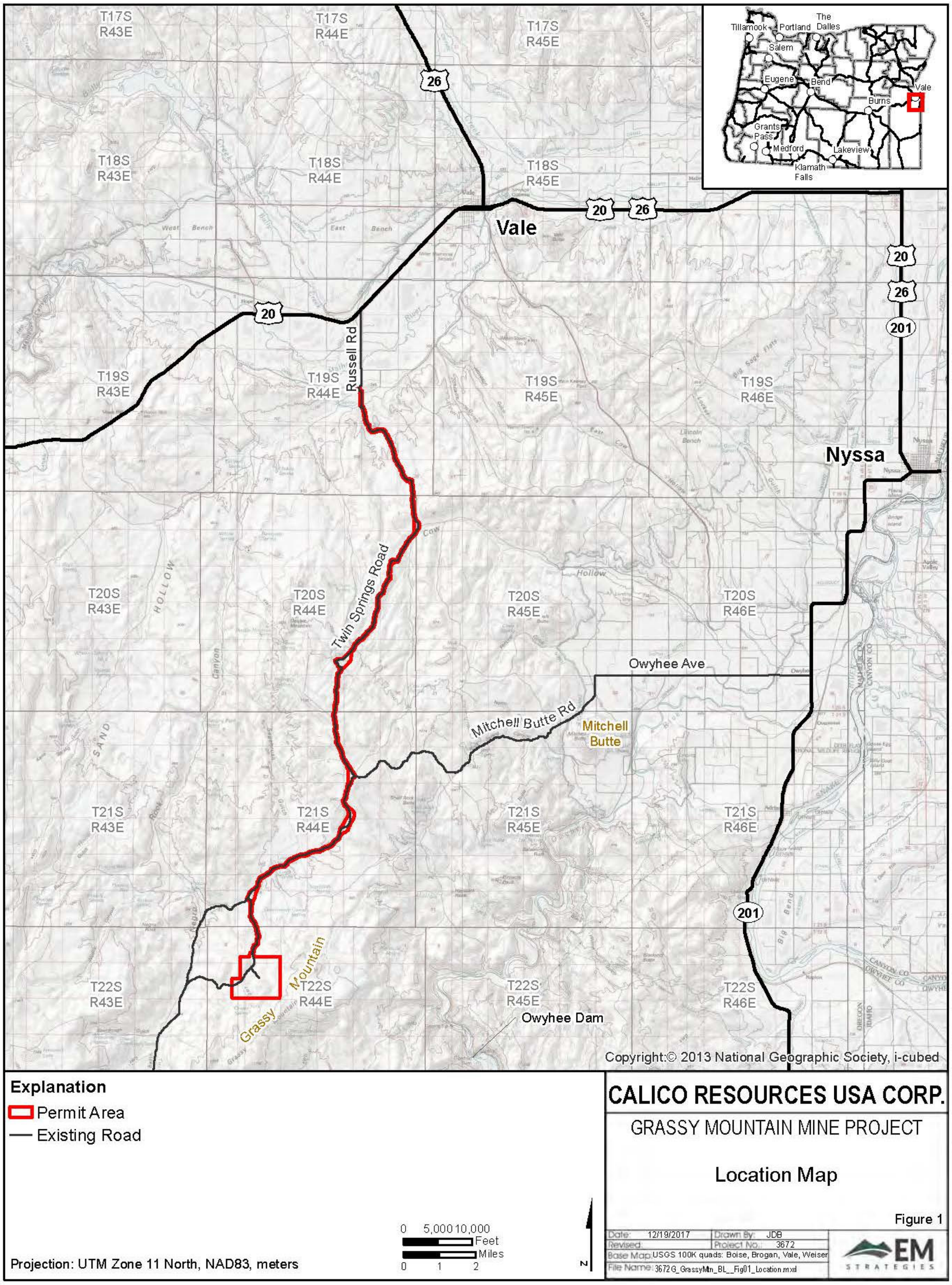
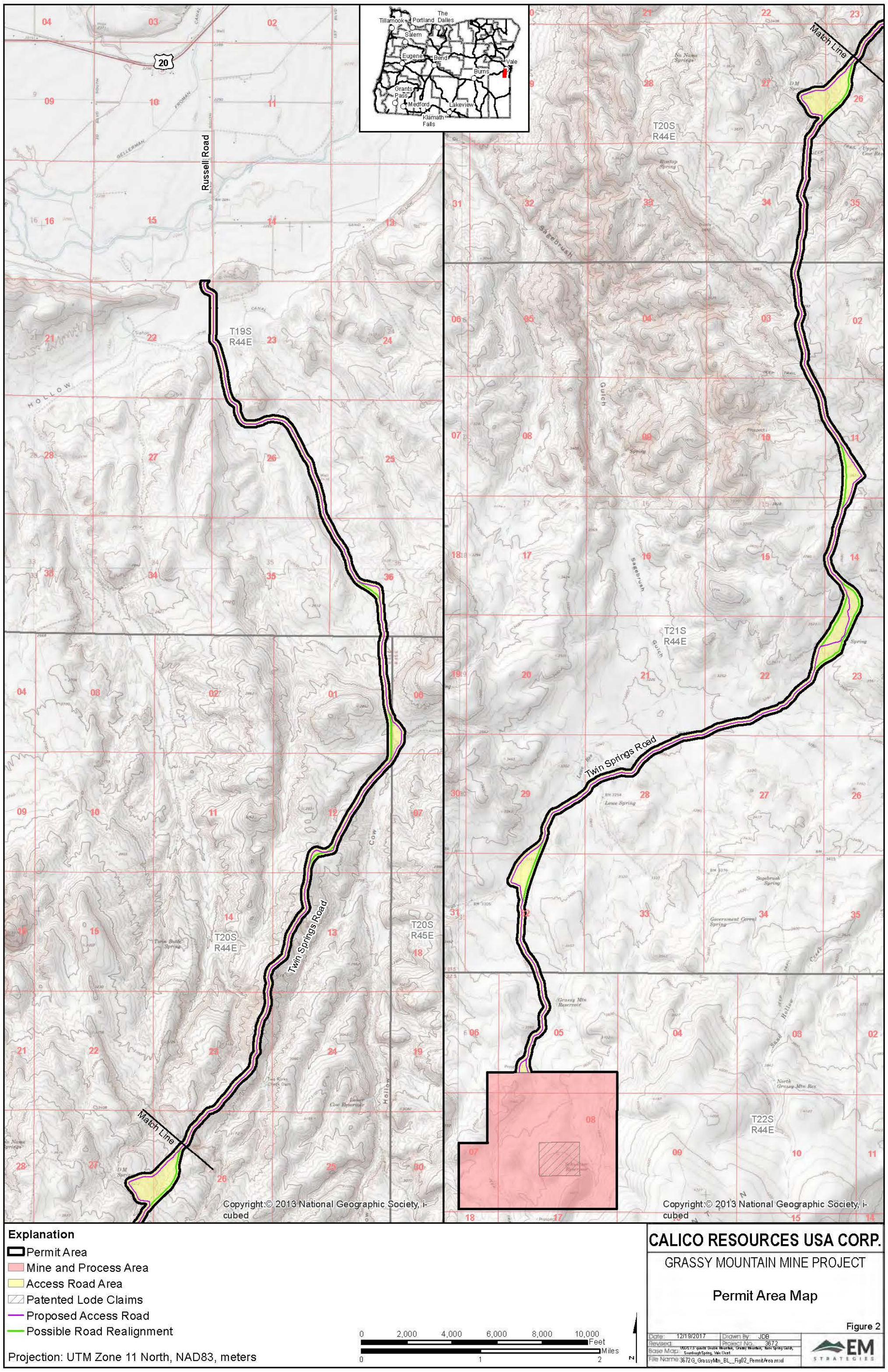


Figure 2: Permit Area Map



The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Figure 2). A portion of the Access Road Area is a Malheur County Road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline) to accommodate possible minor widening or re-routing, and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 feet on the Permit Area Map (Figure 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be 40 feet wide, which includes a 24-foot wide road travel width (12 feet on either side of the road centerline), four-foot wide shoulders on each side of the road, minimum one-foot wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.

The Geology Study Area includes the entire Access Road Area and a 4,000-meter buffer around the Mine and Process Area (Figure 3). The Soils Study Area includes the entire Permit Area (Figure 4).

3 REGULATORY FRAMEWORK

3.1 Bureau of Land Management

Under 43 Code Federal Regulations Part 3800, BLM has defined its final rule regarding *Mining Claims under the General Mining Laws: Surface Management* to include performance standards that govern the operation and reclamation of surface mining projects. Section 3809.420(6)(b)(3) stipulates that the operator must initiate reclamation at the earliest feasible time, and that reclamation shall include, but not be limited to, the following: “saving of topsoil for final application after reshaping of disturbed areas have been completed; measures to control erosion, landslides, and water runoff; measures to isolate, remove, or control toxic materials; [and] reshaping the area disturbed, application of the topsoil, and revegetation of disturbed areas, where reasonably practicable...” When reclamation has been completed, the authorized officer shall be notified such that an inspection of the reclaimed areas can be made.

4 STUDY METHODOLOGY

4.1 Literature Review

Most of the baseline characterization in this report has been taken from the February 2015 RQV report. Additional or updated information has been added where necessary to accommodate for the revision in the Permit Area and Geology and Soils study areas. References used for this report are included in Section 6, Bibliography.

Figure 3: Geology Study Area

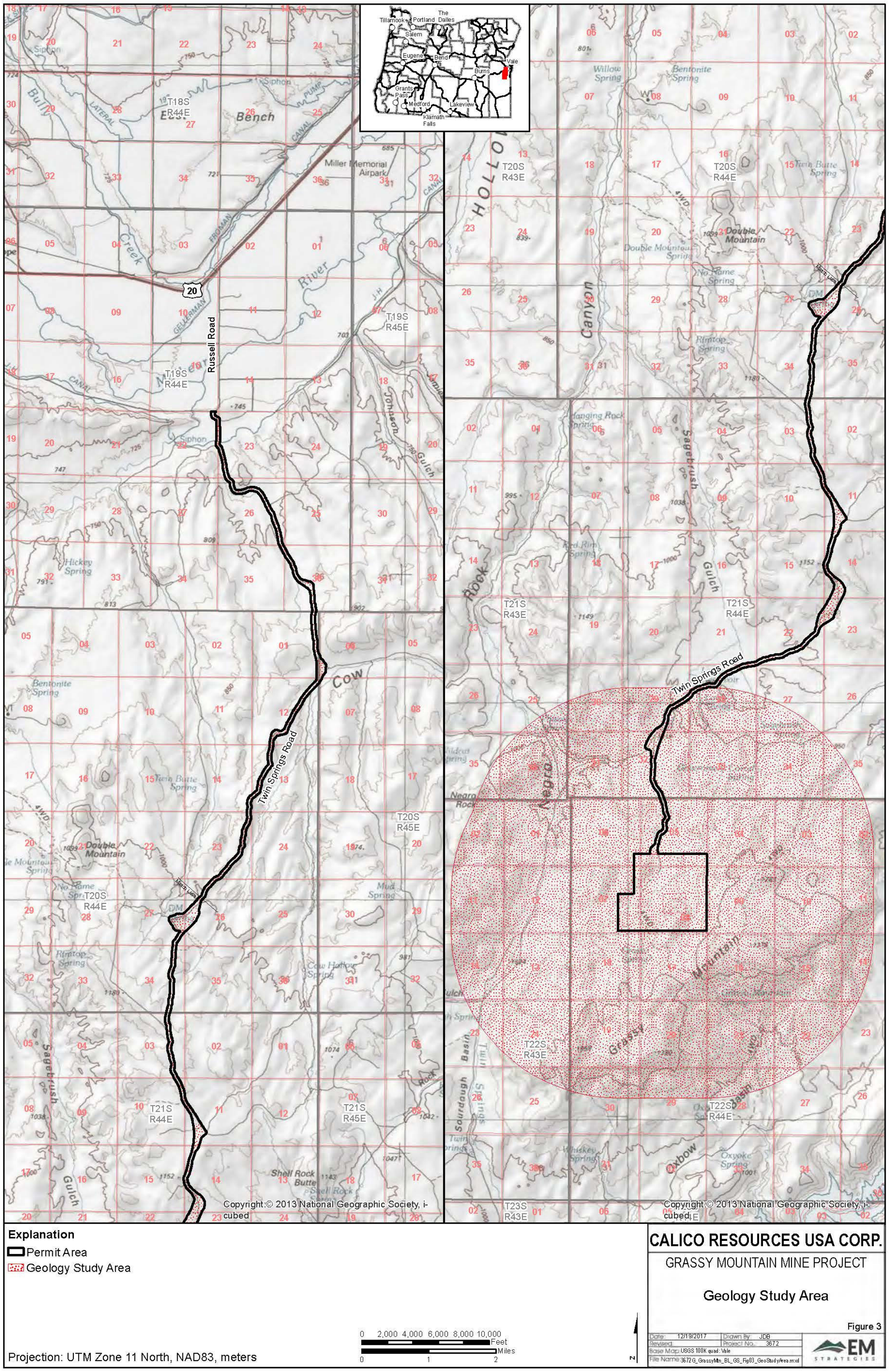
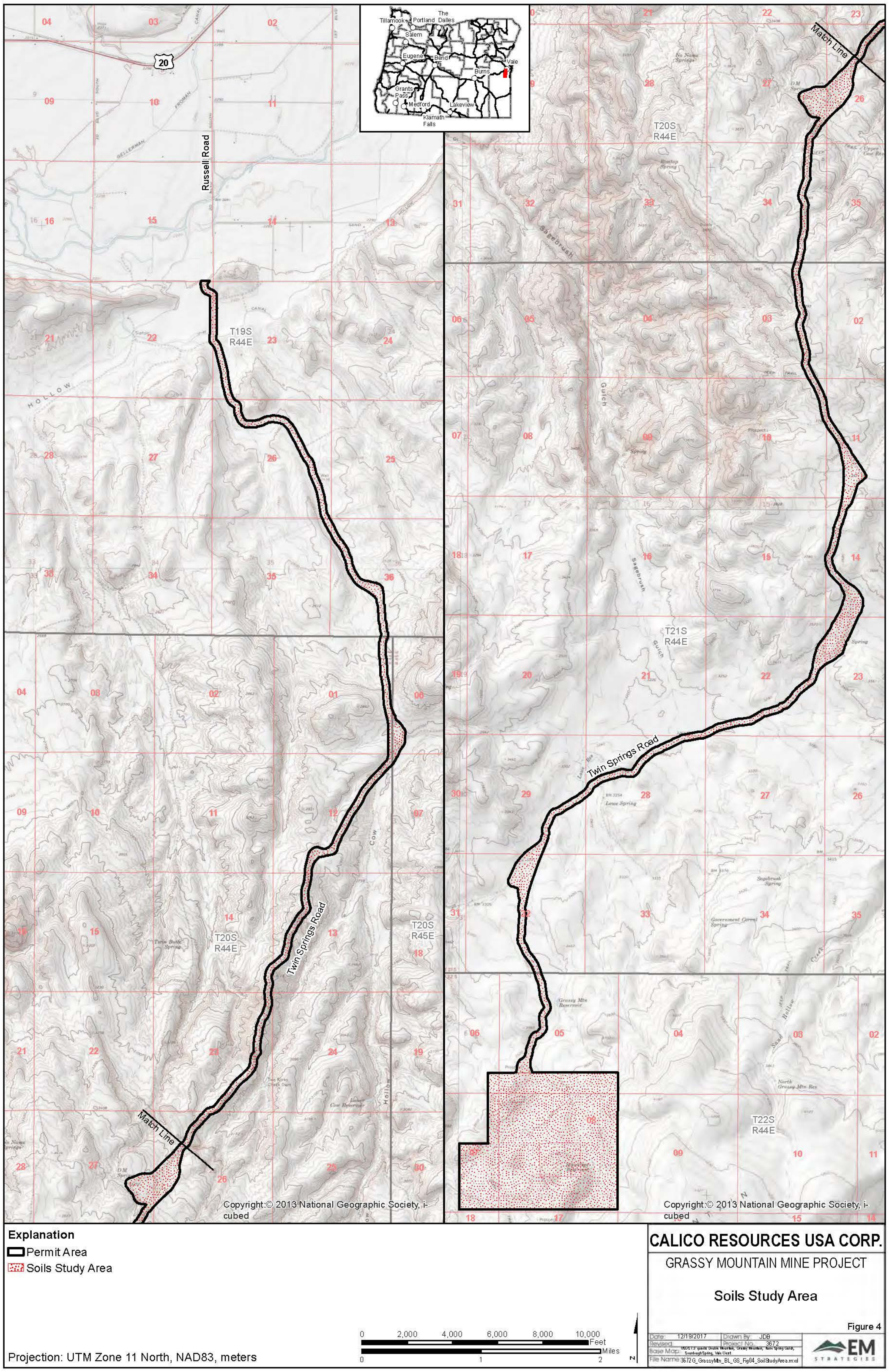


Figure 4: Soils Study Area



4.2 Field Investigations

4.2.1 Geology

Sufficient historic information exists to characterize the baseline topography, soils, geology, geologic hazards and seismic conditions for the study areas. However, Calico Resources USA Corp. (Calico) conducted additional fieldwork and developed geologic mapping from 2011 to 2014. Existing geologic maps were used as the basis of the work and were supplemented with additional field work and field reconnaissance. No additional field work has been conducted in the revised study area.

4.2.2 Soils

Calico developed soil mapping mainly from two historic reports, including one in 1989 by IMS Inc. for Atlas Precious Metals Inc. (Atlas), then a second survey by IMS Inc. in 1991 for Newmont Grassy Mountain Corporation. Sixteen soil samples were collected for fertility and geochemical analysis in August 2014; however, only 12 of those samples are within the Soils Study Area and are described in this report. The soil samples were collected for analyses to determine adequacy for reclamation as well as geochemical content. The soil types were chosen based on soil classifications mapped by the Natural Resources Conservation Service (NRCS) as well as the 1991 and 1993 soil surveys performed by IMS, Inc. and Newmont Mining Corporation (NMC), respectively, and June 2018 soil surveys conducted by CES. Figure 5 shows the 12 soil sample locations from the August 2014 surveys and the 22 soil sample locations from the June 2018 surveys.

One set of the August 2014 samples was sent to Western Laboratories in Parma, Idaho, for reclamation suitability analysis. The second set of samples was sent to ALS Chemex in Reno, Nevada for trace element geochemical analysis. The soil samples were tested for the following trace metals: mercury; arsenic; antimony; tungsten; tellurium; thallium; copper; molybdenum; lead; zinc; cadmium; selenium; and bismuth. The June 2018 samples were also sent to Western Laboratories in Parma, Idaho, for reclamation suitability analysis.

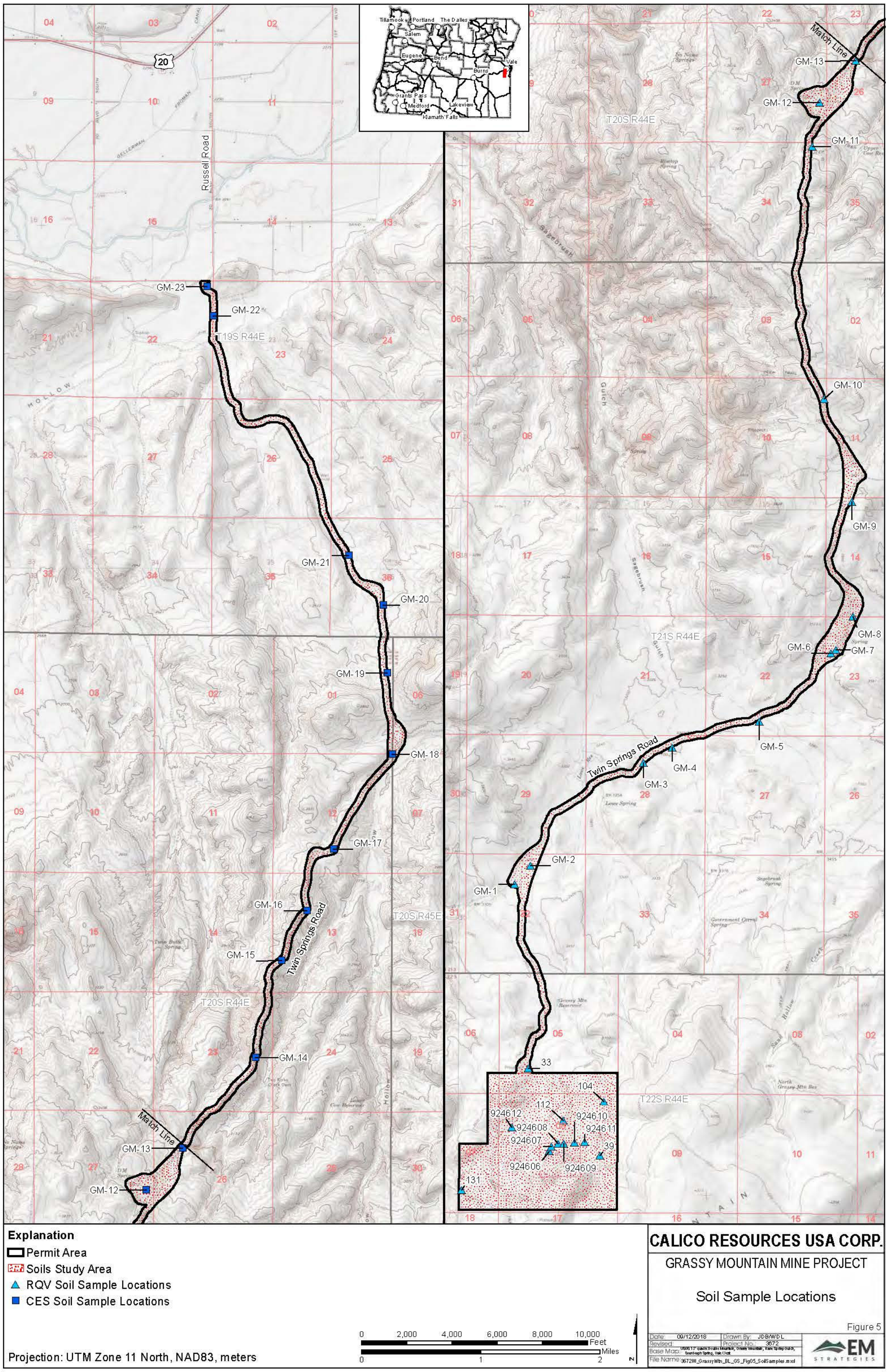
Laboratory test work was conducted using standard methods routinely used in the hard rock mining industry. Rock and soil trace element analysis was determined using United States Environmental Protection Agency methods 3050 and 6010 at detection limits below regulatory standards. Calico coordinated with the laboratories to ensure the correct methods and sample amounts. Soil samples that were collected had a volume of approximately one gallon or five kilograms.

5 BASELINE CHARACTERIZATION

5.1 Introduction

This geology and soils baseline report has primarily been prepared from existing information, which was developed as part of the previous Atlas and NMC baseline data collection programs and incorporated into the February 2015 report prepared by RQV, as well as surveys conducted in June 2018 by CES. This report also includes additional or updated information where necessary to accommodate for the revision in the Permit Area and Geology and Soils study areas. This report presents the following information.

Figure 5: Soil Sample Locations



- Existing geologic environment and geotechnical conditions (descriptions and mapping of the area around the Geology Study Area, extended to 4,000 meters around the Mine and Process Area and the entire Access Road Area). Regional geology features such as regional structures and faults are shown at an appropriate scale to include those features affecting the Geology Study Area.

    - Topographic setting
    - Regional geology
    - Study area geology
    - Structural geology
    - Seismic conditions (fault zones and probabilistic or deterministic ground motion estimates)
    - Slope stability
- Potential geologic hazards (description and mapping)
    - Earthquake failures
    - Unsuitable soil
    - Slope features
    - Landslide areas
    - Soil erosion
    - Volcanic eruptions
    - Erionite deposits (if present)
- Existing geology environment
    - Soil types in Soils Study Area
    - Soil profile thickness
    - Estimated effects of the Project proposal on the local geologic environment
    - Potential monitoring and mitigation measures
    - Residual effects
    - Reclamation/closure considerations

5.2 Existing Environment – Geology

5.2.1 Topographic Setting

The Project is in the semi-arid plateau region of eastern Oregon. The local landscape is typical of a high mountain desert environment and rangeland. The terrain is gentle to moderate, with elevations ranging from approximately 2,320 to 4,040 feet above mean sea level.

5.2.2 Regional Geology

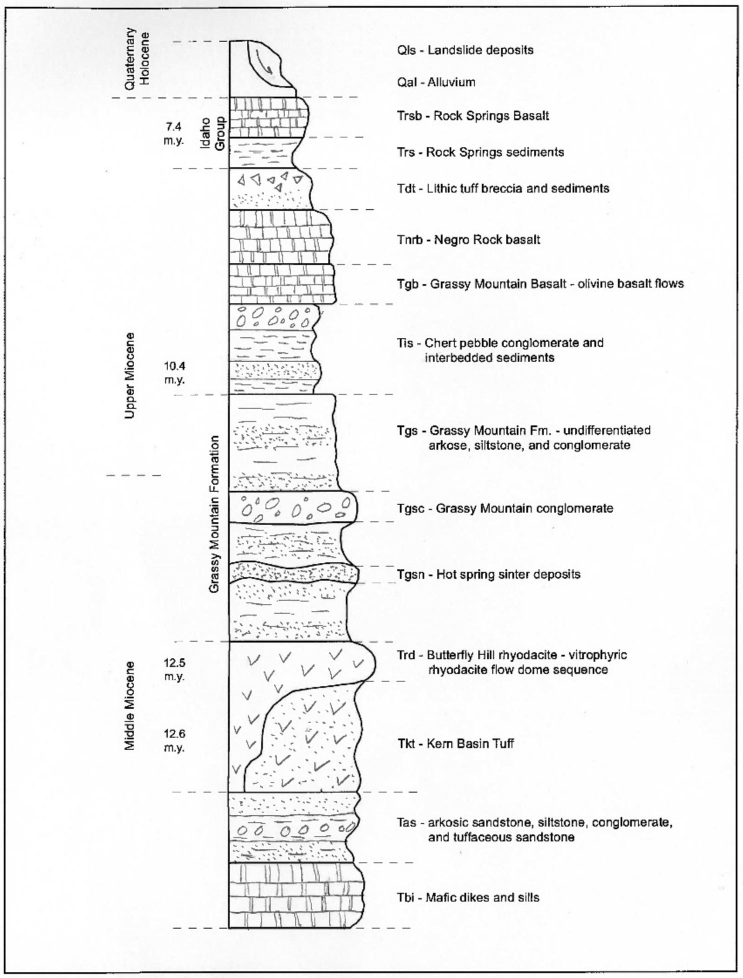
Grassy Mountain is the largest of 12 recognized epithermal hot spring precious metal deposits of the Lake Owyhee volcanic field. The Lake Owyhee volcanic field occurs at the intersection of three tectonic provinces: the buried cratonic margin; the northern basin and range; and the Snake River Plain. During the mid-Miocene, large volume, peralkaline, caldera volcanism occurred in response to large, silicic magma chambers emplaced in the shallow crust throughout the region. The volcanic field includes several caldera-sourced ash-flow sheets and rhyolite tuff cones that were deposited from 15.5 to 15 million years ago (Ma).

At about 15 Ma, subsidence of the Lake Owyhee volcanic field triggered a change in volcanic eruption style, resulting in small volume, basalt-rhyolite deposits of limited extent. Volcanism during the mid to late Miocene is evidenced by small volume, metaluminous, high-silica rhyolite domes and flows, and small volume basalt flows and mafic vent complexes in north- and northwest-trending basin and range-type fracture zones and ring structures related to resurgent calderas. Regional extension and subsidence facilitated the formation of through-going fluvial systems and extensive lacustrine basins. Large volumes of fluvial sediments, sourced from the exhumed Idaho Batholith to the southeast were deposited in conjunction with volcanism and hot spring activity during the waning stages of volcanic field development. The resulting regional stratigraphic section is a thick sequence of mid-Miocene volcanic rocks and coeval-to-Pliocene age non-marine lacustrine, volcaniclastic, and fluvial sedimentary rocks.

5.2.3 Study Area Geology

5.2.3.1 Geology in the Vicinity of the Mine and Process Area

A representative stratigraphic column of the geologic units near the Mine and Process Area is included as Figure 6.



Source: Modified after RQV 2015

Figure 6: Stratigraphic Column of the Mine and Process Area Geology

Table 1 describes the stratigraphic column in more detail. The table describes the geologic units mapped near the Mine and Process Area, the unit's age and lithologic description, and provides the map symbols used to cross reference with the geologic units shown on Figure 7.

Table 1: Stratigraphic Column Descriptions

Map Symbol	Rock Unit	Age (millions of years before present in parentheses)	Description
Qal	Alluvium	Pleistocene and Holocene	Unconsolidated and generally poorly sorted deposits or gravel, sand and silt accumulated along modern streams, drainages and floodplains
Qls	Landslide deposits	Pleistocene and Holocene	Landslide and slump deposits of unconsolidated and unstratified soil and angular rock fragments formed as the result of bedrock failure. Includes large slump and debris flows composed of blocks of capping basalt on the flanks of Grassy Mountain and Sourdough Basin
Trsb	Rock Spring Basalt	Upper Miocene (7.4 Ma)	Snake River type olivine basalt flows and interbedded deposits of tuffaceous siltstone and sandstone. Unit is made up of approximately equal amounts of volcanic flows and interflow sedimentary rocks. Trsb flows range from two to 20 feet thick. Entire unit of basalt with sedimentary interbeds reaches maximum thickness of 400 feet east of Shell Rock Butte
Trs	Rock Spring Basalt – tuffaceous siltstone and sandstone	Upper Miocene	Sandstone and tuffaceous siltstone interbedded with unit Trsb are mapped separately where well exposed. Upper beds are mainly tuffaceous siltstones and include some bentonitic clays
Tdt	Lithic tuff breccias	Upper Miocene	Mafic clast lithic tuff, airfall tuffs and overlying reworked tuffaceous silt and sandstones. Breccia clasts include yellow inflated pumice and basaltic scoria. Distinguished from Tkt by absence of banded rhyolite clasts and absence of biotite and hornblende phenocrysts that are present in Tkt. Unit is approximately 80 feet thick in western portion of map. Unconformably overlies Tis and is conformably overlain by Trsb
Tnrb	Negro Rock Basalt	Upper Miocene	Dark brownish gray, locally flow banded basalt. Dikes, plugs and sills are common. Typically, higher Fe/Mg ratios and much lower chromium content than Tgb or Trsb

Map Symbol	Rock Unit	Age (millions of years before present in parentheses)	Description
Tgb	Grassy Mountain Basalt	Upper Miocene (10.4 Ma)	Flow on flow sequence of olivine basalts capping the summit of Grassy Mountain; includes somewhat younger intra-canyon flows forming benches on the south side of Grassy Mountain. Locally includes overlying stream gravels containing chert pebbles and large rounded basalt clasts. Maximum thickness of 200 feet; individual flows up to 40 feet thick
Tis	Interbedded conglomerate and siltstone	Upper Miocene	Chert pebble conglomerate and interbedded diatomaceous siltstone. Mainly tuffaceous and arkosic sandstone and siltstone with interbedded conglomerate. Locally becomes finer grained upward into pale, white and yellow claystones and interbedded diatomaceous siltstones. Presumed base of Tis near Grassy Mountain Reservoir contains black chert-pebble and granite-clast conglomerate. Erosional contact with underlying unit Tgs marked by rounded boulders of olivine basalt unit Tgb. Unit is approximately 400 feet thick in mapped area
Tgs	Grassy Mountain Formation – undifferentiated	Upper and Middle Miocene	Arkosic sandstones and channel-fill granite clast conglomerates. Mainly white to tan arkosic sandstones. Includes Tgsc, channel fill conglomerates with abundant granite and rhyolite clasts in the upper part of the unit. Uppermost conglomerates locally contain rounded obsidian clasts and rare black chert clasts. Unit Tgs generally becomes finer grained upward and includes white bentonitic clays near the top of the section which, where overlain by unit Tgb often generated large landslide masses. Hot spring activity contemporaneous with the deposition of the arkoses is indicated by sinter beds Tgsn, and sinter boulders containing silicified reeds and wood near the Grassy mountain gold deposit. Unit Tgs is the host for both the Grassy Mountain and Crabgrass gold deposits
Tgsc	Grassy Mountain Formation – Conglomerate		Conglomerates occurring in the upper portion of Tgs – mapped individually where possible
Tgsn	Grassy Mountain Formation – Sinter		Hot spring sinter deposits within Tgs – mapped individually where possible
Trd	Butterfly Hill Rhyodacite	Middle Miocene (12.5 Ma)	Ryodacite flow dome complex

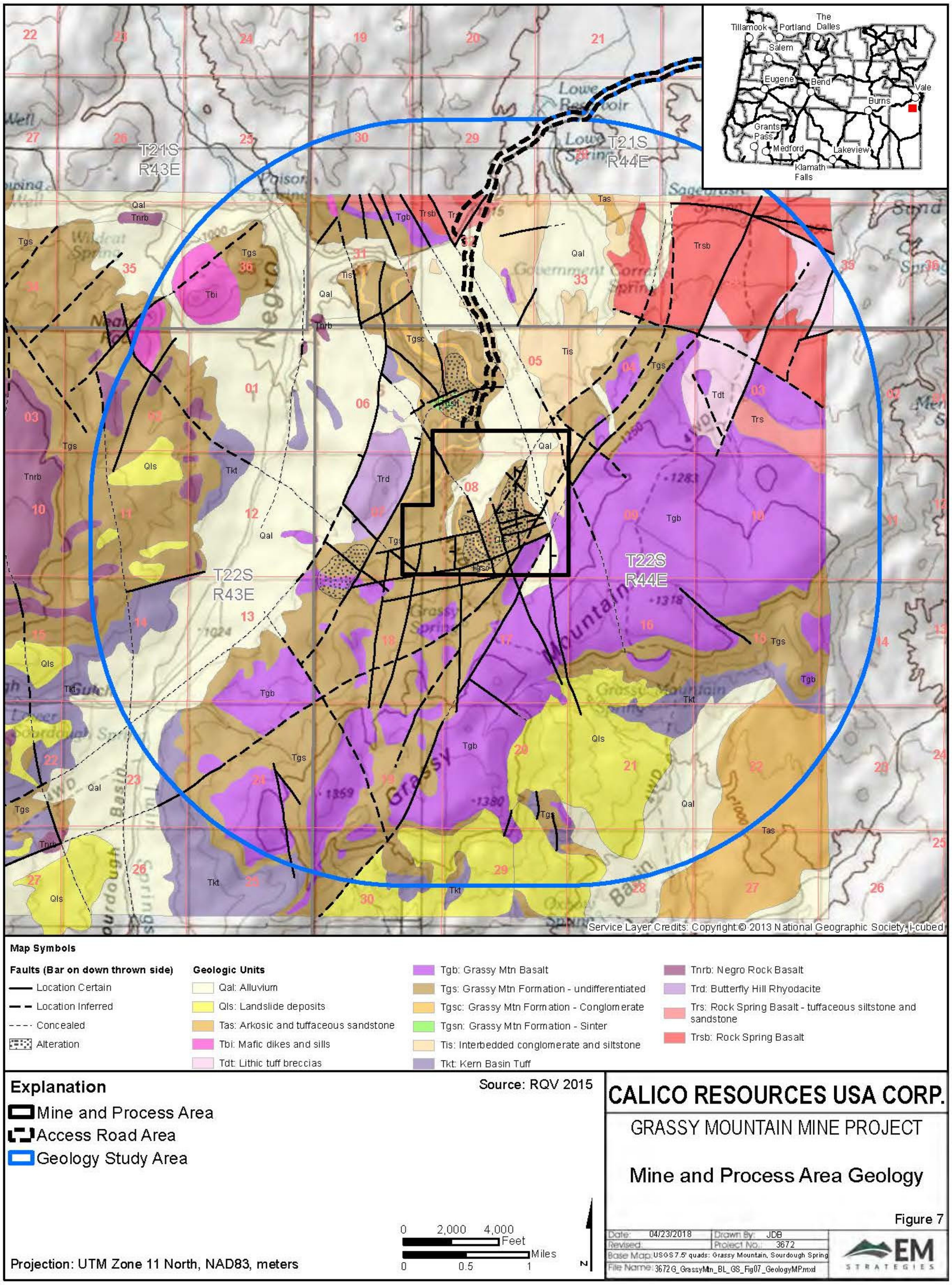
Map Symbol	Rock Unit	Age (millions of years before present in parentheses)	Description
Tkt	Kern Basin Tuff	Middle Miocene	Mainly non-welded fine-grained, white to pale-yellow lithic tuff contain basalt, banded rhyolite, and white pumice clasts with biotite, hornblende, quartz and plagioclase crystals. Includes thinly bedded airfall tuffs at the base of the unit and overlying thin lenses of interbedded tuffaceous and arkosic sandstone and granite-clast conglomerate. Locally includes chaotically bedded airfall tuff with slump structures and massive surge deposits of matrix-supported lithic tuff composed of rhyolite and pumice clasts. Pumice clasts in the lithic tuff deposits increase in abundance and size toward the top of the unit. Uncomformably overlies unit Tas
Tas	Arkosic and tuffaceous sandstone	Middle Miocene	Arkosic and tuffaceous sandstone, siltstone and conglomerate. Mainly white to tan arkosic sandstone with minor amounts of granite-clast conglomerate. Includes 20 feet thick massive beds of coarse matrix supported, granite-clast conglomerate near the exposed base of the unit
Tbi	Mafic dikes and sills	Middle Miocene	Mafic dikes and sills. Younger sequence includes irregularly shaped sills and dikes that intrude units Tas, Tkt and Tgs along both flanks of Grassy Mountain. Dikes and sills are olivine basalts believed to be feeders to units Tbg and Trsb. Dike cut through lowermost flows of unit Trsb north of Grassy Mountain near Willow Spring

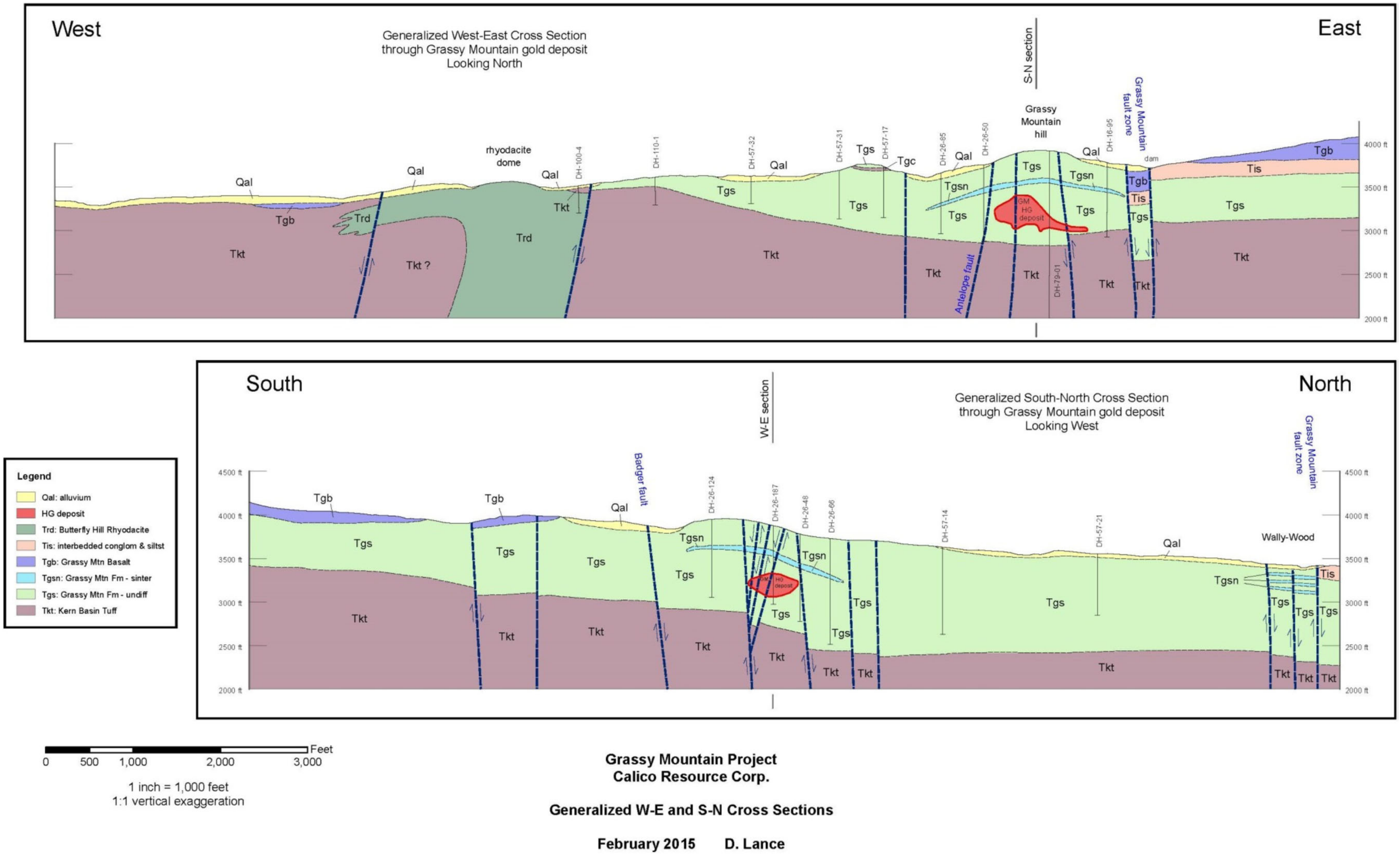
Source: RQV 2015; DOGAMI 2009

Bedrock outcrops near the Mine and Process Area are typically composed of olivine-rich basalt and siltstones, sandstones, and conglomerates of the late Miocene Grassy Mountain Formation (Tgb, Tgsn, and Tgs). These rocks are locally covered with relatively thin, unconsolidated alluvial and colluvial deposits (Qal). Erosion-resistant basalts cap local topographic highs. Arkosic sandstones have been encountered at the surface and at depth but have not been correlated across the vicinity of the Mine and Process Area, in part due to lateral discontinuity associated with sedimentary facies changes and structural offset. Figure 7 focuses on the geology of and near the Mine and Process Area, including fault displacement and numerous strikes and dips, and foliations. The areas within the Mine and Process Area on Figure 7 which do not show geology are included on the Access Road Area Geology map later in this report on Figure 12.

Figure 8 shows two generalized geologic cross sections through the Mine and Process area; west to east and south to north.

Figure 7: Mine and Process Area Geology





Source: RQV 2015

Figure 8: Geologic Cross Sections

Surface and drill-defined stratigraphy near the Mine and Process Area reveals complex facies that were produced during the waning stages of deposition of the Lake Owyhee volcanic field.

The basal unit below the Grassy Mountain Formation is the Kern Basin Tuff (Tkt); a nonwelded, pumiceous, crystal tuff that displays cross beds and local surge structures. Clast size, thickness of individual ash units, and bedding structures suggest a source in the Grassy Mountain area. The Kern Basin Tuff ranges in thickness from 300 feet on the south bluffs of Grassy Mountain, to 1,500 feet in a drill hole beneath the Mine and Process Area.

The Kern Basin Tuff is overlain by a series of fluvial sediments. Most of the sedimentary units in and near the Mine and Process Area are silicified and strongly indurated. These sedimentary units include granitic clast conglomerate, arkosic sandstone, fine grained sandstone, siltstone, and siltstone/mudstone. The sedimentary facies of the Grassy Mountain Formation range from 300 to over 1,000 feet thick and provide the host rocks of the Grassy Mountain mineral resource.

Several siliceous terraces are interbedded with the silicified sediments of the Grassy Mountain Formation. Terrace construction was apparently episodic and intermittently inundated by fluvial sediments, resulting in an interbedded sequence of siltstone, sandstone, conglomerate, and sinter terrace deposits. Load casts, flame textures, convolute lamination and other soft-sediment deformation textures are common in both the sinter beds and sedimentary facies. The amount and size of the sinter clasts in the sedimentary rocks reflect relative proximity to a terrace. Proximal deposits are angular, inhomogeneous, clast-supported breccias of sandstone, siltstone, and sinter with indistinct clast boundaries in a sulfidic mud-textured matrix.

5.2.3.1.1 Ore Deposit Geology, Mineralization and Alteration

The Grassy Mountain gold-silver deposit is located beneath a prominent, 150-foot high, silicified and iron-stained hill. Bedding is horizontal at the hilltop, and dips at ten to 25 degrees to the north-northeast on the northern and eastern flanks of the hill. The bedding dip steepens to 30 to 40 degrees on the west side of the hill due to drag folding in the footwall of the 20 degrees west of north (N20°W), striking Antelope Fault. A small area on the southwest slope of the deposit hill is covered by silicified arkose landslide debris.

The Grassy Mountain gold-silver deposit is located within an interpreted horst block that has been raised 50 to 200 feet in a region of complex block faulting and rotation. Faults at the Grassy Mountain deposit are mainly post-mineral 30 degrees west of north (N30°W) to ten degrees east of north (N10°E), striking normal faults developed during basin and range extension. On the northeast side of the deposit, these faults progressively downdrop mineralization beneath post-mineral cover. These offsets are suggested by interpreted offsets of a prominent white sinter bed in drill holes, as well as drill intersections with fault gouge.

The surface expression of the Grassy Mountain gold-silver system is indicated by weak to moderately strong silicification and iron staining with scattered one-eighth inch to one inch wide creamy to light gray chalcedonic veinlets. Approximate dimensions of the Grassy Mountain deposit at depth are 1,600 feet long by 1,000 feet wide by 600 feet thick. The deposit has a general 70 degrees east of north (N70°E) elongation and an approximate 15-degree bedding plane dip in a northerly direction due to faulting and associated fault block rotation. There is an envelope of lower grade mineralization at depths of 200 to 800 feet that contains a higher-grade zone of mineralization between 500 and 750 feet below the surface. The well-defined base of higher grade mineralization from approximately 700 to 750 feet in depth suggests a strong pressure-temperature control on gold deposition. This pressure-temperature control likely indicates a boiling horizon in the hydrothermal system that acted as a controlling mechanism on gold deposition.

Boiling horizons are common in shallow, epithermal-type hydrothermal systems and are identified by variable liquid-to-vapor ratios in fluid inclusions, relict bladed or boxwork textures in veins where calcite was precipitated and later replaced by quartz, and by hydrothermal breccia. They occur where over-pressuring in the hydrothermal system caused hydrofracturing of the rocks. At the Grassy Mountain deposit, the fractures create a stockwork (irregularly distributed veinlets) pattern generally found below the sinter, though some vein extensions may extend to the surface. The stockwork is surrounded by silicified sediments. Mineralized quartz-adularia stockwork and vein types include single, colloform banded, brecciated, and calcite-pseudomorphed veins. Visible gold has been found within the stockwork portions of the boiling horizon. The gold mostly occurs as electrum along the fracture margins or within microscopic voids. The average silver to gold ratio at Grassy Mountain is 2.5:1.

Silicification in the form of sinters and disseminated quartz is a prominent alteration type at Grassy Mountain and is largely controlled by hot-spring vents. Silicification occurs both pervasively as silica flooding, and as cross-cutting veins and stockworks. The silicified envelope has plan dimensions up to 3,000 feet (north-south) by 2,500 feet (east-west). Silicification is surrounded by widespread, barren, clay-rich (20- to 40-percent montmorillonite), tuffaceous siltstone and arkose with minor disseminated pyrite. Many of the sinters occur as sheets instead of mounds, which suggest that they are related to vents along faults rather than point sources.

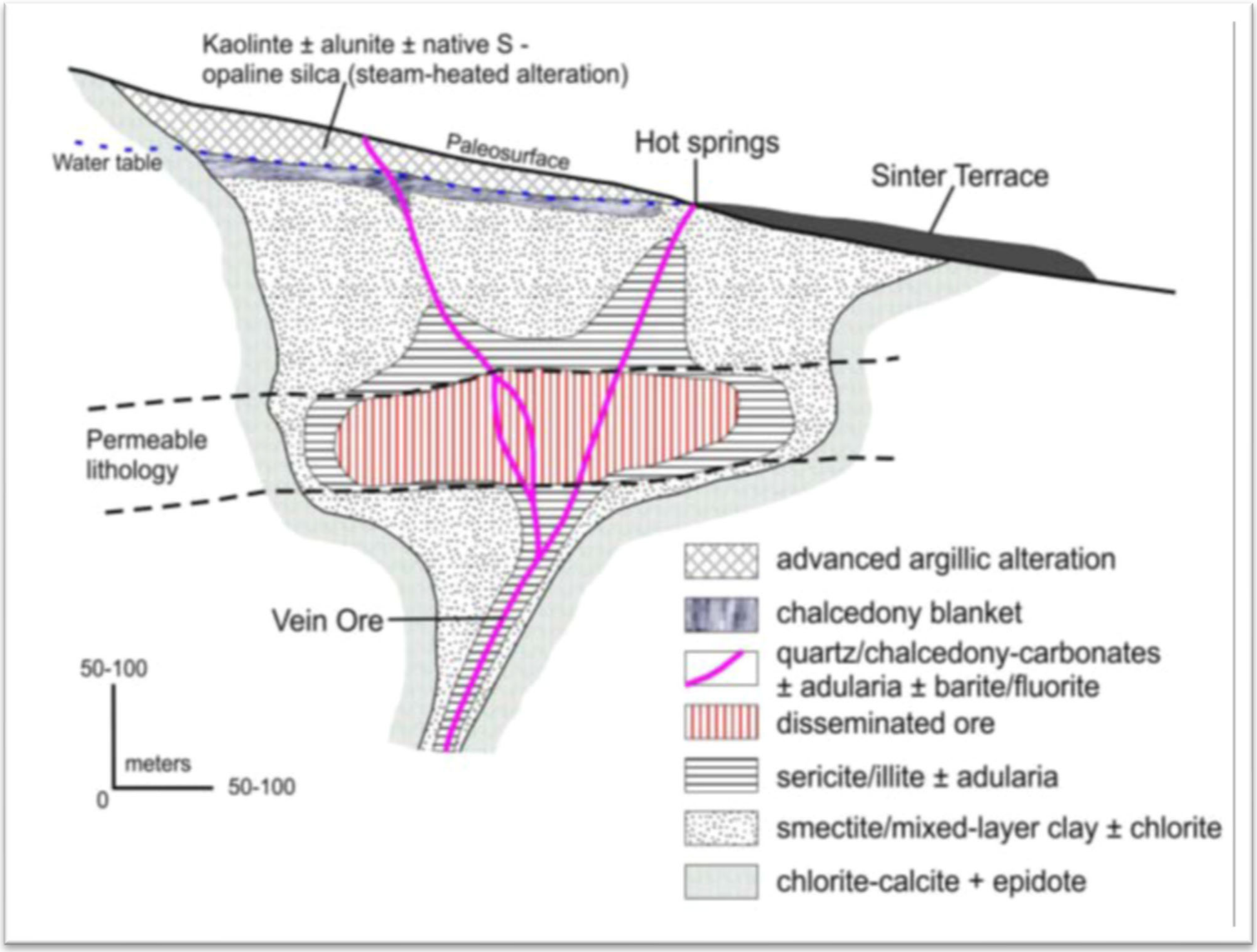
Potassic alteration occurs as adularia flooding with destruction of biotite. Orthoclase is unaffected by potassic alteration, and plagioclase is replaced by adularia. The adularia is extremely fine-grained and is identified microscopically or by cobaltinitrite staining. Sulfate phases identified by x-ray diffraction include jarosite and alunite in several mineralized samples.

The youngest event genetically linked to the hydrothermal system includes the rubble zones of clay matrix breccia, believed to represent a period of late boiling along pre-existing conduits. Since these breccias were formed along mineralized faults they remobilized and rotated veined arkose and siltstone. These clast-supported breccias contain sub-rounded to sub-angular sand to boulder-sized clasts of silicified arkose and siltstone in a jarosite-sericite clay matrix.

Mineralization of the Grassy Mountain deposit includes: low grade gold associated with hot springs silicification; high grade gold associated with multi-stage quartz-adularia-gold-silver veins and stockworks; and late remobilization within sub-vertical rubble zones defined by clay matrix breccias. The deposit is characterized by stacked sinter terraces capping acid-leached sediments and multiple generations of quartz veins, which suggest repeated eruption, brecciation, breeching, and sealing of the hydrothermal system.

Quartz veins greater than three to four inches wide have not been found at Grassy Mountain. Stockwork quartz and quartz veinlets (quartz less than three inches wide) are the most common manifestation of quartz within the deposit. These veinlets are discontinuous and cannot be traced from drill hole to drill hole in the subsurface. Where exposed in surface outcrops, these quartz veinlets are irregular in nature. Further, they can only be traced for maximum distances of several feet. A consistent orientation of the quartz veinlets is difficult to determine from existing drill hole information or from surface outcrops.

Ore minerals include: native gold (50 to 600 microns), electrum, and minor pyrite (up to 80 microns). Gangue minerals include quartz, calcite, chlorite, epidote, orthoclase, plagioclase, illite, sericite, chalcedony, montmorillonite, goethite, and jarosite. A conceptual schematic of the Grassy Mountain geologic and mineralization model is depicted in Figure 9**.**



Source: RQV 2015

Figure 9: Geologic and Mineralization Model

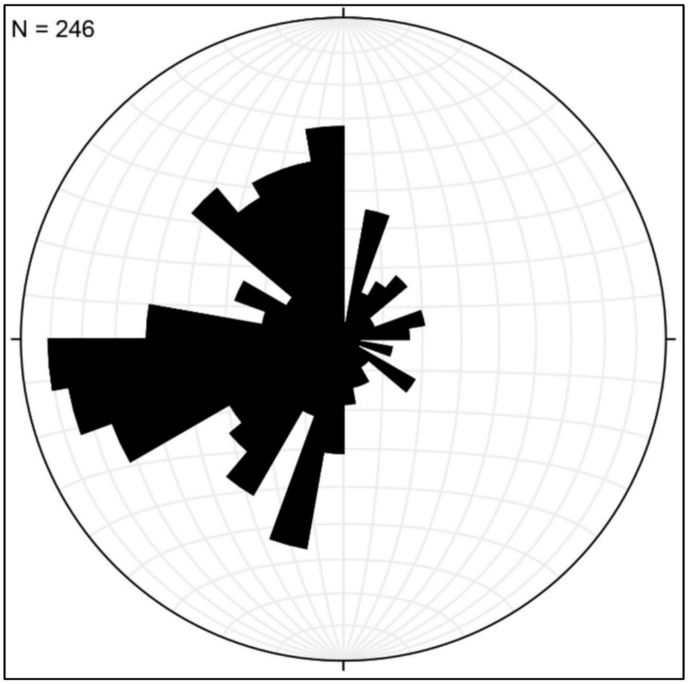
5.2.3.1.2 Structural Geology

The Grassy Mountain gold deposit sits buried below a prominent, 150 feet high, silicified and iron-stained hill. Bedding in volcanic rocks and sediments of the Grassy Mountain Formation is nearly horizontal at the hilltop. Bedding steepens at ten to 35 degrees to the north and northeast on the northern and eastern flanks of the hill. On the west side of the hill, the bedding dip steepens to 30 to 50 degrees due to drag folding in the footwall of the 20 degrees west of north (N20°W), striking Antelope Fault.

At a local scale and within the immediate vicinity of the Grassy Mountain gold deposit, fault orientations can be grouped into two major sets: 20 degrees west of north to ten degrees east of north (N20°W to N10°E) striking faults, and 70 degrees east of north (N70°E) striking faults. These structures will have the greatest impact on underground conditions within the mining environment.

As depicted on the cross sections (Figure 8), faulted offsets are generally less than 40 to 50 feet. Maximum offsets of up to 200 feet occur along the N20°W striking Grassy Mountain fault zone.

The Rose Diagram in Figure 10 depicts the strike and dip orientations of bedding planes in volcanic and volcaniclastic sediments within and near the Mine and Process Area. There are 246 measurements included in the compilation. The measurements are plotted according to the "Right Hand Rule," meaning that strike azimuth is plotted with the dip of the bedding 90 degrees to the right of the azimuth.

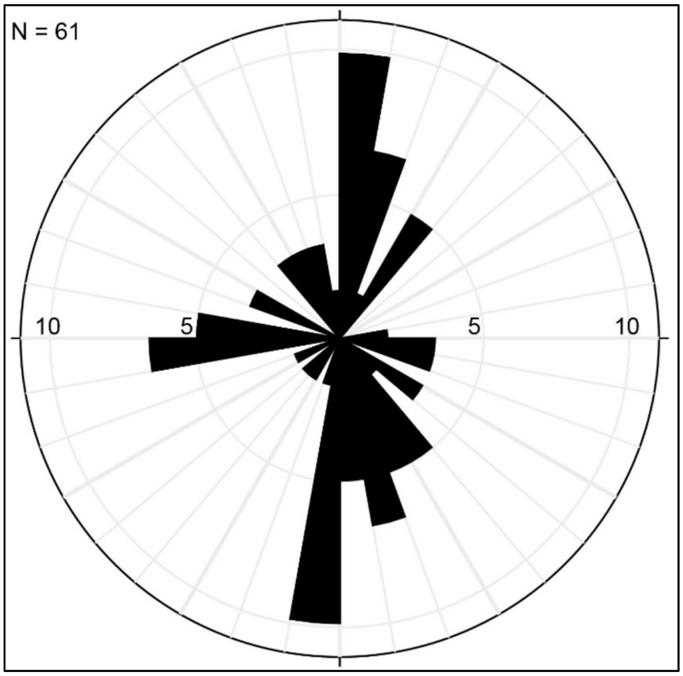


Source: RQV 2015

Figure 10: Strike and Dip of Bedding

The Rose Diagram in Figure 11 depicts the strike and dip orientations of joints and fractures in volcanic and volcaniclastic sediments within and near the Mine and Process Area. There are 61 measurements included in the compilation. These strike and dip locations are shown on Figure 7. The measurements are plotted according to the "Right Hand Rule."

Joint and fractures orientations fall into three major groups: 1) strikes of north to 20 degrees east of north (N to N20°E) dipping to the east-southeast; 2) strikes of a general south direction with dips to the west; and 3) strikes with a general west direction dipping to the north.



Source: RQV 2015

Figure 11: Strike and Dip of Joints and Fractures

5.2.3.2 Access Road Area Geology

The Access Road Area geology is similar to the Mine and Process Area geology (Figure 7 and Figure 12). The southern half of the Access Road Area is underlain by Tertiary Rock Springs Basalt (Trsb) and age-equivalent basalt flows and interbedded volcanic sediments. The northern half of the Access Road Area is underlain predominantly by Tertiary Lacustrine sediments (Tlc and Tlg) and Quaternary alluvium, terrace gravels and alluvial fan deposits (Qal and Qas1).

The Tertiary units are associated with the mid to late Miocene large volume caldera volcanism of the Lake Owyhee volcanic field. During the waning stages of the volcanism, lacustrine sedimentary units dominated. The Quaternary units occur primarily associated with perennial and ephemeral streams and drainages.

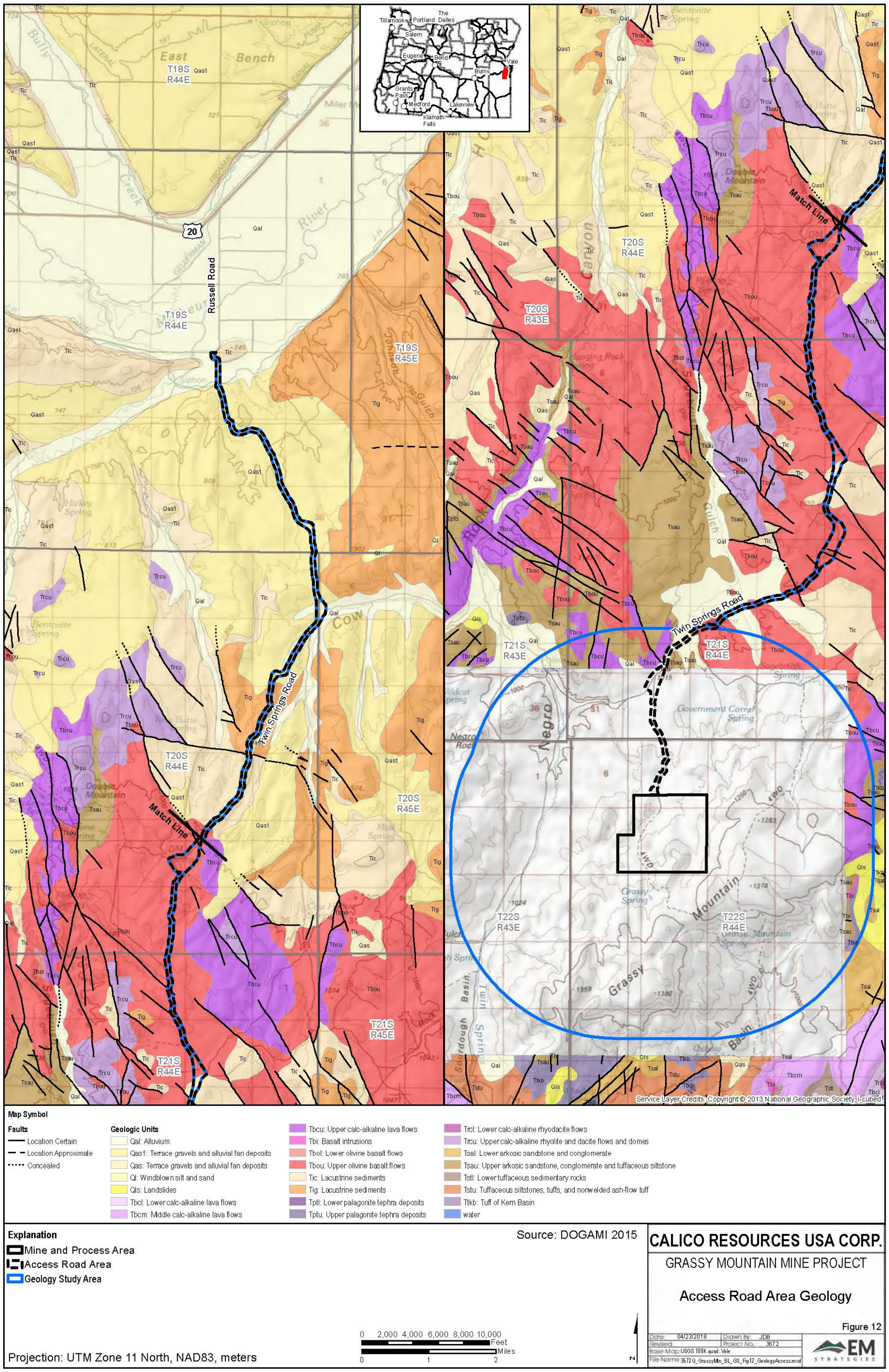
The dominant structural directions are similar to the Mine and Process Area, although the level of geologic mapping is much more detailed in the Mine and Process Area. The dominant structural directions intersecting the Access Road Area are northwest-trending, ranging from N30-50W, with local approximate east-west structures in the northern half of the Access Road Area.

5.2.4 Geologic Hazards

Geologic hazards evaluated while preparing this report include the following and are discussed in the following sections:

- Seismicity/earthquake hazards
- Slope failures/landslide areas
- Volcanic eruptions
- Unsuitable soil/soil erosion

Figure 12: Access Road Area Geology



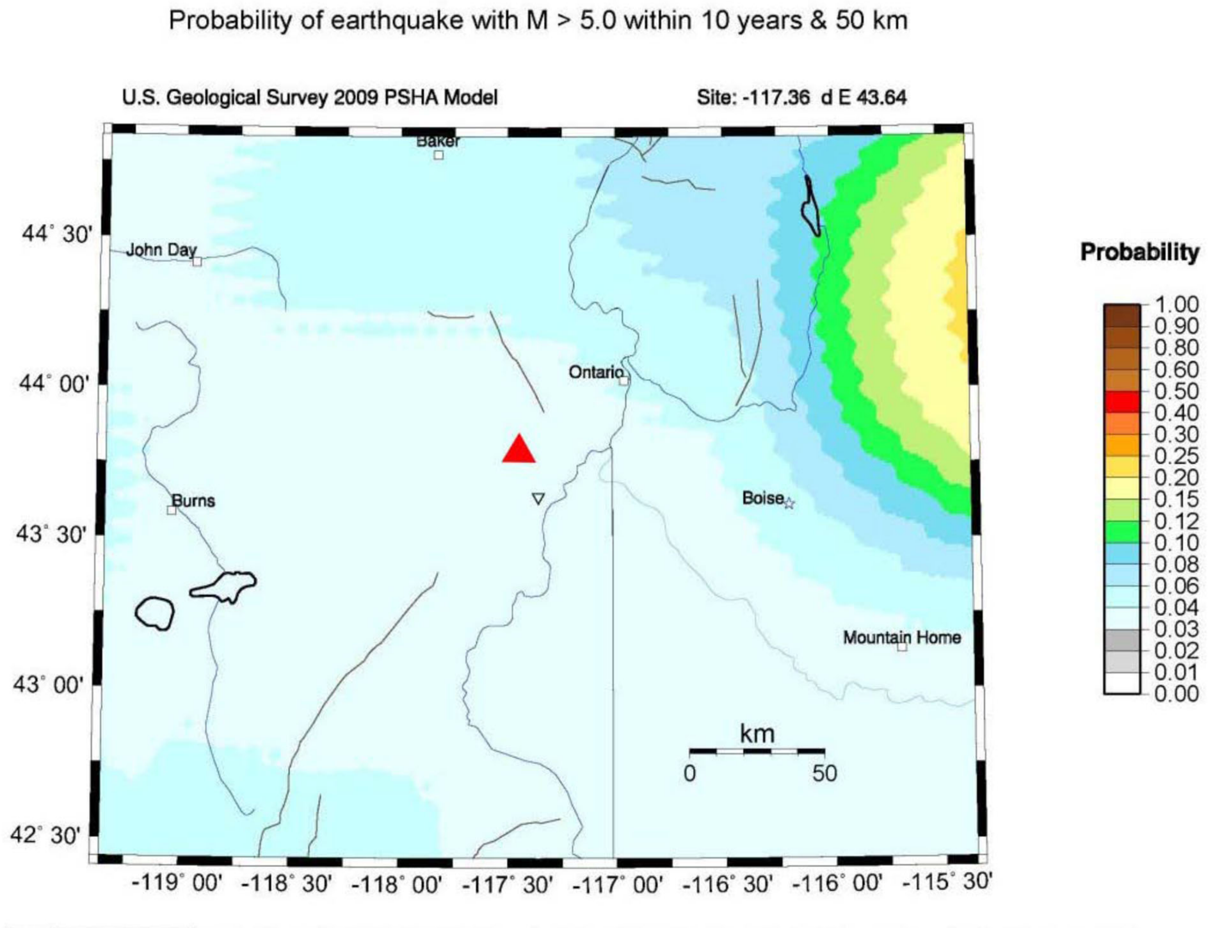
Service Layer Credits: Copyright © 2013 National Geographic Society, i-cubed

Source: DOGAMI 2015

Projection: UTM Zone 11 North, NAD83, meters

5.2.4.1 Seismicity/Earthquake Hazards

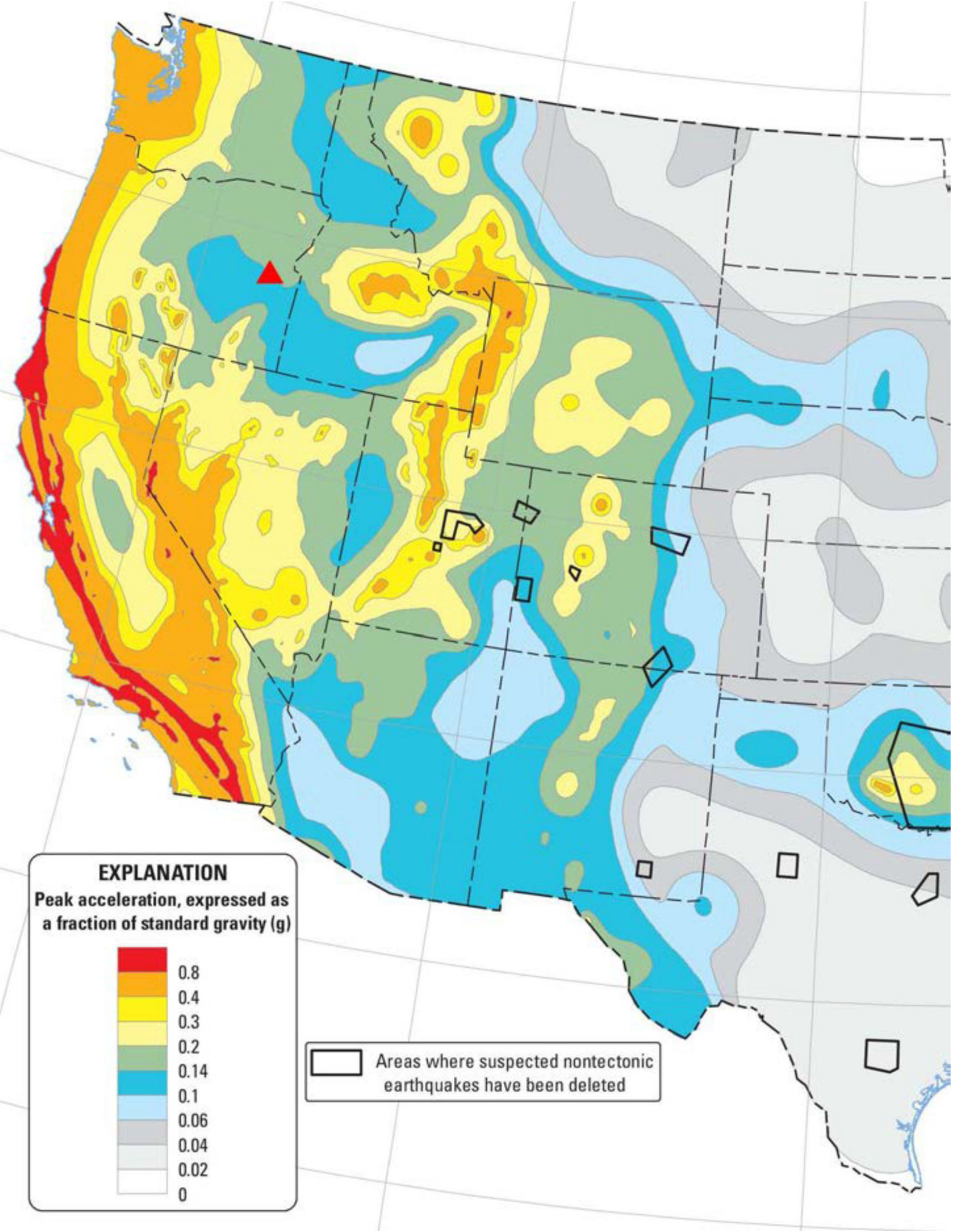
The Geology Study Area is located in a region of low seismic risk. No active or potentially active faults are known in the Geology Study Area. The closest fault with historic surface rupture, the Lost River Fault, is located near Challis, Idaho, approximately 110 miles northeast of the Geology Study Area. The closest potential Holocene age faults are located over 20 miles north of the Geology Study Area. Figure 13 presents a map showing earthquake probabilities for the Geology Study Area. The probability of the occurrence of an earthquake with a magnitude greater than 5.0 over the next ten years is less than 0.03. Figure 14 presents a ground acceleration probability map of Oregon.



Probability of earthquake with M > 5.0 within 10 years & 50 km

GMT 2015 Feb 10 23:10:07 EQ probabilities from USGS OFR 08-1128 PSHA. 50 km maximum horizontal distance. Site of interest: triangle. Fault traces are brown; rivers blue. Epicenters M>=6.0 circles.

Figure 13: Geology Study Area Earthquake Probability Map



Source: USGS 2014

Figure 14: Ground Acceleration Probability Map of Oregon

Within a 50-mile radius of the Geology Study Area, only a few earthquakes have been recorded since 1900 (USGS 2018). Only two earthquakes within a 50-mile radius of the Geology Study Area were associated with known fault systems: a magnitude 3.2 earthquake associated with the Squaw Creek Fault in April 1978 (approximately 47 miles away from the Permit Area); and a magnitude 3.2 earthquake associated with the Cottonwood Mountain fault in July 2009 (approximately 31 miles away from the Permit Area). Approximately 27 miles southeast of the Permit Area, there was a 2.9 magnitude earthquake in November 2012, and it's close to the Owyhee Mountains fault system. There were three other earthquakes that occurred within 50 miles of the Geology Study Area since 1900 that were not associated with any known faults or fault systems: a 3.8 magnitude earthquake in January 1976; a 2.9 magnitude earthquake in July 1989; and a 2.9 magnitude earthquake in October 2010 (USGS 2018).

The International Building Code (IBC) (International Code Council [ICC] 2012), as amended by the Oregon Structural Specialty Code (OSSC) (ICC 2014), requires that for new construction, the site should be designed for the maximum considered earthquake (MCE). The design event has a two percent probability of exceedance in 50 years (or a 2,475-year return period). For this event, the site has a peak ground acceleration (PGA) of 0.11194 accelero-grams (acceleration from gravity) at bedrock surface.

Seismic design parameters were developed in accordance with the IBC. Based on gathered and observed soil information, Site Class D (stiff soil profile) should be used to design Project site facilities. It is anticipated that after additional information is obtained (shear wave velocity in rock and geotechnical boring findings) some of the facilities will be designed using Site Class C (very dense soil and soft rock). Table 2 summarizes the seismic design parameters based on using a Site Class D soil profile.

Table 2: Summary of Seismic Design Parameters for the Project

Earthquake Magnitude	Peak Horizontal Ground Acceleration on Bedrock (accelero-grams)	Soil Amplification Factor, F_a	Peak Horizontal Ground Acceleration at Ground Surface (accelero-grams)
6.09	0.111949	1.583	0.271

Source: RQV 2015

The following additional parameters for the MCE may be used for structural design:

- Short period (0.2-second) spectral response acceleration, SMS = 0.429 accelero-grams for Site Class SD
- One-second period spectral response acceleration, SM1 = 0.244 accelero-grams for Site Class SD

Using the United States Geological Survey (USGS) National Seismic Hazard Mapping Database, the PGA at the facility resulting from a seismic event from one of the seismic sources was calculated. PGA is estimated at a theoretical soft rock/stiff soil interface for different probabilities of exceedance. The USGS database also provides the seismic deaggregation information for the seismic hazard, including estimates of the mean earthquake moment magnitude and mean epicentral distance associated with given probability of exceedance at a given location. An earthquake that has a ten-percent probability of exceedance in 50 years (a nominal 500-year recurrence interval) is the maximum probable earthquake (MPE). An earthquake with a nominal 2,500-year recurrence interval (a two percent probability of exceedance in 50 years) is the MCE. To provide an estimate of magnitudes for seismic events with epicentral distances ranging from zero to 60 miles, the PGA and a spectral acceleration at a period of two seconds were estimated using the USGS seismic hazard database. These estimates of magnitude, epicentral distance, and PGA are provided in Table 3.

Table 3: MPE and MCE Source Characterization Parameters

Earthquake Event	Mean Moment Magnitude	Epicentral Distance (miles)	Peak Ground Acceleration
MPE Events	6.12	35	0.01
MCE Events	6.09	15	0.29

Note: The parameters for both events are for a frequency that corresponds to the PGA.

The design seismic event for Site Class D, C or B will have a 2,500-year recurrence interval. This is for facilities designed to meet current IBC and OSSC guidelines. This is a very-low-probability event so facilities will be designed for no permanent structural damage from vibrational response of the structure or secondary geologic hazards associated with ground movement or failure, which includes landslides, lateral spreading, liquefaction, fault displacement, or subsidence. Risk to human safety will be minimal because structural damage will be mitigated through design.

5.2.4.2 Slope Stability/Slope Failures/Landslide Areas

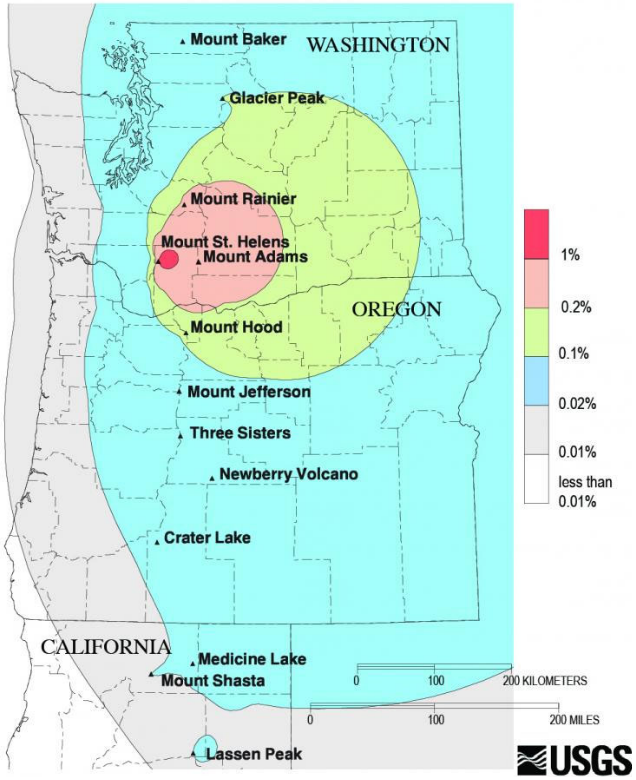
Two areas of recent (Quaternary/Holocene) landslide deposits are shown on the geology map (Figure 7). One area is in the southern portion of the Mine and Process Area. There are no known existing active landslides in the Geology Study Area.

5.2.4.3 Volcanic Hazards

In the Cascade volcanic chain, (extending from Mount Lassen in northern California to Meager Mountain in British Columbia, Canada), over 3,000 large and small volcanoes have erupted over the past five million years.

Numerous volcanoes exist in the Cascade Range located approximately 200 to 250 miles west and northwest of the Geology Study Area. The recently active volcanoes are Mount Hood, Mount Jefferson and Mount Mazama (Crater Lake). Mount Hood has erupted three times over the past 2,000 years and has been active as recently as 400 years ago.

Within the Geology Study Area, the most recent volcanic activity is dated at 7.4 million years before present. The most likely volcanic hazard that could occur in the Geology Study Area would be from effects of a volcanic eruption from one of the Cascade volcanos. The Geology Study Area could possibly be covered by volcanic ash if the prevailing winds were directed toward the area. Figure 15 depicts the hazard potential for volcanic ash over the Geology Study Area.



Source: USGS 2013

Figure 15: One Year Probability of Accumulation of One Centimeter of Tephra from Eruptions of Volcanoes in the Cascade Range

5.2.4.4 Erionite

Erionite is a fibrous zeolite-group mineral often occurring as microscopic acicular, prismatic crystals in altered volcanic tuffs of late Cenozoic age. Erionite can also occur as bedded zeolites within a lacustrine environment containing sediments high in calcium and magnesium. Less commonly erionite occurs in vesicles or cavities within volcanic rocks such as basalt, andesite or rhyolite.

Numerous studies have been conducted concerning the occurrence of zeolites in Oregon. Not all zeolite minerals are considered hazardous. A December 2011 report, *Naturally Occurring Hazardous Materials,* Final Report SPR 686 (DOGAMI 2011), identifies numerous occurrences of zeolites and erionite in Oregon. The erionite localities closest to the Project are Durkee in Baker County, and Rome in southern Malheur County. Durkee is approximately 65 miles north of the Project while Rome is approximately 60 miles to the south-southwest.

Geologists working for Calico have spent thousands of hours analyzing and describing the geology of the Project. They have spent time mapping surface geology as well as logging the geology of drill holes throughout the Permit Area. Further, predecessor companies (i.e., Atlas, NMC, Tombstone) have spent thousands of hours and millions of dollars, analyzing the geology and mineral occurrences near the Project.

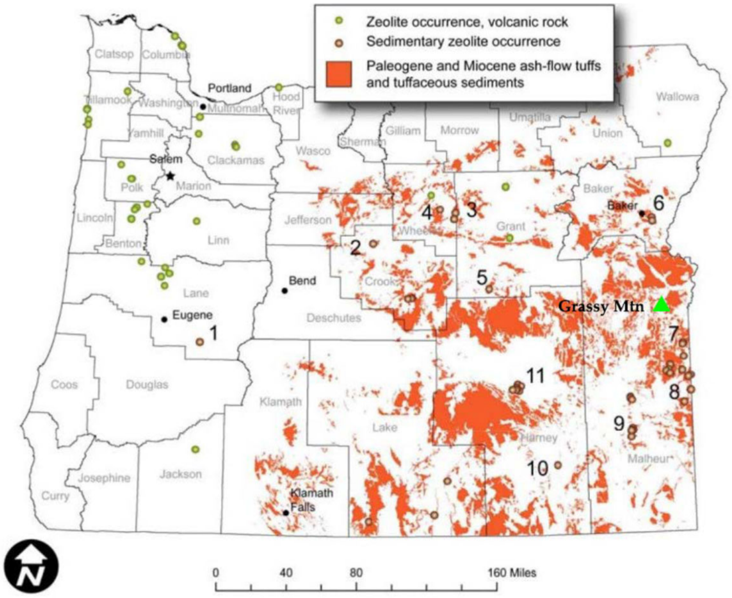
SRK Consulting (U.S.) Inc. (SRK) completed a sampling program during which existing core material was examined and sampled in support of the geochemical characterization program for the Project (SRK 2018). The conclusions are:

> *A total of 12 samples of waste rock and ore were submitted for XRD to determine if erionite is present in the Grassy Valley [Mountain] deposit. The samples submitted for this analysis represent the range of material types associated with the Grassy Mountain deposit. In addition the sample of tailings material was also submitted for XRD. Two standards containing erionite were also submitted and include 924635 and 924636.*
>
> *The results of the XRD analysis are provided in Appendix C and summarized in Table 5-4. The results of this analysis show that erionite was not detected in any of the waste rock/ore samples or the tailings sample. The only samples that contained detectable levels of erionite were the two standards for erionite that contained erionite. Based on these results, additional analysis is not required.*

The details of the sampling program and results along with the Table and Appendix referenced in their conclusions above can be found in the SRK report (SRK 2018).

None of the programs described above identified erionite within the sediments of the Grassy Formation or in any of the volcanic stratigraphy at the Project. Therefore, the potential for this mineral to occur in the Permit Area is unlikely and if it does occur would be limited to low volume, microscopic occurrences.

The map in Figure 16 shows known zeolite occurrence locations as described in the December 2011 DOGAMI report. Numbers on the map correspond with numbers in Table 4.



Source: DOGAMI 2011

Figure 16: Oregon Map of Zeolite Occurrences

Table 4: Oregon Zeolite Occurrences and Localities

Index Number (Figure 6)	Location	Zeolites	Occurrence
1	Section 36, T23S, R2E, near Bearbones Mountain, Lane County	clinoptilolite, mordenite	Tuff and lapilli tuff in the Little Butte Volcanic Series of Oligocene and Miocene ages
2	Section 30, T13S, R18E, vicinity of Stein's Pillar, Crook County	clinoptilolite, mordenite	Welded tuff in the John Day formation of Oligocene and Miocene ages
3	Sections 35 and 36, T10S, R21E, vicinity of Deep Creek, Wheeler County	clinoptilolite	Tuff in the lower part of the John Day Formation of Oligocene and Miocene ages
4	Section 31, T10S, R21E, vicinity of Painted Hills, Wheeler County	clinoptilolite	Tuff and claystone in the lower part of the John Day Formation of Oligocene and Miocene ages
5	Section 18, T17S, R29E, along Lewis Creek, Grant County	heulandite, laumonite	Tuffaceous rocks in the lower part of the Trowbridge Formation
6	Section 36, T11S, R43E, near Durkee, Baker County	chabazite, erionite	Welded tuff of Tertiary age
7	Section 28, T24S, R46E, along Sucker Creek, Malheur County	clinoptilolite	Tuff and tuffaceous sandstone in the Sucker Creek Formation of Miocene age
8	Section 1, T28S, R46E, near Sheaville, Malheur County	clinoptilolite	Tuff probably equivalent to part of the Sucker Creek Formation of Miocene age
9	Section 6, T32S, R41E, near Rome, Malheur County	mordenite, erionite, clinoptilolite, phillipsite, chabazite	Tuff and tuffaceous sandstone in an unnamed lacustrine formation of Pliocene age
10	West ½, T34S, R34E, east face of Steens Mountain, Harney County	clinoptilolite	Tuff in the Pine Creek Formation of Oligocene(?) and Miocene ages
11	Section 13, T27, R30E, hear Harney Lake, Harney County	clinoptilolite, erionite, phillipsite,	Tuff and tuffaceous sedimentary rocks in the Danforth Formation of Pliocene age
12	West face of Hart Mountain, Lane County	clinoptilolite, mordenite, phillipsite	Tuff and tuffaceous sedimentary rocks of late Oligocene or early Miocene age

Source: DOGAMI 2011

5.3 Existing Environment – Soil

5.3.1 Soil Types in the Soils Study Area

The Soils Study Area consists of drainages bounded on the east and west by bedrock-controlled ridges. The underlying bedrock ranges from volcanic basalt and tuffs to sedimentary conglomerates, sandstones and siltstones.

Soil surveys were performed by IMS, Inc. (IMS) near the Mine and Process Area and southern portion of the Access Road Area in 1989 and 1991. Eleven map units, comprised of seven soil types and one undifferentiated soil group, were identified in the soil surveys performed by IMS (1989 and 1991). Soil surveys were performed in June 2018 by CES in the remainder of the Permit Area/Soils Study Area. Six additional soil types were identified during the June 2018 surveys (Figure 17). All 17 map unit descriptions are presented in Table 5. Each map unit description provides basic information about the map unit such as predominant soil or soils of the unit, slope, and rock fragment content. Table 6 shows the taxonomic classification of all soil series found in the Soils Study Area.

Table 5: Soil Survey Map Legend

Map Unit	Name - Description
1[1]	Farmell-Rock outcrop complex, eight to 30 percent slopes
2[1]	Farmell-Chardoton very cobbly soil, 15 to 30 percent slopes
3[1]	Farmell-Chardoton very cobbly soil, four to 15 percent slopes
4[1]	Farmell-Chardoton extremely stony soil, four to 15 percent slopes
5[1]	Farmell-Chardoton soil, eight to 15 percent slopes
6[1]	Ruckles very stony loam, eight to 30 percent slopes
7[1]	Shano silt loam, two to six percent slopes
8[1]	Soil A extremely gravelly sandy loam, 15 to 30 percent slopes
9[1]	Virtue loam, two to eight percent slopes
10[1]	Xeric Torriorthents, eight to 30 percent slopes
11[1]	Soil B very gravelly sandy loam, eight to 30 percent slopes
12[2]	Nyssa silt loam, two to six percent slopes
13[2]	Drewsey very fine sandy loam, two to six percent slopes
14[2]	Ruclick cobbly loam, four to 15 percent slopes
15[2]	Drewsey-Quincy-Solarview complex, eight to 30 percent slopes
16[2]	Owsel silt loam, two to six percent slopes
17[2]	Powder silt loam, zero to three percent slopes

Source: [1]IMS 1989, 1991; [2]CES 2018

Figure 17: Soil Types within the Soils Study Area

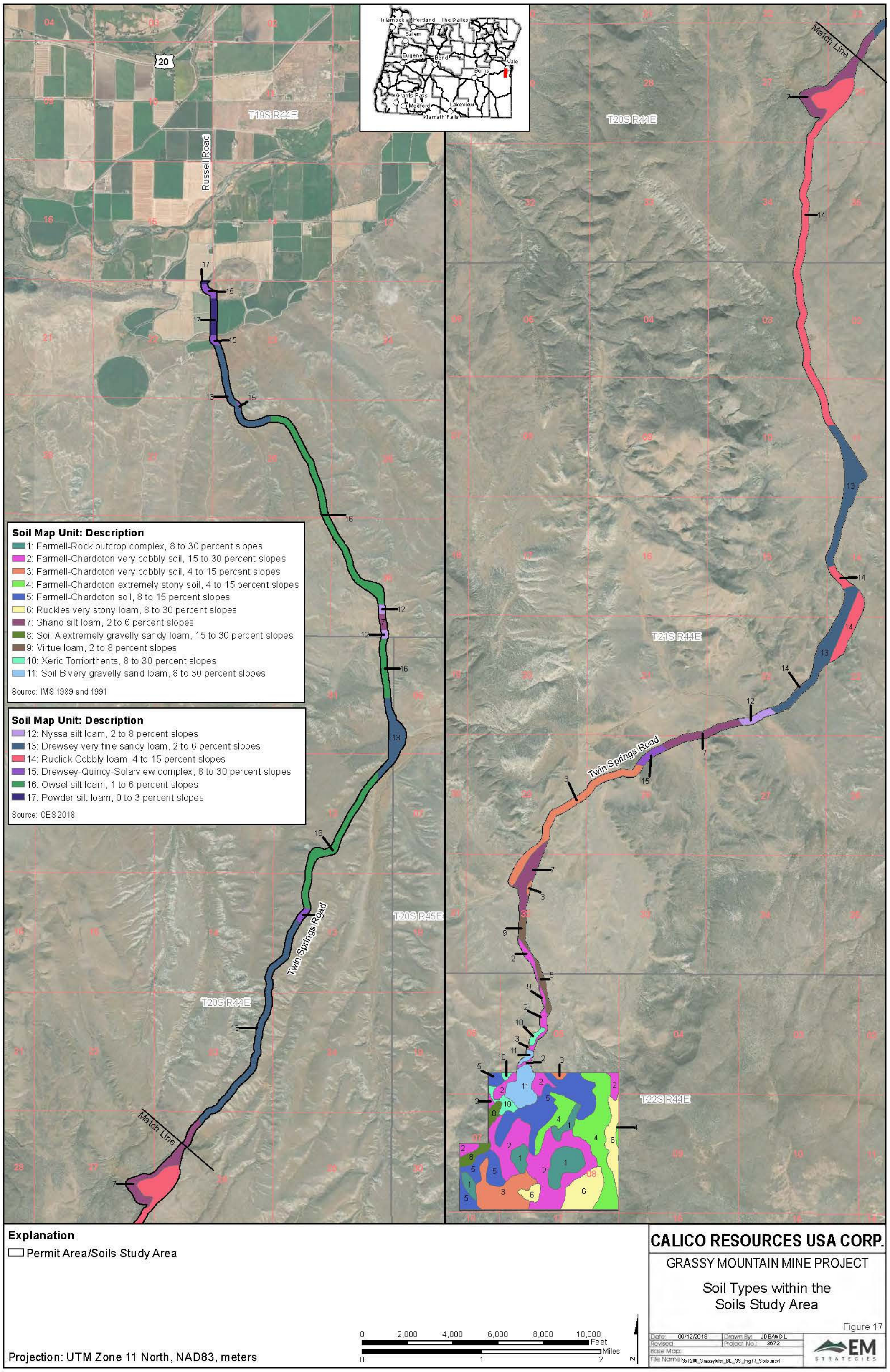


Table 6: Taxonomic Classification of Soil Series

Series	Family
Chardoton[1]	Fine, montmorillonitic, mesic Xerollic Paleargids
Farmell[1]	Fine, montmorillonitic, mesic Xerollic Haplargids
Ruckles[1]	Clayey-skeletal, montmorillonitic, mesic Lithic Argixerolls
Shano[1]	Coarse-silty, mixed, mesic Xerollic Camborthids
Soil A[1]	Fine-loamy, mixed mesic Xerollic Haplargids
Soil B[1]	Clayey-skeletal, montmorillonitic, mesic Xerollic Durargids
Virtue[1]	Fine-silty, mixed, Xerollic Durargids
	Xeric Torriorthents[1]
Nyssa[2]	Coarse-silty, mixed, mesic Xeric Haplodurids
Drewsey[2]	Coarse-loamy, mixed, mesic Xeric Haplocambids
Ruclick[2]	Clayey-skeletal, smectitic, mesic Aridic Argixerolls
Owsel[2]	Fine-silty, mixed, mesic Durinodic Xeric Haplargids
Powder[2]	Coarse-silty, mixed, mesic Cumulic Haploxerolls

Source: [1]IMS 1989, 1991; [2]CES 2018

Soil found on the ridges is typically less than 30 inches deep and is high in rock fragments throughout the profile. Farmell and Chardoton soil, with high amounts of clay in the sub-soil and varying amounts of surficial rock fragments, is found throughout the Mine and Process Area. The moderately fine textured Virtue soil has a hard silica and carbonate hard pan layer at about 20 to 30 inches below the surface. Deep, coarse-textured Shano soil is found along drainage channels. Ruckles soil is typically found over areas where the underlying bedrock is basalt. Soils A and B have high percentages of surficial rock fragments. Soil A is found on slopes of 15 to 30 percent. Soil B is found in areas with slopes of approximately eight percent (IMS 1989, 1991).

The soils located in the valleys consist predominately of alluvium, loess (wind-blown silt) and eolian (wind-blown) sand. These soils belong to the Drewsey, Shano, Power, and Owsel series. The Drewsey series is a deep, coarse-textured soil with a weakly-developed subsoil. The Owsel series is a deep, finer soil with a well-developed subsoil. The Shano series is similar to the Owsel series but lacks a well-developed subsoil. Nyssa soil was encountered sporadically throughout the June 2018 survey area. Nyssa soils are generally silty throughout the profile and exhibit a cemented silica and carbonate layer between 25 to 30 inches. Soils located on and along ridges were formed from the underlying bedrock which generally consisted of conglomerate sandstone and basalt. The soils underlain by basalt were predominantly the Ruclick series, a moderately deep, fine-textured soil. These soils exhibited many surficial and subsurface coarse fragments. The soils underlain by conglomerate sandstone were the Drewsey and the Drewsey-Quincy-Solarview complex. These soils were generally deeper to rock and coarser-textured. Soils further south along Twin Springs Road, closer to the IMS studies, generally consisted of the Shano series and Farnell-Chardoton complex. These soils were also described and mapped in the IMS studies. The Farnell-Chardoton complex exhibited high amounts of clay and rock throughout the profile (CES 2018).

The map unit characteristics of these soils are listed in Table 7. Suitability for reclamation is also included in the table. Soil data sheets, combining the analytical results and soil descriptions, are presented in Appendix C and Appendix D of the February 2015 RQV report (Attachment A) for the soils identified during the IMS surveys, and Appendix A of the June 2018 CES report (Attachment B).

Table 7: Soil Map Unit Characteristics

Map Unit Symbol	Components	Composition (%)	Slope	Typical Surface Texture	Surficial Rock Fragments (%)	Typical Subsurface Texture	Rock Fragments (%)	Reclamation Suitability	Limitation	Recommended Salvage Depth (feet)
1[1]	Farmell	60	8-30	SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Rock outcrop	30		-	-	-	-			
	Soils <40" to bedrock	10						Unsuitable	Surficial rock	0
2[1]	Farmell	45	15-30	SiL	35-60+	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35-60+	C, SiC	0-15	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils <40" to bedrock	10			35-60+			Marginal	Surficial rock	0.5
3[1]	Farmell	55	4-15	SiL	35-60	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35-60	C, SiC	0-15	Marginal	Surficial rock	0.5
	Soils <40" to bedrock	5		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
4[1]	Farmell	55	4-15	SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Chardoton	40		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Soils <40" to bedrock	5		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
5[1]	Farmell	55	4-15	SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0.5
	Soils <40" to bedrock	5		SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0
6[1]	Ruckles	90	8-30	L	35-60+	CL, C	0-15	Marginal	Surficial rock Depth to bedrock	0.5
	Rock outcrop	5								
	Soils >20" to bedrock	5		L	35-60+	CL, C	0-15	Marginal	Surficial rock	0.5
7[1]	Shano	95	2-6	SiL	0-5	SiL	0-5	Good		2.5
	Virtue	5	2-8	SiL	10-35	SiCL, SiL	0-10	Good		2.0
8[1]	Soil A	85	15-30	SL	50+	SL	25-35	Unsuitable	Surficial rock	0
	Soils w/>35% rock fragments	15		SL	50+	SL	35-60	Unsuitable	Surficial rock	0
9[1]	Virtue	95	2-8	SiL	10-35	SiCL, SiL	0-10	Good	Depth to hardpan	2.0
	Soils >40" to hardpan	5		SiL	10-35	SiCL, SiL	0-10	Good		2.0
10[1]	Xeric Torriorthents	90	15-30	Varies	10-50	Varies	Varies	Unsuitable	Depth to bedrock Slope	0
	Other shallow soil	10	15-30	Varies	10-50	Varies	Varies	Unsuitable		0
11[1]	Soil B	100	8-30	SL	60+	CL, C	35+	Unsuitable	Rock fragments	0
12[2]	Nyssa	100	2-6	SiL	0-5	SiL, Si	0-15	Marginal	Soil Erodibility	0.5
13[2]	Drewsey	100	2-6	vfSL	0-5	L, vfSL, fSL	0-15	Marginal	pH	2.5
14[2]	Ruclick	90	4-15	L	15-35	CL, C	35+	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils < 20" to bedrock	5		L	15-35	CL, C	35+	Marginal	Surficial rock	0.5
15[2]	Drewsey	60	8-30	vfSL	0-5	L, vfSL, fSL	0-5	Marginal	pH	2.5
	Quincy	20		fS	0-5	fS	0-5	Marginal	Texture	2.5

Map Unit Symbol	Components	Composition (%)	Slope	Typical Surface Texture	Surficial Rock Fragments (%)	Typical Subsurface Texture	Rock Fragments (%)	Reclamation Suitability	Limitation	Recommended Salvage Depth (feet)
	Solarview	20		SL	0-15	LS, S	0-15	Marginal	Texture	0.5
16[2]	Owsel	90	2-6	SiL	0-5	SiL, SiCL, L, SL	0-15	Marginal	Soil Erodibility	2.0
	Nyssa	10		SiL	0-5	SiL, Si	0-15	Marginal	Soil Erodibility	0.5
17[2]	Powder	100	0-3	SiL	0-5	SiL	0-15	Good		2.5

Source: [1]IMS 1989, 1991; [2]CES 2018

Notes: C = clay; CL = clay loam; fS = fine sand; fSL = fine sandy loam; L = loam; LS = loamy sand; SL = sandy loam; SiC = silty clay; SiCL = silty clay loam; Si = silt; SiL = silt loam; vfSL = very fine sandy loam

5.3.2 Soil Erosion

Erosion related interpretations were estimated for each of the soil types. A K-factor (soil erodibility factor) for each surface horizon was calculated using the Soil Erodibility Nomograph published in the NRCS *National Soil Survey Handbook* (NRCS 2017). A copy of the Soil Erodibility Nomograph is shown in Figure 18. The K-factor indicates the susceptibility of a soil to sheet erosion by water. K-factor values range from 0.00 to 0.70 with the higher factors indicating greater susceptibility to erosion. The soils in the Mine and Process Area have high silt and very fine sand content making it more susceptible to wind erosion; however, the high rock fragment content within the soil significantly reduces the K-factor of each unit.

The Wind Erodibility Group (WEG) is an arbitrary grouping of soils based on texture, structure, and carbonate content. WEG values range from 1 to 8 with the lower values indicating greater susceptibility to wind erosion. The WEG is typically applied only to the surface layer of a soil. Classes are defined by NRCS's *National Soil Survey Handbook*, Part 618, Subpart B (NRCS 2017). Table 8 shows the calculated K-factors and WEG values for each soil type.

Table 8: Erosion Factors of Surface Soils

Soil Series	WEG (Wind Erosion Group)	K-Factor (Soil Erodibility Factor)
Chardoton[1]	8	0.13
Farmell[1]	8	0.10
Ruckles[1]	8	0.10
Shano[1]	5	0.37
Soil A[1]	8	0.07
Soil B[1]	8	0.07
Virtue[1]	5	0.16
Nyssa[2]	5	0.61
Drewsey[2]	3	0.34
Ruclick[2]	8	0.37
Owsel[2]	5	0.46
Powder[2]	5	0.52

Source: [1]IMS 1989, 1991; [2]CES 2018

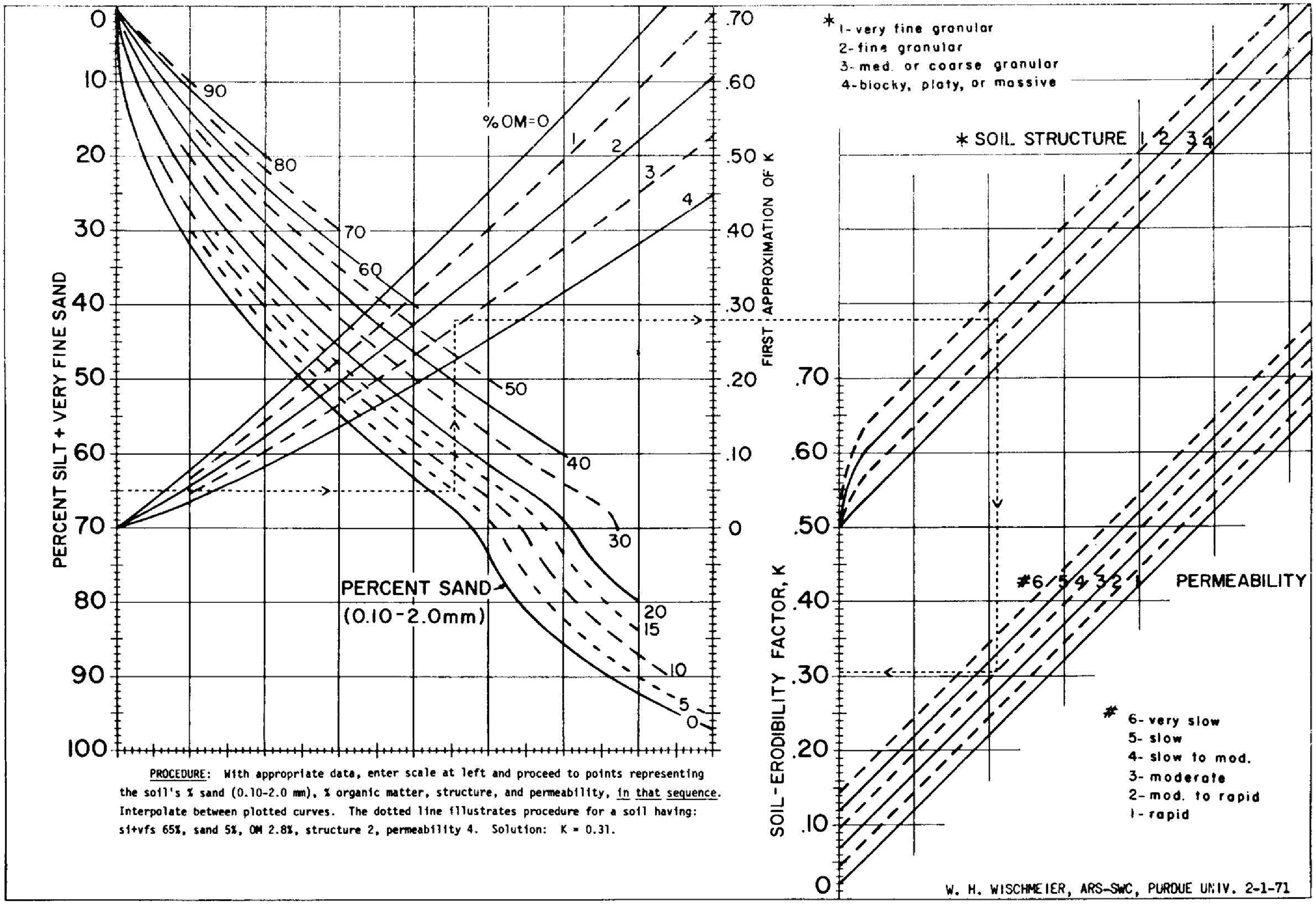
5.3.3 Reclamation Suitability

In all the areas where mining and processing will take place, suitable topsoil will be stripped and stockpiled for reclamation.

A topsoil suitability rating table was developed by IMS (1991) for the three dominant soils within the Soils Study Area. The locations were selected to most accurately represent the pedon sampled and its landscape position. (Pedon is a three-dimensional body of soil with dimensions large enough to permit the study of individual soil horizons.) Topsoil suitability for the soil types identified during the June 2018 surveys were also tested.

Laboratory analyses results for soil samples were compared to suitability criteria for topsoil developed at Colorado State University's soil testing laboratory (Soltanpour and Workman 1981). These criteria are presented in Table 9.

Figure 18: Soil Erodibility Nomograph – K Factor



PROCEDURE: With appropriate data, enter scale at left and proceed to points representing the soil's % sand (0.10-2.0 mm), % organic matter, structure, and permeability, in that sequence. Interpolate between plotted curves. The dotted line illustrates procedure for a soil having: si+vfs 65%, sand 5%, OM 2.8%, structure 2, permeability 4. Solution: K = 0.31.

Source: NRCS 2017

Table 9: Soil Suitability Ratings

Parameter	Testing Method	Good Suitability	Marginal Suitability	Unsuitable
pH	S-2-10	6.0 to 8.4	5.5 to 6.0, 8.4 to 8.8	<5.5, >8.8
EC (dS/m)	S-2.10	<4.0	4.0 to 12.0	>12.0
Texture	S-14.10 ASTM D6913	Loamy sand, sandy loam, loam, silt; soil with <35% clay	Sand, loamy coarse sand; soil with <45% clay	Soils with >45% clay
Saturation %	S-10.20	25 to 80	25 to 80	<25 and/or >80
$CaCO_3$ %	Fizz	0 to 15	15 to 30	>30
Rock fragments %	Field Estimated	<35	35 to 60	>60
Erosion factor K	Calculated	<0.37	>0.37	
Organic Matter	S-9.10			

Source: IMS 1989,1991; CES 2018

In general, the topsoil sampled in and near the Mine and Process Area during the IMS surveys (IMS 1989, 1991) has a higher clay content and is shallower in the soil profile. This soil generally meets the "Marginally Suitable" category. Appendix C of the February 2015 RQV report (Attachment A) contains the analysis reports from Western Laboratories Inc. in Parma, Idaho.

The topsoil throughout the June 2018 survey area appear generally suitable for reclamation. The primary limitation is surficial and subsurface coarse fragments, which were encountered on ridge sides and summits. The Ruclick soils and Drewsey-Quincy-Solarview Complex exhibited high surface and subsurface coarse fragments. Steep slopes also limit reclamation suitability.

The Drewsey and Owsel soils, which generally occur on the valley floors, exhibited marginal limitations for reclamation due to pH level and/or soil erodibility. The Nyssa soil, also located on valley floors, have unsuitable subsurface soil horizons that are cemented and exhibit increased sodium and carbonate levels (CES 2018). Appendix B of the June 2018 CES report (Attachment B) contains the analysis reports from Western Laboratories Inc. in Parma, Idaho.

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ATTACHMENT A
Geology and Soils Baseline Study
February 2015

Geology and Soils Baseline Study

Grassy Mountain Project

Calico Resources USA Corporation

February 2015

Prepared by:

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Geology and Soils Baseline Study

Grassy Mountain Project
Calico Resources USA Corporation

CALICO
RESOURCES

February 2015

REGISTERED PROFESSIONAL
OREGON
NANCY M. SPEAKER
Exp 11/2015
GEOLOGIST

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Acronyms

ABC	Adrian Brown Consultants, Inc.
ACZ	ACZ, Inc.
Atlas	Atlas Precious Metals, Inc.
BLM	Bureau of Land Management
Calico	Calico Resources USA Corporation
CFR	Code of Federal Regulations
DOGAMI	Oregon Department of Geology and Mineral Industries
JMM	J.M. Montgomery, Consulting Engineers, Inc.
Ma	million years ago
MCE	maximum considered earthquake
MPE	maximum probable earthquake
msl	mean sea level
NEPA	National Environmental Policy Act
NMC	Newmont Grassy Mountain Corporation
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
OSBGE	Oregon State Board of Geologist Examiners
OSSC	Oregon Structural Specialty Code
PGA	peak ground acceleration
SRK	Steffen Robertson and Kirsten Consulting (U.S.), Inc.
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geologic Survey
WEG	Wind Erodibility Group
WTI	Western Technologies, Inc.

1 INTRODUCTION

1.1 Purpose and Objectives

The purpose of this geology and soil baseline report is to characterize soil and geology in the project study area prior to the start of proposed mining operations at the Grassy Mountain Project near the city of Vale in Malheur County, Oregon.

Oregon Department of Geology and Mineral Industries (DOGAMI) guidelines require local and regional geologic information be collected to provide a characterization of baseline conditions. These conditions include soil, surface and groundwater, geology and potential geologic hazards, seismicity, mineralogy and pre-mining topography. Characterization of these conditions helps to identify potential impacts to the design, construction, operation, and reclamation of proposed mine features and the environment. The geologic information would be used in a number of applications, including but not limited to: 1) identifying geotechnical conditions; 2) determining foundation stability; 3) use in characterizing hydrogeologic conditions; 4) key input to the geochemical characterization task to identify potential acid-generating rock material and potential sources of heavy metals or other constituents; and 5) input for drafting the Division 37 and potential National Environmental Policy Act (NEPA)-related sections of the respective documents (Oregon Administrative Rule [OAR] 632-037-0055; Oregon State Board of Geologist Examiners [OSBGE] 1996; OSBGE 2005).

The following geologic data is included:

- Information covering local and regional topography, surficial and bedrock geology, and local and regional structural geology;
- Standard geologic map, including faults, veins, joints, and fractures, lithologies, mineralized areas, and alteration patterns;
- Description of and map showing local and regional fault zones, seismic conditions, earthquake probability, including maximum credible and maximum probable seismic events;
- Description of and geologic hazard map showing the location and age of landslides, avalanches, slumps, mass wasting and fall areas, liquefaction, lateral spreading, fault displacement and subsidence within the project study area;
- Geologic mapping of the study area that is consistent with U.S. Geological Survey (USGS) geologic map requirements and standards as applicable; and
- Inventory of legacy land disturbances from existing or past exploration or mining and other land disturbing activities in the project study area.

The following soil information is included:

- Soil mapping of the project study area, including U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) soil map units;
- Discussion of soil susceptibility to erosion;
- Identification of any hydric soil in project study area; and
- Suitability of soil for reclamation (soil fertility).

1.2 Background

Calico Resources USA Corporation (Calico), a minerals exploration company and wholly-owned subsidiary of Calico Resources Corporation, engages in the acquisition, exploration, and development of mineral properties. Calico holds 100 percent interest in the Grassy Mountain Project (see **Figure 1-1** for project location). The project involves over 9,300 acres of unpatented mining claims administered by the U.S. Department of the Interior, Bureau of Land Management (BLM); 3 patented lode mining claims, which cover about 61 acres; 6 association placer claims; and 9 mill site claims. All proposed mining would occur on these patented claims. Calico leases an additional 1,380 acres of fee land. The proposed access road connecting the mine and mill involves about 74 acres of unpatented land. Up to 134 additional acres of fee land would accommodate the processing facilities, administration, maintenance, and the tailings storage facility. The mine and processing area are linked by a haul road on federal BLM land.

1.3 Project Study Area Description

As shown in **Figure 1-1**, the Grassy Mountain project is located in Malheur County, Oregon, about 25 miles south-southwest of the City of Vale. The project study area, shown in **Figure 1-2**, encompasses portions of Section 32, Township 21 South, Range 44 East; Sections 1 and 12, Township 22 South, Range 43 East; and Sections 5, 6, 7, and 8, Township 22 South, Range 43 East. The project is accessed via Highway 20, west from Vale, to Russell Road. The site is approximately 25 to 30 miles south, up Russell Road and Twin Springs Road.

1.4 Organization of the Report

This *Geology and Soils Baseline Study* has been organized as follows:

- Chapter 1: Introduction (purposes, background, and objectives)
- Chapter 2: Resource Study Area
- Chapter 3: Regulatory Framework
- Chapter 4: Study Methodology
- Chapter 5: Affected Environment
- Chapter 6: Bibliography
- Chapter 7: List of Contributor(s)
- Appendices: Supporting Information

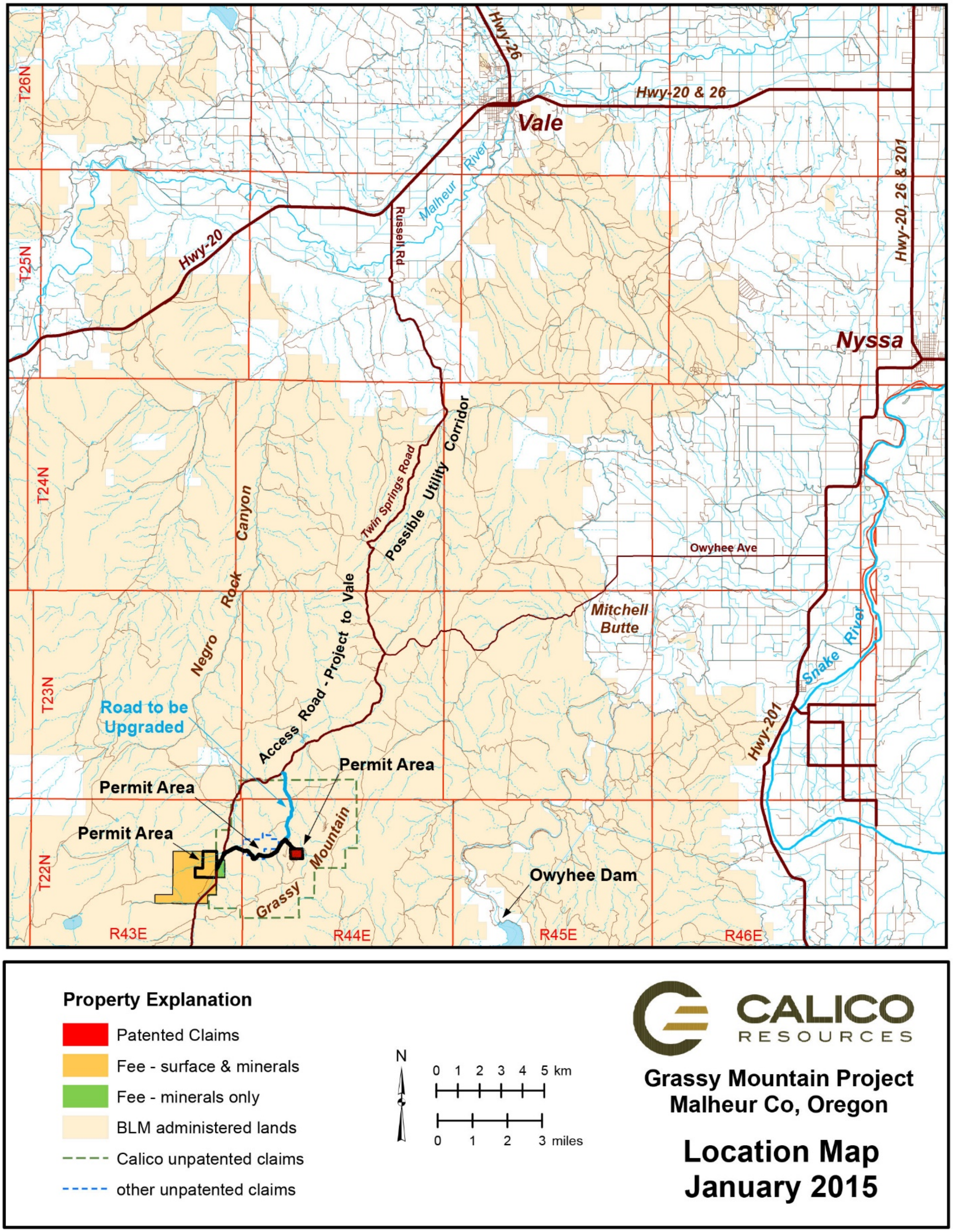
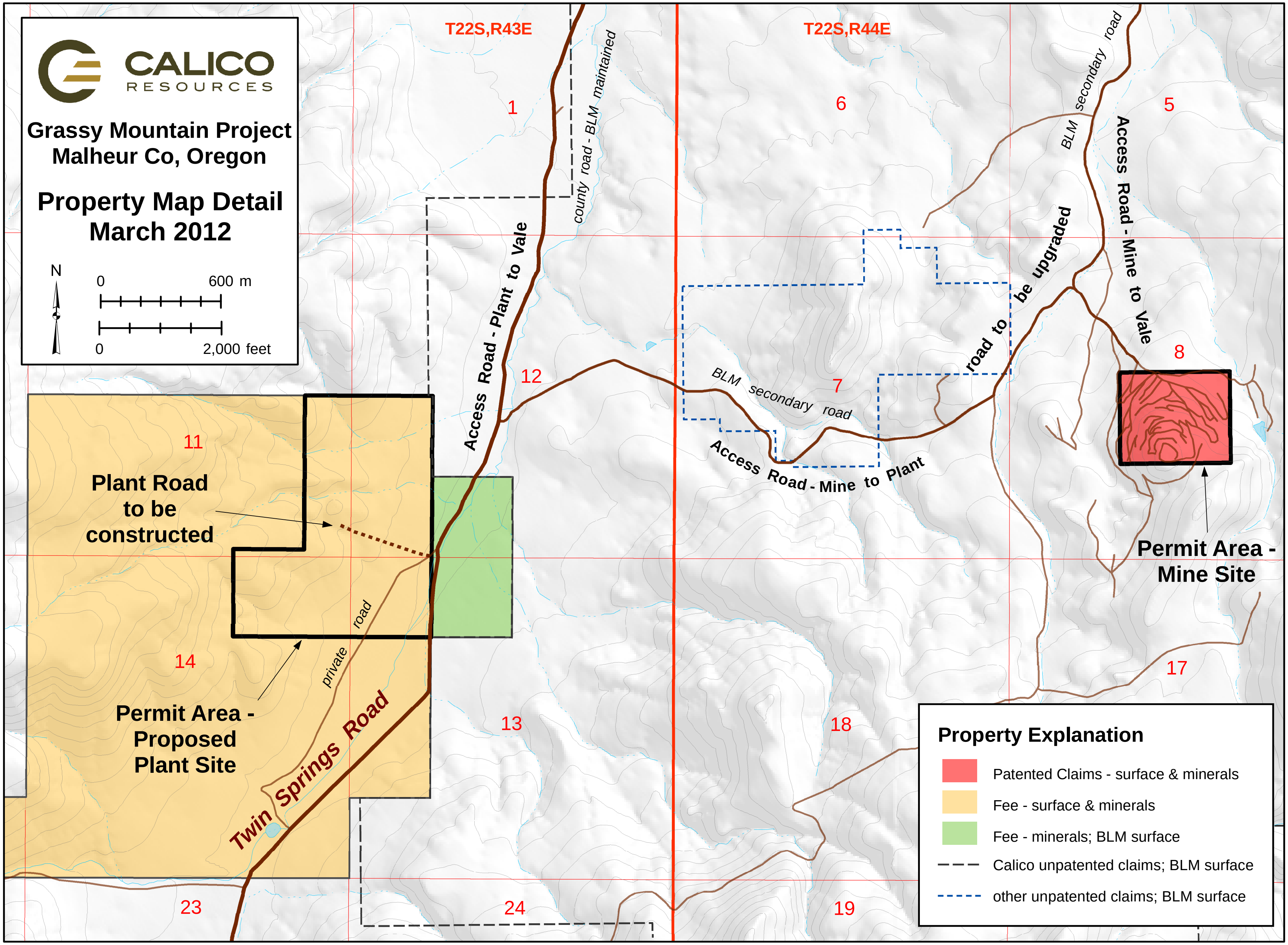


Figure 1-1. Project Location Map



CALICO RESOURCES

Grassy Mountain Project
Malheur Co, Oregon

Property Map Detail
March 2012

Figure 1-2

2 PROJECT STUDY AREA

The proposed mine is located on three patented lode mining claims that cover an estimated 62 acres. The three patented lode claims are part of a larger land position defined as three patented lode claims; 419 un-patented lode claims managed by BLM; and 1,300 acres of the land, including six association placer claims all controlled by Calico. The project study area is defined as follows:

• Mine permit area	62 acres
• Mill permit area	134 acres
• Access road area	74 acres

Total permit area = approximately 270 total acres of disturbance

The project study area for this proposed project is located in portions of the following sections:

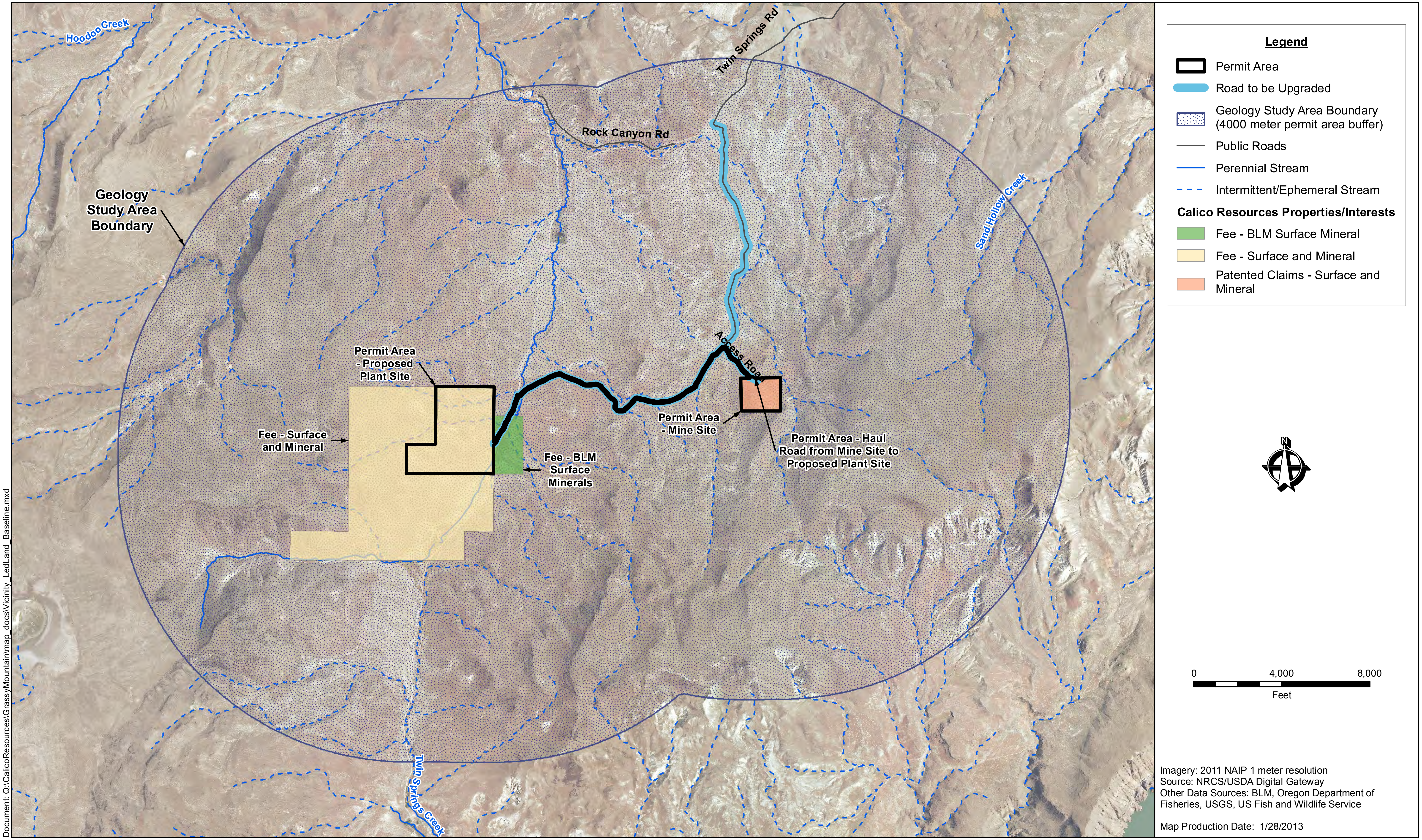
- Sections 11, 12, 13, 14 and 15, Township 22 South, Range 43 East, Willamette Meridian
- Sections 7 and 8, Township 22 South, Range 44 East, Willamette Meridian

Figure 2-1 depicts the limits of the baseline geology study area. **Figure 2-2** depicts the limits of the baseline soil study area.

2.1 Accessibility, Infrastructure and Local Resources

Access to the Grassy Mountain property is provided by Twin Springs Road, a partially maintained gravel road, which originates at US Highway 20 approximately 4 miles west of the city of Vale.

At present, no infrastructure is located on the Grassy Mountain property, except for several unimproved dirt access and drilling exploration roads. Ample land is available for the construction of the plant site, infrastructure and operations center.



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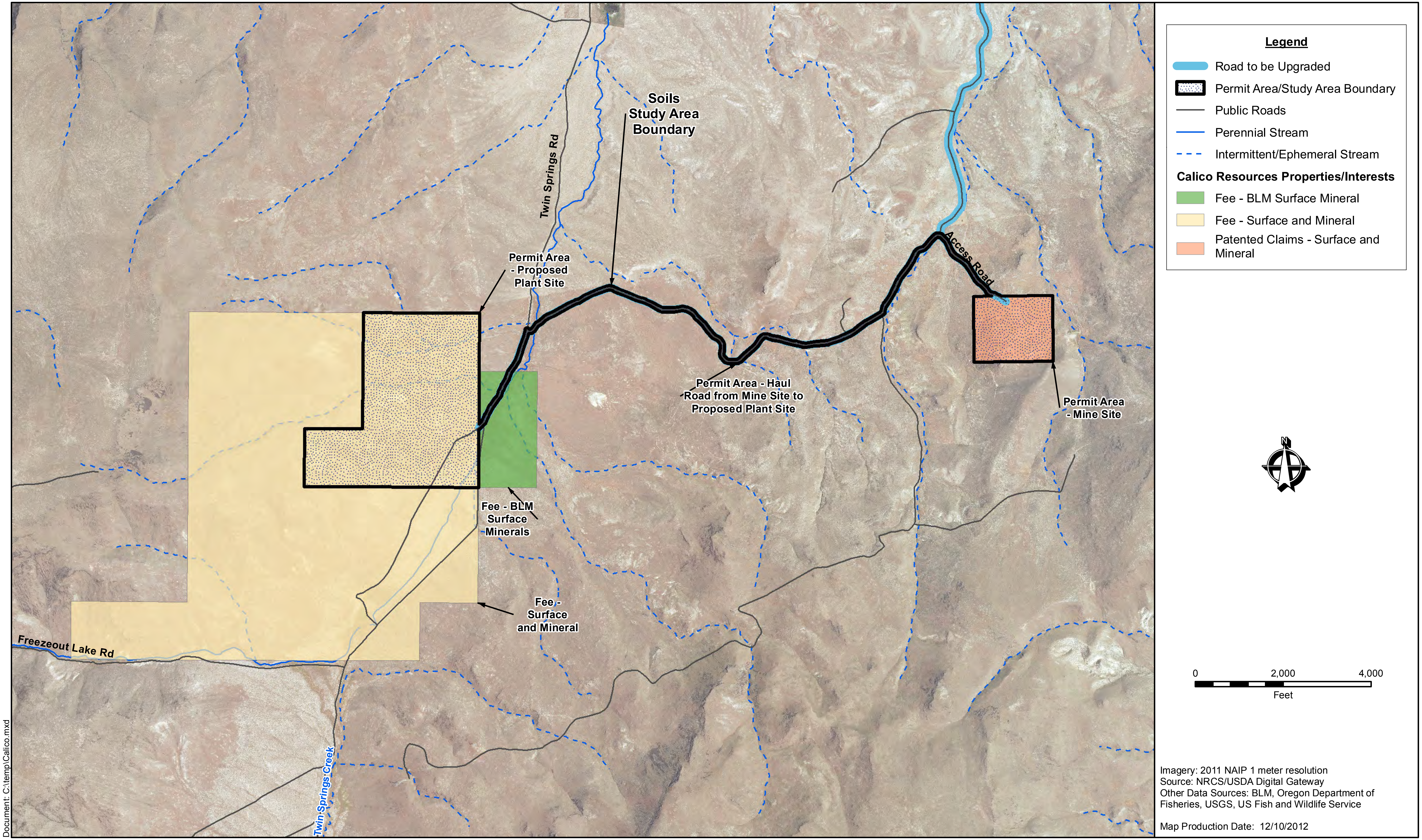
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, Oregon Department of Fisheries, USGS, US Fish and Wildlife Service

Map Production Date: 1/28/2013

Document: Q:\CalicoResources\GrassyMountain\map_docs\Vicinity_LedLand_Baseline.mxd

Figure 2-1. Geology Study Area
Calico Resources, Grassy Mountain Project
Malheur County, OR



Imagery: 2011 NAIP 1 meter resolution
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, Oregon Department of Fisheries, USGS, US Fish and Wildlife Service

Map Production Date: 12/10/2012

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Figure 2-2. Soils Study Area
Calico Resources, Grassy Mountain Project
Malheur County, OR

3 REGULATORY FRAMEWORK

3.1 Regulatory Framework

The Permit for Chemical Processing Mining is required under Chapter 735, Division 037, 1991 Oregon Laws (OAR 632-037-0005) (Division 37). Chemical Process Mine means “a mining and processing operation for metal bearing ores that uses chemicals to dissolve metals from ore.” The Calico processing facility will be subject to Division 37, based on the final metallurgical process.

3.1.1 Bureau of Land Management, 43 CFR Part 3800

Under 43 Code Federal Regulations (CFR) Part 3800, BLM has defined its final rule regarding *Mining Claims under the General Mining Laws: Surface Management* to include performance standards that govern the operation and reclamation of surface mining projects. Section 3809.420(6)(b)(3) stipulates that the operator must initiate reclamation at the earliest feasible time and that reclamation shall include, but not be limited to, the following: “saving of topsoil for final application after reshaping of disturbed areas have been completed; measures to control erosion, landslides, and water runoff; measures to isolate, remove, or control toxic materials; [and] reshaping the area disturbed, application of the topsoil, and re-vegetation of disturbed areas, where reasonably practicable....” When reclamation has been completed, the authorized officer shall be notified so that an inspection of the reclaimed areas can be made.

4 STUDY METHODOLOGY

4.1 Literature Review

The baseline geology and soil were characterized using existing information generated from previous studies along with new work completed from 2011 through 2014. The following documents and literature were reviewed as applicable:

- Adrian Brown Consultants, Inc. (ABC). 1992. *Physical Resources Technical Memorandum*.
- ACZ Inc. (ACZ). *Workplan for Baseline Hydrologic Studies* developed for Newmont Grassy Mountain Corporation in 1993. Information compiled in this report includes a characterization of geology and geologic hazards, summary of a geotechnical investigation conducted by Denver Knight Piesold, Inc. For the geotechnical investigation, 11 test borings were drilled and 71 test pits were excavated.
- Atlas Precious Metals, Inc. (Atlas) and Newmont Grassy Mountain Corporation (NMC).Atlas and NMC conducted exploration drilling in the project vicinity during the 1980s and 1990s. As part of that exploratory, feasibility and baseline activities work, they developed detailed geologic and geochemical information on a project-level scale.
- Bureau of Land Management (BLM), Vale District Office. April 2001. *Proposed Southeastern Oregon, Resource Management Plan and Final Environmental Statement*. http://www.blm.gov/or/districts/vale/plans/files/seormp/SEORMP-FEIS-Vol1Txt.pdf
- Ferns and Ramp (DOGAMI). 1989. Geologic mapping and regional resource evaluations conducted by the Oregon Department of Geology and Mining in the 1980s. These studies provide detailed information on local geology and regional-scale data on mineral and energy resources.
- IMS, Inc. (1989). *Final Report: Soil, Vegetation and Wildlife Resources of the Grassy Mountain Area*.
- IMS, Inc. (1991). *Soil Resources of the Grassy Mountain Area*.
- J.M. Montgomery, Consulting Engineers, Inc. (JMM). In 1991, JMM conducted various investigations and tests associated with developing a hydrogeologic evaluation of the project area in its regional context adequate for the purpose of evaluating potential for use of groundwater to supply the Grassy Mountain operational needs. JMM’s findings include a section that characterizes the project area geology.
- Lovell, B.B. et al. 1972. *Soil Survey of Malheur, Oregon, Northeastern Part*. USDA-Soil Conservation Service.
- Newmont Mining Company (NMC) *Grassy Mountain Corporation*. 1993.
- Seegmiller International (1989), Golder Associates, Inc. (1989, 1991, and Denver Knight Piesold Environmental Consultants, Inc. (1991). Geotechnical investigations conducted by each included evaluations of pit wall stability, surface water flows, potential for underground development, and conceptual reclamation plans.

- Steffen Robertson and Kirsten Consulting (U.S.), Inc. (SRK). In 1989 and 1990, SRK conducted several studies in connection with feasibility studies for the Grassy Mountain Project. Activities included installation of an additional groundwater well (GW-4-GM) and two additional production wells (PW-1 and PW-4) and logging and description of the hydrogeologic conditions in these wells. SRK performed a variety of geochemical tests on waste rock, tailing, and heap-leach materials. SRK performed standard geotechnical tests on aspects of the site soil and evaluated surface water conditions in terms of flooding potential and stability relationships of key project facilities. SRK summarized analytical data and presented interpretations of site conditions in a series of reports to Atlas (SRK 1991).
- Western Technologies, Inc. (WTI).In 1988, WTI supervised the drilling and installation of three monitoring wells (GW-1-GM, GW-2-GM and GM-3-GM and completion of GM-Prod-1. The WTI work included logging of drill cuttings and recordation of lithologies.

Published information and records have been reviewed and used to determine the seismic potential / earthquake hazards of the project area.

4.2 Field Investigations

Sufficient historic information exists to characterize the baseline topography, soil, geology, geologic hazards and seismic conditions for the study area. However, Calico conducted additional fieldwork to update and validate the historic information. Existing information was compiled and used for the basis of the current work.

4.2.1 Geology

Calico developed geologic mapping from 2011 through 2014. Dennis Lance, geological consultant to Calico, compiled a geology map. He used existing geology maps as described in the bibliography of this report. The historic information was supplemented with additional field work and field reconnaissance. The map is presented in **Figure 5-2**.

4.2.2 Soil

Calico developed soil mapping from historic reports, in particular, two past soil surveys: one in 1989 by IMS Inc. for Atlas Precious Metals Inc., then a second survey by IMS Inc. in 1991 for Newmont Grassy Mountain Corporation.

Sixteen soil samples were collected for fertility and geochemical analysis August 2014

4.2.2.1 Data Collection and Methodology

The soil samples were collected at sites representative of areas that will be disturbed during mining and processing operations:

- 6 samples were collected from the eastern area that will be part of the underground mining operations and facilities
- 4 representative samples were collected along the proposed haul road
- 6 samples were collected in the vicinity of the proposed processing facilities

Photo 4-1. "Ground Hog" Auger

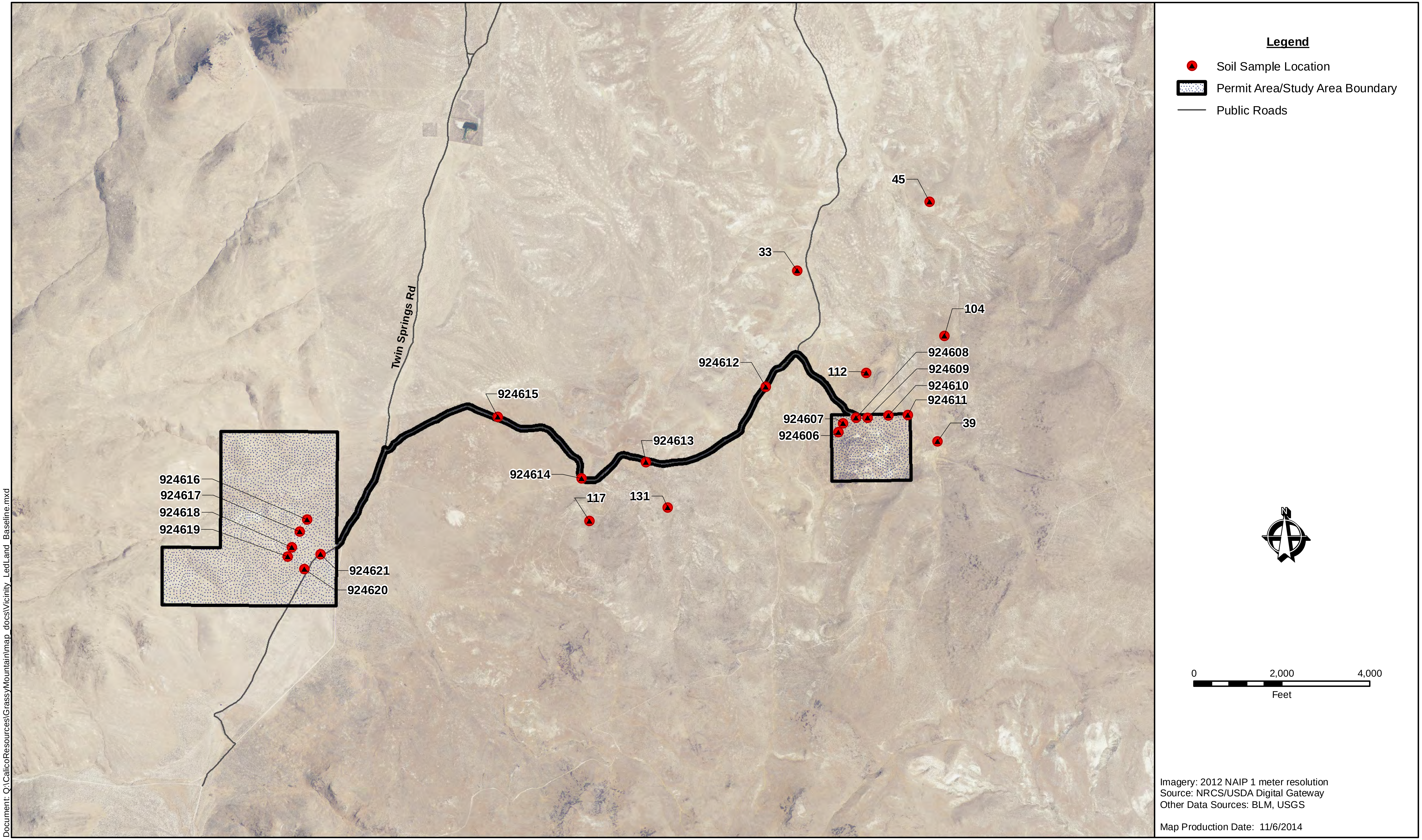
Locations of the sample collection sites are shown on **Figure 4-1**. These samples were collected using a 6-inch diameter, gas-powered, "Ground Hog" auger pictured in **Photo 4-1**. McGinnis and Lance collected duplicate samples from each sample site; described the samples as they were collected using approved field forms (see Appendix A); and bagged, numbered, and photographed each sample site. See the photographs in Appendix B.

The 16 soil samples were collected for analyses to determine adequacy for reclamation as well as geochemical content. The soil types were chosen based on soil classification by the USDA – Soil Conservation Service (now NRCS) as well as the 1991and 1993 soil surveys performed by IMS, Inc. and Newmont Mining Corporation.

One set of samples was sent to Western Laboratories in Parma, Idaho, for agricultural analysis. The second set of samples was sent to ALS Chemex in Reno, Nevada for trace element geochemical analysis. The soil samples were tested for the following trace metals:

- Mercury
- Arsenic
- Antimony
- Tungsten
- Tellurium
- Thallium
- Copper
- Molybdenum
- Lead
- Zinc
- Cadmium
- Selenium
- Bismuth

Laboratory test work for the project was conducted using standard methods routinely used in the hard rock mining industry. For this baseline study, rock and soil trace element analysis were determined using U.S. Environmental Protection Agency (USEPA) methods 3050 and 6010 at detection limits below regulatory standards. Calico coordinated with the laboratories to ensure correct method and sample amount. Soil samples that were collected had a volume of approximately 1 gallon or 5 kilograms.



Legend

● Soil Sample Location

▨ Permit Area/Study Area Boundary

— Public Roads

Imagery: 2012 NAIP 1 meter resolution
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 11/6/2014

Document: Q:\CalicoResources\GrassyMountain\map docs\Vicinity LedLand Baseline.mxd

Figure 4-1. Soil Sample Locations
Calico Resources, Grassy Mountain Project
Malheur County, OR

5 AFFECTED ENVIRONMENT (BASELINE CONDITIONS)

5.1 Introduction

The geology baseline report has been prepared from existing information, which was developed as part of the previous Atlas and NMC baseline data collection programs. The referenced materials were prepared as part of a NEPA analysis for a large-scale, open pit mine and cyanide heap leach operation. Over the past several years, Calico has developed a comprehensive geologic database that has been used in the assessment of existing environmental conditions.. This chapter presents the following information.

- Existing geology environment and geotechnical conditions (description and mapping of the regional area around the project study area, extended to 4,000 meters). However, regional geology features such as regional structures and faulting are shown at an appropriate scale to include those features affecting the project study area.
    - Topographic setting
    - Regional geology
    - Project study area geology
    - Structural geology
    - Groundwater and springs
    - Seismic conditions (fault zones and probabilistic or deterministic ground motion estimates)
    - Slope stability
- Potential geologic hazards (description and mapping)
    - Earthquake failures
    - Unsuitable soil
    - Slope failures
    - Landslide areas
    - Groundwater considerations
    - Soil erosion
    - Volcanic eruptions
    - Erionite deposits (if present)
- Existing geology environment
    - Soil types in the project study area (map of soil)
    - Soil profile thickness
    - Waste rock and ore characterization
    - Estimated effects of the project proposal on the local-geologic environment
    - Potential monitoring and mitigation measures
    - Residual effects
    - Reclamation/closure considerations

Note: Waste rock and ore characterization studies are near completion and a summary of the findings will be added to this report at that time.

5.2 Existing Environment – Geology

5.2.1 Topographic Setting

The Grassy Mountain property is located in the semi-arid plateau region of eastern Oregon. The local landscape is typical of a high mountain desert environment and rangeland. Terrain is gentle to moderate throughout most of the project study area, with elevations ranging from 3,300 to 4,300 feet – mean sea level (msl).

5.2.2 Legacy Sites

Modern usage of the project area has primarily been for cattle grazing, mineral prospecting, and game hunting. The first patent recorded near the proposed mining area was in March 1993 by Sherry and Yates, for a three lode mine claims covering 61.93 acres, called Poison Springs 24, 25, and 35 (BLM 2015).

The Grassy Mountain property was explored from the mid 1980s until the late 1990s by three operators (Atlas, Newmont, and Tombstone). In April 2003, Seabridge acquired the Grassy Mountain project from Atlas. Calico acquired all rights, title, and interest in and to the unpatented mining claims, patented mining claims, fee lands and mining leases. This also included existing exploration and water rights pertaining to the Grassy Mountain project pursuant to the Deed and Assignment of Mining Properties, between Seabridge Gold Inc., Seabridge Gold Corporation, and Calico, dated February 5, 2013.

Since the mid 1980s, a number of geologic, mine planning, metallurgical, and permitting studies have been completed in the area. The project site area is pockmarked with numerous exploration roads and drill hole locations; however, there are no mine works or buildings in the project area.

There is a valid existing exploration permit (plan of operations) with the BLM. A bond in the amount of $146,000 is associated with the exploration permit. This bond covers the reclamation requirement on all of the existing drill roads, drill pads and legacy land issues present on the mining claims controlled by Calico.

5.2.3 Regional Geology

Grassy Mountain is the largest of twelve recognized epithermal hot spring precious metal deposits of the Lake Owyhee volcanic field. The Lake Owyhee volcanic field occurs at the intersection of three tectonic provinces: the buried cratonic margin, the northern basin and range, and the Snake River Plain. During the mid-Miocene, large volume, peralkaline, caldera volcanism occurred in response to large, silicic magma chambers emplaced in the shallow crust throughout the region. The volcanic field includes several caldera-sourced ash-flow sheets and rhyolite tuff cones that were deposited from 15.5 to 15 million years ago (Ma).

At about 15 Ma, subsidence of the Lake Owyhee volcanic field triggered a change in volcanic eruption style, resulting in small volume, basalt-rhyolite deposits of limited extent. Volcanism during the mid to late Miocene is evidenced by small volume, metaluminous, high-silica rhyolite domes and flows, and small volume basalt flows and mafic vent complexes in north- and northwest-trending basin and range-type fracture zones and ring structures related to resurgent calderas. Regional subsidence facilitated the formation of through-going fluvial systems, and large volumes of fluvial sediments, sourced from the exhumed Idaho Batholith to the east, were deposited in conjunction with volcanism and hot spring activity during the waning stages of volcanic field development. The resulting regional stratigraphic section is a thick sequence of mid-Miocene volcanic rocks and coeval-to-Pliocene age non-marine lacustrine, volcaniclastic, and fluvial sedimentary rocks. For the purpose of geologic mapping in the project study area, a stratigraphic column is included as **Figure 5-1**.

Table 5-1 describes the stratigraphic column in more detail. The table describes the geologic units mapped within the project study area, the unit's age and lithologic description, and provides the map symbols used to cross reference with the geologic units shown on the project study area geology map (see **Figure 5-2**).

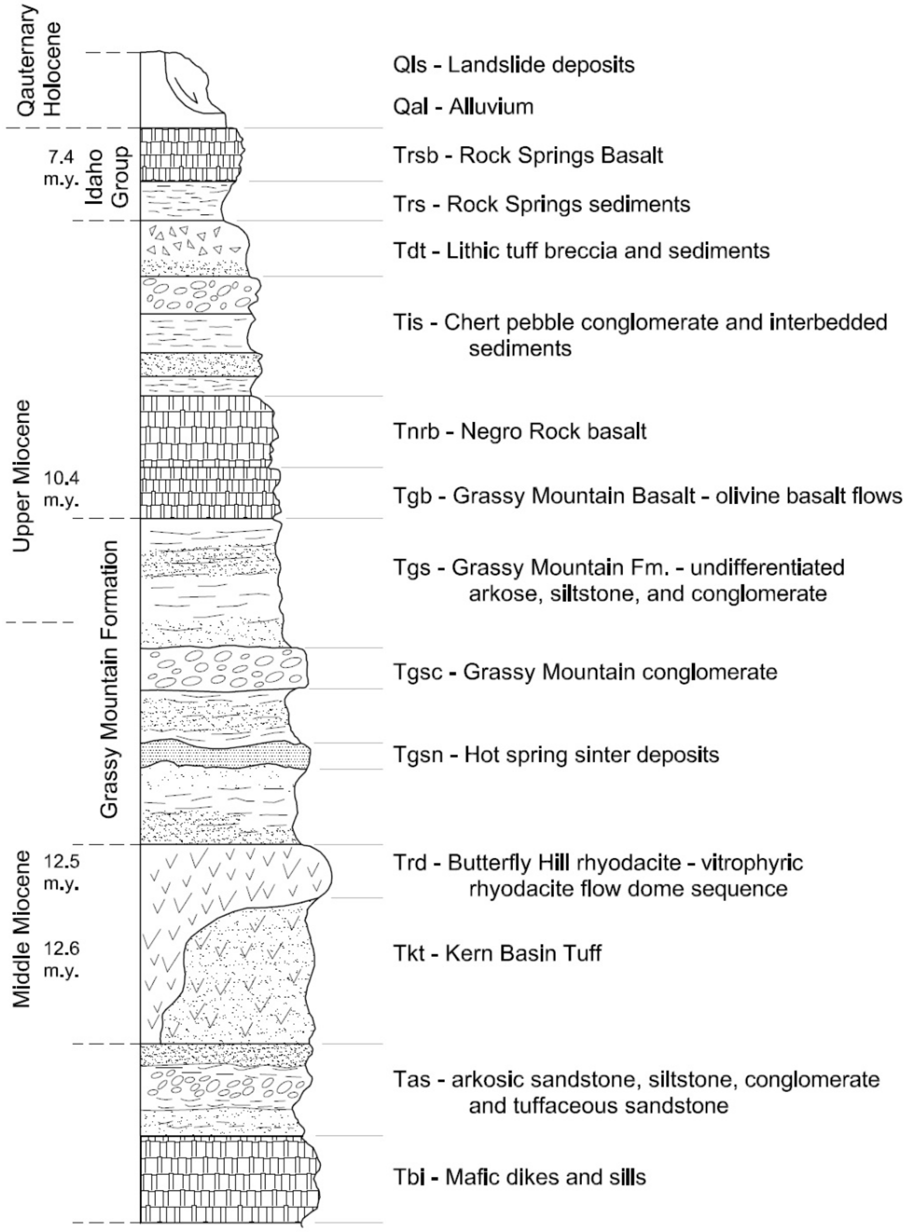


Figure 5-1. Grassy Mountain Stratigraphic Column

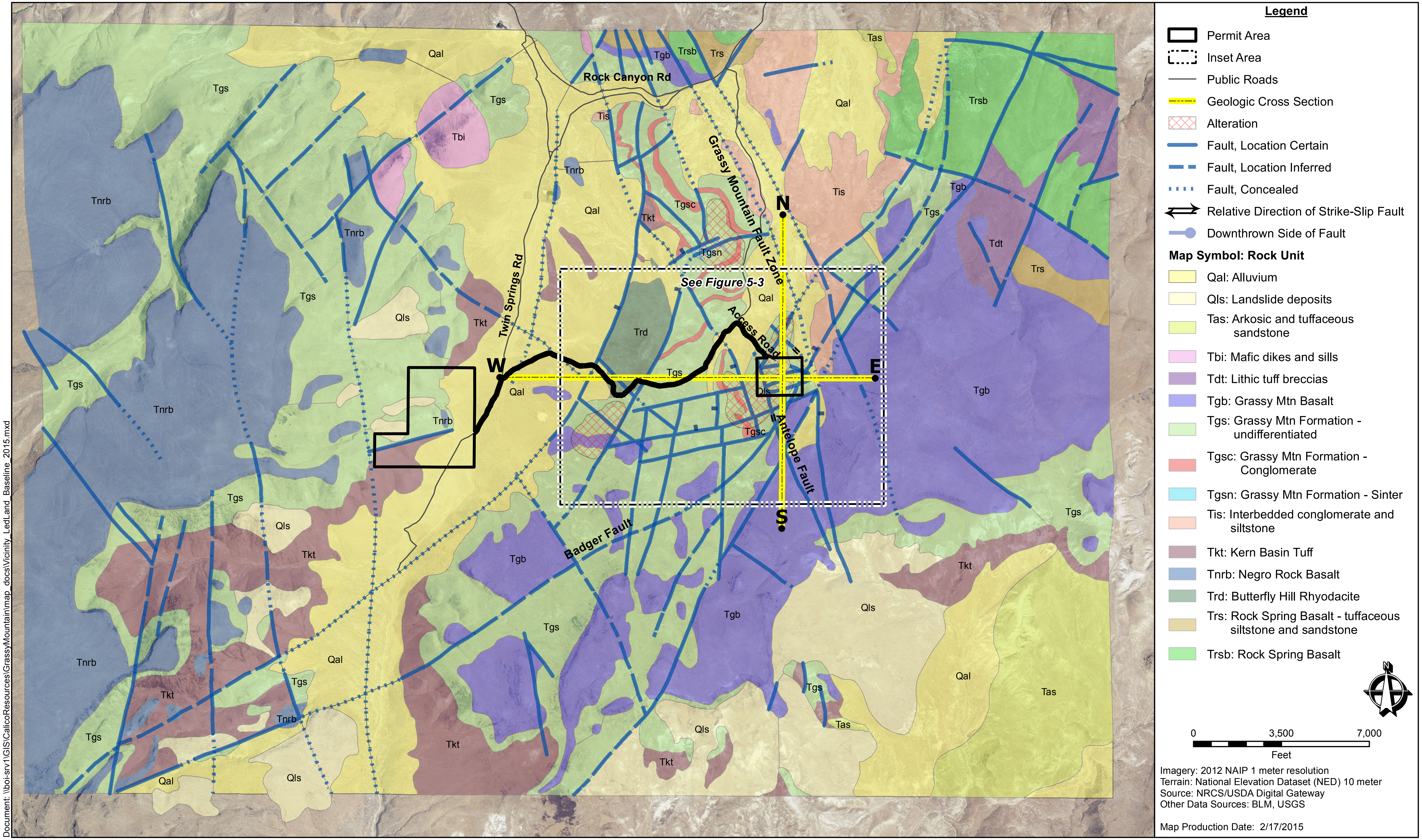
Table 5-1. Stratigraphic Column Descriptions

Map Symbol	Rock Unit	Age (millions of years before present in parenthesis)	Description
Qal	Alluvium	Pleistocene and Holocene	Unconsolidated and generally poorly sorted deposits of gravel, sand and silt accumulated along modern streams, drainages and flood plains
Qls	Landslide deposits	Pleistocene and Holocene	Landslide and slump deposits of unconsolidated and un-stratified soil and angular rock fragments formed as the result of bedrock failure. Includes large slump and debris flows composed of blocks of capping basalt on the flanks of Grassy Mountain and Sourdough Basin
Trsb	Rock Spring Basalt	Upper Miocene (7.4 m.y.)	Snake River type olivine basalt flows and interbedded deposits of tuffaceous siltstone and sandstone. Unit is made up of approximately equal amounts of volcanic flows and interflow sedimentary rocks. Trsb flows range from 2 to 20 feet thick. Entire unit of basalt with sedimentary interbeds reaches maximum thickness of 400 feet east of Shell Rock Butte.
Trs	Rock Spring Basalt - tuffaceous siltstone and sandstone	Upper Miocene	Sandstone and tuffaceous siltstone interbedded with unit Trsb are mapped separately where well exposed. Upper beds are mainly tuffaceous siltstones and include some bentonitic clays.
Tdt	Lithic tuff breccias	Upper Miocene	Mafic clast lithic tuff, airfall tuffs and overlying reworked tuffaceous silt and sandstones. Breccia clasts include yellow inflated pumice and basaltic scoria. Distinguished from Tkt by absence of banded rhyolite clasts and absence of biotite and hornblende phenocrysts that are present in Tkt. Unit is approximately 80 feet thick in western portion of map. Unconformably overlies Tis and is conformably overlain by Trsb.
Tis	Interbedded conglomerate and siltstone	Upper Miocene	Chert pebble conglomerate and interbedded diatomaceous siltstone. Mainly tuffaceous and arkosic sandstone and siltstone with interbedded conglomerate. Locally becomes finer grained upward into pale, white and yellow claystones and interbedded diatomaceous siltstones. Presumed base of Tis near Grassy Mountain Reservoir contains black chert-pebble and granite-clast conglomerate. Erosional contact with underlying unit Tgs marked by rounded boulders of olivine basalt unit Tgb. Unit is approximately 400 feet thick in mapped area.
Tnrb	Negro Rock Basalt	Upper Miocene	Dark brownish gray, locally flow banded basalt. Dikes, plugs and sills are common. Typically higher Fe/Mg ratios and much lower chromium content than Tgb or Trsb
Tgb	Grassy Mtn Basalt	Upper Miocene (10.4 m.y.)	Flow on flow sequence of olivine basalts capping the summit of Grassy Mountain; includes somewhat younger intra-canyon flows forming benches on the south side of Grassy Mountain. Locally includes overlying stream gravels containing chert pebbles and large rounded basalt clasts. Maximum thickness of 200 feet; individual flows up to 40 feet thick.

Table 5-1. Stratigraphic Column Descriptions

Map Symbol	Rock Unit	Age (millions of years before present in parenthesis)	Description
Tgs	Grassy Mtn Formation – undifferentiated	Upper and Middle Miocene	Arkosic sandstones and channel-fill granite clast conglomerates. Mainly white to tan arkosic sandstones. Includes Tgsc, channel fill conglomerates with abundant granite and rhyolite clasts in the upper part of the unit. Uppermost conglomerates locally contain rounded obsidian clasts and rare black chert clasts. Unit Tgs generally becomes finer grained upward and includes white bentonitic clays near the top of the section which, where overlain by unit Tgb often generate large landslide masses. Hot spring activity contemporaneous with the deposition of the arkoses is indicated by sinter beds Tgsn, and sinter boulders containing silicified reeds and wood near the Grassy Mountain gold deposit. Unit Tgs is the host for both the Grassy Mountain and Crabgrass gold deposits.
Tgsc	Grassy Mtn Formation - Conglomerate		Conglomerates occurring in the upper portion of Tgs – mapped individually where possible
Tgsn	Grassy Mtn Formation - Sinter		Hot spring sinter deposits within Tgs – mapped individually where possible
Trd	Butterfly Hill Rhyodacite	Middle Miocene (12.5 m.y.)	Ryodacite flow dome complex.
Tkt	Kern Basin Tuff	Middle Miocene	Mainly non-welded fine-grained, white to pale-yellow lithic tuff contain basalt, banded rhyolite, and white pumice clasts with biotite, hornblende, quartz and plagioclase crystals. Includes thinly bedded airfall tuffs at the base of the unit and overlying thin lenses of interbedded tuffaceous and arkosic sandstone and granite-clast conglomerate. Locally includes chaotically bedded airfall tuff with slump structures and massive surge deposits of matrix-supported lithic tuff composed of rhyolite and pumice clasts. Pumice clasts in the lithic tuff deposits increase in abundance and size toward the top of the unit. Uncomformably overlies unit Tas.
Tas	Arkosic and tuffaceous sandstone	Middle Miocene	Arkosic and tuffaceous sandstone, siltstone and conglomerate. Mainly white to tan arkosic sandstone with minor amounts of granite-clast conglomerate. Includes 20 feet thick massive beds of coarse matrix supported, granite-clast conglomerate near the exposed base of the unit.
Tbi	Mafic dikes and sills	Middle Miocene	Mafic dikes and sills. Younger sequence includes irregularly shaped sills and dikes that intrude units Tas, Tkt and Tgs along both flanks of Grassy Mountain. Dikes and sills are olivine basalts believed to be feeders to units Tbg and Trsb. Dike cut through lowermost flows of unit Trsb north of Grassy Mountain near Willow Spring.

Source: DOGAMI 2009



Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/17/2015

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Figure 5-2. Regional Geology Map
Calico Resources, Grassy Mountain Project
Malheur County, OR

5.2.4 Study Area Geology

Bedrock outcrops in the project study area are typically composed of olivine-rich basalt and siltstones, sandstones, and conglomerates of the late Miocene Grassy Mountain Formation (Tgb, Tgsn, and Tgs). These rocks are locally covered with relatively thin, unconsolidated alluvial and colluvial deposits (Qal). Erosion-resistant basalts cap local topographic highs. Arkosic sandstones have been encountered at the surface and at depth, but have not been correlated across the project study area, in part due to lateral discontinuity associated with sedimentary facies changes and structural offset. **Figure 5-3** focuses on the geology of and near the mine permit area, including fault displacement and numerous strikes and dips, and foliations. This map shows three bounded areas of multiple and dense strike and dip and foliation areas. **Figure 5-4**, **Figure 5-5**, and **Figure 5-6** are magnified maps of each of these areas. **Figure 5-7** shows two generalized geologic cross sections through the mining permit area; west to east and south to north.

Surface and drill-defined stratigraphy within the project study area reveals complex facies that were produced during the waning stages of deposition of the Lake Owyhee volcanic field. The oldest units encountered are the flow-on-flow Blackjack and Owyhee Basalts (14.3 to 13.6 Ma). These basalts are overlain by arkosic sandstone, tuffaceous sandstone, and conglomerates of the Deer Butte Formation.

The basal unit to the overlying Grassy Mountain Formation is the Kern Basin Tuff (Tkt); a non-welded, pumiceous, crystal tuff that displays cross beds and local surge structures. Clast size, thickness of individual ash units, and bedding structures suggest a source in the Grassy Mountain area. The Kern Basin Tuff ranges in thickness from 300 feet on the south bluffs of Grassy Mountain, to 1,500 feet in a drill hole beneath the project study area.

The Kern Basin Tuff is overlain by a series of fluvial sediments. Most of the sedimentary units in the project study area are silicified and strongly indurated. These sedimentary units include granitic clast conglomerate, arkosic sandstone, fine grained sandstone, siltstone, and siltstone/mudstone. The sedimentary facies of the Grassy Mountain Formation range from 300 to over 1,000 feet thick, and provide the host rocks of the Grassy Mountain mineral resource.

Several siliceous terraces are interbedded with the silicified sediments of the Grassy Mountain Formation. Terrace construction was apparently episodic and intermittently inundated by fluvial sediments, resulting in an interbedded sequence of siltstone, sandstone, conglomerate, and sinter terrace deposits. Load casts, flame textures, convolute lamination and other soft-sediment deformation textures are common in both the sinter beds and sedimentary facies. The amount and size of the sinter clasts in the sedimentary rocks reflect relative proximity to a terrace. Proximal deposits are angular, inhomogeneous, clast-supported breccias of sandstone, siltstone, and sinter with indistinct clast boundaries in a sulfidic mud-textured matrix.

5.2.5 Ore Deposit Geology, Mineralization and Alteration

Grassy Mountain is a prominent, 150-foot-high, silicified and iron-stained knob. Bedding is horizontal at the hilltop, and dips at 10 to 25 degrees to the north-northeast on the northern and eastern flanks of the hill. The bedding dip steepens to 30 to 40 degrees on the west side of the hill due to drag folding in the footwall 20 degrees west of north (N20°W), striking Antelope Fault. A small area on the southwest slope of Grassy Mountain is covered by silicified arkose landslide debris.

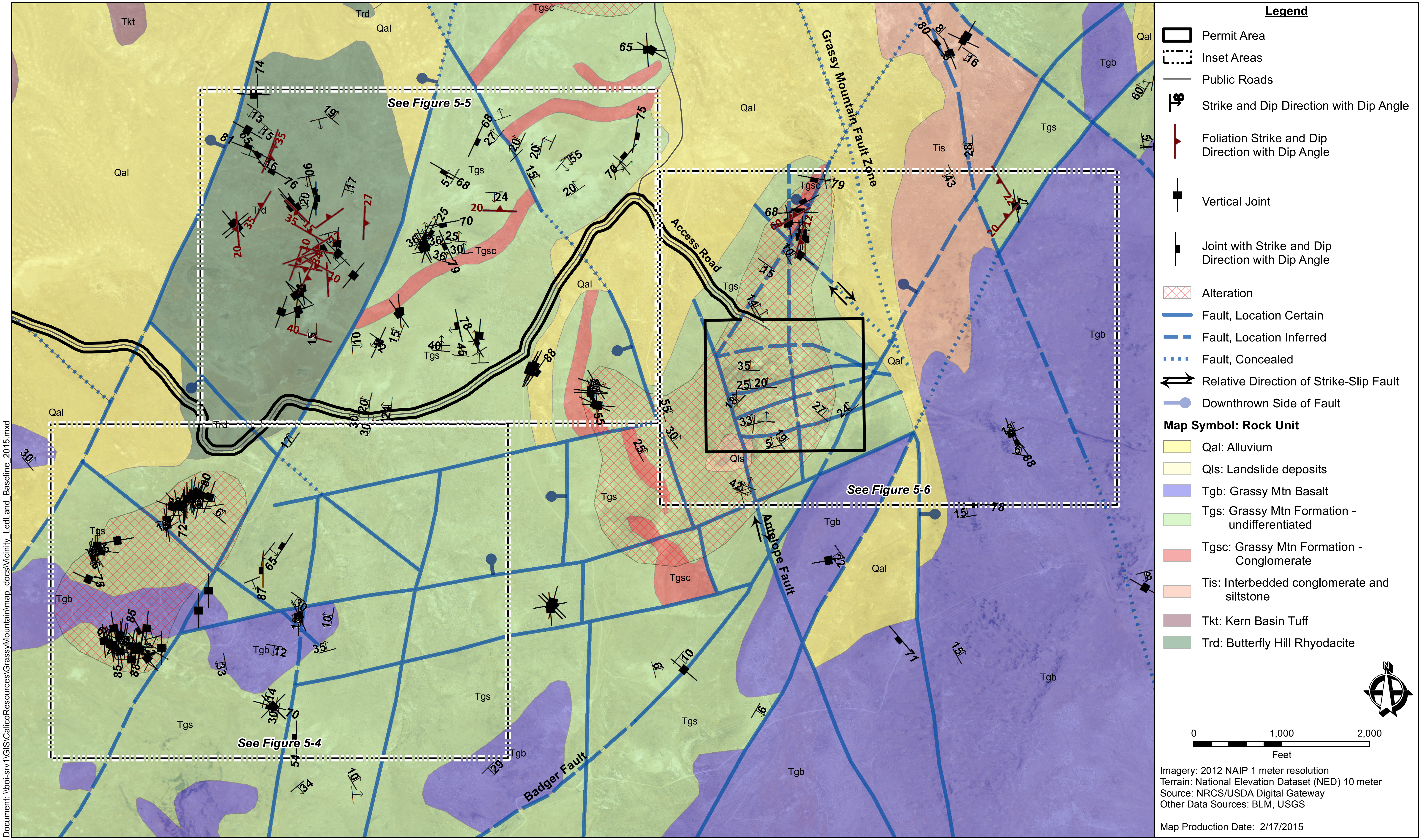
Grassy Mountain is a horst block that has been raised 50 to 200 feet in a region of complex block faulting and rotation. Faulting at Grassy Mountain is dominated by post-mineral 30 degrees west of north (N30°W) to 10 degrees east of north (N10°E), striking normal faults developed during basin and range extension. On the northeast side of the deposit, these faults progressively down-drop mineralization beneath post-mineral cover. These offsets are suggested by interpreted offsets of a prominent white sinter bed in drill holes as well as intersections with fault gouge.

The surface expression of the Grassy Mountain system is indicated by weak to moderately strong silicification and iron staining with scattered 1/8-inch to 1-inch wide creamy to light gray chalcedonic veinlets. Approximate dimensions of the Grassy Mountain deposit at depth are 1,600 feet long by 1,000 feet wide by 600 feet thick. The deposit has a general 70 degrees east of north (N70°E) elongation and a 15-degree bedding plane dip to the north-northeast as a result of faulting and fault block rotation. There is an envelope of lower grade mineralization at depths of 200 to 800 feet that contains a higher-grade zone of mineralization between 500 and 750 feet below the surface. The well-defined base of higher grade mineralization from about 700 to 750 feet in depth suggests a strong pressure-temperature control on gold deposition. This pressure-temperature control likely indicates a boiling horizon in the hydrothermal system that acted as a controlling mechanism on gold deposition.

Boiling horizons are common in hydrothermal systems and are identified by sinter and/or hydrothermal breccia. These sinters and breccias often parallel the paleosurface present at the time of mineralization. Breccias tend to be clast supported with minimal clast rotation. They occur where over-pressuring in the hydrothermal system caused hydrofracturing of the rocks. The fractures create a stockwork (irregularly distributed veinlets) pattern generally found below the sinter, though some vein extensions may extend to the surface. The stockwork is surrounded by silicified sediments. Mineralized quartz-adularia stockwork and vein types include single, colloform banded, brecciated, and calcite-pseudomorphed veins. Visible gold (0.5 millimeters) has been found within the stockwork portions of the boiling horizon. The gold mostly occurs as electrum along the fracture margins or within microscopic voids. A brassy color is imparted due to the high silver content. The average silver to gold ratio at Grassy Mountain is 2.5:1. Vein adularia was K-Ar (potassium-argon) dated at 13.1 million years.

Silicification in the form of sinters and disseminated quartz is the dominant alteration type at Grassy Mountain and is largely controlled by hot-spring vents. Silicification occurs both pervasively as silica flooding and as cross-cutting veins and stockworks. The silicified envelope has plan dimensions of 3,000 feet (north-south) by 2,500 feet (east-west). Silicification is surrounded by barren, unaltered, clay-rich (20- to 40-percent montmorillonite), tuffaceous siltstone and arkose with minor disseminated diagenetic pyrite. Many of the sinters occur as sheets instead of mounds, which suggest that they are related to vents along faults rather than point sources.

Potassic alteration occurs as adularia flooding with destruction of biotite. Orthoclase is unaffected by potassic alteration, and plagioclase is replaced by adularia. The adularia is extremely fine-grained and is identified microscopically or by cobaltinitrite staining. Sulfate phases identified by x-ray diffraction include jarosite and alunite in several mineralized samples.



Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/17/2015

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Figure 5-3. Geology of Mine Permit Area
Calico Resources, Grassy Mountain Project
Malheur County, OR

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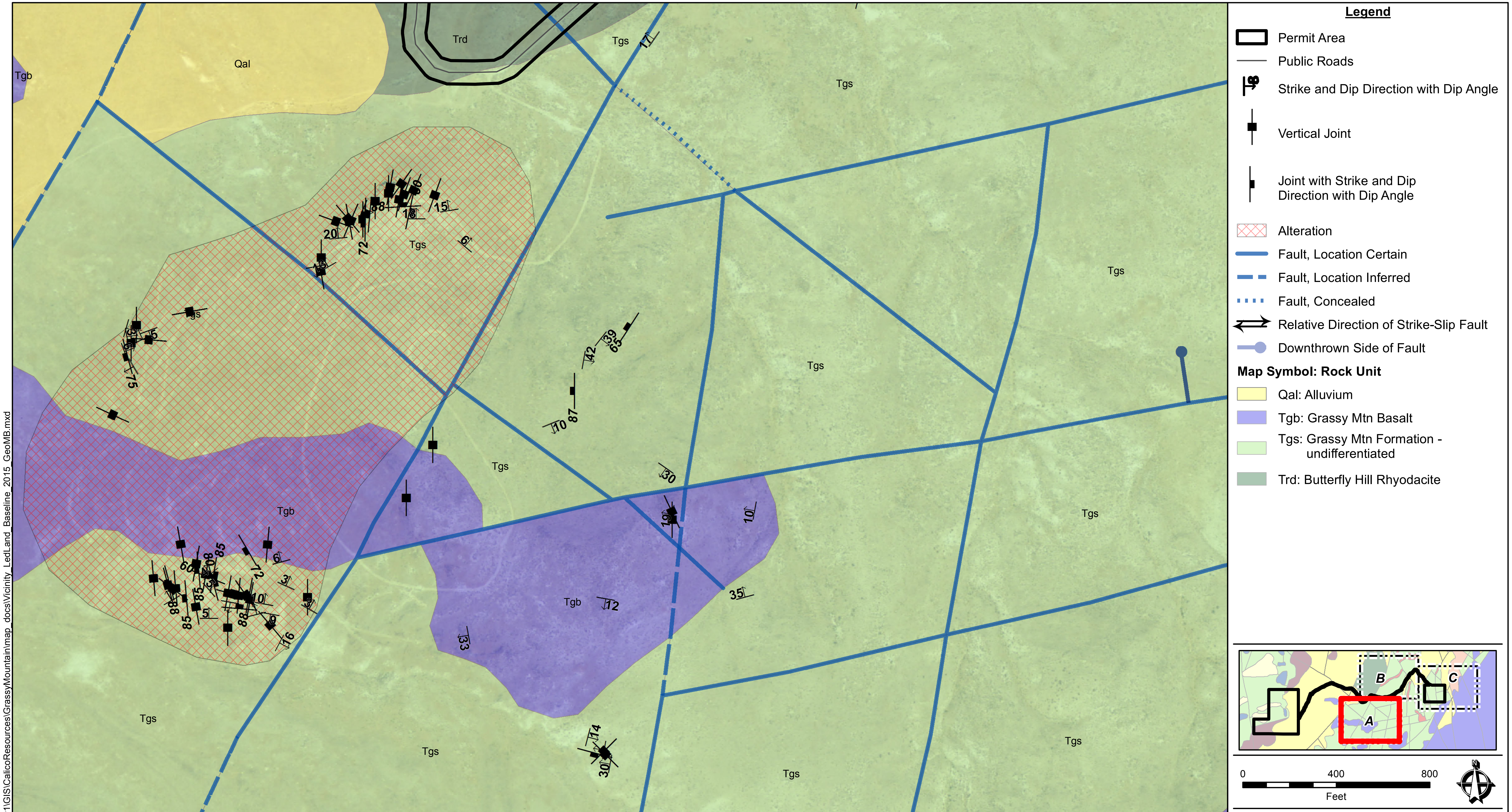
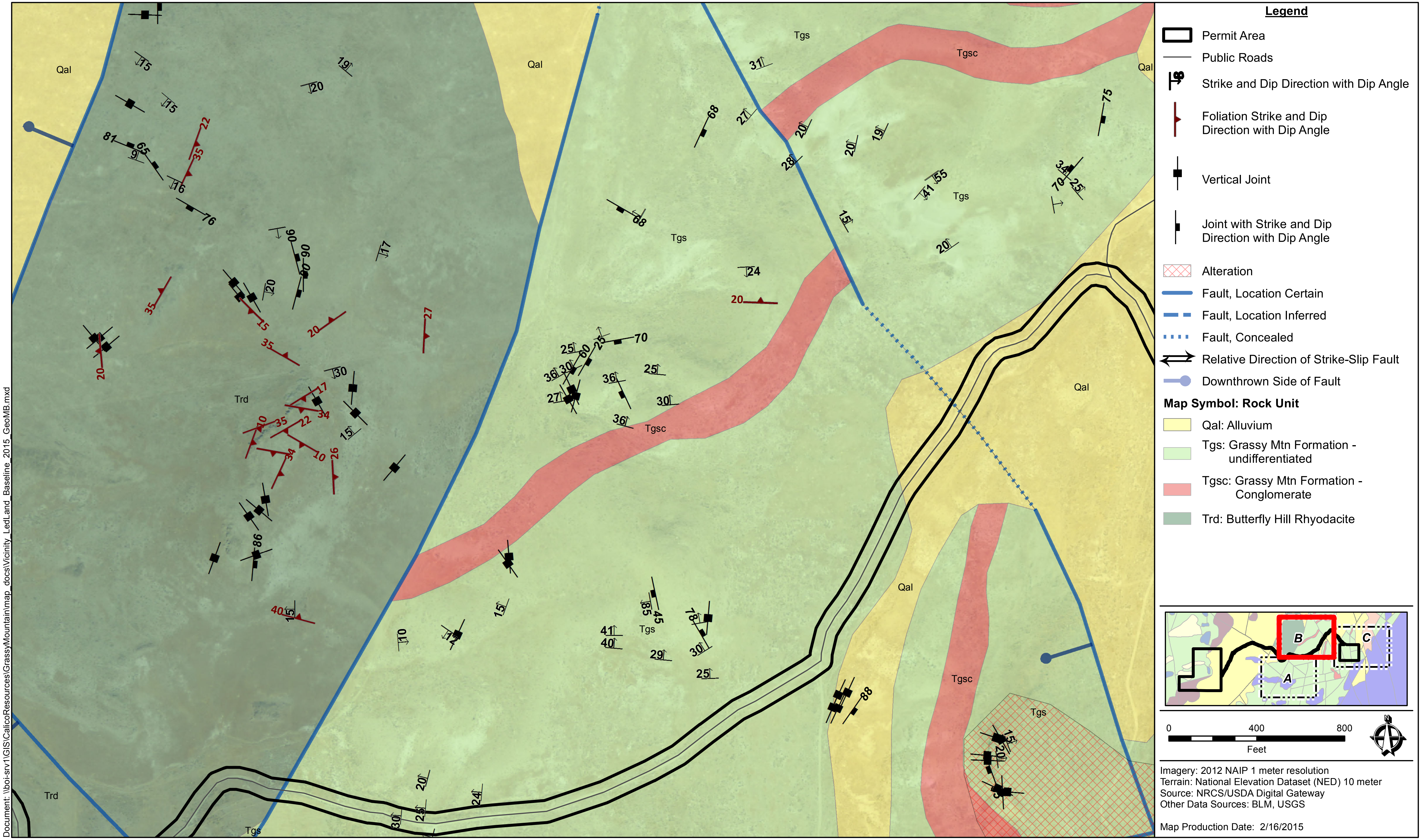


Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/16/2015

Figure 5-4. Area A Geology
Calico Resources, Grassy Mountain Project
Malheur County, OR



Legend

- ▭ Permit Area
- — Public Roads
- Strike and Dip Direction with Dip Angle
- Foliation Strike and Dip Direction with Dip Angle
- Vertical Joint
- Joint with Strike and Dip Direction with Dip Angle
- ▨ Alteration
- Fault, Location Certain
- Fault, Location Inferred
- Fault, Concealed
- ⇄ Relative Direction of Strike-Slip Fault
- ● Downthrown Side of Fault

Map Symbol: Rock Unit

- 🟨 Qal: Alluvium
- 🟩 Tgs: Grassy Mtn Formation - undifferentiated
- 🟥 Tgsc: Grassy Mtn Formation - Conglomerate
- 🟩 Trd: Butterfly Hill Rhyodacite

Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/16/2015

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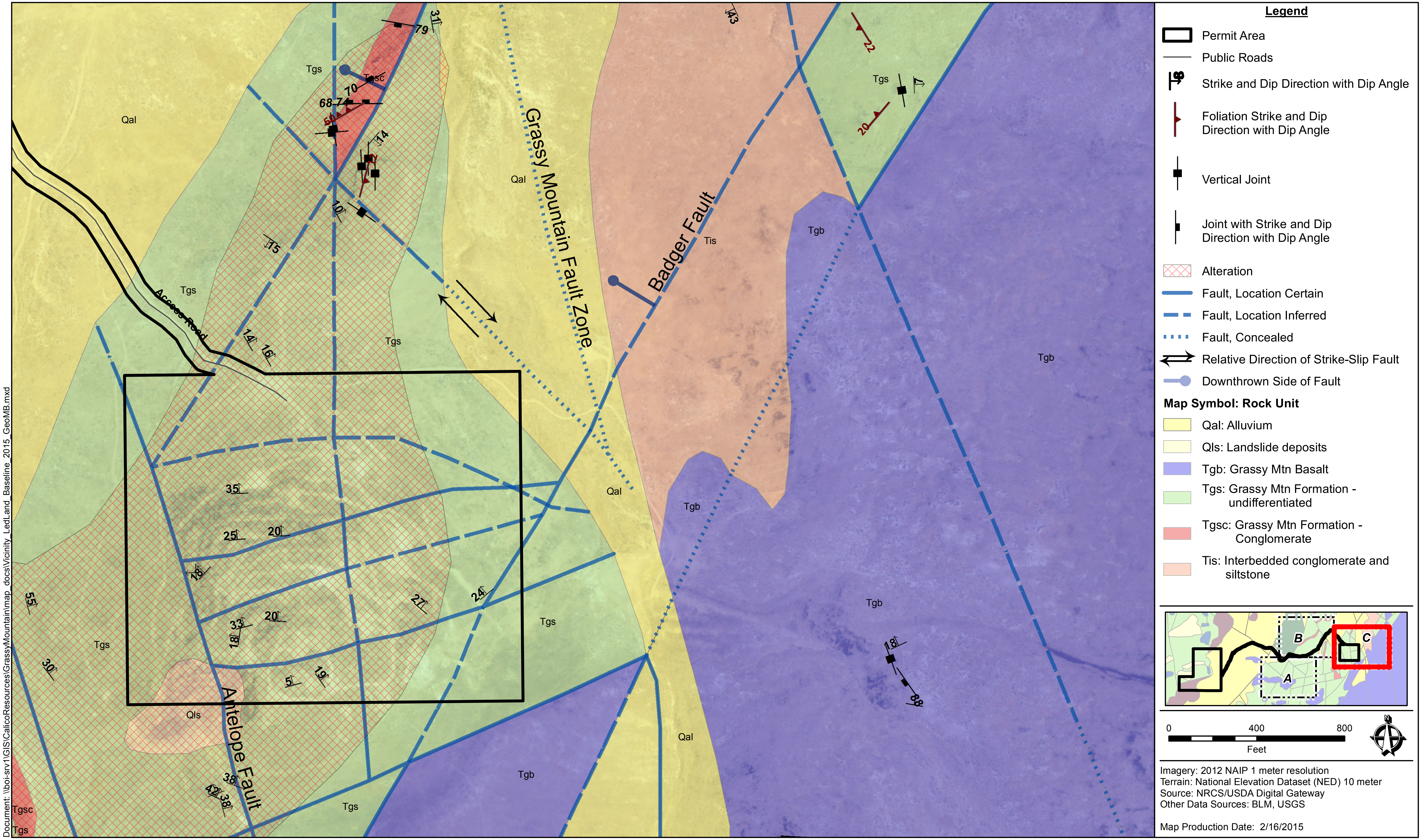
Figure 5-5. Area B Geology
Calico Resources, Grassy Mountain Project
Malheur County, OR



Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/16/2015

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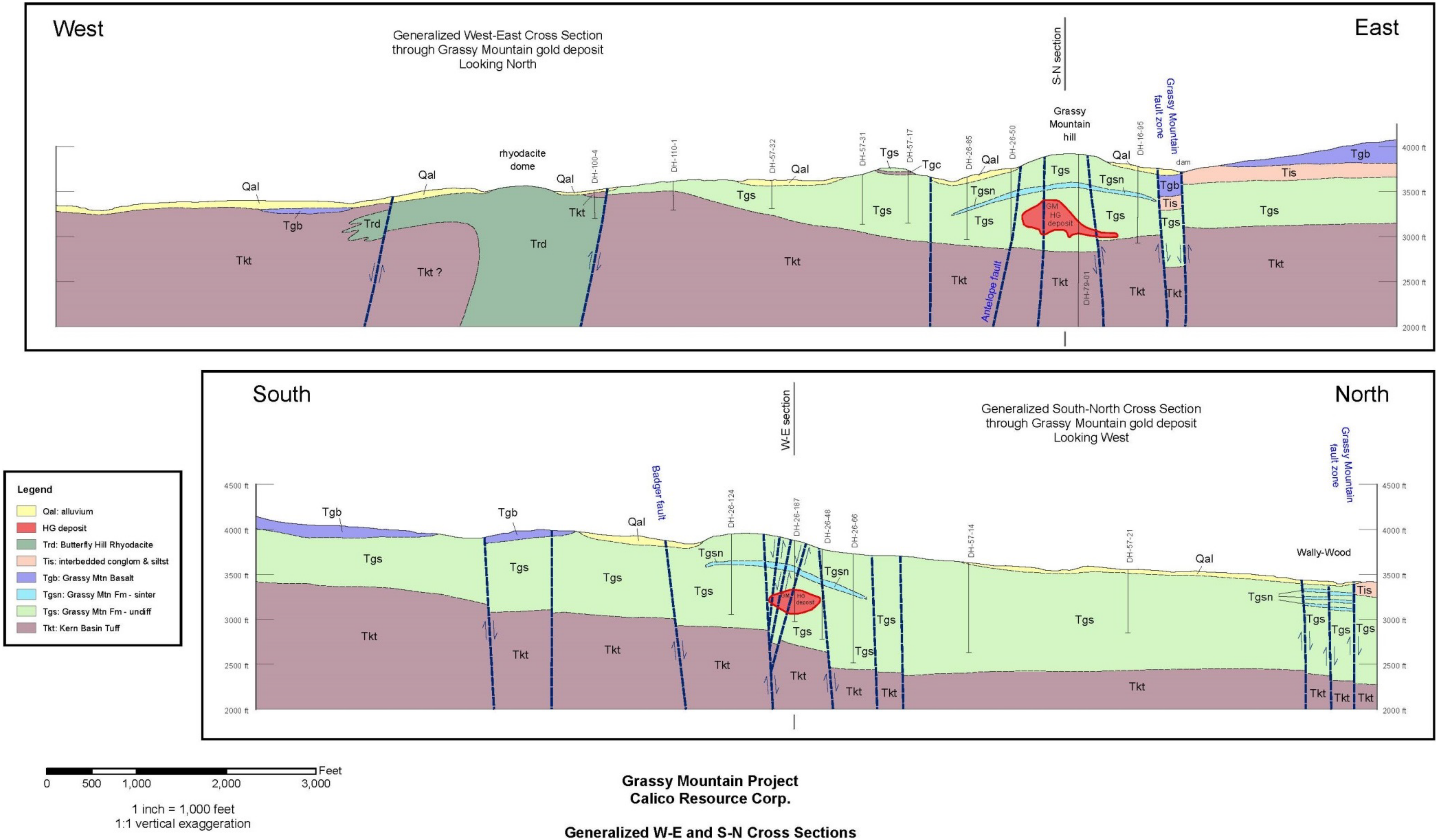
Figure 5-6. Area C Geology
Calico Resources, Grassy Mountain Project
Malheur County, OR



Grassy Mountain Project
Calico Resource Corp.

Generalized W-E and S-N Cross Sections

February 2015 D. Lance

Figure 5-7. Geologic Cross Sections

The youngest event genetically linked to the hydrothermal system includes the rubble zones of clay matrix breccia, believed to represent a period of late boiling along pre-existing conduits as hydrogen sulfide (H_2S) and carbon dioxide ($CO_{2)}$ were expelled from the system. Since these breccias were formed along mineralized faults they remobilized and rotated veined arkose and siltstone. These clast-supported breccias contain sub-rounded to sub-angular sand to boulder-sized clasts of silicified arkose and siltstone in a jarosite-sericite clay matrix.

The Grassy Mountain deposit has a trace element signature that includes anomalous levels of arsenic (As), antimony (Sb), and mercury (Hg). Details of the trace element occurrence will be discussed in the *Geochemistry Baseline Study* to be submitted by SRK.

Mineralization of the Grassy Mountain deposit includes low grade gold associated with hot springs sinter deposition; high grade gold associated with multi-stage quartz-adularia-gold-silver veining and stockworks; late remobilization within sub-vertical rubble zones defined by clay matrix breccias; and kaolinitic acid-leached zones beneath sinter caps. The deposit is characterized by stacked sinter terraces capping acid-leached sediments and multiple generations of veining, which suggest repeated eruption, brecciation, breeching, and sealing of the hydrothermal system. At a depth of 300 feet below surface, the main sinter at Grassy Mountain is underlain by a zone of intense silicification that formed a seal or cap over the hydrothermal system. Explosive brecciation (indicated by the clay matrix breccia lithology) beneath the silicified cap suggests that the over-pressured hot-springs system discharged a violent and sudden release of energy. H_2S- and CO_2-rich gases evolved during boiling to produce an acid-sulfate solution that acid-leached the host rock through downward percolation.

Vein-type mineralization (quartz veins > 3 to 4 inches wide) has not been found at Grassy Mountain. Stockwork quartz and quartz veinlets (quartz < 3 inches wide) are the most common manifestation of quartz within the deposit. These veinlets are discontinuous and cannot be traced from drill hole to drill hole in the subsurface. Where exposed in surface outcrops, these quartz veinlets are irregular in nature. Further, they can only be traced for maximum distances of several feet. A consistent orientation of the quartz veinlets cannot be determined from existing drill hole information or from surface outcrops.

Ore minerals include: native gold (50 to 600 microns), electrum, and minor pyrite (up to 80 microns). Gangue minerals include quartz, calcite, chlorite, epidote, orthoclase, plagioclase, illite, sericite, chalcedony, montmorillonite, goethite, and jarosite.

A conceptual schematic of the Grassy Mountain geologic and mineralization model is depicted in **Figure 5-8.**

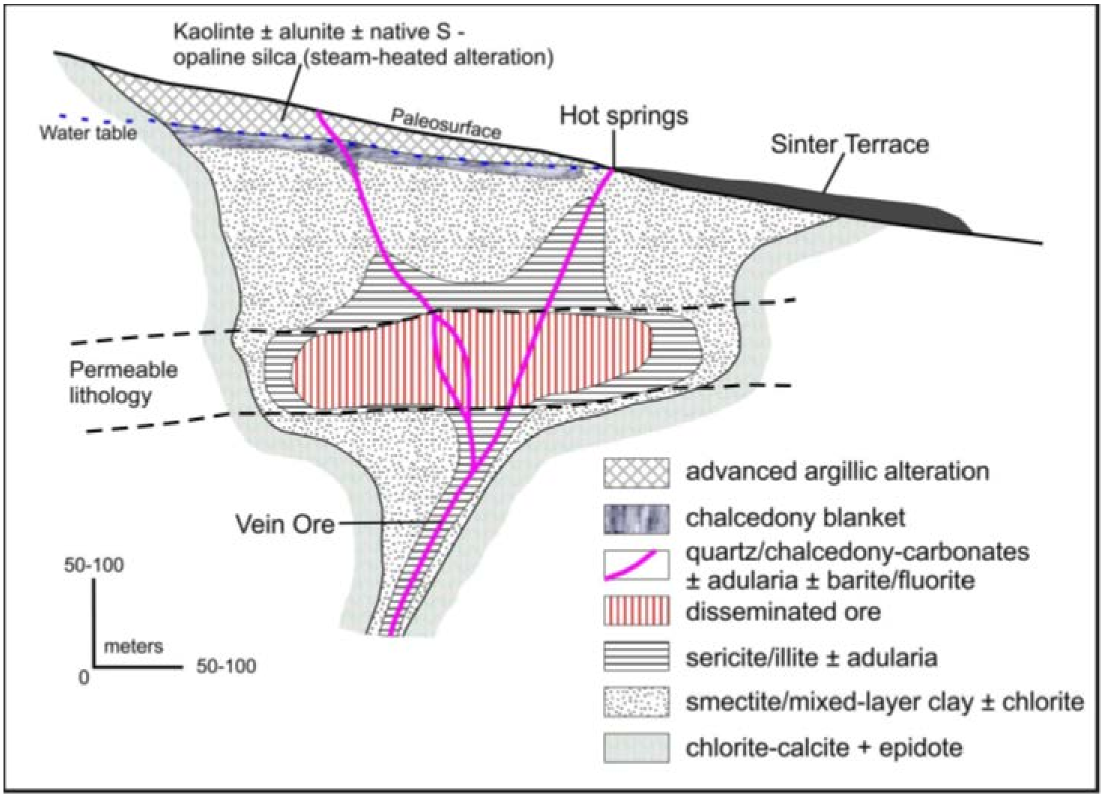


Figure 5-8. Geologic and Mineralization Model

5.2.6 Structural Geology

The Grassy Mountain gold deposit sits buried below a prominent, 150 feet high, silicified and iron-stained knob. Stratigraphic bedding in volcanic rocks and sediments of the Grassy Mountain Formation, is nearly horizontal at the hilltop. Bedding steepens at 10 to 35 degrees to the north and northeast on the northern and eastern flanks of the hill. On the west side of the hill, the bedding dip steepens to 30 to 50 degrees due to drag folding in the footwall 20 degrees west of north (N20°W), striking Antelope Fault.

At a local scale and within the immediate vicinity of the Grassy Mountain gold deposit, fault orientations can be grouped into two major sets: 20 degrees west of north to 10 degrees east of north (N20°W to N10°E) striking faults, and 70 degrees east of north (N70°E) striking faults. These structures will have the greatest impact on underground conditions within the mining environment.

As depicted on the cross sections (**Figure 5-7**), faulted offsets are generally less than 40 to 50 feet. Maximum offsets of up to 200 feet occur along the N20°W striking Grassy Mountain fault zone.

The Rose Diagram in **Figure 5-9** depicts the strike and dip orientations of bedding planes in volcanic and volcaniclastic sediments within the project area. There are 246 measurements included in the compilation. These strikes and dips are shown on the project geology map. The measurements are plotted according to the “Right Hand Rule,” meaning that strike azimuth is plotted with the dip of the bedding 90 degrees to the right of the azimuth.

The bedding orientations fall into two major groups: 1) Strikes of 45 degrees west of north to north (N45°W to N) with dips to the northeast, 2) Strikes of 60 degrees west of south to west (S60°W to W) with dips to the northwest.

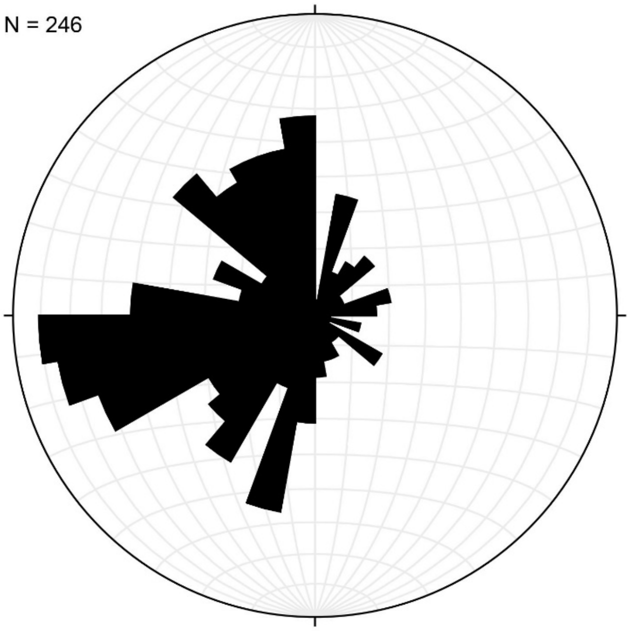


Figure 5-9. Strike and Dip of Bedding

The Rose Diagram in **Figure 5-10** depicts the strike and dip orientations of joints and fractures in volcanic and volcaniclastic sediments within the project area. There are 61 measurements included in the compilation. These strike and dip locations are shown on the project geology map. The measurements are plotted according to the "Right Hand Rule."

Joint and fractures orientations fall into three major groups: 1) Strikes of north to 20 degrees east of north (N to N20°E) dipping to the east-southeast; 2) Strikes of a general south direction with dips to the west; 3) Strikes with a general west direction dipping to the north.

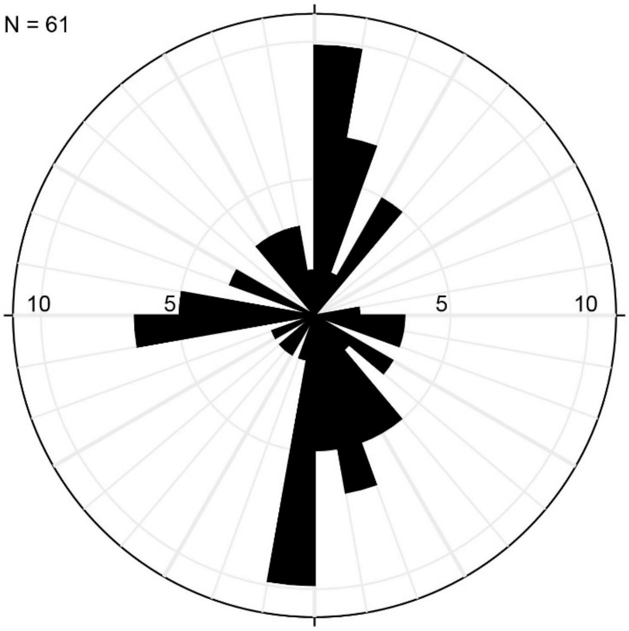


Figure 5-10. Strike and Dip of Joints and Fractures

5.2.7 Water Resources

5.2.7.1 Surface Water and Springs

The project area is rolling hill terrain. Negro Rock Canyon to the west of the main project area and the Owyhee River Canyon to the southeast provide more relief in topography. The highest elevation is about 4,800 feet msl along the west flank of Grassy Mountain. Elevation decreases to the north (about 3,250 feet msl at Negro Rock Canyon). Elevation falls to about 2,300 feet msl at the Malheur River 18 miles to the north and to 2,340 feet above msl at the Owyhee River 5 miles to the west.

The Owyhee River is the largest surface water body in the region. The U.S. Bureau of Reclamation supplies about 500,000 acre-feet of water from the river basin to irrigate a little over 118,000 acres along the west side of the Snake River in the vicinity of Adrian, Nyssa, and Ontario. Negro Rock Canyon drainage contains an intermittent stream that only flows in response to snowmelt or heavy rainfall. There are no known stream gaging records within the Negro Rock Canyon basin. There are published stream gaging records for the Owyhee River, Malheur River, and the north fork of the Malheur River. Owyhee Reservoir and several reservoirs in the Malheur River Basin also report water surface elevations (USGS 2001).

There are two surface watersheds that could be affected by surface runoff from Grassy Mountain Gold Project surface facilities; Negro Rock Canyon, which could receive runoff from processing facilities; and Sagebrush Gulch (a tributary to Negro Rock Canyon), which could potentially receive runoff from mine facilities). It is assumed that project facilities will not extend south into the Dry Creek drainage (an Owyhee River tributary).

All the drainages in the vicinity of the project boundary are ephemeral or intermittent.

Several springs exist within the project area. Many of the springs appear to represent discharge of groundwater from deep aquifers while others represent discharge of groundwater from local shallow perched water-bearing zones. Some of the springs are dry during most of the year and are active only during the spring and early summer.

There are no jurisdictional wetlands or floodplains within the study area.

5.2.7.2 Groundwater Resources

The regional groundwater system that includes the project study area is bordered roughly by the Sourdough Mountain upland area to the west of Grassy Mountain, the Malheur River to the north and west, and the Owyhee Reservoir and Owyhee River, and the Snake River to the south and east. Groundwater studies by Adrian Brown Consultants, Inc. (ABC 1992) and J.M. Montgomery, Consulting Engineers, Inc. (JMM 1991) further identified the following hydrostratigraphic units within the project study area:

- Local discontinuous water-bearing zones within the Grassy Mountain formation;
- Less permeable fine-grained sedimentary rocks (clay, clayey and tuffaceous siltstones, and indurated siltstone predominantly overlying and underlying the sandstone and conglomerate unites), acting as aquitards beneath the project study area; and
- Sandstone and conglomerate units that are inconsistent water-bearing units.

While the groundwater system appears to be continuous on a regional basis, individual water-bearing units are scattered and have restricted areal extent across the site. These units range from roughly 25 to 420 or more feet below ground surface. Groundwater flow in the shallowest, unconfined water bearing zones generally follows the topography. Flow in deeper, confined water-bearing zones is likely disrupted by faults and other structures in the study area. Grassy Mountain appears to be a hydrologic divide between the Owhyee River and Negro Rock Canyon. Recharge to the regional system is by infiltration of incident precipitation and runoff.

The general direction of groundwater flow in 2013 (SPF) was to the northwest, which was consistent with previous studies. **Figure 5-11** shows the 2013 groundwater contours.

Estimates of the transmissivity of the aquifers vary from 175 to 2,800 gallons per day per foot (JMM 1991). Aquifer testing suggests that the transmissivity decreased to the south, with low permeability near areas where the sedimentary rocks become silicified and more indurated. The hydrothermal alteration and silicification at Grassy Mountain may have locally affected the hydraulic properties of sedimentary rocks within the area and caused permeabilities in the vicinity of the ore deposit to be significantly reduced relative to permeabilities north and west of the mine.

Geologic and hydrogeologic information from the site indicates that water-bearing zones are generally protected by layers of fine-grained sedimentary rocks. Low permeabilities are also expected in siltstone and claystone materials at depth (JMM 1991). The fine-grained sediments retards downward migration of surface contaminants to potential deeper water-bearing units.

The potential for faults to act as contaminant transport pathways has been examined. Aquifer test data indicate that the faults probably restrict lateral groundwater flow, acting as negative hydraulic boundaries. This information, together with the evidence that low-permeability sediments dominate the subsurface for at least 100 feet in the vicinity of the proposed mine and process facilities (which would have lower permeabilities along fault zones) indicates that faults in the area have little potential to act as contaminant transport pathways.

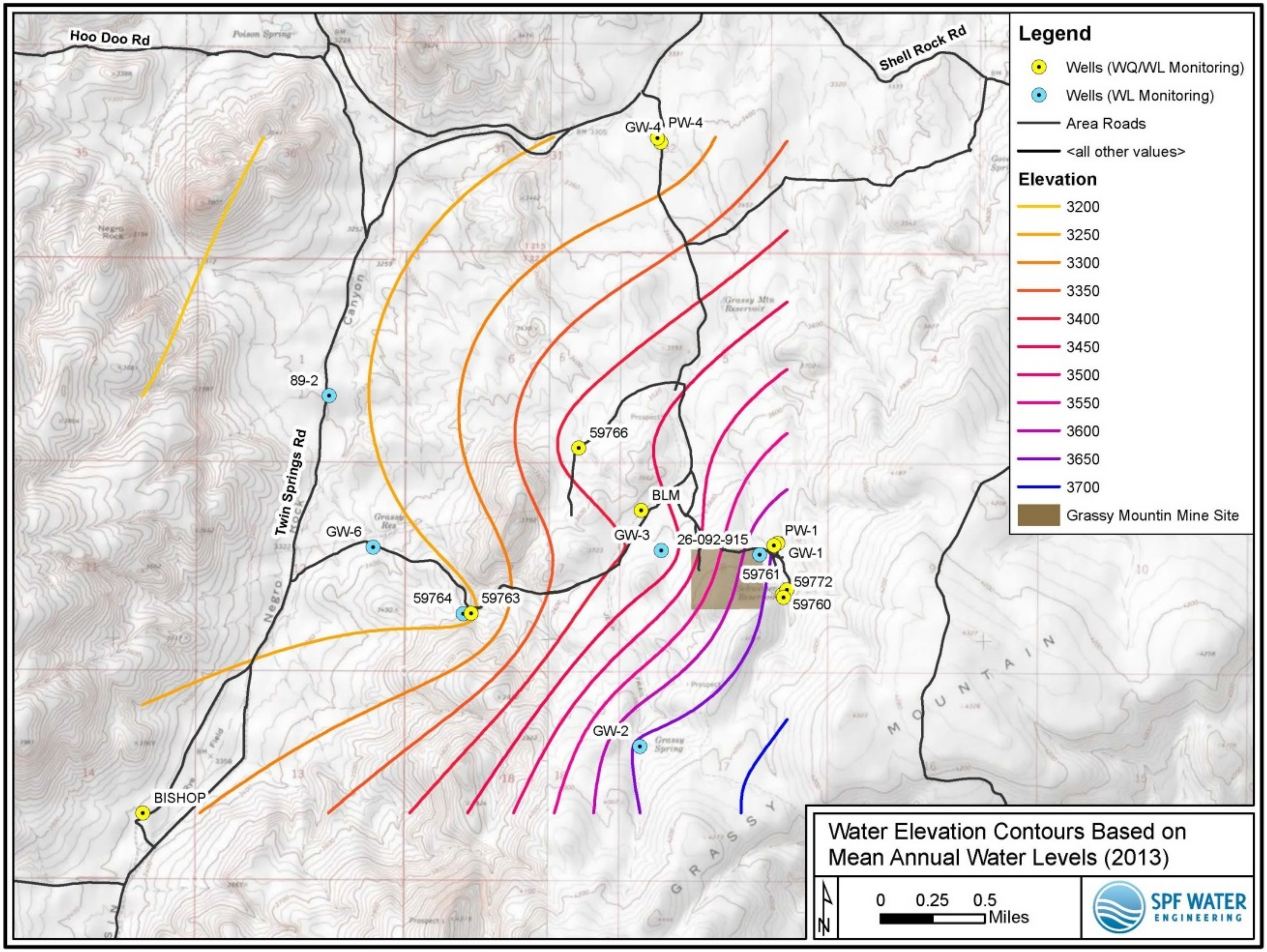


Figure 5-11. 2013 Groundwater Contour Map

5.3 Geologic Hazards

Geologic hazards evaluated while preparing this report include the following and are discussed in the following sections:

- Seismicity/earthquake hazards
- Slope failures/landslide areas
- Volcanic eruptions
- Unsuitable soil/soil erosion (see Section 5.4)

5.3.1 Seismicity/Earthquake Hazards

The project study area is located in a region of low seismic risk. No active or potentially active faults are in the project study area. The closest historic fault with surface rupture, the Lost River Fault, is located near Challis, Idaho, about 180 miles east of the project study area. The closest potential Holocene age faults are located over 30 miles north of the project study area. **Figure 5-12** presents a map showing earthquake probabilities for the project study area. The probability of the occurrence of an earthquake with a magnitude >5.0 over the next 10 years is <0.03. **Figure 5-13** presents a seismicity map of the U.S. depicting the areas of earthquake hazards. **Figure 5-14** shows seismic hazards specific to Oregon.

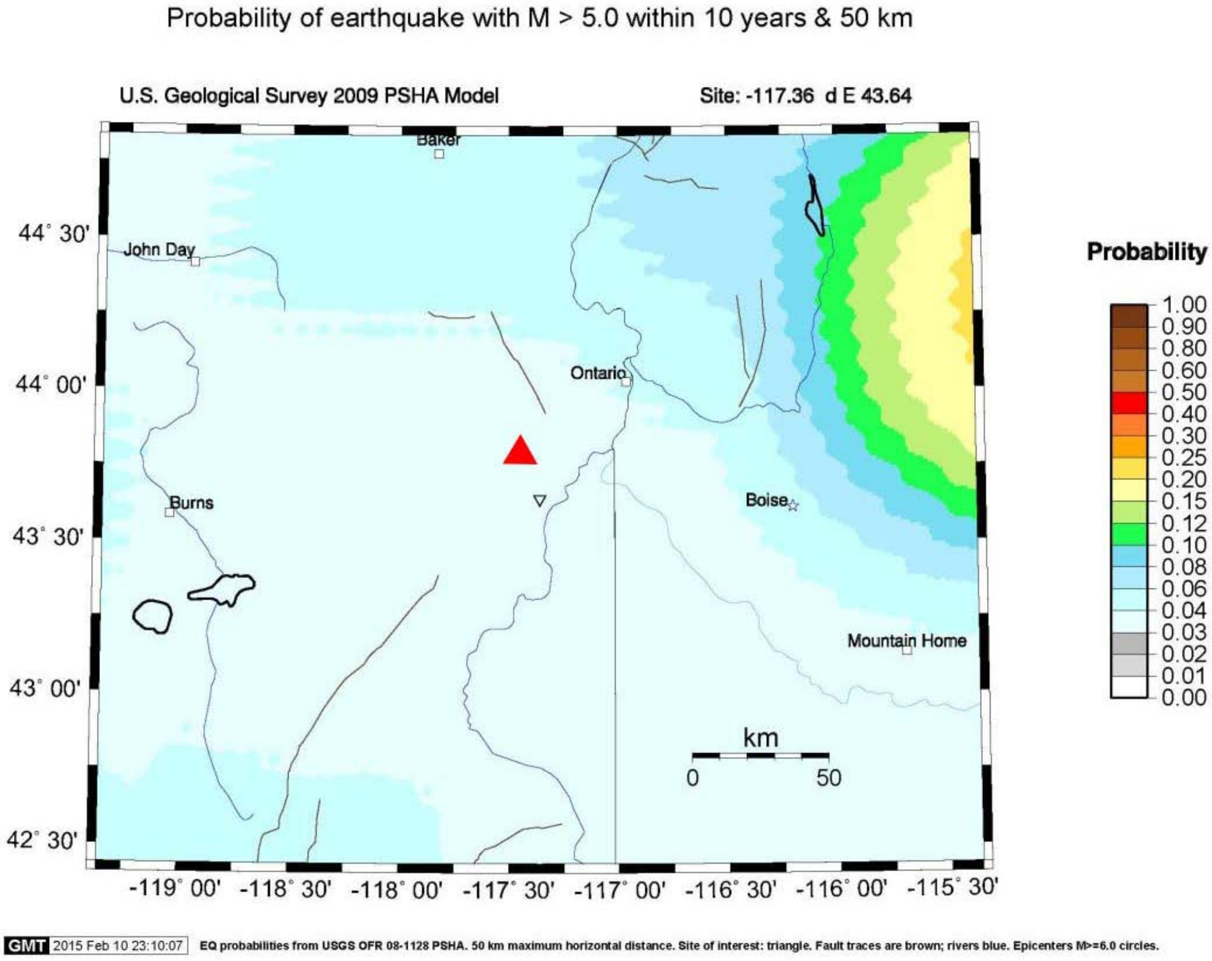


Figure 5-12. Project Study Area Earthquake Probability Map

Source: http://geohazards.usgs.gov/eqprob/2009/index.php

▲Triangle = Approximate location of Grassy Mountain Project

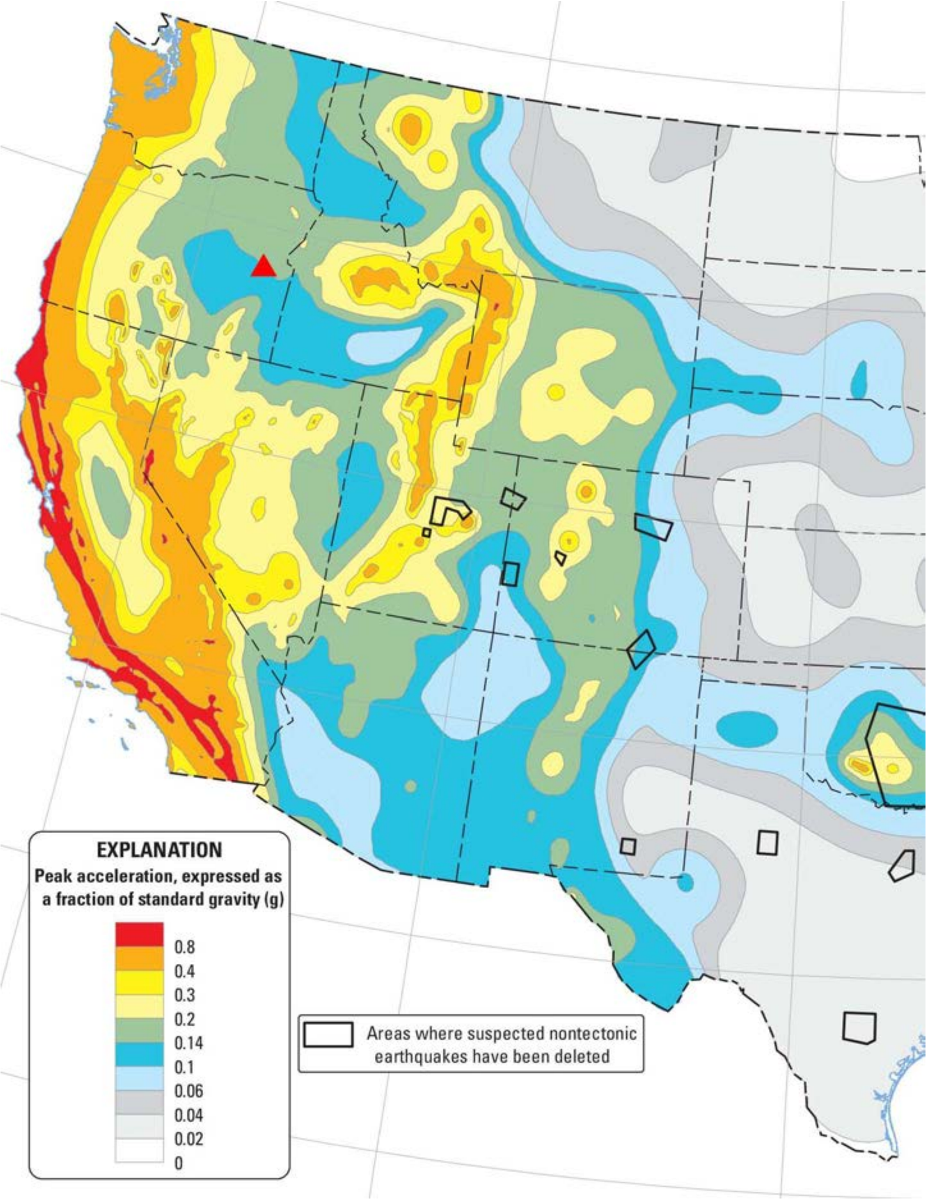


Figure 5-13. Ground Acceleration Probability Map

Two percent probability of exceedance in 50 years map of peak ground acceleration

Source: http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014_pga2pct50yrs.pdf

▲Triangle = Approximate location of Grassy Mountain Project

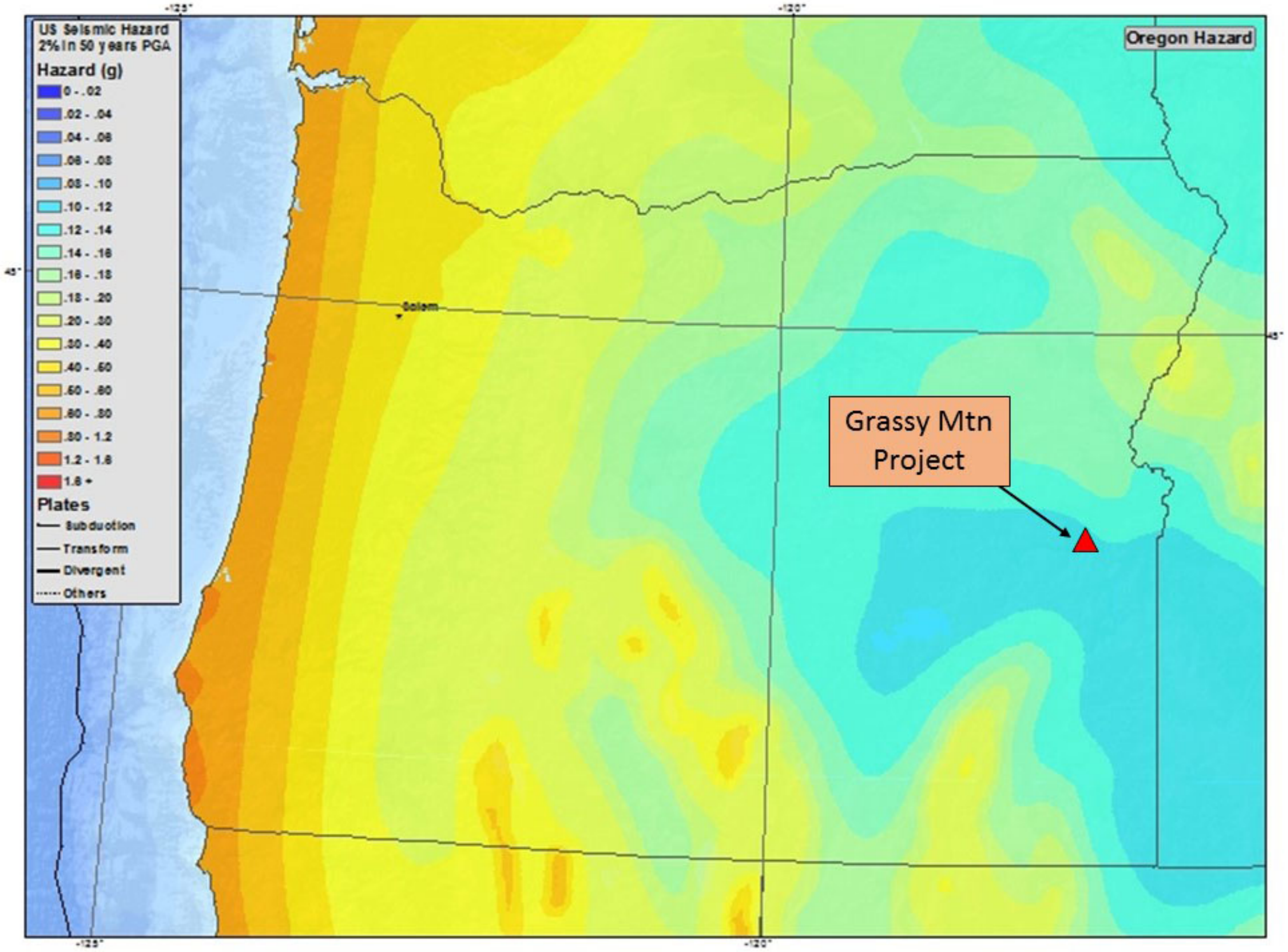


Figure 5-14. Oregon Seismic Hazards Map

Source: http://earthquake.usgs.gov/earthquakes/states/oregon/hazards.php

Within a 50-mile radius of the project study area, only a few earthquakes have been recorded since 1900. North of the project study area are the Cottonwood Canyon fault (48 miles away) and the Squaw Creek fault (37 miles away), with magnitude earthquakes of 3.2 in July 2009 and 3.7 in July 1989, respectively. Approximately 29 miles southeast of the project study area in southwestern Idaho, there was a 2.9 magnitude earthquake in November 2012, but no named fault is associated with it.

The International Building Code (IBC 2012) as amended by the Oregon Structural Specialty Code (OSSC 2014) requires that for new construction, the site should be designed for the maximum considered earthquake (MCE). The design event has a 2 percent probability of exceedance in 50 years (or a 2,475-year return period). For this event, the site has a peak ground acceleration (PGA) of 0.11194 accelero-grams (acceleration from gravity) at bedrock surface.

Seismic design parameters were developed in accordance with the IBC. Based on gathered and observed soil information, Site Class D (stiff soil profile) should be used to design project site facilities. It is anticipated that after information is obtained from the geotechnical exploration study (shear wave velocity in rock and geotechnical boring findings) some of the facilities will be designed using Site Class C (very dense soil and soft rock). **Table 5-2** summarizes the seismic design parameters based on using a Site Class D soil profile.

Table 5-2. Summary of Seismic Design Parameters for Project

Earthquake Magnitude	Peak Horizontal Ground Acceleration on Bedrock (accelero-grams)	Soil Amplification Factor, F_a	Peak Horizontal Ground Acceleration at Ground Surface (accelero-grams)
6.09	0.11194 9	1.583	0.271

The following additional parameters for the MCE may be used for structural design:

- Short period (0.2-second) spectral response acceleration, SMS = 0.429 accelero-grams for Site Class SD
- 1-second period spectral response acceleration, SM1 = 0.244 accelero-grams for Site Class SD

For the short period and the 1-second period, the design spectral response accelerations, S_{DS}, are determined by multiplying the MCE spectral response accelerations (S_{MS} and S_{M1}) by a factor of 2/3; S_{DS} is 0.286 accelero-grams and S_{D1} is 0.162 accelero-grams.

Using the USGS National Seismic Hazard Mapping Database (USGS 2009c, 2009d, 2009e), the PGA at the facility resulting from seismic event from one of the seismic sources was calculated. PGA is estimated at a theoretical soft rock/stiff soil interface for different probabilities of exceedance. The USGS database also provides the seismic deaggregation information for the seismic hazard, including estimates of the mean earthquake moment magnitude and mean epicentral distance associated with given probability of exceedance at a given location.

An earthquake that has a 10-percent probability of exceedance in 50 years (a nominal 500-year recurrence interval) is the maximum probable earthquake (MPE). An earthquake with a nominal 2,500-year recurrence interval (a 2 percent probability of exceedance in 50 years) is the MCE. To provide an estimate of magnitudes for seismic events with epicentral distances ranging from 0 to 60 miles, the PGA and a spectral acceleration at a period of 2.0 seconds were estimated using the USGS seismic hazard database (USGS 2009c and 2009d). These estimates of magnitude, epicentral distance, and PGA are provided in **Table 5-3**.

Table 5-3. MPE and MCE Source Characterization Parameters

Earthquake Event	Mean Moment Magnitude	Epicentral Distance (miles)	Peak Ground Acceleration (PGA)
Maximum Probable Earthquake (MPE) Events	6.12	35	0.01
Maximum Considered Earthquake Events	6.09	15	0.29g

Note: The parameters for both events are for a frequency that corresponds to the PGA.

The design seismic event for Site Class D, C or B will have a 2,500-year recurrence interval. This is for facilities designed to meet current IBC and OSSC guidelines. This is a very-low-probability event and so facilities will be designed for no permanent structural damage from vibrational response of the structure or secondary geologic hazards associated with ground movement or failure, which includes landslides, lateral spreading, liquefaction, fault displacement, or subsidence. Risk to human safety will be minimal because structural damage will be mitigated through design.

5.3.2 Slope Stability/Slope Failures/Landslide Areas

Several areas of recent (Quaternary/Holocene) landslides are shown on the geology map (**Figure 5-2)**. One area is on the southwest slope of the mine site hill above the proposed underground mine but away from any planned disturbance. Two other areas exist near the proposed plant site. These areas are away from any planned construction or mining activities. There are no existing active landslides in the project study area.

5.3.3 Volcanic Hazards

In the Cascade volcanic chain, (extending from Mount Lassen in northern California to Meager Mountain in British Columbia, Canada), over 3,000 large and small volcanoes have erupted over the past 5 million years.

Numerous volcanoes exist in the Cascade Range located approximately 200 to 250 miles west and northwest of the project study area. The recently active volcanoes are Mount Hood, Mount Jefferson and Mount Mazama (Crater Lake). Mount Hood has erupted three times over the past 2,000 years and has been active as recently as 400 years ago.

Within the project study area, the most recent volcanic activity is dated at 7.4 million years before present. The most likely volcanic hazard that could occur in the project study area would be from effects of a volcanic eruption from one of the Cascade volcanos. The project study area could possibly be covered by volcanic ash if the prevailing winds were directed toward the area. **Figure 5-15** depicts the hazard potential for volcanic ash over the project study area.

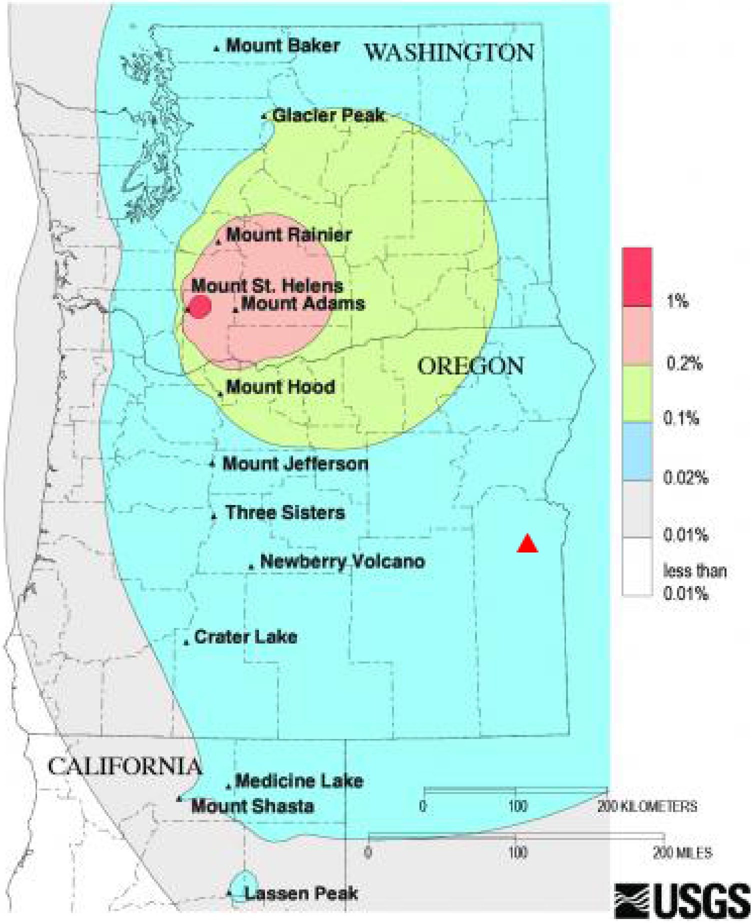


Figure 5-15. One Year Probability of Accumulation of 1 Centimeter of Tephra from Eruptions of Volcanoes in the Cascade Range

Source: http://volcanoes.usgs.gov/volcanoes/mount_jefferson/mount_jefferson_hazard_113.html

▲Triangle = Approximate location of Grassy Mountain Project

5.3.4 Erionite

Erionite is a fibrous zeolite-group mineral often occurring as microscopic acicular, prismatic crystals in altered volcanic tuffs of late Cenozoic age. Erionite can also occur as bedded zeolites within a lacustrine environment containing sediments high in calcium and magnesium. Less commonly erionite occurs in vesicles or cavities within volcanic rocks such as basalt, andesite or rhyolite.

Numerous studies have been conducted concerning the occurrence of zeolites in Oregon. Not all zeolite minerals are considered hazardous. A December 2011 report, *Naturally Occurring Hazardous Materials* (Final Report – SPR 686), by Clark A. Niewendorp of DOGAMI identifies numerous occurrences of zeolites and erionite in Oregon. The erionite localities closest to the Grassy Mountain Project are Durkee in Baker County, and Rome in southern Malheur County. Durkee is approximately 65 miles north of the project while Rome is about 60 miles to the south-southwest.

Geologists working for Calico have spent thousands of hours analyzing and describing the geology of the Grassy Mountain Project. They have spent time mapping surface geology as well as logging the geology of drill holes throughout the project area. Further, predecessor companies (Atlas, NMC, Tombstone) have spent thousands of hours and millions of dollars, analyzing the geology and mineral occurrences at the project area. In addition, SRK recently completed a sampling program during which existing core material was examined and sampled in support of the geochemical characterization program for the project. None of these programs identified erionite within the sediments of the Grassy Formation or in any of the volcanic stratigraphy at the project. Therefore, the potential for this mineral to occur in the project area is unlikely and if it does occur would be limited to low volume, microscopic occurrences.

The map in **Figure 5-16** shows known zeolite occurrence locations as described in *Naturally Occurring Hazardous Materials* (Niewendorp 2011). Numbers on map correspond with numbers in **Table 5-4.**

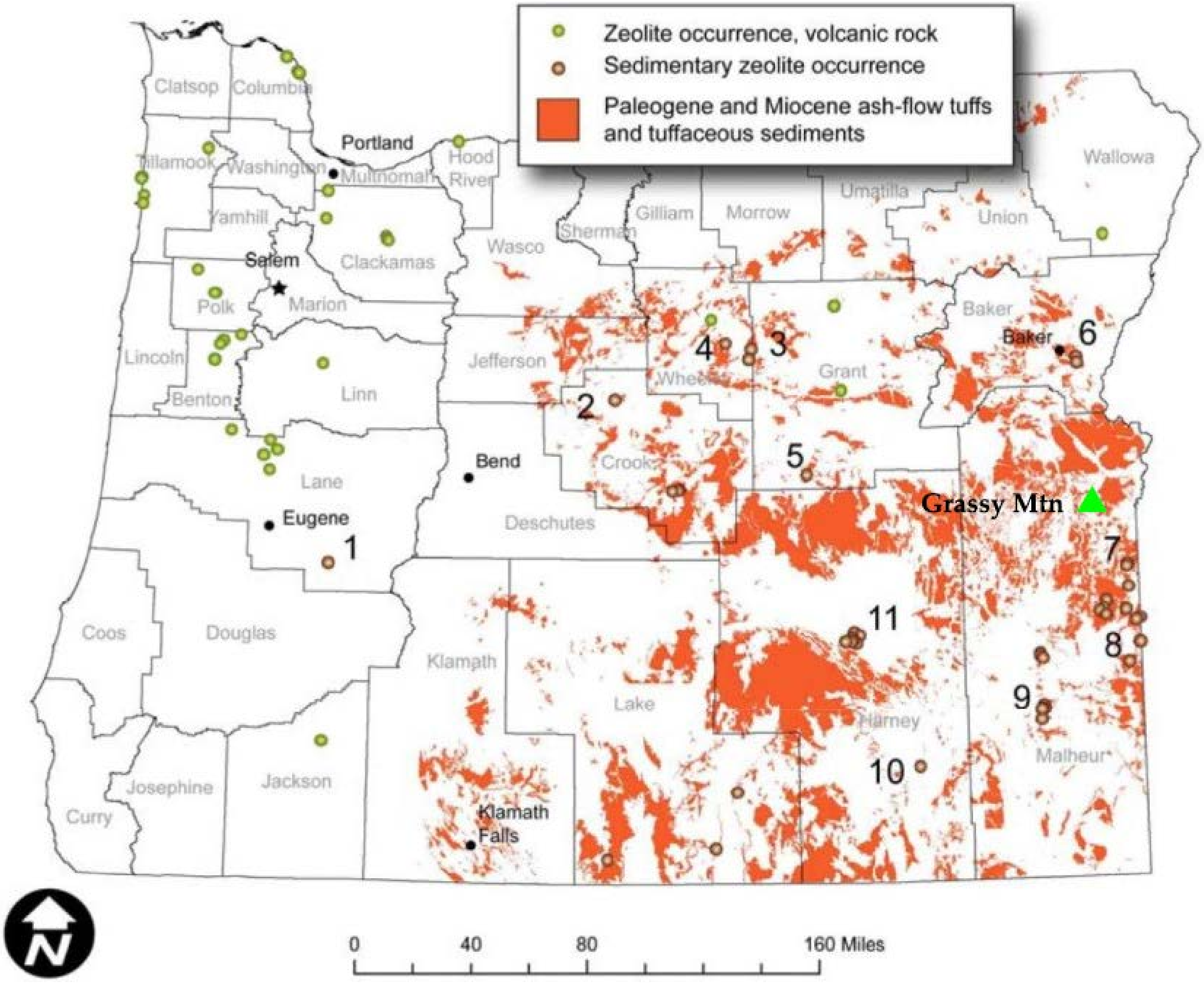


Figure 5-16. Oregon map of Zeolite Occurrences

▲= Approximate location of Grassy Mountain; for reference only.

Table 5-4. Oregon Zeolite Occurrences and Localities

Index Number (see Figure 5-16)	Location	Zeolites	Occurrence
1	Section 36, Township 23 South, Range 2 East, near Bearbones Mountain, Lane County	clinoptilolite, mordenite	Tuff and lapilli tuff in the Little Butte Volcanic Series of Oligocene and Miocene ages
2	Section 30, Township 13 South, Range 18 East, vicinity of Stein's Pillar, Crook County	clinoptilolite, mordenite	Welded tuff in the John Day formation of Oligocene and Miocene ages
3	Sections 35 and 36, Township 10 South, Range 21 East, vicinity of Deep Creek, Wheeler County	clinoptilolite	Tuff in the lower part of the John Day Formation of Oligocene and Miocene ages
4	Section 31, Township 10 South, Range 21 East, vicinity of Painted Hills, Wheeler County	clinoptilolite	Tuff and claystone in the lower part of the John Day formation of Oligocene and Miocene ages

Table 5-4. Oregon Zeolite Occurrences and Localities

Index Number (see Figure 5-16)	Location	Zeolites	Occurrence
5	Section 18, Township 17 South, Range 29 East, along Lewis Creek, Grant County	heulandite, laumontite	Tuffaceous rocks in the lower part of the Trowbridge Formation
6	Section 36, Township 11 South, Range 43 East, near Durkee, Baker County	chabazite, erionite	Welded tuff of Tertiary age
7	Section 28, Township 24 South, Range 46 East, along Sucker Creek, Malheur County	clinoptilolite	Tuff and tuffaceous sandstone in the Sucker Creek Formation of Miocene age
8	Section 1, Township 28 South, Range 46 East, near Sheaville, Malheur County	clinoptilolite	Tuff probably equivalent to part of the Sucker Creek Formation of Miocene age
9	Section 6, Township 32 South, Range 41 East, near Rome, Malheur County	mordenite, erionite, clinoptilolite, phillipsite, chabazite	Tuff and tuffaceous sandstone in an unnamed lacustrine formation of Pliocene age
10	West ½, Township 34 South, Range 34 East, east face of Steens Mountain, Harney County	clinoptilolite	Tuff in the Pike Creek Formation of Oligocene(?) and Miocene ages
11	Section 13, Township 27, Range 30 East, near Harney Lake, Harney County	clinoptilolite, erionite, phillipsite	Tuff and tuffaceous sedimentary rocks in the Danforth Formation of Pliocene age
12	West face of Hart Mountain, Lane County	clinoptilolite, mordenite, phillipsite	Tuff and tuffaceous sedimentary rocks of late Oligocene or early Miocene age

5.3.4.1 Proposed Erionite Testing (part of Geochemistry Baseline Study)

As described in Section 3.2 – Geochemistry of the *Final Revised Geochemistry Environmental Baseline Work Plan* (March 2013), the objective of the geochemical characterization program currently underway for the Project is to characterize development rock and surface development rock anticipated to be produced by the proposed Grassy Mountain mine. The following samples will be collected as part of the geochemical characterization program:

- Waste rock and ore from the spiral decline and underground workings collected from core and coarse rejects from past exploration programs.
- Rock samples representative of each lithology expected to be intersected during road construction will be collected from outcrop.

In addition to the geochemical testing that will be completed, a sub-set of these samples will be selected for mineralogical analysis to confirm erionite is not present within the geologic materials that will be encountered during mining and construction. Samples selected for mineralogical analysis will focus on those lithologies for which erionite is most likely to occur, including some lithologies of the Grassy Mountain Formation and Butterfly Hill rhyodacite. Erionite is not likely to occur with the sinter units, arkosic sandstone and sandstone units of the

Grassy Mountain Formation or soil/alluvium. Therefore, samples of these lithologies will not be included in this program.

Samples will be selected in order to provide a sample set that is spatially representative of the geologic material that will be encountered during mining/construction.

5.4 Existing Environment - Soil

5.4.1 Soil Types in Project Study Area

The project study area consists of drainages bounded on the east and west by bedrock controlled ridges. The underlying bedrock ranges from volcanic basalt and tuffs to sedimentary conglomerates, sandstones and siltstones.

Eleven map units, comprised of seven soil types and one undifferentiated soil group, were identified in the soil survey performed by IMS (1989 and 1991). The map unit boundaries and symbols are shown on the soil map in **Figure 5-17.** The map unit descriptions are presented in **Table 5-5**. Each map unit description provides basic information about the map unit such as predominant soil or soils of the unit, slope, and rock fragment content. Although there are 11 soil units mapped in the project study area, only 9 of these occur within the permit boundary for the purposes of the soil study area. Map units 6 and 11 do not occur in the soil study area so they are not included in **Table 5-6.**

Table 5-5. Soil Survey Map Legend

Map Unit	Name – Description
1	Farmell-Rock outcrop complex, 8 to 30 percent slopes
2	Farmell-Chardoton very cobbly soil, 15 to 30 percent slopes
3	Farmell-Chardoton very cobbly soil, 4 to 15 percent slopes
4	Farmell-Chardoton extremely stony soil, 4 to 15 percent slopes
5	Farmell-Chardoton soil, 8 to 15 percent slopes
6	Ruckles very stony loam, 8 to 30 percent slopes
7	Shano silt loam, 2 to 6 percent slopes
8	Soil A extremely gravelly sandy loam, 15 to 30 percent slopes
9	Virtue loam, 2 to 8 percent slopes
10	Xeric Torriorthents, 8 to 30 percent slopes
11	Soil B very gravelly sand loam, 8 to 30 percent slopes

Source: IMS Inc., 1989, 1991

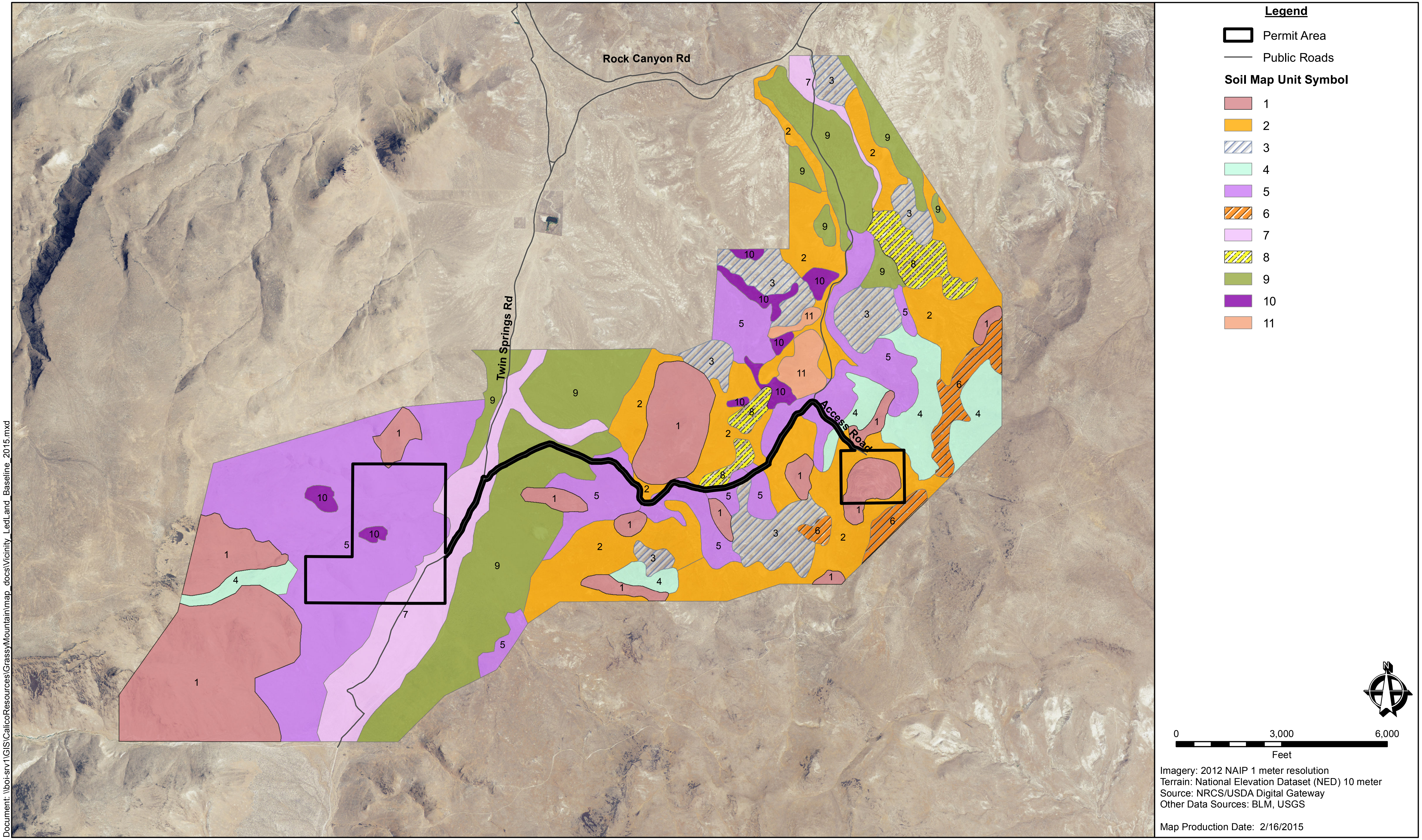
Table 5-6. Taxonomic Classification of Soil Series

Series	Family
Chardoton	Fine, montmorillonitic, mesic Xerollic Paleargids
Farmell	Fine, montmorillonitic, mesic Xerollic Haplargids
Ruckles	Clayey-skeletal, montmorillonitic, mesic Lithic Argixerolls
Shano	Coarse-silty, mixed, mesic Xerollic Camborthids
Soil A	Fine-loamy, mixed mesic Xerollic Haplargids
Soil B	Clayey-skeletal, montmorillonitc, mesic Xerollic Durargids
Virtues	Fine-silty, mixed, Xerollic Durargids
	Xeric Torriorthents

Source: IMS Inc., 1989, 1991

Soil found on the ridges is typically less than 30-inches deep, and are high in rock fragments throughout the profile. Farmell and Chardoton soil, with high amounts of clay in the sub-soil and varying amounts of surficial rock fragments, is found throughout the project study area. The moderately fine textured Virtue soil has a hard silica and carbonate hard pan layer at about 20 to 30 inches below the surface. Deep, coarse-textured Shano soil is found along drainage channels. Ruckles soil is typically found over areas where the underlying bedrock is basalt.

Soil A and B have high percentages of surficial rock fragments. Soil A is found on slopes of 15 to 30 percent. Soil B is found in areas with slopes of about 8 percent. The map unit characteristics of these soils are listed in **Table 5-7**. Suitability for reclamation is also included in the table. Soil data sheets, combining the analytical results and soil descriptions, are presented in Appendix C and Appendix D of this report.



Imagery: 2012 NAIP 1 meter resolution
Terrain: National Elevation Dataset (NED) 10 meter
Source: NRCS/USDA Digital Gateway
Other Data Sources: BLM, USGS

Map Production Date: 2/16/2015

Document: \\boi-srv1\GIS\CalicoResources\GrassyMountain\map_docs\Vicinity_LedLand_Baseline_2015.mxd

Figure 5-17. Project Area Soils Map
Calico Resources, Grassy Mountain Project
Malheur County, OR

Table 5-7. Soil Map Unit Characteristics

Map Unit Symbol	Components	Composition (%)	Slope	Typical Surface Texture	Surficial Rock Fragments (%)	Typical Subsurface Texture	Rock Fragments (%)	Reclamation Suitability	Limitation	Recommended Salvage Depth (feet)
1	Farmell	60	8–30	SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Rock outcrop	30		-	-	-	-			
	Soils <40" to bedrock	10						Unsuitable	Surficial rock	0
2	Farmell	45	15-30	SiL	35-60+	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35-60+	C, SiC	0-15	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils <40" to bedrock	10			35-60+			Marginal	Surficial rock	0.5
3	Farmell	55	4-15	SiL	35-60	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35-60	C, SiC	0-15	Marginal	Surficial rock	0.5
	Soils <40" to bedrock	5		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
4	Farmell	55	4-15	SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Chardoton	40		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
	Soils <40" to bedrock	5		SiL	60+	C, SiC	0-15	Unsuitable	Surficial rock	0
5	Farmell	55	4-15	SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0.5
	Soils <40" to bedrock	5		SiL	0-25	C, SiC	0-15	Marginal	Surficial rock	0
6	Ruckles	90	8-30	L	35-60+	CL, C	0-15	Marginal	Surficial rock Depth to bedrock	0.5
	Rock outcrop	5							Surficial rock	
	Soils >20" to bedrock	5		L	35-60+	CL, C	0-15	Marginal		0.5
7	Shano	95	2-6	SiL	0-5	SiL	0-5	Good		2.5
	Virtue	5	2-8	SiL	10-35	SiCL, SiL	0-10	Good		2.0
8	Soil A	85	15-30	SL	50+	SL	25-35	Unsuitable	Surficial rock	0
	Soils w/ >35% rock fragments	15		SL	50+	SL	35-60	Unsuitable	Surficial rock	0
9	Virtue	95	2-8	SiL	10-35	SiCL, SiL	0-10	Good	Depth to hardpan	2.0
	Soils >40" to hardpan	5		SiL	10-35	SiCL, SiL	0-10	Good		2.0
10	Zeric-Torriorthents	90	15-30	Varies	10-50	Varies	Varies	Unsuitable	Depth to bedrock	0
	Other shallow soil	10	15-30	Varies	10-50	Varies	Varies	Unsuitable	Slope	0
11	Soil B	100	8-30	SL	60+	CL, C	35+	Unsuitable	Rock Frags.	0

Source: IMS, Inc. 1989, 1991

5.4.2 Soil Erosion

Erosion related interpretations were estimated for each of the soil types. A K-factor (soil erodibility factor) for each surface horizon was calculated using the Soil Erodibility Nomograph published in the NRCS *National Soil Survey Handbook* (see website: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054224).

The K-factor indicates the susceptibility of a soil to sheet erosion by water. K-factor values range from 0.00 to 0.70 with the higher factors indicating greater susceptibility to erosion.

The soil in the study area has high silt and very fine sand content making it more susceptible to wind erosion; however, the high rock fragment content within the soil significantly reduces the K-factor of each unit.

Wind Erodibility Group (WEG) is an arbitrary grouping of soil based on texture, structure, and carbonate content. WEG values range from 1 to 8 with the lower values indicating greater susceptibility to wind erosion. WEG is typically applied only to the surface layer of a soil. Classes are defined by NRCS's *National Soil Survey Handbook*, Part 618, Subpart B.

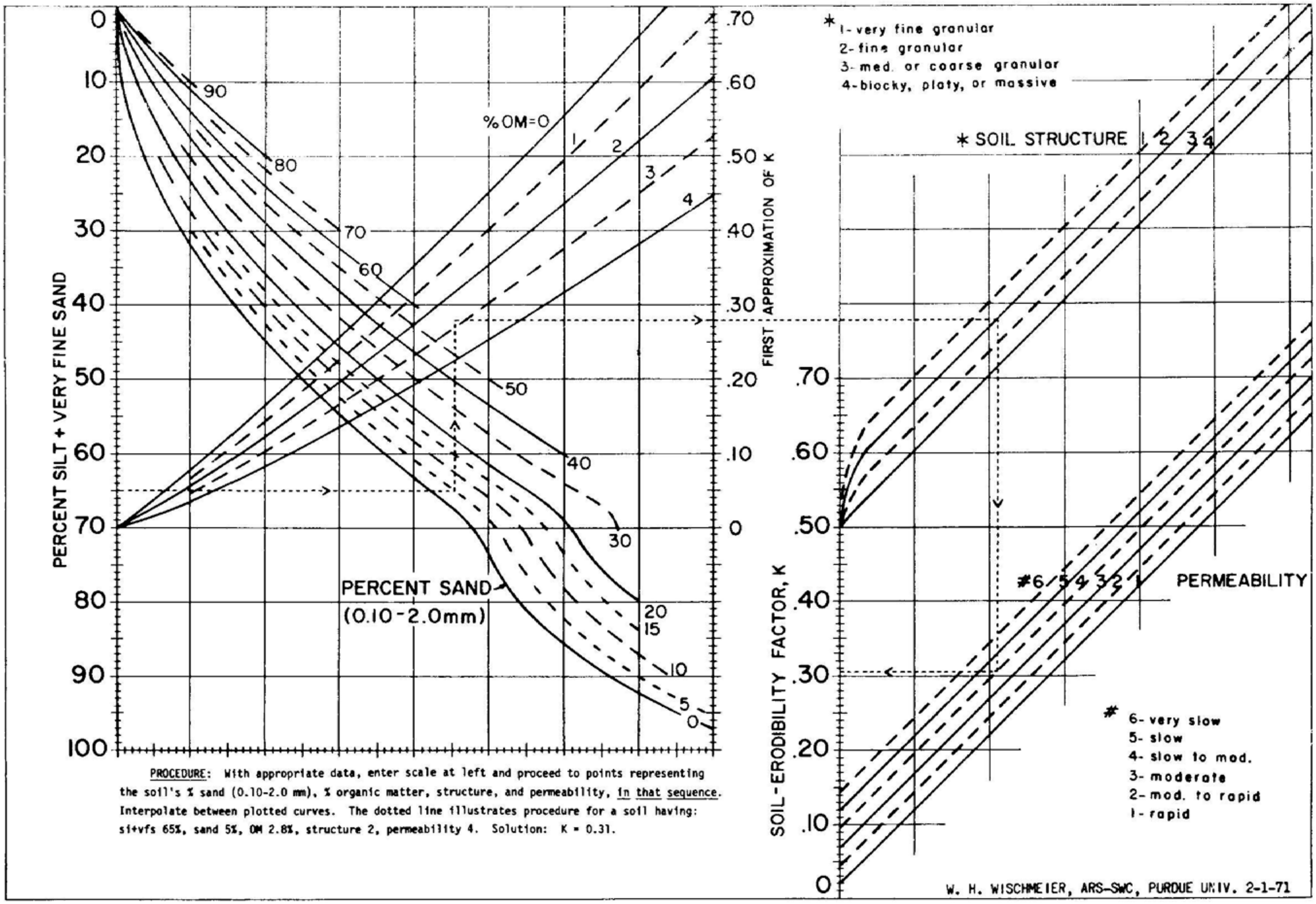
Figure 5-8 shows the calculated K-factors and WEG values for each soil type.

Table 5-8. Erosion Factors of Surface Soils

Soil Series	WEG (Wind Erosion Group)	K-factor (Soil Erodibility Factor)
Chardoton	8	0.13
Farmell	8	0.10
Ruckles	8	0.10
Shano	5	0.37
Soil A	8	0.07
Soil B	8	0.07
Virtue	5	0.16

Source: IMS, Inc. 1989, 1991

Figure 5-18 shows the Soil Erodibility Nomograph used for determining K-Factors for soil erosion.



PROCEDURE: With appropriate data, enter scale at left and proceed to points representing the soil's % sand (0.10-2.0 mm), % organic matter, structure, and permeability, in that sequence. Interpolate between plotted curves. The dotted line illustrates procedure for a soil having: si+vfs 65%, sand 5%, OM 2.8%, structure 2, permeability 4. Solution: K = 0.31.

Figure 5-18. Soil Erodibility Nomograph – K Factor

Source: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054224

5.4.3 Reclamation Suitability

At all of the areas where mining and processing will take place, suitable topsoil will be stripped and stockpiled for reclamation.

A topsoil suitability rating table was developed by IMS (1991) for the three dominant soils within the project study area. The locations were selected to most accurately represent the pedon sampled and its landscape position. (Pedon is a three-dimensional body of soil with dimensions large enough to permit the study of individual soil horizons.)

Laboratory analyses results for soil samples were compared to suitability criteria for topsoil developed at Colorado State University's soil testing laboratory (Soltanpour 1981). These criteria are presented in **Table 5-9**.

Table 5-9. Soil Suitability Ratings

Parameter	Good Suitability	Marginal Suitability	Unsuitable
pH	6.0 to 8.4	5.5 to 6.0, 8.4 to 8.8	<5.5, >8.8
EC (dS/m)	<4.0	4.0 to 12.0	>12.0
Texture	Loamy sand, sandy loam, loam, silt; soil w/ <35% clay	sand, loamy coarse sand; soil w/ <45% clay	Soils w/ >45% clay
Saturation %	25 to 80	25 to 80	<25 and/or >80
CaCO3 %	0 to 15	15 to 30	>30
Rock fragments %	<35	35 to 60	>60
Erosion factor K	<0.37	>0.37	

Source: IMS 1989, 1991

In general, the topsoil sampled in the vicinity of the proposed underground mine access has a higher clay content and is shallower in the soil profile. This soil generally meets the "Marginally Suitable" category. The topsoil in the western areas have lower clay content, higher loam content, and are deeper in the soil profile. This soil generally meets the "Good Suitability" category. Appendix C contains the analysis reports from Western Laboratories Inc. in Parma, Idaho.

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Appendix A
Soil Sample Field Forms

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 1

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/20/14

Time: 9:00 A

Weather: P. CLOUDY 65°F

Location Description: NEAR DH 26-35

GPS Coordinates

N: 4835270

E: 470925

Section, Township, Range:

Datum: 3731 ELEV

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

SOIL · ORGANIC ~~30~~ 0 TO 30 IN. DEPTH

0-12 IN. TOP SOIL

12-30IN CLAY + ORGANICS

Sample # and Lab Analysis: 924606

Attitude:

Slope: 20 %

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

6 PHOTOS TO SE

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 2

Field Surveyor(s):
1. LANCE
2. MCGINNIS

Date: 8/20/14

Time: 9:25 A

Weather: CLEAR 70°F

Location Description: NEAR DECLINE PORTAL
100 m N OF PREV. 924606

GPS Coordinates
N: 4835331
E: 470956

Section, Township, Range:

Datum: 3727 FT.

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):
0 - 3 IN - TOP SOIL
3 - 30 IN · CLAY · ROCKS INCREASING W/ DEPTH

Sample # and Lab Analysis: 924607

Attitude: ~~10%~~

Slope: 10%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):
#1 TO WEST
#2 TO S.
#3 TO SE

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 3

Field Surveyor(s):
1. D LANCE
2. M MCGINNIS

Date: 8/20/14

Time: 9:45 A

Weather: CLEAR 70°F PTLY CLDY

Location Description: 50 m S. OF CLAIM CORNER N. END PS 24 & PS 25 ON SADDLE

GPS Coordinates

N: 4835369

E: 471049

Section, Township, Range:

Datum:

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

HOLE DEPTH 30 in

0-12 - TOP SOIL - ORGANIC

12-24 - CLAY & SOIL - CHUNKY

24-30 - FINE GR. SILTY LOAM

Sample # and Lab Analysis: 924608

Attitude:

Slope: ALMOST LEVEL

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

PHOTOS TO S, SE, E & N

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 4

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/20/14

Time: 10:10 A

Weather: P.CLOUDY 75°F

Location Description: ON SADDLE TO E SIDE

GPS Coordinates

N: 4835370

E: 471126

Section, Township, Range:

Datum: EL 3768 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TOTAL DEPTH 30 IN

6 IN AUGER HOLE

0 - 6 IN - TOP SOIL - ORGANIC

6 - 18 IN - CLAY ZONE - CHUNKY

18 - 30 IN - FINE SILTY SOIL

Sample # and Lab Analysis: ~~[illegible]~~ 924609

Attitude:

Slope:

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 5

Field Surveyor(s):
1. M. MCGINNIS
2. D. LANCE

Date: 8/20/14

Time: 10:30A

Weather: P.CLOUDY 75°F

Location Description: NE SIDE OF SADDLE 200 FT SE OF @ N. CLAIM COR. PS25/PS35

GPS Coordinates
N: 4835386
E: 471271

Section, Township, Range:

Datum: EL 3734 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

24 IN. TOTAL DEPTH

0-24 - CLAY & ROCK ENTIRE HOLE

Sample # and Lab Analysis: 924610

Attitude:

Slope: 15%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 6

Field Surveyor(s):
1. D. LANCE
2. M MCGINNES

Date: 8/20/14

Time: 11:05 A

Weather: P. CLOUDY 75°F

Location Description: NE SIDE OF CLAIMS
FLAT AREA E. OF WATER WELLS
± 100 FT FROM NE COR PS 35

GPS Coordinates
N: 4835389
E: 471406

Section, Township, Range:

Datum: EL 3709 FT.

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):
24 IN TOTAL DEPTH - HIT ROCKY ZONE 6 IN AUGER
0 - 24 IN - MIXED ORGANICS, CLAY & SILTY LOAM

Sample # and Lab Analysis: 924611

Attitude:

Slope: 0 %

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):
YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 7

Field Surveyor(s):
1. D LANCE
2. M MCGINNIS

Date: 8/20/14

Time: 11:30A

Weather: SUNNY 80°F

Location Description: ALONG HAUL ROAD

GPS Coordinates
N: 4835585
E: 470421

Section, Township, Range:

Datum: EL 3594 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

24 IN TOTAL DEPTH
ROCKY LAYER AT 24 IN
0-24 - ORGANICS & SILTY LOAM

Sample # and Lab Analysis: 924612

Attitude:

Slope: 0%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 8

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/20/14

Time: 11:55A

Weather: SUNNY 80°F

Location Description: ALONG HAUL ROAD
6 IN AUGER HOLE

GPS Coordinates
N: 4835062
E: 469592

Section, Township, Range:

Datum: EL 3552 FT.

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):
36 IN TOTAL DEPTH - EXCELLENT DIGGING
0 - 18 IN - ORGANIC TOP SOIL
18 - 20 IN CALICHE - HARD PACK
20 - 36 IN SILTY LOAM - ROCKS < 1 IN DIA.

Sample # and Lab Analysis: 924613

Attitude:

Slope: 0%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):
YES #1 - SOUTH
#2 - EAST
#3 - NW

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 9

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/21/14

Time: 8:47A

Weather: CLEAR 55°F

Location Description: ALONG HAUL ROAD AT N. END OF CRAB GRASS

GPS Coordinates

N: 4834948

E: 469144

Section, Township, Range:

Datum: EL 3514 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

0-12 IN	TOPSOIL · ORGANICS
12-20	CLAY
@ 20	CALICHE - HARD LAYER
20-22	HARD CLAY
22-30	CLAY & SILTY LOAM -

Sample # and Lab Analysis: 924614

Attitude:

Slope: 0-5%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 10

Field Surveyor(s):
1. M. MCGINNIS
2. D. LANCE

Date: 8/21/14

Time: 9:05A

Weather: CLEAR

Location Description: ALONG HAUL ROAD TOWARD W. END - NW OF CRABGRASS

GPS Coordinates

N: 4835375

E: 468564

Section, Township, Range:

Datum:

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TOTAL DEPTH, 30 IN.

0-6 IN	ROCKS & TOPSOIL
6-18	SILTY-SANDY LOAM
18-24	CLAY & ROCKS TO 4 IN.
24-30	SILTY-LOAM

Sample # and Lab Analysis: 924615

Attitude:

Slope: 5% ~~TO~~ LOW TO THE WEST

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 11

Field Surveyor(s):
1. M. MCGINNIS
2. D. LANCE

Date: 8/21/14

Time: 9:48 AM

Weather: CLEAR 75°

Location Description: BISHOP LEASE

GPS Coordinates

N: 4834662

E: 467241

Section, Township, Range:

Datum: EL: 3425

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TD =

0-10 IN: TOPSOIL - ORGANICS + ROCKS TO 2 IN.
10-20 IN: SILTY LOAM
20-24 IN: CLAY LOAM
24 IN: ROCK - BOULDER

Sample # and Lab Analysis: 924616

Attitude:

Slope: 5-10% DOWN TO EAST

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 12

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/21/14

Time: 10:06A

Weather: CLEAR 80 °F

Location Description: BISHOP LEASE

GPS Coordinates

N: 4834579

E: 467192

Section, Township, Range:

Datum: EL 3435 FT.

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TD - 18 IN.
0-6 IN : POOR TOPSOIL - ORGANICS & ROCKS TO 4 IN.
6-12 IN : SILTY LOAM - TAN, BUFF COLORED
12 IN : HARD ROCKY - CLAY LAYER
12-18 IN: DECOMP KERN BASIN TUFF & SILTY LOAM - ASH COLORED
18 IN : HARD PAN

Sample # and Lab Analysis: 924617

Attitude:

Slope: 10% DOWN TO EAST

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 13

Field Surveyor(s):
1. D. LANCE
2. M. MCGINNIS

Date: 8/21/14

Time: 10:25A

Weather: CLEAR 80°F

Location Description: BISHOP LEASE

GPS Coordinates

N: 4834471

E: 467137

Section, Township, Range:

Datum: EL 3425

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

0-6 IN: TOP SOIL - ORGANICS
6-18IN: SILTY LOAM
18-30IN: SILTY LOAM & CLAY - ASHY-BROWN COLOR

Sample # and Lab Analysis: 924618

Attitude:

Slope: 5-10% LOW TO SOUTH

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project	**Sample Site #:** 14
Field Surveyor(s): 1. M. MCGINNIS 2. D. LANCE	Date: 8/21/14 Time: 10:40 A Weather: CLEAR 80°F
Location Description: BISHOP LEASE	GPS Coordinates N: 4834407 E: 467106
Section, Township, Range:	Datum: EL 3416 FT
Land Ownership (BLM, private):	Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TD. 36 IN.
0-6 IN. TOPSOIL - ORGANICS
6.12 IN SILTY LOAM
12 IN. MINOR CALICHE
12.36 IN - SILTY LOAM - TAN COLOR
ROCKS TO 1 IN.

Sample # and Lab Analysis: 924619

Attitude:

Slope: 5% DOWN TO SE.

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 15

Field Surveyor(s):
1. M. MCGINNIS
2. D. LAAKE

Date: 8/21/14

Time: 10:52A

Weather: CLEAR 82°F

Location Description: BISHOP LEASE

GPS Coordinates

N: 4834319

E: 467223

Section, Township, Range:

Datum: EL: 3380 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TD - 36 IN

0 - 8 IN - ORGANIC TOPSOIL

8 - 16 IN - SILTY LOAM - ASHEY GRAY

16 - 18 IN: CALICHE LAYER

18 - 36 IN: SILTY LOAM - ASHEY GRAY

Sample # and Lab Analysis: 924620

Attitude:

Slope: 0%

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Calico Resources Grassy Mountain Project
Rock and Soil Sampling Reporting Form

Project: Calico Resources – Grassy Mountain Exploration Project

Sample Site #: 16

Field Surveyor(s):
1. M. MCGINNIS
2. D. LANCE

Date: 8/21/14

Time: 11:08A

Weather: CLEAR 85°F

Location Description: BISHOP LEASE

GPS Coordinates

N: 4834423

E: 467336

Section, Township, Range:

Datum: EL 3370 FT

Land Ownership (BLM, private):

Accuracy:

Description (rock or soil type/color/grain size/weathering-alteration/fractures/other):

TD 20 IN
0-6 IN: TOPSOIL - ORGANIC
6-12 IN: SILTY LOAM ASHEY GRAY
12 IN: HARD CALICHE LAYER
12-20 IN. HARD CLAY · CALICHE
20 IN HARD PAN

Sample # and Lab Analysis: 924621

Attitude:

Slope: 20 %

Contacts:

Additional Notes:

Site Photographs (Include Photo # and Direction):

YES

Appendix B

Photos of Soil Sample Collection Locations

These pictures show some of the soil collection sites and correspond to the test results in Appendix C. These soil samples were collected during the early summer of 2014 and show site conditions at that time.


924606


924607


924608


924609


924610


5136
924611


924612


924613


924614


924615


924616


924617


924618


924619


924620


924621

Appendix C
Western Laboratories Data Analysis Reports

Western Laboratories.com

211 Highway 95 • P.O. Box 1020 • Parma, ID 83660
800-658-3858 • FAX 208-722-6550
http://www.westernlaboratories.com

Methods: www.westernlaboratories.com/methods.

PAP-Accredited
NAPT
2012

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8847

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924606	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Clay Loam	2.32	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.9	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.53	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	3.96	Medium	
NO_3-Nitrates-ppm	12	Adequate	10 - 35
NH_4-Ammonium-ppm	4	Low	5 +
P-Phosphorus-ppm	12	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	358	Adequate	300 +
S-Sulfur-ppm	16	Low	20 +
Ca-Calcium-ppm	5822	Very High	1,800 +
Mg-Magnesium-ppm	176	Low	250 +
Na-Sodium-ppm	131	OK	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.3	Adequate	0.8 - 2.5
Mn-Manganese-ppm	6	Low	6 - 30
Fe-Iron-ppm	5	Very Low	7 +
B-Boron-ppm	1.2	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
422			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft	2nd ft	Total lbs	**TBS%**		**P Index**		**Add Phos for P INDEX**	
	48 **LBS**	**LBS**	48 **LBS**						

Percent Base Saturation-%BS	**100**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**32**	**YOURS**	**88**	**4**	**3**	**2**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

"Always practice the laws of Agronomy."
John P. Taberna, Soil Scientist

Western Laboratories.com
211 Highway 95 • P.O. Box 1020 • Parma, ID 83660
800-658-3858 • FAX 208-722-6550
http://www.westernlaboratories.com
Methods: www.westernlaboratories.com/methods.

PAP-Accredited NAPT 2012

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #: **8848**

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924607	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Clay Loam	2.30	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.7	Slightly Basic	
pH-SMP			
EC Soluble Salts	0.55	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	3.33	Medium	
NO_3-Nitrates-ppm	40	High	10 - 35
NH_4-Ammonium-ppm	5	Low	5 +
P-Phosphorus-ppm	12	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	362	Adequate	300 +
S-Sulfur-ppm	18	Low	20 +
Ca-Calcium-ppm	5826	Very High	1,800 +
Mg-Magnesium-ppm	185	Low	250 +
Na-Sodium-ppm	97	OK	< 225
Z-Zinc-ppm	1.3	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.2	Adequate	0.8 - 2.5
Mn-Manganese-ppm	5	Low	6 - 30
Fe-Iron-ppm	7	Very Low	7 +
B-Boron-ppm	1.0	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
423			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 135 **LBS**	2nd ft **LBS**	Total lbs 135 **LBS**	**TBS%**	3	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**103**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**31**	**YOURS**	**92**	**5**	**3**	**1**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

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NAPT
2012

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8849

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924608	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Clay Loam	2.35	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.1	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.65	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	5.00	High	
NO_3-Nitrates-ppm	13	Adequate	10 - 35
NH_4-Ammonium-ppm	5	Low	5 +
P-Phosphorus-ppm	15	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	379	Adequate	300 +
S-Sulfur-ppm	21	Adequate	20 +
Ca-Calcium-ppm	6452	Very High	1,800 +
Mg-Magnesium-ppm	166	Low	250 +
Na-Sodium-ppm	265	High	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.3	Adequate	0.8 - 2.5
Mn-Manganese-ppm	3	Very Low	6 - 30
Fe-Iron-ppm	4	Very Low	7 +
B-Boron-ppm	1.2	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
520			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 54 **LBS**	2nd ft **LBS**	Total lbs 54 **LBS**	**TBS%**	2	**P Index**		**Add Phos for P INDEX**	

		BASES	**Ca**	**Mg**	**K**	**Na**	**H**
Percent Base Saturation-%BS	**102**	**IDEAL**	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**35**	**YOURS**	**88**	**4**	**3**	**3**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8850

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924609	Texture	Water Holding Capacity/ft	Bulk Density
Acres:	Clay Loam	2.34	1.35

ELEMENT	YOUR ANSWER	INTERP	SHOULD BE
pH-Soil	8.7	Strongly Basic	
pH-SMP			
EC Soluble Salts	0.85	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	4.58	Medium	
NO_3-Nitrates-ppm	14	Adequate	10 - 35
NH_4-Ammonium-ppm	5	Low	5 +
P-Phosphorus-ppm	18	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	252	Low	300 +
S-Sulfur-ppm	21	Adequate	20 +
Ca-Calcium-ppm	6652	Very High	1,800 +
Mg-Magnesium-ppm	165	Low	250 +
Na-Sodium-ppm	125	OK	< 225
Z-Zinc-ppm	1.5	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.3	Adequate	0.8 - 2.5
Mn-Manganese-ppm	5	Low	6 - 30
Fe-Iron-ppm	3	Very Low	7 +
B-Boron-ppm	2.7	High	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	Lime	Gypsum	Dolomite
505			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 57 LBS	2nd ft LBS	Total lbs 57 LBS	TBS%	2	P Index		Add Phos for P INDEX	

Percent Base Saturation-%BS	102	BASES	Ca	Mg	K	Na	H
		IDEAL	65-80	10-20	2-6	< 5	< 15
Cation Exchange Capacity - CEC	35	YOURS	92	4	2	2	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8851

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924610	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Clay Loam	2.31	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.0	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.64	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	3.53	Medium	
NO_3-Nitrates-ppm	15	Adequate	10 - 35
NH_4-Ammonium-ppm	5	Low	5 +
P-Phosphorus-ppm	10	Very Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	264	Low	300 +
S-Sulfur-ppm	15	Low	20 +
Ca-Calcium-ppm	6715	Very High	1,800 +
Mg-Magnesium-ppm	152	Low	250 +
Na-Sodium-ppm	369	Very High	< 225
Z-Zinc-ppm	1.5	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.4	Adequate	0.8 - 2.5
Mn-Manganese-ppm	6	Low	6 - 30
Fe-Iron-ppm	6	Very Low	7 +
B-Boron-ppm	1.1	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
599			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 60 **LBS**	2nd ft **LBS**	Total lbs 60 **LBS**	**TBS%**		**P Index**		**Add Phos for P INDEX**	

		BASES	**Ca**	**Mg**	**K**	**Na**	**H**
Percent Base Saturation-%BS	**100**	**IDEAL**	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**37**	**YOURS**	**89**	**3**	**2**	**4**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

Dealer:	HDR
Reported:	8-27-2014
Test #:	1
Grower:	Calico Resources-

Lab #:
8852

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924611	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Silt Loam	2.29	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.2	Neutral Soil	
pH-SMP			
EC Soluble Salts	0.33	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	2.86	Medium	
NO_3-Nitrates-ppm	4	Very Low	10 - 35
NH_4-Ammonium-ppm	1	Low	5 +
P-Phosphorus-ppm	13	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	377	Adequate	300 +
S-Sulfur-ppm	7	Very Low	20 +
Ca-Calcium-ppm	4141	High	1,800 +
Mg-Magnesium-ppm	203	Low	250 +
Na-Sodium-ppm	142	OK	< 225
Z-Zinc-ppm	1.6	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.3	Adequate	0.8 - 2.5
Mn-Manganese-ppm	6	Low	6 - 30
Fe-Iron-ppm	8	Adequate	7 +
B-Boron-ppm	0.6	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
254			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	10	10
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 15 **LBS**	2nd ft **LBS**	Total lbs 15 **LBS**	**TBS%**	9	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**109**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**22**	**YOURS**	**92**	**8**	**4**	**3**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8853

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924612	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Sandy Clay Loam	2.16	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.3	Slightly Basic	
pH-SMP			
EC Soluble Salts	0.32	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	2.15	Low	
NO_3-Nitrates-ppm	3	Very Low	10 - 35
NH_4-Ammonium-ppm	1	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	210	Low	300 +
S-Sulfur-ppm	7	Very Low	20 +
Ca-Calcium-ppm	4580	High	1,800 +
Mg-Magnesium-ppm	154	Low	250 +
Na-Sodium-ppm	126	OK	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.1	Adequate	0.8 - 2.5
Mn-Manganese-ppm	3	Very Low	6 - 30
Fe-Iron-ppm	6	Very Low	7 +
B-Boron-ppm	0.5	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
298			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 12 **LBS**	2nd ft **LBS**	Total lbs 12 **LBS**	**TBS%**	1	**P Index**		**Add Phos for P INDEX**	

		BASES	**Ca**	**Mg**	**K**	**Na**	**H**
Percent Base Saturation-%BS	**101**	**IDEAL**	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**25**	**YOURS**	**91**	**5**	**2**	**2**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #: **8854**

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924613	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Silt Loam	2.25	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.0	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.42	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	1.61	Low	
NO_3-Nitrates-ppm	12	Adequate	10 - 35
NH_4-Ammonium-ppm	4	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	322	Adequate	300 +
S-Sulfur-ppm	15	Low	20 +
Ca-Calcium-ppm	5500	High	1,800 +
Mg-Magnesium-ppm	155	Low	250 +
Na-Sodium-ppm	174	OK	< 225
Z-Zinc-ppm	1.3	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.8	Low	0.8 - 2.5
Mn-Manganese-ppm	9	Adequate	6 - 30
Fe-Iron-ppm	5	Very Low	7 +
B-Boron-ppm	0.7	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
390			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 48 **LBS**	2nd ft **LBS**	Total lbs 48 **LBS**	**TBS%**	27	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**127**
Cation Exchange Capacity - CEC	**24**

BASES	**Ca**	**Mg**	**K**	**Na**	**H**
IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
YOURS	**115**	**5**	**3**	**3**	

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8855

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924614	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Clay Loam	2.29	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.2	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.55	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	3.11	Medium	
NO_3-Nitrates-ppm	10	Low	10 - 35
NH_4-Ammonium-ppm	3	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	396	Adequate	300 +
S-Sulfur-ppm	13	Low	20 +
Ca-Calcium-ppm	6183	Very High	1,800 +
Mg-Magnesium-ppm	156	Low	250 +
Na-Sodium-ppm	126	OK	< 225
Z-Zinc-ppm	1.1	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.9	Adequate	0.8 - 2.5
Mn-Manganese-ppm	2	Very Low	6 - 30
Fe-Iron-ppm	5	Very Low	7 +
B-Boron-ppm	1.5	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
458			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 39 **LBS**	2nd ft **LBS**	Total lbs 39 **LBS**	**TBS%**	2	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**102**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**33**	**YOURS**	**92**	**4**	**3**	**2**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8856

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924615	Texture	Water Holding Capacity/ft	Bulk Density
Acres:	Clay Loam	2.31	1.35

ELEMENT	YOUR ANSWER	INTERP	SHOULD BE
pH-Soil	8.5	Strongly Basic	
pH-SMP			
EC Soluble Salts	0.61	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	3.53	Medium	
NO_3-Nitrates-ppm	9	Low	10 - 35
NH_4-Ammonium-ppm	3	Low	5 +
P-Phosphorus-ppm	12	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	229	Low	300 +
S-Sulfur-ppm	13	Low	20 +
Ca-Calcium-ppm	6061	Very High	1,800 +
Mg-Magnesium-ppm	105	Very Low	250 +
Na-Sodium-ppm	121	OK	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.1	Adequate	0.8 - 2.5
Mn-Manganese-ppm	2	Very Low	6 - 30
Fe-Iron-ppm	5	Very Low	7 +
B-Boron-ppm	1.1	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	Lime	Gypsum	Dolomite
446			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	20	20
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft	2nd ft	Total lbs	TBS%	1	P Index		Add Phos for P INDEX	
	36 LBS	LBS	36 LBS						

Percent Base Saturation-%BS	101	BASES	Ca	Mg	K	Na	H
		IDEAL	65-80	10-20	2-6	< 5	< 15
Cation Exchange Capacity - CEC	32	YOURS	92	3	2	2	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8857

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924616	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Sandy Clay Loam	2.18	1.35

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.0	Neutral Soil	
pH-SMP			
EC Soluble Salts	0.43	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	2.76	Medium	
NO$_3$-Nitrates-ppm	7	Low	10 - 35
NH$_4$-Ammonium-ppm	2	Low	5 +
P-Phosphorus-ppm	25	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	236	Low	300 +
S-Sulfur-ppm	8	Very Low	20 +
Ca-Calcium-ppm	4478	High	1,800 +
Mg-Magnesium-ppm	216	Low	250 +
Na-Sodium-ppm	110	OK	< 225
Z-Zinc-ppm	1.3	Adequate	1.0 - 3.0
Cu-Copper-ppm	1.3	Adequate	0.8 - 2.5
Mn-Manganese-ppm	9	Adequate	6 - 30
Fe-Iron-ppm	12	Adequate	7 +
B-Boron-ppm	0.6	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
288			

Nitrogen-N		
Phosphate- P$_2$O$_5$		
Potash-K$_2$O		
P.F. Sulfur-S		
Magnesium-Mg	10	10
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 27 **LBS**	2nd ft **LBS**	Total lbs 27 **LBS**	**TBS%**		**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**100**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**25**	**YOURS**	**88**	**7**	**2**	**2**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #: 8858

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924617	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Loam	2.09	1.4

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.9	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.46	Normal	< 1.5
% Lime	H	over 5.5% lime	
% Organic Matter	3.13	Medium	
NO_3-Nitrates-ppm	16	Adequate	10 - 35
NH_4-Ammonium-ppm	6	Adequate	5 +
P-Phosphorus-ppm	15	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	247	Low	300 +
S-Sulfur-ppm	18	Low	20 +
Ca-Calcium-ppm	6753	Very High	1,800 +
Mg-Magnesium-ppm	214	Low	250 +
Na-Sodium-ppm	53	OK	< 225
Z-Zinc-ppm	1.6	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.9	Adequate	0.8 - 2.5
Mn-Manganese-ppm	2	Very Low	6 - 30
Fe-Iron-ppm	6	Very Low	7 +
B-Boron-ppm	1.0	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
515			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	10	10
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft	2nd ft	Total lbs	**TBS%**	100	**P Index**		**Add Phos for P INDEX**	
	66 **LBS**	**LBS**	66 **LBS**						

Percent Base Saturation-%BS	214	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**17**	**YOURS**	**192**	**10**	**4**	**1**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Methods: www.westernlaboratories.com/methods.

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8859

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924618	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Loam	2.13	1.4

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.1	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.57	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	4.20	Medium	
NO_3-Nitrates-ppm	9	Low	10 - 35
NH_4-Ammonium-ppm	3	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	396	Adequate	300 +
S-Sulfur-ppm	14	Low	20 +
Ca-Calcium-ppm	5161	High	1,800 +
Mg-Magnesium-ppm	210	Low	250 +
Na-Sodium-ppm	353	Very High	< 225
Z-Zinc-ppm	1.5	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.8	Low	0.8 - 2.5
Mn-Manganese-ppm	9	Adequate	6 - 30
Fe-Iron-ppm	4	Very Low	7 +
B-Boron-ppm	0.8	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
435			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg	10	10
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft	2nd ft	Total lbs	**TBS%**	67	**P Index**		**Add Phos for P INDEX**	
	36 **LBS**	**LBS**	36 **LBS**						

Percent Base Saturation-%BS	**167**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**18**	**YOURS**	**135**	**9**	**5**	**8**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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2012

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8860

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924619	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Loam	2.09	1.4

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	8.2	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.33	Normal	< 1.5
% Lime	L	1.5 to 3.0 % lime	
% Organic Matter	2.86	Medium	
NO_3-Nitrates-ppm	8	Low	10 - 35
NH_4-Ammonium-ppm	3	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	167	Low	300 +
S-Sulfur-ppm	18	Low	20 +
Ca-Calcium-ppm	3184	Adequate	1,800 +
Mg-Magnesium-ppm	371	Adequate	250 +
Na-Sodium-ppm	91	OK	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.4	Low	0.8 - 2.5
Mn-Manganese-ppm	9	Adequate	6 - 30
Fe-Iron-ppm	2	Very Low	7 +
B-Boron-ppm	0.9	Adequate	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
158			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg		
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 33 **LBS**	2nd ft **LBS**	Total lbs 33 **LBS**	**TBS%**	24	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**124**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
Cation Exchange Capacity - CEC	**16**	**IDEAL**	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
		YOURS	**97**	**19**	**3**	**2**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8861

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

Field ID: 924620	**Texture**	**Water Holding Capacity/ft**	**Bulk Density**
Acres:	Loam	2.06	1.4

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.8	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.28	Normal	< 1.5
% Lime	L	1.5 to 3.0 % lime	
% Organic Matter	1.85	Low	
NO_3-Nitrates-ppm	3	Very Low	10 - 35
NH_4-Ammonium-ppm	1	Low	5 +
P-Phosphorus-ppm	12	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	299	Low	300 +
S-Sulfur-ppm	6	Very Low	20 +
Ca-Calcium-ppm	3252	Adequate	1,800 +
Mg-Magnesium-ppm	210	Low	250 +
Na-Sodium-ppm	191	OK	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.5	Low	0.8 - 2.5
Mn-Manganese-ppm	8	Adequate	6 - 30
Fe-Iron-ppm	4	Very Low	7 +
B-Boron-ppm	0.5	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
165			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg		
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft 12 **LBS**	2nd ft **LBS**	Total lbs 12 **LBS**	**TBS%**	15	**P Index**		**Add Phos for P INDEX**	

Percent Base Saturation-%BS	**115**	**BASES**	**Ca**	**Mg**	**K**	**Na**	**H**
		IDEAL	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**17**	**YOURS**	**96**	**10**	**5**	**5**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-

Lab #:
8862

AGRICULTURAL SOIL REPORT

Blue=High Red=Low Black=Normal

	Texture	**Water Holding Capacity/ft**	**Bulk Density**
Field ID: 924621			
Acres:	Loam	2.05	1.4

ELEMENT	**YOUR ANSWER**	**INTERP**	**SHOULD BE**
pH-Soil	7.8	Moderately Basic	
pH-SMP			
EC Soluble Salts	0.28	Normal	< 1.5
% Lime	M	3.1 to 5.5 % lime	
% Organic Matter	1.80	Low	
NO_3-Nitrates-ppm	4	Very Low	10 - 35
NH_4-Ammonium-ppm	1	Low	5 +
P-Phosphorus-ppm	11	Low	25 - 40
P-Phos-ppm-Bray			50 - 100
K-Potassium-ppm	262	Low	300 +
S-Sulfur-ppm	5	Very Low	20 +
Ca-Calcium-ppm	3746	High	1,800 +
Mg-Magnesium-ppm	211	Low	250 +
Na-Sodium-ppm	348	High	< 225
Z-Zinc-ppm	1.2	Adequate	1.0 - 3.0
Cu-Copper-ppm	0.6	Low	0.8 - 2.5
Mn-Manganese-ppm	2	Very Low	6 - 30
Fe-Iron-ppm	5	Very Low	7 +
B-Boron-ppm	0.5	Low	0.7 - 1.5

Crop		
Yield Goal		
Past Crop		

Fertilizer Suggestions in Actual Pounds/Acre/Year

Elemental Sulfur	**Lime**	**Gypsum**	**Dolomite**
291			

Nitrogen-N		
Phosphate- P_2O_5		
Potash-K_2O		
P.F. Sulfur-S		
Magnesium-Mg		
Zinc-Zn		
Copper-Cu		
Manganese-Mn		
Boron-B		

Nitrogen	Top ft	2nd ft	Total lbs	**TBS%**	**P Index**	**Add Phos for P INDEX**
	15 **LBS**	**LBS**	15 **LBS**	26		

		BASES	**Ca**	**Mg**	**K**	**Na**	**H**
Percent Base Saturation-%BS	**126**	**IDEAL**	**65-80**	**10-20**	**2-6**	**< 5**	**< 15**
Cation Exchange Capacity - CEC	**18**	**YOURS**	**104**	**10**	**4**	**8**	

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

Split apply Nitrogen. Split apply Elemental Sulfur and Lime recommendations over a 2-3 year period. Tissue and soil test in-season gives the best results

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924606

Lab #:
8847

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.9	Moderately Basic		Sulfur-ppm	16	Low	20 +
pH-SMP				Calcium-ppm	5822	Very High	1,800 +
Soluble Salts	0.53	Normal	< 1.5	Magnesium-ppm	176	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	131	OK	< 225
% Organic Matter	3.96	Medium		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	12	Adequate	10 - 35	Copper-ppm	1.3	Adequate	0.8 - 2.5
Ammonium-ppm	4	Low	5 +	Manganese-ppm	6	Low	6 - 30
Phosphorus-ppm	12	Low	25 - 40	Iron-ppm	5	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.2	Adequate	0.7 - 1.5
Potassium-ppm	358	Adequate	300 +	TBS%	0		

Texture	Clay Loam	Water Holding Capacity/foot	2.32	Bulk Density	1.35

Cation Exchange Capacity - CEC	32	P Index	
Percent Base Saturation	100		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	88	1 Ft	12	4
Magnesium-% of CEC	10-20	4	2 Ft		
Potassium-% of CEC	2-6	2.8	3 Ft		
Sodium-% of CEC (ESP)	< 5	1.7	Total N PPM		16
Hydrogen-% of CEC	< 15		Lbs N / Acre		48

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	33 :1	High	Watch Mg
Ca:K pH >7	15:1	16 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	485:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	10 :1	OK	
P:Mn	4:1	2:1	OK	
P:Cu	25:1	9 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	5 :1	High	Watch Zn
Mn:Cu	7:1	5 :1	OK	
K:B	200:1	298 :1	High	Watch B
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	422	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924607

Lab #: 8848

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.7	Slightly Basic		Sulfur-ppm	18	Low	20 +
pH-SMP				Calcium-ppm	5826	Very High	1,800 +
Soluble Salts	0.55	Normal	< 1.5	Magnesium-ppm	185	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	97	OK	< 225
% Organic Matter	3.33	Medium		Zinc-ppm	1.3	Adequate	1.0 - 3.0
Nitrates-ppm	40	High	10 - 35	Copper-ppm	1.2	Adequate	0.8 - 2.5
Ammonium-ppm	5	Low	5 +	Manganese-ppm	5	Low	6 - 30
Phosphorus-ppm	12	Low	25 - 40	Iron-ppm	7	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.0	Adequate	0.7 - 1.5
Potassium-ppm	362	Adequate	300 +	TBS%	3		

Texture	Clay Loam	Water Holding Capacity/foot	2.30	Bulk Density	1.35

Cation Exchange Capacity - CEC	31	P Index	
Percent Base Saturation	103		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	92
Magnesium-% of CEC	10-20	5
Potassium-% of CEC	2-6	2.9
Sodium-% of CEC (ESP)	< 5	1.3
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	40	5
2 Ft		
3 Ft		
Total N PPM		45
Lbs N / Acre		135

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	31 :1	High	Watch Mg
Ca:K pH >7	15:1	16 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	486:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	9 :1	OK	
P:Mn	4:1	2:1	OK	
P:Cu	25:1	10 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	4 :1	High	Watch Zn
Mn:Cu	7:1	4 :1	OK	
K:B	200:1	362 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	423	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924608

Lab #:
8849

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.1	Moderately Basic		Sulfur-ppm	21	Adequate	20 +
pH-SMP				Calcium-ppm	6452	Very High	1,800 +
Soluble Salts	0.65	Normal	< 1.5	Magnesium-ppm	166	Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	265	High	< 225
% Organic Matter	5.00	High		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	13	Adequate	10 - 35	Copper-ppm	1.3	Adequate	0.8 - 2.5
Ammonium-ppm	5	Low	5 +	Manganese-ppm	3	Very Low	6 - 30
Phosphorus-ppm	15	Low	25 - 40	Iron-ppm	4	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.2	Adequate	0.7 - 1.5
Potassium-ppm	379	Adequate	300 +	TBS%	2		

Texture	Clay Loam	Water Holding Capacity/foot	2.35	Bulk Density	1.35

Cation Exchange Capacity - CEC	35	P Index	
Percent Base Saturation	102		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	88
Magnesium-% of CEC	10-20	4
Potassium-% of CEC	2-6	2.7
Sodium-% of CEC (ESP)	< 5	3.2
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	13	5
2 Ft		
3 Ft		
Total N PPM		18
Lbs N / Acre		54

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	39 :1	High	Watch Mg
Ca:K pH >7	15:1	17 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	430:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	13 :1	OK	
P:Mn	4:1	5:1	High	Watch Mn
P:Cu	25:1	12 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	3 :1	OK	
Mn:Cu	7:1	2 :1	OK	
K:B	200:1	316 :1	High	Watch B
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	520	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924609

Lab #:
8850

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.7	Strongly Basic		Sulfur-ppm	21	Adequate	20 +
pH-SMP				Calcium-ppm	6652	Very High	1,800 +
Soluble Salts	0.85	Normal	< 1.5	Magnesium-ppm	165	Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	125	OK	< 225
% Organic Matter	4.58	Medium		Zinc-ppm	1.5	Adequate	1.0 - 3.0
Nitrates-ppm	14	Adequate	10 - 35	Copper-ppm	1.3	Adequate	0.8 - 2.5
Ammonium-ppm	5	Low	5 +	Manganese-ppm	5	Low	6 - 30
Phosphorus-ppm	18	Low	25 - 40	Iron-ppm	3	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	2.7	High	0.7 - 1.5
Potassium-ppm	252	Low	300 +	TBS%	2		

Texture	Clay Loam	Water Holding Capacity/foot	2.34	Bulk Density	1.35

Cation Exchange Capacity - CEC	35	P Index	
Percent Base Saturation	102		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	92
Magnesium-% of CEC	10-20	4
Potassium-% of CEC	2-6	1.8
Sodium-% of CEC (ESP)	< 5	1.5
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	14	5
2 Ft		
3 Ft		
Total N PPM		19
Lbs N / Acre		57

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	40 :1	High	Watch Mg
Ca:K pH >7	15:1	26 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	370:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	12 :1	OK	
P:Mn	4:1	4:1	OK	
P:Cu	25:1	14 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	3 :1	OK	
Mn:Cu	7:1	4 :1	OK	
K:B	200:1	93 :1	OK	
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	505	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924610

Lab #:
8851

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.0	Moderately Basic		Sulfur-ppm	15	Low	20 +
pH-SMP				Calcium-ppm	6715	Very High	1,800 +
Soluble Salts	0.64	Normal	< 1.5	Magnesium-ppm	152	Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	369	Very High	< 225
% Organic Matter	3.53	Medium		Zinc-ppm	1.5	Adequate	1.0 - 3.0
Nitrates-ppm	15	Adequate	10 - 35	Copper-ppm	1.4	Adequate	0.8 - 2.5
Ammonium-ppm	5	Low	5 +	Manganese-ppm	6	Low	6 - 30
Phosphorus-ppm	10	Very Low	25 - 40	Iron-ppm	6	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.1	Adequate	0.7 - 1.5
Potassium-ppm	264	Low	300 +	TBS%	0		

Texture	Clay Loam	Water Holding Capacity/foot	2.31	Bulk Density	1.35

Cation Exchange Capacity - CEC	37	P Index	
Percent Base Saturation	100		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	89
Magnesium-% of CEC	10-20	3
Potassium-% of CEC	2-6	1.8
Sodium-% of CEC (ESP)	< 5	4.2
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	15	5
2 Ft		
3 Ft		
Total N PPM		20
Lbs N / Acre		60

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	44 :1	High	Watch Mg
Ca:K pH >7	15:1	25 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	672:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	7 :1	OK	
P:Mn	4:1	2:1	OK	
P:Cu	25:1	7 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	4 :1	High	Watch Zn
Mn:Cu	7:1	4 :1	OK	
K:B	200:1	240 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	599	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924611

Lab #:
8852

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.2	Neutral Soil		Sulfur-ppm	7	Very Low	20 +
pH-SMP				Calcium-ppm	4141	High	1,800 +
Soluble Salts	0.33	Normal	< 1.5	Magnesium-ppm	203	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	142	OK	< 225
% Organic Matter	2.86	Medium		Zinc-ppm	1.6	Adequate	1.0 - 3.0
Nitrates-ppm	4	Very Low	10 - 35	Copper-ppm	1.3	Adequate	0.8 - 2.5
Ammonium-ppm	1	Low	5 +	Manganese-ppm	6	Low	6 - 30
Phosphorus-ppm	13	Low	25 - 40	Iron-ppm	8	Adequate	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.6	Low	0.7 - 1.5
Potassium-ppm	377	Adequate	300 +	TBS%	9		

Texture	Silt Loam	Water Holding Capacity/foot	2.29	Bulk Density	1.35

Cation Exchange Capacity - CEC	22	P Index	
Percent Base Saturation	109		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	92
Magnesium-% of CEC	10-20	8
Potassium-% of CEC	2-6	4.3
Sodium-% of CEC (ESP)	< 5	2.8
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	4	1
2 Ft		
3 Ft		
Total N PPM		5
Lbs N / Acre		15

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	20 :1	OK	
Ca:K pH >7	15:1	11 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	319:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	8 :1	OK	
P:Mn	4:1	2:1	OK	
P:Cu	25:1	10 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	4 :1	High	Watch Zn
Mn:Cu	7:1	5 :1	OK	
K:B	200:1	628 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	254	
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924612

Lab #:
8853

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.3	Slightly Basic		Sulfur-ppm	7	Very Low	20 +
pH-SMP				Calcium-ppm	4580	High	1,800 +
Soluble Salts	0.32	Normal	< 1.5	Magnesium-ppm	154	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	126	OK	< 225
% Organic Matter	2.15	Low		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	3	Very Low	10 - 35	Copper-ppm	1.1	Adequate	0.8 - 2.5
Ammonium-ppm	1	Low	5 +	Manganese-ppm	3	Very Low	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	6	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.5	Low	0.7 - 1.5
Potassium-ppm	210	Low	300 +	TBS%	1		

Texture	Sandy Clay Loam	Water Holding Capacity/foot	2.16	Bulk Density	1.35

Cation Exchange Capacity - CEC	25	P Index	
Percent Base Saturation	101		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	91
Magnesium-% of CEC	10-20	5
Potassium-% of CEC	2-6	2.1
Sodium-% of CEC (ESP)	< 5	2.2
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	3	1
2 Ft		
3 Ft		
Total N PPM		4
Lbs N / Acre		12

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	30 :1	High	Watch Mg
Ca:K pH >7	15:1	22 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	416:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	9 :1	OK	
P:Mn	4:1	4:1	OK	
P:Cu	25:1	10 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	3 :1	OK	
Mn:Cu	7:1	3 :1	OK	
K:B	200:1	420 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	298	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924613

Lab #:
8854

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.0	Moderately Basic		Sulfur-ppm	15	Low	20 +
pH-SMP				Calcium-ppm	5500	High	1,800 +
Soluble Salts	0.42	Normal	< 1.5	Magnesium-ppm	155	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	174	OK	< 225
% Organic Matter	1.61	Low		Zinc-ppm	1.3	Adequate	1.0 - 3.0
Nitrates-ppm	12	Adequate	10 - 35	Copper-ppm	0.8	Low	0.8 - 2.5
Ammonium-ppm	4	Low	5 +	Manganese-ppm	9	Adequate	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	5	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.7	Low	0.7 - 1.5
Potassium-ppm	322	Adequate	300 +	TBS%	27		

Texture	Silt Loam	Water Holding Capacity/foot	2.25	Bulk Density	1.35

Cation Exchange Capacity - CEC	24	P Index	
Percent Base Saturation	127		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	115	1 Ft	12	4
Magnesium-% of CEC	10-20	5	2 Ft		
Potassium-% of CEC	2-6	3.4	3 Ft		
Sodium-% of CEC (ESP)	< 5	3.2	Total N PPM		16
Hydrogen-% of CEC	< 15		Lbs N / Acre		48

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	35 :1	High	Watch Mg
Ca:K pH >7	15:1	17 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	500 :1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	8 :1	OK	
P:Mn	4:1	1 :1	OK	
P:Cu	25:1	14 :1	OK	
Zn:Cu	3:1	2 :1	OK	
Mn:Zn	3:1	7 :1	High	Watch Zn
Mn:Cu	7:1	11 :1	High	Watch Cu
K:B	200:1	460 :1	High	Watch B
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	390	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

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Dealer:	HDR
Reported:	8-27-2014
Test #:	1
Grower:	Calico Resources-Grassy
Field ID:	924614

Lab #:
8855

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.2	Moderately Basic		Sulfur-ppm	13	Low	20 +
pH-SMP				Calcium-ppm	6183	Very High	1,800 +
Soluble Salts	0.55	Normal	< 1.5	Magnesium-ppm	156	Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	126	OK	< 225
% Organic Matter	3.11	Medium		Zinc-ppm	1.1	Adequate	1.0 - 3.0
Nitrates-ppm	10	Low	10 - 35	Copper-ppm	0.9	Adequate	0.8 - 2.5
Ammonium-ppm	3	Low	5 +	Manganese-ppm	2	Very Low	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	5	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.5	Adequate	0.7 - 1.5
Potassium-ppm	396	Adequate	300 +	TBS%	2		

Texture	Clay Loam	Water Holding Capacity/foot	2.29	Bulk Density	1.35

Cation Exchange Capacity - CEC	33	P Index	
Percent Base Saturation	102		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	92
Magnesium-% of CEC	10-20	4
Potassium-% of CEC	2-6	3
Sodium-% of CEC (ESP)	< 5	1.6
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	10	3
2 Ft		
3 Ft		
Total N PPM		13
Lbs N / Acre		39

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	40 :1	High	Watch Mg
Ca:K pH >7	15:1	16 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	562:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	10 :1	OK	
P:Mn	4:1	6:1	High	Watch Mn
P:Cu	25:1	12 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	2 :1	OK	
Mn:Cu	7:1	2 :1	OK	
K:B	200:1	264 :1	High	Watch B
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	458	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924615

Lab #:
8856

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.5	Strongly Basic		Sulfur-ppm	13	Low	20 +
pH-SMP				Calcium-ppm	6061	Very High	1,800 +
Soluble Salts	0.61	Normal	< 1.5	Magnesium-ppm	105	Very Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	121	OK	< 225
% Organic Matter	3.53	Medium		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	9	Low	10 - 35	Copper-ppm	1.1	Adequate	0.8 - 2.5
Ammonium-ppm	3	Low	5 +	Manganese-ppm	2	Very Low	6 - 30
Phosphorus-ppm	12	Low	25 - 40	Iron-ppm	5	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.1	Adequate	0.7 - 1.5
Potassium-ppm	229	Low	300 +	TBS%	1		

Texture	Clay Loam	Water Holding Capacity/foot	2.31	Bulk Density	1.35

Cation Exchange Capacity - CEC	32	P Index	
Percent Base Saturation	101		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	92
Magnesium-% of CEC	10-20	3
Potassium-% of CEC	2-6	1.8
Sodium-% of CEC (ESP)	< 5	1.6
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	9	3
2 Ft		
3 Ft		
Total N PPM		12
Lbs N / Acre		36

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	58 :1	High	Watch Mg
Ca:K pH >7	15:1	26 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	505:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	10 :1	OK	
P:Mn	4:1	6:1	High	Watch Mn
P:Cu	25:1	11 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	2 :1	OK	
Mn:Cu	7:1	2 :1	OK	
K:B	200:1	208 :1	High	Watch B
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	446	
Gypsum		
Lime		
Dolomite		
Magnesium	20	20
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

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Methods: www.westernlaboratories.com/methods.

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924616

Lab #:
8857

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.0	Neutral Soil		Sulfur-ppm	8	Very Low	20 +
pH-SMP				Calcium-ppm	4478	High	1,800 +
Soluble Salts	0.43	Normal	< 1.5	Magnesium-ppm	216	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	110	OK	< 225
% Organic Matter	2.76	Medium		Zinc-ppm	1.3	Adequate	1.0 - 3.0
Nitrates-ppm	7	Low	10 - 35	Copper-ppm	1.3	Adequate	0.8 - 2.5
Ammonium-ppm	2	Low	5 +	Manganese-ppm	9	Adequate	6 - 30
Phosphorus-ppm	25	Low	25 - 40	Iron-ppm	12	Adequate	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.6	Low	0.7 - 1.5
Potassium-ppm	236	Low	300 +	TBS%	0		

Texture	Sandy Clay Loam	Water Holding Capacity/foot	2.18	Bulk Density	1.35

Cation Exchange Capacity - CEC	25	P Index	
Percent Base Saturation	100		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	88
Magnesium-% of CEC	10-20	7
Potassium-% of CEC	2-6	2.4
Sodium-% of CEC (ESP)	< 5	1.9
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	7	2
2 Ft		
3 Ft		
Total N PPM		9
Lbs N / Acre		27

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	21 :1	High	Watch Mg
Ca:K pH >7	15:1	19 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	179:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	19 :1	High	Watch Zn
P:Mn	4:1	3:1	OK	
P:Cu	25:1	19 :1	OK	
Zn:Cu	3:1	1 :1	OK	
Mn:Zn	3:1	7 :1	High	Watch Zn
Mn:Cu	7:1	7 :1	High	Watch Cu
K:B	200:1	393 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	288	
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924617

Lab #: 8858

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.9	Moderately Basic		Sulfur-ppm	18	Low	20 +
pH-SMP				Calcium-ppm	6753	Very High	1,800 +
Soluble Salts	0.46	Normal	< 1.5	Magnesium-ppm	214	Low	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	53	OK	< 225
% Organic Matter	3.13	Medium		Zinc-ppm	1.6	Adequate	1.0 - 3.0
Nitrates-ppm	16	Adequate	10 - 35	Copper-ppm	0.9	Adequate	0.8 - 2.5
Ammonium-ppm	6	Adequate	5 +	Manganese-ppm	2	Very Low	6 - 30
Phosphorus-ppm	15	Low	25 - 40	Iron-ppm	6	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	1.0	Adequate	0.7 - 1.5
Potassium-ppm	247	Low	300 +	TBS%	100		

Texture	Loam	Water Holding Capacity/foot	2.09	Bulk Density	1.4

Cation Exchange Capacity - CEC	17	P Index
Percent Base Saturation	214	

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	192	1 Ft	16	6
Magnesium-% of CEC	10-20	10	2 Ft		
Potassium-% of CEC	2-6	3.6	3 Ft		
Sodium-% of CEC (ESP)	< 5	1.3	Total N PPM		22
Hydrogen-% of CEC	< 15		Lbs N / Acre		66

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	32 :1	High	Watch Mg
Ca:K pH >7	15:1	27 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	450 :1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	9 :1	OK	
P:Mn	4:1	8 :1	High	Watch Mn
P:Cu	25:1	17 :1	OK	
Zn:Cu	3:1	2 :1	OK	
Mn:Zn	3:1	1 :1	OK	
Mn:Cu	7:1	2 :1	OK	
K:B	200:1	247 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	515	
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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AGRICULTURAL SOIL REPORT

Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924618

Lab #: 8859

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.1	Moderately Basic		Sulfur-ppm	14	Low	20 +
pH-SMP				Calcium-ppm	5161	High	1,800 +
Soluble Salts	0.57	Normal	< 1.5	Magnesium-ppm	210	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	353	Very High	< 225
% Organic Matter	4.20	Medium		Zinc-ppm	1.5	Adequate	1.0 - 3.0
Nitrates-ppm	9	Low	10 - 35	Copper-ppm	0.8	Low	0.8 - 2.5
Ammonium-ppm	3	Low	5 +	Manganese-ppm	9	Adequate	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	4	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.8	Adequate	0.7 - 1.5
Potassium-ppm	396	Adequate	300 +	TBS%	67		

Texture	Loam	Water Holding Capacity/foot	2.13	Bulk Density	1.4

Cation Exchange Capacity - CEC	18	P Index	
Percent Base Saturation	167		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	135
Magnesium-% of CEC	10-20	9
Potassium-% of CEC	2-6	5.3
Sodium-% of CEC (ESP)	< 5	8
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	9	3
2 Ft		
3 Ft		
Total N PPM		12
Lbs N / Acre		36

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	25 :1	High	Watch Mg
Ca:K pH >7	15:1	13 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	469:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	7 :1	OK	
P:Mn	4:1	1:1	OK	
P:Cu	25:1	14 :1	OK	
Zn:Cu	3:1	2 :1	OK	
Mn:Zn	3:1	6 :1	High	Watch Zn
Mn:Cu	7:1	11 :1	High	Watch Cu
K:B	200:1	495 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	435	
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur P.F. Sulfur = Plant Food Sulfur

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924619

Lab #: 8860

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.2	Moderately Basic		Sulfur-ppm	18	Low	20 +
pH-SMP				Calcium-ppm	3184	Adequate	1,800 +
Soluble Salts	0.33	Normal	< 1.5	Magnesium-ppm	371	Adequate	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	91	OK	< 225
% Organic Matter	2.86	Medium		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	8	Low	10 - 35	Copper-ppm	0.4	Low	0.8 - 2.5
Ammonium-ppm	3	Low	5 +	Manganese-ppm	9	Adequate	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	2	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.9	Adequate	0.7 - 1.5
Potassium-ppm	167	Low	300 +	TBS%	24		

Texture	Loam	Water Holding Capacity/foot	2.09	Bulk Density	1.4

Cation Exchange Capacity - CEC	16	P Index	
Percent Base Saturation	124		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	97
Magnesium-% of CEC	10-20	19
Potassium-% of CEC	2-6	2.6
Sodium-% of CEC (ESP)	< 5	2.4
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	8	3
2 Ft		
3 Ft		
Total N PPM		11
Lbs N / Acre		33

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	9 :1	OK	
Ca:K pH >7	15:1	19 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	289:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	9 :1	OK	
P:Mn	4:1	1:1	OK	
P:Cu	25:1	28 :1	High	Watch Cu
Zn:Cu	3:1	3 :1	High	Watch Cu
Mn:Zn	3:1	8 :1	High	Watch Zn
Mn:Cu	7:1	23 :1	High	Watch Cu
K:B	200:1	186 :1	OK	
Mg:K	2:1	2 :1	Ok	

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	158	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924620

Lab #:
8861

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm	6	Very Low	20 +
pH-SMP				Calcium-ppm	3252	Adequate	1,800 +
Soluble Salts	0.28	Normal	< 1.5	Magnesium-ppm	210	Low	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	191	OK	< 225
% Organic Matter	1.85	Low		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	3	Very Low	10 - 35	Copper-ppm	0.5	Low	0.8 - 2.5
Ammonium-ppm	1	Low	5 +	Manganese-ppm	8	Adequate	6 - 30
Phosphorus-ppm	12	Low	25 - 40	Iron-ppm	4	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.5	Low	0.7 - 1.5
Potassium-ppm	299	Low	300 +	TBS%	15		

Texture	Loam	Water Holding Capacity/foot	2.06	Bulk Density	1.4

Cation Exchange Capacity - CEC	17	P Index	
Percent Base Saturation	115		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	96
Magnesium-% of CEC	10-20	10
Potassium-% of CEC	2-6	4.5
Sodium-% of CEC (ESP)	< 5	4.9
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	3	1
2 Ft		
3 Ft		
Total N PPM		4
Lbs N / Acre		12

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	15 :1	OK	
Ca:K pH >7	15:1	11 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	271:1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	10 :1	OK	
P:Mn	4:1	2:1	OK	
P:Cu	25:1	24 :1	OK	
Zn:Cu	3:1	2 :1	OK	
Mn:Zn	3:1	7 :1	High	Watch Zn
Mn:Cu	7:1	16 :1	High	Watch Cu
K:B	200:1	598 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	165	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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Dealer: HDR
Reported: 8-27-2014
Test #: 1
Grower: Calico Resources-Grassy
Field ID: 924621

Lab #: 8862

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm	5	Very Low	20 +
pH-SMP				Calcium-ppm	3746	High	1,800 +
Soluble Salts	0.28	Normal	< 1.5	Magnesium-ppm	211	Low	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	348	High	< 225
% Organic Matter	1.80	Low		Zinc-ppm	1.2	Adequate	1.0 - 3.0
Nitrates-ppm	4	Very Low	10 - 35	Copper-ppm	0.6	Low	0.8 - 2.5
Ammonium-ppm	1	Low	5 +	Manganese-ppm	2	Very Low	6 - 30
Phosphorus-ppm	11	Low	25 - 40	Iron-ppm	5	Very Low	7 +
Phos-ppm-Bray			50 - 100	Boron-ppm	0.5	Low	0.7 - 1.5
Potassium-ppm	262	Low	300 +	TBS%	26		

Texture	Loam	Water Holding Capacity/foot	2.05	Bulk Density	1.4

Cation Exchange Capacity - CEC	18	P Index	
Percent Base Saturation	126		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	104
Magnesium-% of CEC	10-20	10
Potassium-% of CEC	2-6	3.7
Sodium-% of CEC (ESP)	< 5	8.4
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft	4	1
2 Ft		
3 Ft		
Total N PPM		5
Lbs N / Acre		15

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	18 :1	OK	
Ca:K pH >7	15:1	14 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	341 :1	High	Watch P
Ca:P pH <7	40:1	:1		
P:Zn	15:1	9 :1	OK	
P:Mn	4:1	6 :1	High	Watch Mn
P:Cu	25:1	18 :1	OK	
Zn:Cu	3:1	2 :1	OK	
Mn:Zn	3:1	2 :1	OK	
Mn:Cu	7:1	3 :1	OK	
K:B	200:1	524 :1	High	Watch B
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop		
Yield Goal		
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	291	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Elemental Sulfur = Reclamation Sulfur   P.F. Sulfur = Plant Food Sulfur

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Appendix D
ALS Chemex Soil Sample Geochemical Analysis

ALS USA Inc.
4977 Energy Way
Reno NV 89502
Phone: 775 356 5395 Fax: 775 355 0179 www.alsglobal.com

To: CALICO RESOURCES
425 S. WILCOX STREET
SUITE 500
CASTLE ROCK CO 80104

Page: 1
Total # Pages: 2 (A - D)
Plus Appendix Pages
Finalized Date: 25- SEP- 2014
Account: CALIRS

CERTIFICATE RE14138716

Project: Grassy Mountain

This report is for 16 Soil samples submitted to our lab in Reno, NV, USA on 12- SEP- 2014.

The following have access to data associated with this certificate:

MICHAEL MCGINNIS	AMY PRESTIA	VANCE THORNSBERRY

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI- 21	Received Sample Weight
LOG- 22	Sample login - Rcd w/o BarCode
SCR- 41	Screen to - 180um and save both

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
Au- AA24	Au 50g FA AA finish	AAS
ME- MS61	48 element four acid ICP- MS	
Hg- MS42	Trace Hg by ICPMS	ICP- MS

The results of this assay were based solely upon the content of the sample submitted. Any decision to invest should be made only after the potential investment value of the claim 'or deposit has been determined based on the results of assays of multiple samples of geological materials collected by the prospective investor or by a qualified person selected by him/her and based on an evaluation of all engineering data which is available concerning any proposed project. Statement required by Nevada State Law NRS 519

To: CALICO RESOURCES
ATTN: MICHAEL MCGINNIS
220 MORTON ST W2
VALE OR 97918

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:
Gael McGibbon, Director of Operations USA

ALS USA Inc.
4977 Energy Way
Reno NV 89502
Phone: 775 356 5395   Fax: 775 355 0179   www.alsglobal.com

To: CALICO RESOURCES
425 S. WILCOX STREET
SUITE 500
CASTLE ROCK CO 80104

Finalized Date: 25- SEP- 2014
Account: CALIRS

Project: Grassy Mountain

CERTIFICATE OF ANALYSIS   RE14138716

Sample Description	Method	WEI- 21	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61
	Analyte	Recvd Wt.	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe
	Units	kg	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%
	LOR	0.02	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2	0.01
924606		1.52	0.11	7.74	21.7	700	1.97	0.17	2.18	0.23	54.7	14.7	50	5.77	38.6	4.06
924607		1.02	0.10	7.27	18.2	650	1.78	0.15	2.93	0.22	56.4	14.1	51	4.64	31.8	3.60
924608		1.22	0.10	7.69	9.7	630	1.95	0.17	2.36	0.22	53.1	13.3	47	5.85	36.9	4.11
924609		1.76	0.13	7.41	9.5	640	1.87	0.17	3.44	0.20	48.5	10.8	49	5.63	39.6	4.03
924610		1.30	0.11	7.66	9.5	660	1.80	0.14	2.44	0.23	53.1	16.8	76	4.85	33.3	3.91
924611		1.24	0.08	7.38	8.1	740	1.68	0.14	2.31	0.28	63.9	20.3	93	3.99	32.5	3.61
924612		1.75	0.08	7.75	15.1	860	2.01	0.17	1.84	0.19	51.1	11.3	53	13.40	31.4	3.44
924613		1.71	0.10	7.37	11.5	780	1.95	0.17	2.94	0.15	43.8	8.4	36	12.50	25.7	2.97
924614		1.93	0.15	7.71	9.5	760	1.84	0.17	2.06	0.18	53.9	12.8	43	5.68	33.4	3.61
924615		2.88	0.09	7.80	6.0	700	1.86	0.17	2.06	0.17	44.6	12.0	61	4.22	37.3	3.95
924616		1.56	0.07	7.51	6.3	840	1.96	0.18	1.87	0.30	65.2	14.4	40	4.45	30.4	3.17
924617		2.17	0.10	7.52	12.0	840	2.76	0.25	2.28	0.21	66.4	9.5	28	7.75	27.3	3.17
924618		1.82	0.07	7.39	21.1	810	2.91	0.28	1.82	0.22	75.0	7.5	19	13.10	22.1	3.12
924619		1.52	0.09	7.41	11.2	840	2.54	0.23	3.37	0.15	96.1	7.4	25	6.21	22.0	2.80
924620		1.62	0.10	7.86	9.4	980	2.71	0.23	1.50	0.17	69.8	8.0	23	7.91	20.8	2.66
924621		1.16	0.09	8.03	11.0	1080	2.80	0.25	1.42	0.21	74.7	9.6	28	8.50	19.8	2.68

***** See Appendix Page for comments regarding this certificate *****

Project: Grassy Mountain

CERTIFICATE OF ANALYSIS RE14138716

Sample Description / Method Analyte Units LOR	ME- MS61 Ga ppm 0.05	ME- MS61 Ge ppm 0.05	ME- MS61 Hf ppm 0.1	Hg- MS42 Hg ppm 0.005	ME- MS61 In ppm 0.005	ME- MS61 K % 0.01	ME- MS61 La ppm 0.5	ME- MS61 Li ppm 0.2	ME- MS61 Mg % 0.01	ME- MS61 Mn ppm 5	ME- MS61 Mo ppm 0.05	ME- MS61 Na % 0.01	ME- MS61 Nb ppm 0.1	ME- MS61 Ni ppm 0.2	ME- MS61 P ppm 10
924606	18.75	0.12	3.9	0.200	0.063	1.33	26.4	31.2	1.19	694	0.88	1.03	13.4	31.8	700
924607	17.60	0.10	3.4	0.224	0.055	1.24	27.4	26.3	1.00	675	0.87	1.22	12.7	26.8	470
924608	18.70	0.10	4.0	0.093	0.066	1.13	28.0	32.6	1.34	598	0.69	0.91	13.2	31.8	490
924609	18.05	0.10	4.0	0.266	0.064	1.10	27.9	34.3	1.52	490	0.71	1.06	13.2	30.7	740
924610	17.55	0.10	3.4	0.136	0.055	1.18	24.8	30.0	1.17	754	0.81	1.34	12.9	35.5	470
924611	16.90	0.11	3.3	0.031	0.051	1.41	29.0	24.0	0.91	957	1.02	1.56	14.3	36.0	530
924612	18.55	0.12	4.1	0.027	0.056	1.55	29.1	31.1	0.73	587	1.28	1.53	14.8	23.1	460
924613	17.50	0.12	3.5	0.030	0.046	1.66	24.2	36.7	0.85	516	1.14	1.56	21.7	19.3	450
924614	18.20	0.12	3.6	0.026	0.053	1.38	29.5	28.2	0.97	642	1.04	1.39	12.4	25.5	510
924615	18.70	0.10	3.9	0.021	0.057	1.30	24.4	27.1	0.98	574	0.94	1.54	14.6	26.5	400
924616	18.20	0.13	3.8	0.023	0.055	1.62	30.2	23.5	0.63	782	2.01	1.64	16.4	21.2	650
924617	20.8	0.13	4.8	0.031	0.078	1.76	33.3	36.7	0.88	476	4.83	1.28	20.5	19.4	560
924618	20.3	0.14	6.1	0.042	0.089	1.51	35.0	50.3	0.73	403	8.07	1.11	19.3	11.9	410
924619	19.95	0.17	3.9	0.035	0.063	1.81	51.0	31.7	0.87	420	3.65	1.42	25.5	16.5	590
924620	20.5	0.14	4.4	0.022	0.065	1.91	34.7	38.8	0.66	398	3.98	1.72	21.4	13.5	430
924621	20.7	0.15	4.5	0.020	0.065	2.06	36.1	34.5	0.54	476	5.17	1.84	22.6	13.5	390

To: CALICO RESOURCES
425 S. WILCOX STREET
SUITE 500
CASTLE ROCK CO 80104

Project: Grassy Mountain

CERTIFICATE OF ANALYSIS RE14138716

Method	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61
Analyte	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U
Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
LOR	0.5	0.1	0.002	0.01	0.05	0.1	1	0.2	0.2	0.05	0.05	0.2	0.005	0.02	0.1
Sample Description															
924606	15.3	61.2	<0.002	0.03	5.46	13.8	1	1.7	296	0.81	<0.05	7.4	0.485	0.60	1.5
924607	13.1	50.3	<0.002	0.03	4.48	11.8	1	1.5	331	0.75	<0.05	7.0	0.491	0.44	1.5
924608	12.1	67.7	<0.002	0.02	2.83	14.3	1	1.7	276	0.82	<0.05	7.1	0.455	0.44	1.3
924609	11.0	62.9	<0.002	0.02	2.58	14.3	1	1.7	343	0.80	<0.05	7.0	0.459	0.43	1.4
924610	12.8	46.3	<0.002	0.01	3.27	13.8	1	1.5	334	0.80	<0.05	6.3	0.521	0.41	1.3
924611	13.8	61.8	<0.002	0.02	1.79	13.4	1	1.4	341	0.81	<0.05	6.6	0.575	0.36	1.8
924612	13.6	76.3	<0.002	0.02	3.59	12.3	1	1.6	334	0.92	<0.05	8.2	0.499	0.42	2.4
924613	13.5	76.2	<0.002	0.02	4.93	10.2	1	1.7	349	1.42	<0.05	6.9	0.390	0.40	1.9
924614	13.4	67.6	<0.002	0.02	1.60	11.9	1	1.5	341	0.80	<0.05	7.0	0.455	0.41	1.8
924615	12.6	52.0	<0.002	0.01	0.93	13.0	1	1.7	335	0.89	<0.05	7.0	0.559	0.40	1.9
924616	16.7	69.1	<0.002	0.02	0.86	10.7	1	1.7	340	0.99	<0.05	8.5	0.477	0.45	2.3
924617	18.1	78.9	0.002	0.03	1.36	10.9	1	2.5	257	1.25	<0.05	10.2	0.392	0.61	2.9
924618	16.9	77.8	<0.002	0.03	1.91	11.6	1	2.6	251	1.15	<0.05	11.8	0.390	0.59	4.2
924619	19.0	88.1	<0.002	0.02	0.93	8.6	1	2.7	291	1.51	<0.05	18.7	0.333	0.62	3.9
924620	18.9	96.5	<0.002	0.02	1.10	9.4	1	2.3	314	1.27	<0.05	18.0	0.367	0.59	3.6
924621	20.3	102.5	<0.002	0.02	1.12	9.3	1	2.3	322	1.44	<0.05	10.7	0.388	0.64	3.8

***** See Appendix Page for comments regarding this certificate *****

To: CALICO RESOURCES
425 S. WILCOX STREET
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Project: Grassy Mountain

CERTIFICATE OF ANALYSIS RE14138716

Sample Description	Method	ME- MS61	ME- MS61	ME- MS61	ME- MS61	ME- MS61	Au- AA24
	Analyte	V	W	Y	Zn	Zr	Au
	Units	ppm	ppm	ppm	ppm	ppm	ppm
	LOR	1	0.1	0.1	2	0.5	0.005
924606		89	2.2	25.9	92	153.0	0.017
924607		88	1.8	24.7	76	131.5	0.009
924608		77	1.9	27.7	88	153.5	0.009
924609		84	1.8	27.3	88	152.0	0.010
924610		98	1.7	24.2	76	132.0	0.007
924611		107	1.7	25.8	74	133.5	<0.005
924612		86	2.4	26.2	79	154.0	<0.005
924613		66	2.9	21.1	72	129.5	<0.005
924614		84	1.7	24.8	79	136.5	0.012
924615		99	1.6	23.5	84	151.0	<0.005
924616		79	2.1	26.3	75	147.0	<0.005
924617		64	4.7	32.8	84	177.5	0.007
924618		70	7.2	36.3	85	228	<0.005
924619		56	3.9	30.3	75	139.5	<0.005
924620		69	5.0	28.3	73	166.5	<0.005
924621		65	5.0	29.5	74	170.0	<0.005

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Page: Appendix 1
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Finalized Date: 25- SEP- 2014
Account: CALIRS

Project: Grassy Mountain

CERTIFICATE OF ANALYSIS RE14138716

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

REE's may not be totally soluble in this method.

Applies to Method: ME- MS61

LABORATORY ADDRESSES

Processed at ALS Reno located at 4977 Energy Way, Reno, NV, USA.

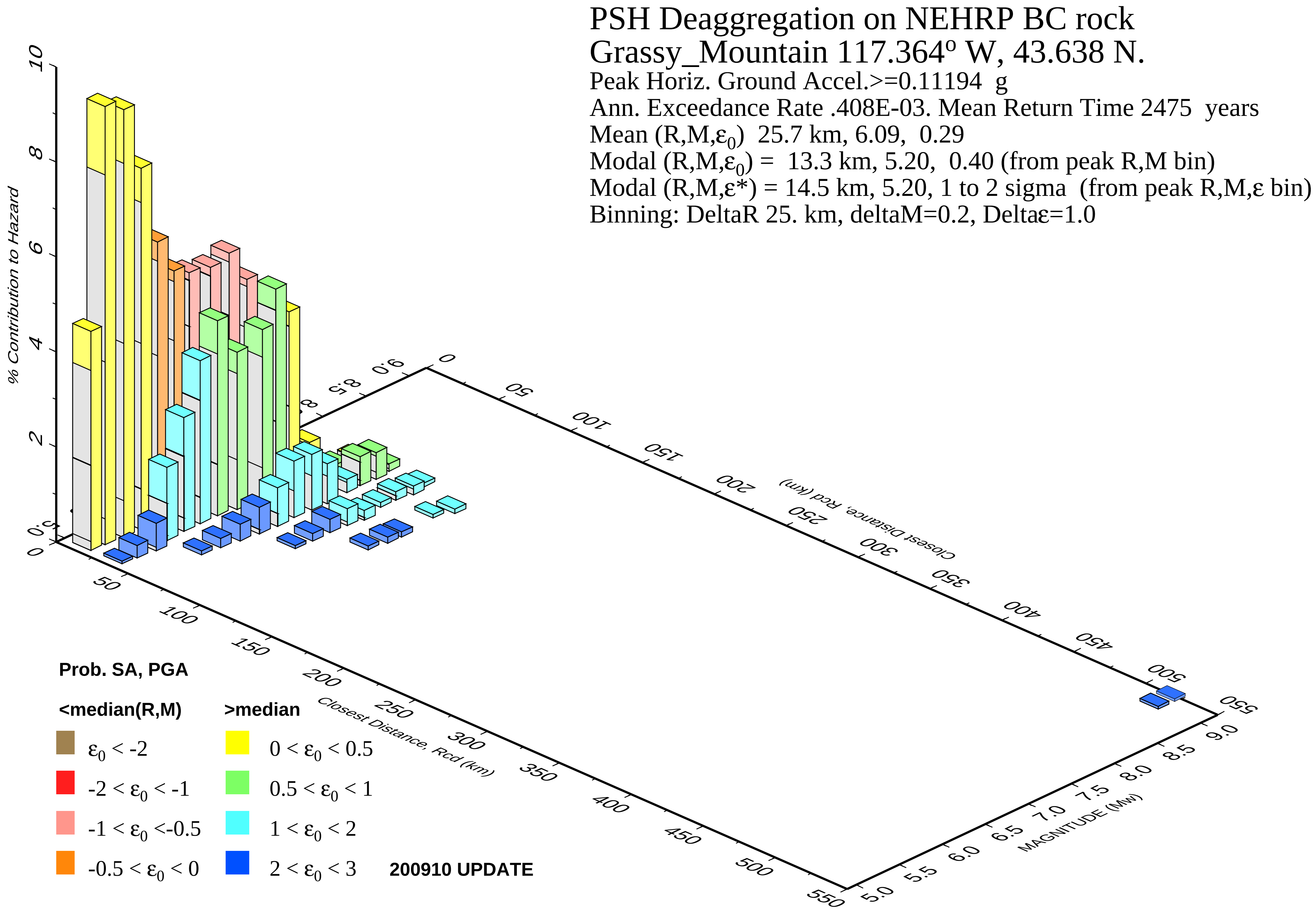
Applies to Method: Au- AA24 LOG- 22 SCR- 41 WEI- 21

Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Applies to Method: Hg- MS42 ME- MS61

Appendix E

Seismic/Earthquake Probability and Design Factors



PSH Deaggregation on NEHRP BC rock

Grassy_Mountain 117.364° W, 43.638 N.

Peak Horiz. Ground Accel.>=0.11194 g

Ann. Exceedance Rate .408E-03. Mean Return Time 2475 years

Mean (R,M,ε_0) 25.7 km, 6.09, 0.29

Modal (R,M,ε_0) = 13.3 km, 5.20, 0.40 (from peak R,M bin)

Modal (R,M,ε*) = 14.5 km, 5.20, 1 to 2 sigma (from peak R,M,ε bin)

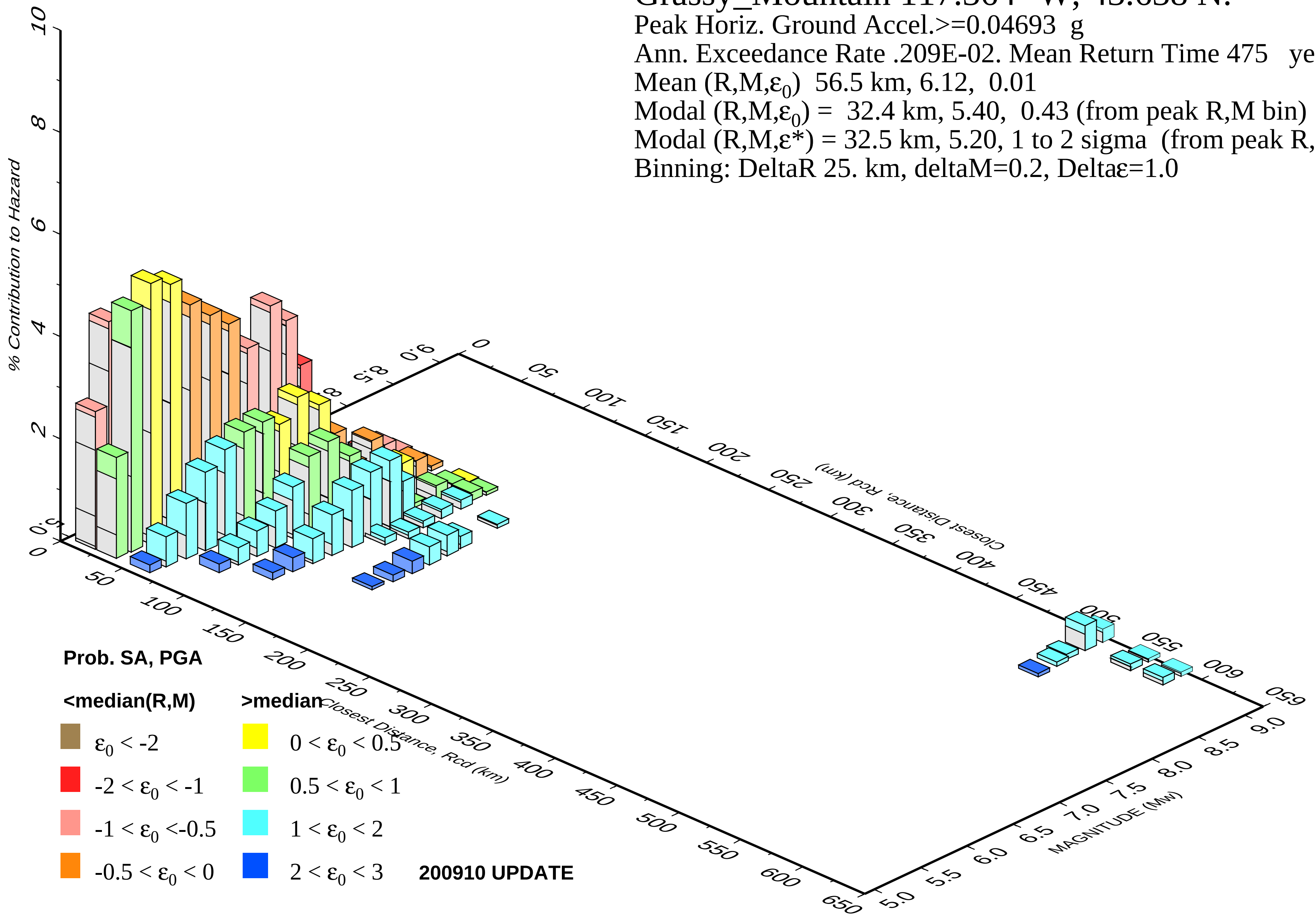
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0

GMT 2015 Feb 11 20:28:02 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP BC rock

Grassy_Mountain 117.364° W, 43.638 N.

Peak Horiz. Ground Accel.>=0.04693 g
Ann. Exceedance Rate .209E-02. Mean Return Time 475 years
Mean (R,M,ε_0) 56.5 km, 6.12, 0.01
Modal (R,M,ε_0) = 32.4 km, 5.40, 0.43 (from peak R,M bin)
Modal (R,M,ε^*) = 32.5 km, 5.20, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0



GMT 2015 Feb 11 20:30:29 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

USGS Design Maps Detailed Report

2012 International Building Code (43.63754°N, 117.36407°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1]	$S_S = 0.271$ g
From Figure 1613.3.1(2) [2]	$S_1 = 0.102$ g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_s = 0.271 g, F_a = 1.583

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.102 g, F_v = 2.393

Equation (16-37):	$S_{MS} = F_aS_S = 1.583 \times 0.271 = 0.429$ g
Equation (16-38):	$S_{M1} = F_vS_1 = 2.393 \times 0.102 = 0.244$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39):	$S_{DS} = ⅔\ S_{MS} = ⅔ \times 0.429 = 0.286$ g
Equation (16-40):	$S_{D1} = ⅔\ S_{M1} = ⅔ \times 0.244 = 0.162$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	**RISK CATEGORY**		
	I or II	**III**	**IV**
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.286 g, Seismic Design Category = B

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	**RISK CATEGORY**		
	I or II	**III**	**IV**
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.162 g, Seismic Design Category = C

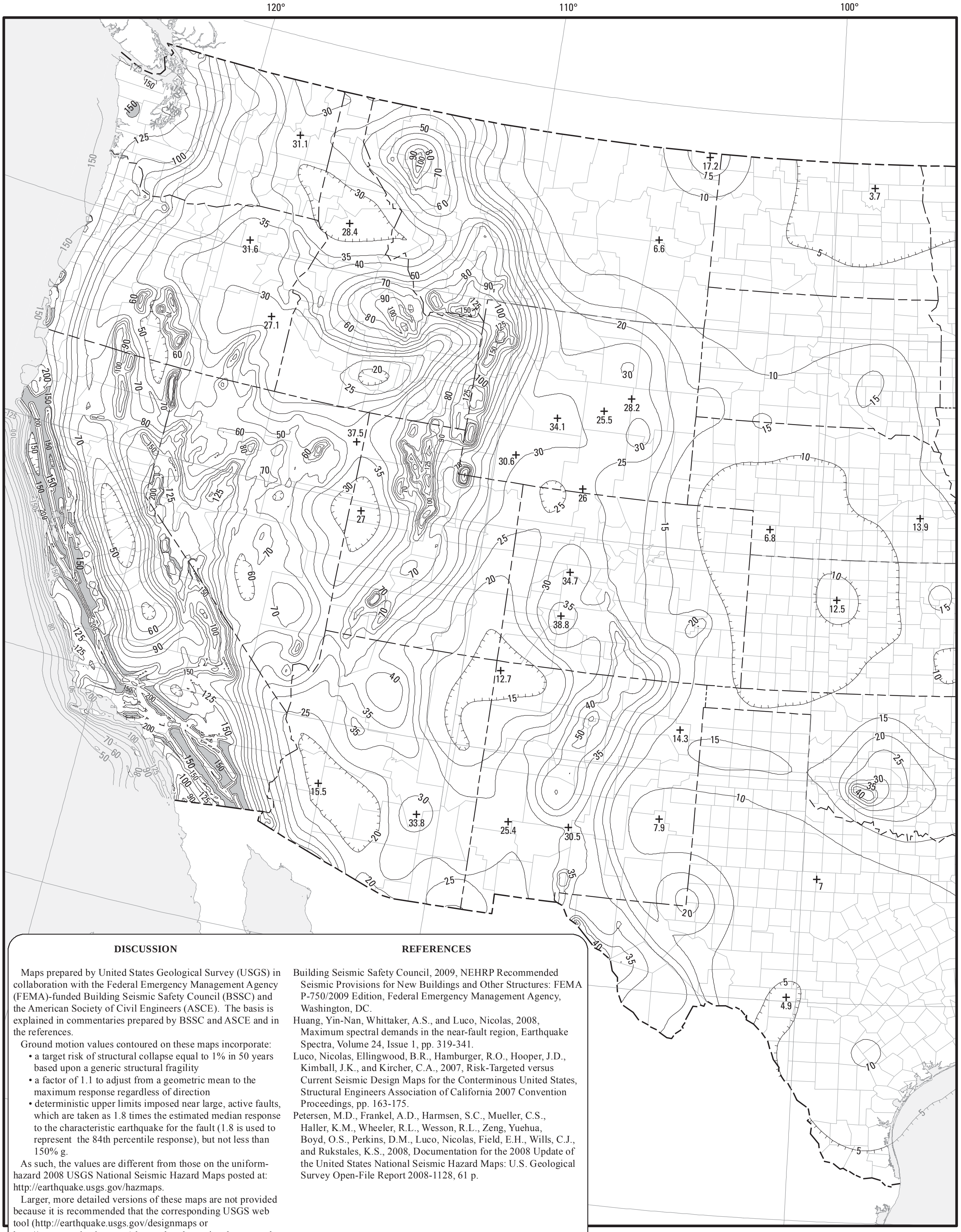
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = C

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(1)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf



DISCUSSION

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.1 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% g.

As such, the values are different from those on the uniform-hazard 2008 USGS National Seismic Hazard Maps posted at: http://earthquake.usgs.gov/hazmaps.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seinstitute.org) be used to determine the mapped value for a specified location.

REFERENCES

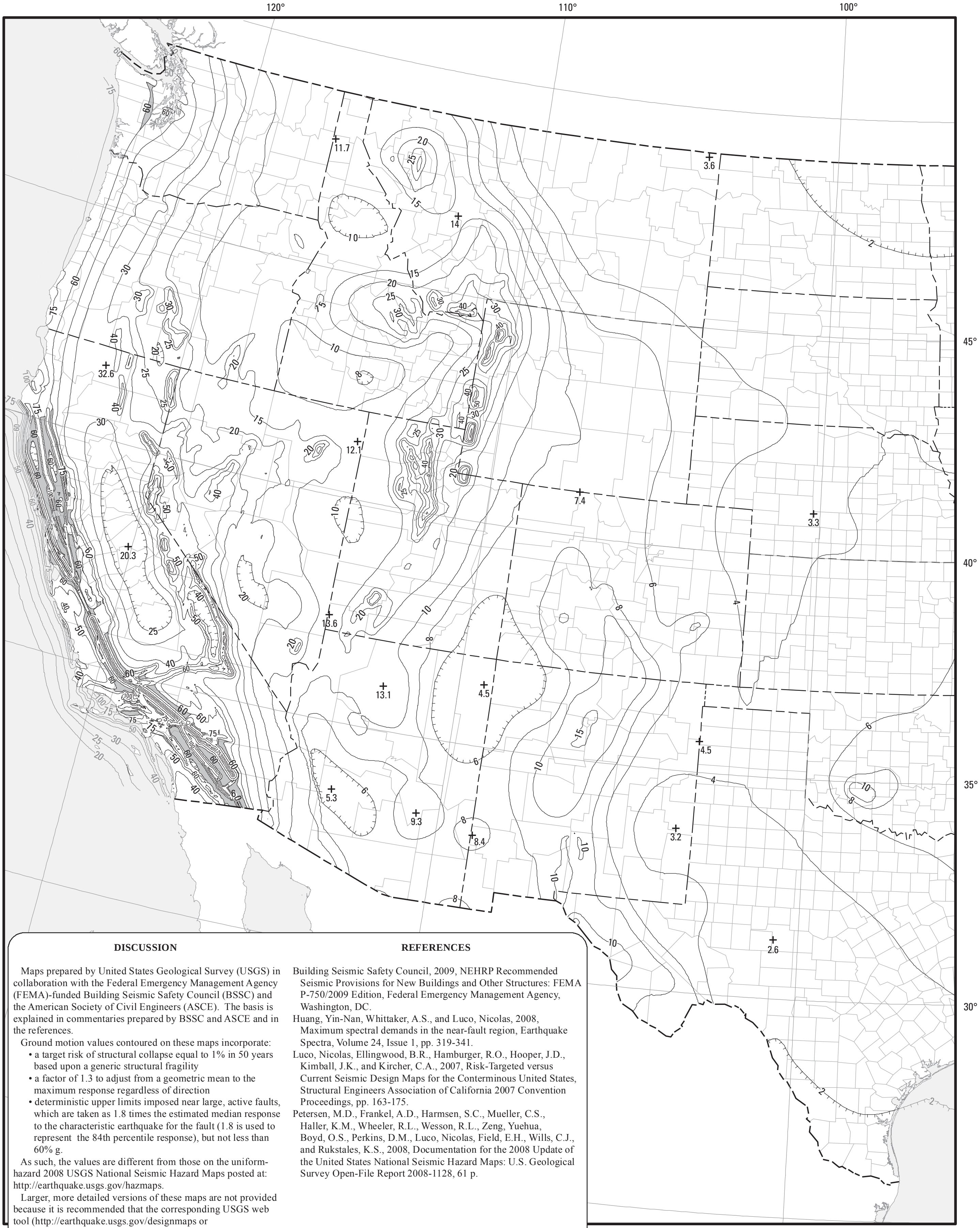
Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Yuehua, Boyd, O.S., Perkins, D.M., Luco, Nicolas, Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61 p.

Figure 1613.3.1(1) Risk-Targeted Maximum Considered Earthquake (MCE$_R$) Ground Motion Response Accelerations for the Conterminous United States of 0.2-Second Spectral Response Acceleration (5% of Critical Damping), Site Class B *(continued)*



DISCUSSION

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.3 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 60% g.

As such, the values are different from those on the uniform-hazard 2008 USGS National Seismic Hazard Maps posted at: http://earthquake.usgs.gov/hazmaps.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seinstitute.org) be used to determine the mapped value for a specified location.

REFERENCES

Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Yuehua, Boyd, O.S., Perkins, D.M., Luco, Nicolas, Field, E.H., Wills, C.J., and Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128, 61 p.

Figure 1613.3.1(2) Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for the Conterminous United States of 1-Second Spectral Response Acceleration (5% of Critical Damping), Site Class B *(continued)*

USGS Design Maps Summary Report

User–Specified Input

Report Title	Ground Response Spectra Sat February 14, 2015 16:41:44 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	43.638°N, 117.364°W
Site Soil Classification	Site Class D – “Stiff Soil”
Risk Category	I/II/III

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do not have a key, you can obtain a free k
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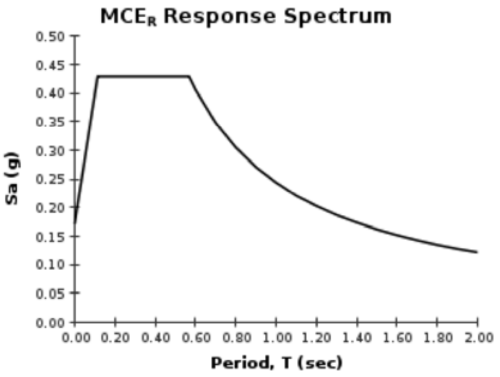
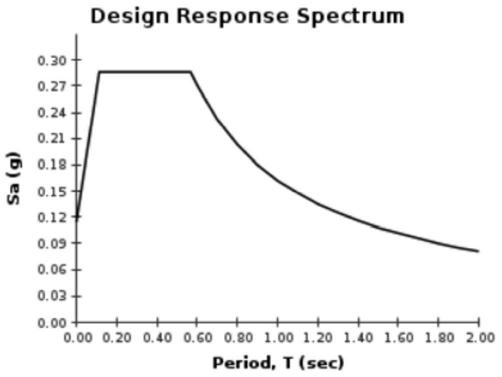
USGS–Provided Output

S_S = 0.271 g
S_{MS} = 0.429 g
S_{DS} = 0.286 g
S_1 = 0.102 g
S_{M1} = 0.244 g
S_{D1} = 0.162 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.





Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

ATTACHMENT B
Grassy Mountain Mine Soil Survey
Malheur County, Oregon
August 2018

CES

2902 W Main Street
Visalia, CA 93291 USA
P: 559.732.3665 | cascade-earth.com

September 14, 2018

Nancy Wolverson
Calico Resources USA Corp
665 Anderson St
Winnemucca, NV 89445

Subject: **Grassy Mountain Mine Soil Survey, Malheur County, Oregon**

Dear Ms. Wolverson,

CES recently completed the requested soil survey for the Grassy Mountain Mine Project located in Malheur County, Oregon. The purpose of this soil survey was to provide soil classification and mapping along the corridor between the north end of the previous IMS, LLC (IMS) soil study along Twin Springs Road to the intersection of Bishop Road (study area, Figure 1). CES reported data for the new study area in a manner similar to the previous data and information collected by IMS. This data and information includes:

- Determination of the soil types occurring within the requested Twin Springs Road corridor study area.
- Creating (or modifying) existing maps to include identified soil types.
- The assessment of physical and chemical characteristics of the soils with respect to suitability for plant growth media.
- The determination of available quantity of topsoil for reclamation.

SOIL SURVEY METHODS

Multiple soil survey methods were utilized to provide the information required to interpret, classify, and map the soils in the study area. These methods included a review of previously conducted soil studies, a Natural Resource Conservation Service (NRCS) soil data review, and a physical site-specific soil study.

Existing Soils Information

IMS conducted soil studies at the Grassy Mountain Mine Project site in 1989 and 1991 (IMS, 1989, 1991). IMS used specific criteria to interpret, characterize and classify the soil, which provided a baseline for this soil study. An additional soil study was conducted in 2015 by Red Quill Ventures, LLC (Red Quill, 2015). This study consisted of the collection of soils for analytical analysis to assess reclamation suitability and geochemical content. The current NRCS soil mapping for the project site was also reviewed. The NRCS soil mapping for most of the site is in draft form at the time of report production. Some published data was available for the north end of the study area near Twin Springs and Bishop Roads (Figure 1).

Site-Specific Study

Michael Sowers of CES, Soil Science Society of America, Certified Professional Soil Scientist (No. 25019), conducted this site-specific soil study from June 25 through June 29, 2018, utilizing standards described in the Soil Survey Manual (Soil Science Division Staff, 2017). A base map provided by EM Strategies, Inc., defined the limits of the soil study that encompassed approximately 500 acres and 16 miles of roadway (Figure 1). Twenty-two soil morphological descriptions were completed throughout the study area with the location recorded for each. Locations of the morphological descriptions are provided in Figure 2. The descriptions were completed utilizing soil collected from either a hand auger or freshly exposed soil surfaces from road cuts and erosion channels. The soils at each location were described according to methods and standards set forth in the *Field Book for Describing and Sampling Soils, Version 3.0,* (Schoeneberger, et.al, 2012). The soil descriptions noted soil texture, consistency, depth, coarse fragment content, secondary carbonate accumulation, and additional characteristics that affect quality and reclamation suitability. The information and data collected in soil morphological descriptions were utilized to classify the soils and to determine soil map units. Map units generally comprised of a single soil series except where soil variability required the establishment of a soil complex (multiple series) as a single map unit. The pedon that most accurately represented each soil series was classified to the family level according to the *Key to Soil Taxonomy, Twelfth Edition,* (Soil Survey Staff, 2014). Copies of the soil morphological descriptions (Gm-1 – Gm-22) are included in Appendix A.

Soil samples were collected from the five predominate soil series described in the study area to provide additional data to assist with the determination of reclamation suitability. The sampling location for each series was selected from the pedon that most accurately represented the series. Soil samples were collected from Gm-5, Gm-6, Gm-8, Gm-13, and Gm-22, which best represented the Nyssa, Drewsey, Ruclick, Shano, and Owsel series, respectively. At each sampling location, a hand auger was used to collect samples from individual soil horizons. Each sample was placed in a clean polyethylene bag and labelled with the sample location number, depth, date and time. The samples were hand-delivered to Western Laboratories, Inc., an accredited laboratory utilizing standard chain-of-custody procedures. The results of the laboratory analyses were compared to suitability criteria rankings for topsoil developed by IMS (IMS 1989, 1991, Table 1).

Soil Survey Results

Six additional soil types and map units from the initial study completed by IMS (IMS 1989, 1991) were identified in CES' soil survey (Table 2). The taxonomic classification for each soil, including the soils described by IMS, is provided in Table 3. The map unit boundaries, including the boundaries of the previous study area, are provided in Figure 1. Map unit descriptions are presented in Table 4, and provide information such as: predominate soils of the unit, slope, coarse fragment content, and contrasting and similar soils that may occur within the delineation. The suitability for reclamation is also included. The results of the laboratory analysis are provided in Appendix B.

Study Area Soils

CES' soil study encompassed approximately 500 acres along the Twin Springs Road corridor and consisted of eight soil series. The soils located in the valleys consisted predominately of alluvium, loess (wind-blown silt) and eolian (wind-blown) sand. These soils belong to the Drewsey, Shano, Power, and Owsel series. The Drewsey series is a deep, coarse-textured soil with a weakly-developed subsoil. The Owsel is a deep, finer soil with a well-developed subsoil. The Shano series is similar to the Owsel series but lacks a well-developed subsoil. Nyssa soil was encountered sporadically in the study area. Nyssa soils are generally silty throughout the profile and exhibit a cemented silica and carbonate layer between 25 to 30 inches. Soils located on and along ridges were formed from the underlying bedrock which generally consisted of conglomerate sandstone and basalt. The soils underlain by basalt were predominantly the Ruclick series, a moderately deep, fine-textured soil. These soils exhibited many surficial and subsurface coarse fragments. The soils underlain by conglomerate sandstone were the Drewsey and the Drewsey-Quincy-Solarview complex. These soils were generally deeper to rock and coarser-textured. Soils further south along Twin Springs Road, closer to the previous soil study, generally consisted of the Shano series and Farmell–Chardoton complex. These soils were also described and mapped in the previous study (IMS 1989, 1991). The Farmell–Chardoton complex exhibited high amounts of clay and rock throughout the profile.

Analysis Results

The results of the soil morphological descriptions and laboratory analysis are provided in Appendix A and Appendix B, respectively. The physical and chemical characteristics are typical for the region. The soils in the study area exhibited a decreased amount of clay and a generally decrease in soil development as compared to the soils described in the IMS reports (IMS, 1989, 1991).

- Soil textures were dominated by sand throughout the profile. Sand percentages ranged from 32% to 82%.
- Coarse fragment content was low in soils located on the valley floors.
- Coarse fragment content was high in the soils located on ridges, especially where the underlying bedrock was basalt.
- Organic matter content ranged from 1.60 % to 8.46 % and cation saturation percentage varied with soil texture.
- The soil pH was moderately basic to strongly basic with values ranging from 7.8 to 8.9.
- Soil salinity levels were low (less than 1.5 deciSiemens per meter, dS/m).
- Sodicity was also low with exception to the soil collected directly above and within cemented horizons. These soils exhibited higher than desirable sodium levels.

Topsoil Suitability

The surface soils throughout the study area appear generally suitable for reclamation. The primary limitation is surficial and subsurface coarse fragments, which were encountered on ridge sides and summits. The Ruclick soils and Drewsey-Quincy-Solarview Complex exhibited high surface and subsurface coarse fragments. Steep slopes will also limit reclamation feasibility.

The Drewsey and Owsel soils, which generally occur on the valley floors, exhibited marginal limitations for reclamation due to pH level and/or soil erodibility. The Nyssa soil, also located on valley floors, have unsuitable subsurface soil horizons that are cemented and exhibit increased sodium and carbonate levels. A summary of topsoil suitability is presented in Table 4.

Soil Interpretations

The soil erosion factor (K factor) was calculated using the Soil Erodibility Nomograph published in the National Soils Handbook (NRCS, 2018a). A copy of the Soil Erodibility Nomograph is provided in Appendix C. The K factor indicates the susceptibility of the soil to sheet erosion by water with a range in value from 0.0 to 0.7, with higher factors indicating a greater erosion potential. The soils in the study area have a high silt and very fine sand content, especially soils located on the valley floors, which increase the potential for wind erosion. The Wind Erodibility Group (WEG) is an arbitrary grouping of soils based on texture, structure and carbonate content. Values range from 1 to 8 with lower values indicating increased potential to wind erosion. The WEG is typically applied to the surface horizon, but can be applied to any horizon. WEG values for each series was obtained from a published Web Soil Survey from the NRCS (NRCS, 2018b). Calculated K factor and WEG for each soil series are provided in Table 5, including series from the IMS Soil study (IMS, 1989, 1991).

Hydrologic groups have also been developed by the NRCS to describe the potential for soil to produce run-off. Four groups (A, B, C, D) are recognized with group A having the lowest run-off potential and group D having the highest. The NRCS-designated hydrologic group and additional hydrologic-related information is provided in Table 6. Data for the soils in the study area was obtained from published soil series data from the NRCS (NRCS, 2018b) and the IMS report (IMS, 1989, 1991).

Prime Farmland

The NRCS has established criteria for prime farmland soils. The critical criterion relevant to the soils in the study area is that prime farmland must have a developed irrigation water supply. The only soil that qualifies as prime farmland in the study area is the Powder series located at the north end of Twin Springs Road, just south of the Bishop Road intersection. This soil is located on an actively irrigated agricultural field. All other soils mapped in the study area are not considered prime farmland since there is no developed irrigation.

Hydric Soils

The NRCS defines hydric soils as "*those soils that are sufficiently wet in the upper part to develop anaerobic conditions during the growing season*" (NRCS, 2018b). The soils described in the study area did not exhibit indications of anaerobic conditions, either by the observed saturation or by indications of seasonal wetness (redoximorphic features), in any part. The soils described and mapped in the study area did not meet hydric soil criteria.

REFERENCES

IMS, Inc. (December, 1989) Final Report: Soil, Vegetation, and Wildlife Resources of the Grassy Mountain Project Area.

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Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resource Conservation Service, National Soil Survey Center, Lincoln, NE.

Soil Science Division Staff. 2017. Soil survey manual. C. Ditzler, K. Scheffe, and H.C. Monger (eds.). USDA Handbook 18. Government Printing Office, Washington, D.C.

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NRCS, 2018b. Web Soil Survey. United States Department of Agriculture, Natural Resource Conservation Service. Web Soil Survey Accessed on July 24, 2018

Thank you for allowing CES to perform the soil survey. Should you have any questions on our survey, please feel free to contact me at (559) 732- 3665 with any questions.

CASCADE EARTH SCIENCES

Michael Sowers, CPSS, CCA-WR
Managing Soil Scientist

CPSS
Certified Professional
Soil Scientist
MICHAEL SOWERS
25019 Exp. 12/31/18

MSS/mjb;ccm

Att: Table 1. Soil Suitability Ratings
Table 2. Soil Survey Map Legend
Table 3. Taxonomic Classification of Soil Series
Table 4. Soil Survey Map Characteristics
Table 5. Erosion Factors of Surface Soils
Table 6. Hydrology-related Interpretations of the Soils of the Project Site
Figure 1. Soils Map
Figure 2. Soil Description Locations
Appendix A. Soil Profile Descriptions
Appendix B. Laboratory Analysis Results
Appendix C. Soil Erodibility Nomograph
c: Catherine Lee- E.M. Strategies
Doc: 2018240035 Calico Resources - Grassy Mtn Mine Report

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TABLES

Table 1. Soil Suitability Ratings

Parameter	Testing Method	Good Suitability	Marginal Suitability	Unsuitable
pH	S2.10	6.0 - 8.4	5.5 - 6.0, 8.4 - 8.8	< 5.5, > 8.8
EC (dS/m)	S-2.10	< 4.0	4.0 - 12.0	> 12.0
Texture	S -14.10 ASTM D6913	Loamy sand, sandy loam, loam silt; soil w/ < 35% clay	sand, loamy coarse sand; soil w/ < 45% clay	soils w/ > 45% clay
Saturation %	S-10.20	25 - 80	25 - 80	< 25 and /or > 80
$CaCO_3$%	Fizz	0 - 15	15 - 30	> 30
Rock fragments %	Field Estimated	< 35	35 - 60	> 60
Erosion factor K	Calculated	< 0.37	> 0.37	

NOTE:

Source: IMS 1989, 1991

Table 2. Soil Survey Map Legend

Map Unit [1]	Name - Description
1	Farmell- Rock outcrop complex, 8 to 30 percent slopes
2	Farmel-Chardoton very cobbly soil, 15 to 30 percent slopes
3	Farmell-Chardoton very cobbly soil, 4 to 15 percent slopes
4	Farmell-Chardoton extremely stony soil, 4 to 15 percent slopes
5	Farmell-Chardoton soil, 8 to 15 percent slopes
6	Ruckles very stony loam, 8 to 30 percent slopes
7	Shano silt loam, 2 to 6 percent slopes
8	Soil A extremely gravelly sandy loam, 15 to 30 percent slope
9	Virtue loam, 2 to 8 perfect slopes
10	Xeric Torriorthents, 8 to 30 percent slopes
11	Soil B very gravelly sand loam, 8 to 30 percent slopes
12	Nyssa silt loam, 2 to 6 percent slopes
13	Drewsey very fine sandy loam, 2 to 6 percent slopes
14	Ruclick cobbly loam, 4 to 15 percent slopes
15	Drewsey-Quincy-Solarview Complex 8 to 30 percent slopes
16	Owsel silt loam, 2 to 6 percent slopes
17	Powder silt loam, 0 to 3 percent slopes

NOTE:

1 Map units 1-11 were obtained from IMS report (IMS, Inc. 1989, 1991)

Table 3. Taxonomic Classification of Soil Series

Series	Family
Chardoton [1]	Fine, montmorillontic, mesic Xerollic Paleargids
Farmell [1]	Fine, montmorillontic, mesic Xerollic Haplargids
Ruckles [1]	Clayey-skeletal, montmorillonitic, mesic lithic Argixerolls
Shano [1]	Coarse-silty, mixed, mesic Xerollic Camborthids
Soil A [1]	fine-loamy, mixed mesic Xerollic Haplargids
Soil B [1]	Clayey-skeletal, montmorillonitic, mesic Xerollic Durargids
Virtue [1]	Fine-silty, mixed, Xerollic Duragids
	Xeric Torriorthents[1]
Nyssa	Coarse-silty, mixed, mesic Xeric Haplodurids
Drewsey	Coarse-loamy, mixed, mesic Xeric Haplocambids
Ruclick	Clayey-skeletal, smectitic, mesic Aridic Argixerolls
Owsel	Fine-silty, mixed, mesic Durinodic Xeric Haplargids
Powder	Coarse-silty, mixed, mesic Cumulic Haploxerolls

NOTE:

Source: IMS, Inc. 1989, 1991

1 Soil Series data obtained from IMS report (IMS Inc, 1989, 1991)

Table 4. Soil Survey Map Characteristics

Map Unit [1]	Components	Composition (%)	Slope	Typical Surface Texture	Surficial Rock Fragments (%)	Typical Subsurface Texture	Rock Fragments (%)	Reclamation Suitability	Limitation	Recommended Salvage Depth (feet)
1	Farmell	60	8 -30	SiL	60+	C, SiC	0 - 15	Unsuitable	Surficial rock	0.0
	Rock outcrop	30								
	Soils < 40" to bedrock	10						Unsuitable	Surficial rock	0.0
2	Farmell	45	15 -30	SiL	35 - 60+	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35 - 60+	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils < 40" to bedrock	10			35 - 60+			Marginal	Surficial rock	0.5
3	Farmell	55	4 - 15	SiL	35 - 60	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	35 - 60	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Soils < 40" to bedrock	5		SiL	60+	C, SiC	0 - 15	Unsuitable	Surficial rock	0.0
4	Farmell	55	4 - 15	SiL	60+	C, SiC	0 - 15	Unsuitable	Surficial rock	0.0
	Chardoton	40		SiL	60+	C, SiC	0 - 15	Unsuitable	Surficial rock	0.0
	Soils < 40" to bedrock	5		SiL	60+	C, SiC	0 - 15	Unsuitable	Surficial rock	0.0
5	Farmell	55	4 - 15	SiL	0 - 25	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Chardoton	40		SiL	0 - 25	C, SiC	0 - 15	Marginal	Surficial rock	0.5
	Soils < 40" to bedrock	5		SiL	0 - 25	C, SiC	0 - 15	Marginal	Surficial rock	0.0
6	Ruckles	90	8 - 30	L	35 - 60+	CL, C	0 - 15	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils < 20" to bedrock	5		L	35 - 60+	CL, C	0 - 15	Marginal	Surficial rock	0.5
7	Shano	95	2 - 6	SiL	0 - 5	SiL	0 - 5	Good		2.5
	Virtue	5	2 - 8	SiL	10 - 35	SiCL, SL	0 - 10	Good		2.0
8	Soil A	85	15 - 30	SL	50+	SL	25 - 35	Unsuitable	Surficial rock	0.0
	Soils w/ > 35% rock fragments	15		SL	50+	SL	35 - 60	Unsuitable	Surficial rock	0.0
9	Virtue	95	2 - 8	SiL	10 - 35	SiCL, SiL	0 - 10	Good	Depth to	2.0
	Soils > 40% to hardpan	5		SiL	10 - 35	SiCL, SiL	0 - 10	Good	hardpan	2.0
10	Xeric-Torriorthents	90	15 - 30	Varies	10 - 50	Varies	Varies	Unsuitable	Depth to bedrock	0.0
	Other shallow soil	10		Varies	10 - 50	Varies	Varies	Unsuitable	slope	0.0
11	Soil B	100	8 - 30	SL	60+	CL, C	35+	Unsuitable	Rock Frags.	0.0
12	Nyssa	100	2 - 6	SiL	0 - 5	SiL, Si	0 - 15	Marginal	Soil Erodibility	0.5
13	Drewsey	100	2 - 6	vfSL	0 - 5	L, vfSL, fSL	0 - 15	Marginal	pH	2.5
14	Ruclick	90	4 - 15	L	15 - 35	CL, C	35+	Marginal	Surficial rock	0.5
	Rock outcrop	5								
	Soils < 20" to bedrock	5		L	15 - 35	CL, C	35+	Marginal	Surficial rock	0.5
15	Drewsey	60	8 - 30	vfSL	0 - 5	L, vfSL, fSL	0 - 5	Marginal	pH	2.5
	Quincy	20		fS	0 - 5	fS	0 - 5	Marginal	Texture	2.5
	Solarview	20		SL	0 - 15	LS, S	0 - 15	Marginal	Texture	0.5
16	Owsel	90	2 - 6	SiL	0 - 5	SiL, SiCL, L, SL	0 - 15	Marginal	Soil Erodibility	2.0
	Nyssa	10		SiL	0 - 5	SiL, Si	0 - 15	Marginal	Soil Erodibility	0.5
17	Powder	100	0 - 3	SiL	0 - 5	SiL	0 - 15	Good		2.5

NOTES:

Source: IMS, Inc. 1989, 1991

Abbreviations- C = clay, CL = clay loam, fS = fine sand, fSL = fine sandy loam, L = loam, LS = loamy sand, SL = sandy loam, SiC = silty clay, SiCL = silty clay loam, Si = silt, SiL = silt loam, vfSL = vey fine sandy loam

1 Map units 1 - 11 were obtained from IMS report (IMS Inc, 1989, 1991)

Table 5. Erosion Factors of Surface Soils

Soil Series	WEG (Wind Erosion Group)	K-Factor (Soil Erodibility Factor)
Chardoton	8	0.13
Farmell	8	0.1
Ruckles	8	0.1
Shano	5	0.37
Soil A	8	0.07
Soil B	8	0.07
Virtue	5	0.16
Nyssa	5	0.61
Drewsey	3	0.34
Ruclick	8	0.37
Owsel	5	0.46
Powder	5	0.52

NOTE:

Source: IMS, Inc. 1989, 1991, NRCS, 2018

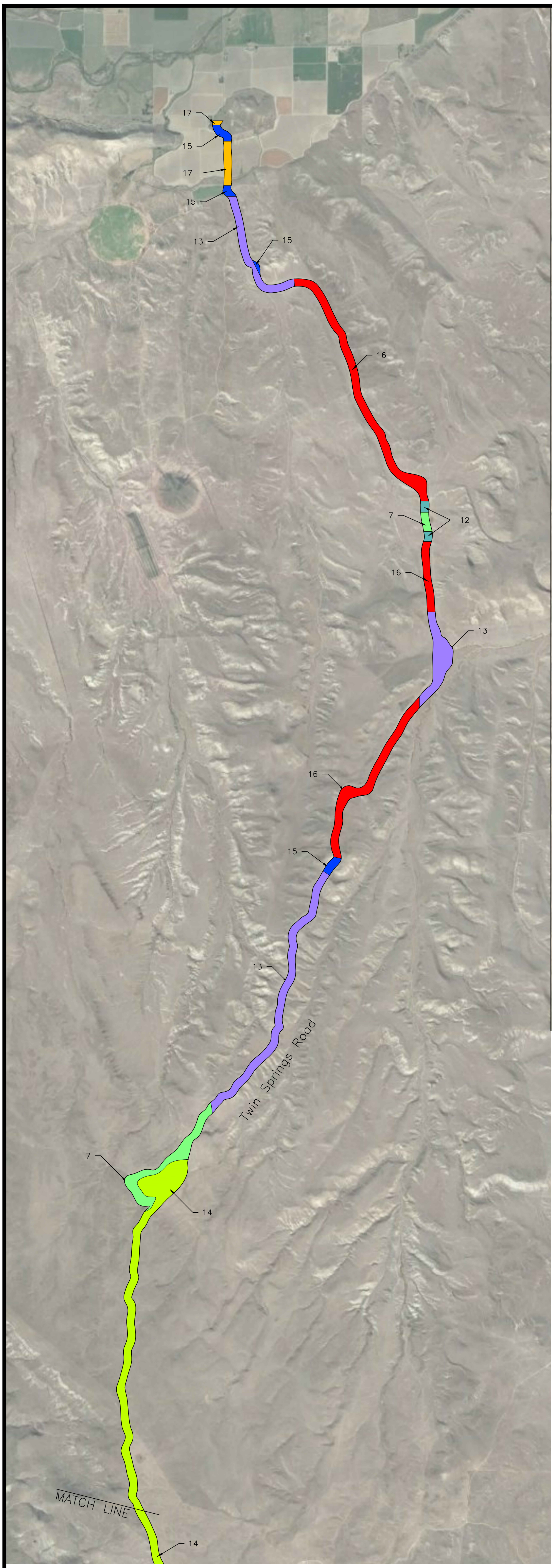
Table 6. Hydrology-related Interpretations of the Soils of the Project Site

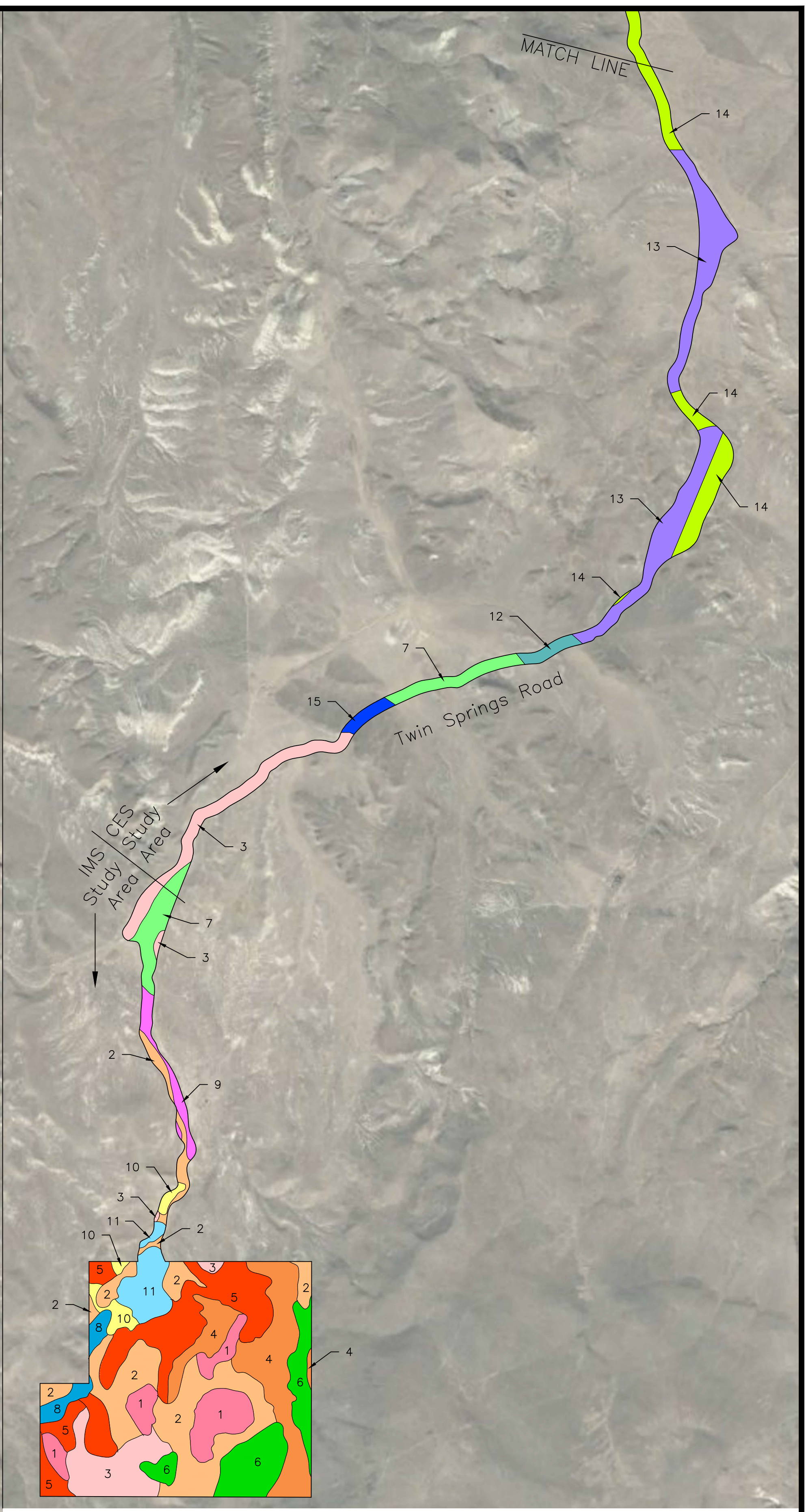
Soil Series	Internal Drainage	Permeability	Available Water Capacity	Hydrologic Group
Chardoton	Well	Very Slow	High	C
Farmell	Well	Very Slow	High	C
Ruckles	Well	Slow	Low	D
Shano	Well	Moderate	High	B
Soil A	Well	Moderately Rapid	Low	B
Soil B	Well	Moderately Rapid	Low	B
Virtue	Well	Moderate	Mod. To High	B
Nyssa	Well	Moderate	Low	C
Drewsey	Well	Moderate	High	B
Ruclick	Well	Slow	Very Low	D
Owsel	Well	Moderately Slow	Moderate	C
Powder	Well	Moderate	Very High	B

NOTE:

Source: IMS, Inc. 1989, 1991, NRCS, 2018

FIGURES





Map Unit Description

- ■ 1. Farmell–Rock outcrop complex, 8 to 30 percent slopes
- ■ 2. Farmell–Chardoton very cobbly soil, 15 to 30 percent slopes
- ■ 3. Farmell–Chardoton very cobbly soil, 4 to 15 percent slopes
- ■ 4. Farmell–Chardoton extremely stony soil, 4 to 15 percent slopes
- ■ 5. Farmell–Chardoton soil, 8 to 15 percent slopes
- ■ 6. Ruckles very stony loam, 8 to 30 percent slopes
- ■ 7. Shano silt loam, 2 to 6 percent slopes
- ■ 8. Soil A extremely gravelly sandy loam, 15 to 30 percent slopes
- ■ 9. Virtue loam, 2 to 8 percent slopes
- ■ 10. Xeric Torrithents, 8 to 30 percent slopes
- ■ 11. Soil B very gravelly sand loam, 8 to 30 percent slopes
- ■ 12. Nyssa silt loam, 2 to 8 percent slopes
- ■ 13. Drewsey very fine sandy loam, 2 to 6 percent slopes
- ■ 14. Ruclick Cobbly loam, 4 to 15 percent slopes
- ■ 15. Drewsey–Quincy–Solarview complex, 8 to 30 percent slopes
- ■ 16. Owsel silt loam, 1 to 6 percent slopes
- ■ 17. Powder silt loam, 0 to 3 percent slopes

Figure 1. Soils Map

0 4,000'
1"=4,000'

N

Note: Map Units 1-11 provided by IMS 1989 and 1991

(SOURCE: Google Earth Pro Image, 9-28-2015)

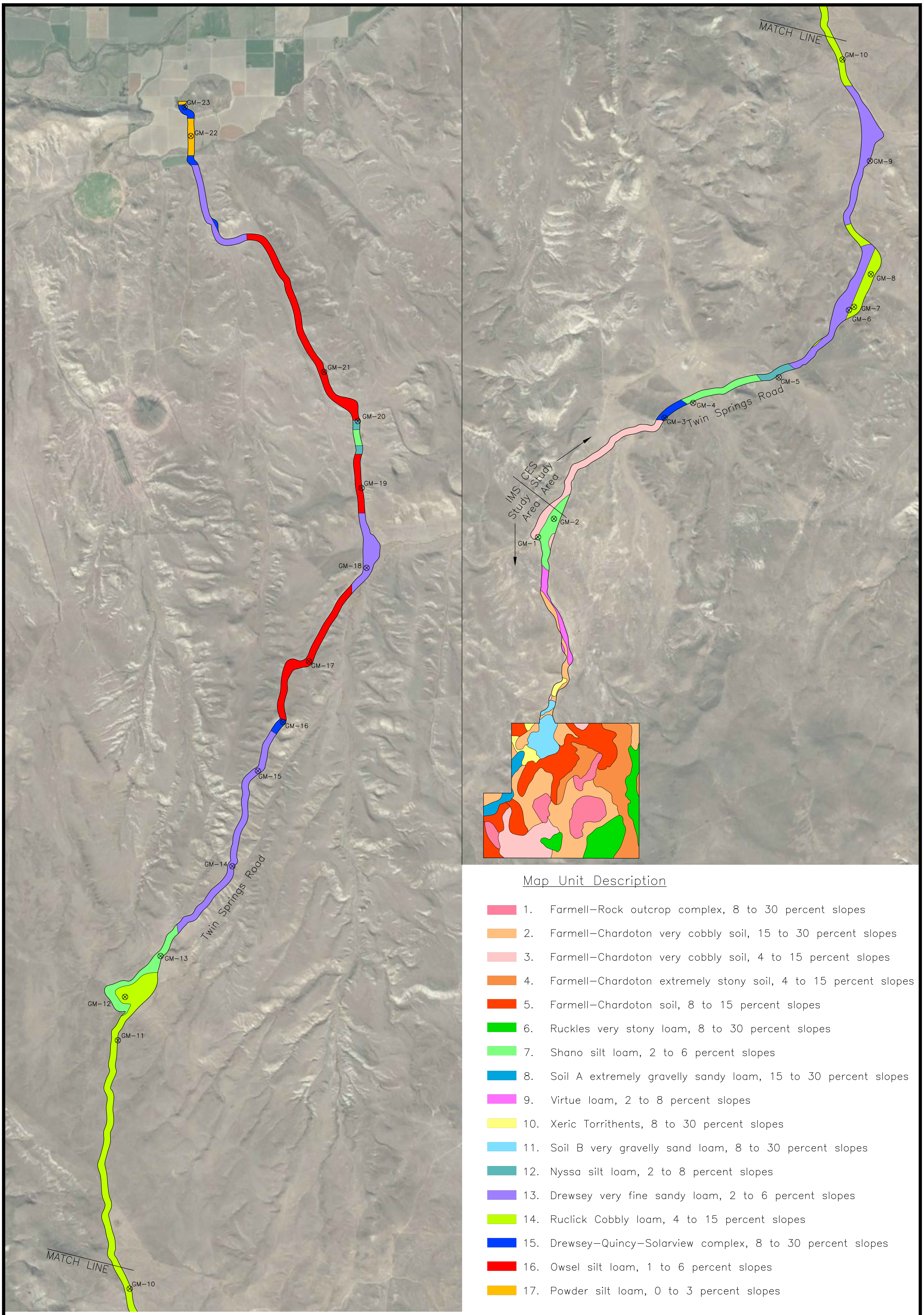
PROJECT NUMBER: 2018240035
DATE: 7/27/2018
DWG NO: 2018240035.DWG
DWG BY: 6DJR
PROJECT MANAGER: 13MSS
REVISED:

Grassy Mountain Mine Project
Soils Types within Soils Study Area

Calico Resources USA Corp.
Vale, Oregon

CES CASCADE EARTH SCIENCES

S:\[Working Drafting]\2018240035 Calico Resources\DWG\2018240035.dwg August 27, 2018 DR702784



Map Unit Description

- 🟥 1. Farmell–Rock outcrop complex, 8 to 30 percent slopes
- 🟧 2. Farmell–Chardoton very cobbly soil, 15 to 30 percent slopes
- 🟥 3. Farmell–Chardoton very cobbly soil, 4 to 15 percent slopes
- 🟧 4. Farmell–Chardoton extremely stony soil, 4 to 15 percent slopes
- 🟥 5. Farmell–Chardoton soil, 8 to 15 percent slopes
- 🟩 6. Ruckles very stony loam, 8 to 30 percent slopes
- 🟩 7. Shano silt loam, 2 to 6 percent slopes
- 🟦 8. Soil A extremely gravelly sandy loam, 15 to 30 percent slopes
- 🟪 9. Virtue loam, 2 to 8 percent slopes
- 🟨 10. Xeric Torrithents, 8 to 30 percent slopes
- 🟦 11. Soil B very gravelly sand loam, 8 to 30 percent slopes
- 🟦 12. Nyssa silt loam, 2 to 8 percent slopes
- 🟪 13. Drewsey very fine sandy loam, 2 to 6 percent slopes
- 🟩 14. Ruclick Cobbly loam, 4 to 15 percent slopes
- 🟦 15. Drewsey–Quincy–Solarview complex, 8 to 30 percent slopes
- 🟥 16. Owsel silt loam, 1 to 6 percent slopes
- 🟧 17. Powder silt loam, 0 to 3 percent slopes

Legend

⊗GM–10 Soil Description Location

0 4,000'

1"=4,000'

N

Note: Map Units 1-11 provided by IMS 1989 and 1991

(SOURCE: Google Earth Pro Image, 9-28-2015)

Figure 2. Soil Description Locations

PROJECT NUMBER: 2018240035	Grassy Mountain Mine Project Soils Types within Soils Study Area
DATE: 7/27/2018	
DWG NO: 2018240035.DWG	Calico Resources USA Corp. Vale, Oregon
DWG BY: 6DJR PROJECT MANAGER: 13MSS	
REVISED:	CES CASCADE EARTH SCIENCES

S:\[Working Drafting]\2018240035 Calico Resources\DWG\2018240035.dwg August 27, 2018 DR702784

APPENDICES

Appendix A.

Soil Profile Descriptions

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon

Date: 6/26/2018

No. Gm - 1

Location: Twin Springs Road N 43.70496 W117.36733

Soil Type/Classification: Faemell - Chardotan

Vegetation: Thistle and Sagebrush

Landform: Upland

Parent Material: Loess

Climate: Dry/Arid

Relief:

Elevation: 3,324 ft

Slope: 3%

Aspect:

Moisture: Dry

Groundwater: Not Encountered

Drainage: Well Drained

Depth to Restrictive Layer: NE

Depth to Seasonally High Water Table: Not Encountered

Root Distribution: Not Described

Estimated Permeability: N/A

Estimated Infiltration Rate: N/A

Soils Samples Collected: No

Depths:

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 11	10YR 4/3	C	--	1gr	lo	fr	s	--	--	0	0	0	--	--	--	C/W	48
Bt1	11 - 24	10YR 5/4	CL	--	1sbk	so	fr	s	--	--	0	0	0	pf	--	--	C/W	35
Bt2	24 - 36	10YR 3/4	CL	--	2sbk	so	fr	s	--	--	0	0	0	pf	--	s	C/W	35
Bt3	36 - 38	10YR 5/4	grCL	--	1sbk	so	fr	s	--	--	15	0	0	pf	--	es	--	35
AR	38+																	

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon		**Date:** 6/26/2018	**No.** Gm - 2

Location: Twin Springs Road N 43.70720 W117.36464

Soil Type/Classification: Shano

Vegetation: Thistle and Sagebrush

Landform: Upland

Parent Material: Loess

Climate: Dry/Arid

Relief:

Elevation: 3,310 ft

Slope: 3%

Aspect:

Moisture: Dry

Groundwater: Not Encountered

Drainage: Well Drained

Depth to Restrictive Layer: Not Encountered

Depth to Seasonally High Water Table: Not Encountered

Root Distribution: Not Described

Estimated Permeability: N/A

Estimated Infiltration Rate: N/A

Soils Samples Collected: No

Depths:

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 10	10YR 4/3	L	--	1pl	lo	fr	ss	--	--	10	0	0	--	--	--	A/S	12
Bk1	10 - 18	10YR 4/3	grSL	--	1sbk	so	fr	ss	--	--	20	0	0	pf	--	s	C/S	15
Bk2	18 - 26	10YR 4/3	fSL	--	3abk	so	fr	so	--	--	3	0	0	pf	--	s	C/S	8
C	26 - 38+	10YR 5/3	vfSL	--	m	so	fr	so	--	--	3	0	0	pf	--	es	--	7

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon		**Date:** 6/26/2018	**No.** Gm - 3
Location: Twin Springs Road N 43.71849 W117.36631			
Soil Type/Classification: Drewsey - Quincy - Solarview Complex		**Vegetation:** Thistle and Sagebrush	
Landform: Upland	**Parent Material:** Eolian Sand		**Climate:** Dry/Arid
Relief:	**Elevation:** 3,244 ft	**Slope:** 8%	**Aspect:**
Moisture: Dry	**Groundwater:** Not Encountered	**Drainage:** Well Drained	**Depth to Restrictive Layer:** Not Encountered
Depth to Seasonally High Water Table: Not Encountered	**Root Distribution:** Not Described	**Estimated Permeability:** N/A	**Estimated Infiltration Rate:** N/A
Soils Samples Collected: No	**Depths:**		
Miscellaneous Notes:			

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 11	7.5YR 3/2	grSL	--	1gr	lo	vfr	so	--	--	18	0	0	--	--	--	C/S	6
C_1	11 - 19	7.5YR 3/3	SL	--	m	lo	fr	ss	--	--	0	0	0	--	--	--	CW	20
C_2	19 - 35	7.5YR 3/3	SL	--	m	lo	vfr	so	--	--	0	0	0	--	--	--	C/U	16
C_3	35 - 40+	7.5YR 3/3	SCL	--	m	so	vfr	s	--	--	0	0	0	--	--	s	--	35

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/26/2018 **No.** Gm - 4

Location: Twin Springs Road N 43.72142 W117.34109

Soil Type/Classification: Shano **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Loess **Climate:** Dry/Arid

Relief: **Elevation:** 3,197 ft **Slope:** 8% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 9	10YR 4/3	SL	--	2gr	so	vfr	ss	--	--	0	0	0	--	--	s	C/S	20
Bw	9 - 48	7.5YR 4/3	SL	--	1sbk	so	fr	ss	--	--	0	0	0	--	--	s	--	21

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/26/2018 **No.** Gm - 5

Location: Twin Springs Road N 43.72455 W117.32660

Soil Type/Classification: Nyssa **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Loess **Climate:** Dry/Arid

Relief: **Elevation:** 3,233 ft **Slope:** 3% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** 26"

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: Yes **Depths:** 0-5, 5-12, 12-12, 26-38

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 5	7.5YR 3/2	L	--	1gr	lo	vfr	so	--	--	0	0	0	--	7.8	--	C/S	12
Bw1	5 - 12	7.5YR 3/3	L	--	2sbk	so	fr	ss	--	--	0	0	0	--	8.8	--	C/S	14
Bw2	12 - 26	7.5YR 3/3	SL	--	2pr	sh	fr	so	--	--	0	0	0	--	8.9	--	A/S	8
Bqm	26 - 38	10YR 4/3	LS	--	2pr	h	fi	so	--	--	0	0	0	--	8.6	s	--	6

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/26/2018 **No.** Gm - 6

Location: Twin Springs Road N 43.73321 W117.31465

Soil Type/Classification: Drewsey **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Colluvium **Climate:** Dry/Arid

Relief: **Elevation:** 3,404 ft **Slope:** 8% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: Yes **Depths:** 0-15, 15-24, 24-35, 35-40

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A1	0 - 13	10YR 4/3	SCL	--	2gr	lo	fr	ss	--	--	0	0	0	--	8.0	--	C/W	22
A2	13 - 15	10YR 4/3	SCL	--	1sbk	lo	fr	ss	--	--	0	0	0	--	8.0	--	C/W	22
Bw1	15 - 24	10YR 4/3	SL	--	2sbk	so	fr	so	--	--	0	0	0	--	8.7	--	C/W	8
Bw2	24 - 35	10YR 3/3	L	--	2sbk	so	fr	ss	--	--	0	0	0	--	8.8	s	C/W	24
Bk	35 - 40	10YR 3/3	CL	--	2sbk	so	fr	ps	--	--	0	0	0	--	8.6	s	--	32

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/26/2018 **No.** Gm - 7

Location: Twin Springs Road N 43.73280 W117.31474

Soil Type/Classification: Ruclick **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Residuum **Climate:** Dry/Arid

Relief: Summit **Elevation:** 3,436 ft **Slope:** 0-4% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** 6"

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 11	7.5YR 4/3	grLcoS	--	sg	lo	lo	so	--	--	25	0	0	--	--	es	a/s	3
AR	6+																	

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon
Date: 6/26/2018
No. Gm - 8
Location: Twin Springs Road N 43.73721 W117.31101
Soil Type/Classification: Ruclick
Vegetation: Thistle and Sagebrush
Landform: Upland
Parent Material: Colluvium
Climate: Dry/Arid
Relief: backslope
Elevation: 3,525 ft
Slope: 3-8%
Aspect:
Moisture: Dry
Groundwater: Not Encountered
Drainage: Well Drained
Depth to Restrictive Layer: 19"
Depth to Seasonally High Water Table: Not Encountered
Root Distribution: Not Described
Estimated Permeability: N/A
Estimated Infiltration Rate: N/A
Soils Samples Collected: yes
Depths: 0-8, 8-19
Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 8	7.5YR 3/2	grSL	--	2gr	lo	fr	so	--	--	15	0	0	--	7.9	--	C/W	12
Bt	8 - 19	7.5YR 3/3	grSL	--	1sbk	so	fr	so	--	--	20	0	0	pf	7.8	--	--	14
AR	19+																	

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon		**Date:** 6/26/2018	**No.** Gm - 9
Location: Twin Springs Road N 43.75111 W117.31116			
Soil Type/Classification: Drewsey		**Vegetation:** Thistle and Sagebrush	
Landform: Upland	**Parent Material:**		**Climate:** Dry/Arid
Relief: Backslope	**Elevation:** 3,697 ft	**Slope:** 5%	**Aspect:**
Moisture: Dry	**Groundwater:** Not Encountered	**Drainage:** Well Drained	**Depth to Restrictive Layer:** Not Encountered
Depth to Seasonally High Water Table: Not Encountered	**Root Distribution:** Not Described	**Estimated Permeability:** N/A	**Estimated Infiltration Rate:** N/A
Soils Samples Collected: No	**Depths:**		
Miscellaneous Notes:			

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 8	7.5YR 3/2	L	--	2gr	lo	vfr	ss	--	--	0	0	0	--	--	--	C/W	14
Bw1	8 - 12	10YR 4/3	L	--	1sbk	so	fr	ss	--	--	0	0	0	--	--	--	C/W	12
Bw2	12 - 35	10YR 4/3	SL	--	1sbk	so	vfr	so	--	--	4	0	0	--	--	es	G/W	7
C	35 - 40+	10YR 5/3	LS	--	m	so	vfr	so	--	--	0	0	0	--	--	ev	--	6

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 10

Location: Twin Springs Road N 43.76357 W117.31578

Soil Type/Classification: Ruclick **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Residuum **Climate:** Dry/Arid

Relief: Backslope **Elevation:** 3,795 ft **Slope:** 5% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 7	7.5YR 3/2	L	--	2gr	lo	fr	ss	--	--	10	0	0	--	--	--	--	26
AR	7+																	

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 11

Location: Twin Springs Road N 43.79406 W117.31776

Soil Type/Classification: Ruclick **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Colluvium **Climate:** Dry/Arid

Relief: Backslope **Elevation:** 3,579ft **Slope:** 4% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 9	7.5YR 3/3	CL	--	2gr	lo	fr	ss	--	--	5	5	0	--	--	--	C/W	32
Bt	9 - 13	7.5YR 4/3	CL	--	2sbk	so	fr	ps	--	--	5	5	0	pf	--	--	--	35
AR	13+																	

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon			**Date:** 6/27/2018		**No.** Gm - 12
Location: Twin Springs Road N 43.79939 W117.31654					
Soil Type/Classification: Ruclick			**Vegetation:** Thistle and Sagebrush		
Landform: Upland	**Parent Material:** Loess/Residuum				**Climate:** Dry/Arid
Relief: Backslope	**Elevation:**			**Slope:** 5%	**Aspect:**
Moisture: Dry	**Groundwater:** Not Encountered		**Drainage:** Well Drained	**Depth to Restrictive Layer:** Not Encountered	
Depth to Seasonally High Water Table: Not Encountered	**Root Distribution:** Not Described		**Estimated Permeability:** N/A	**Estimated Infiltration Rate:** N/A	
Soils Samples Collected: No	**Depths:**				
Miscellaneous Notes:					

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 7	7.5YR 3/3	SiL	--	2gr	lo	vfr	ss	--	--	0	0	0	--	--	--	C/S	25
Bt1	7 - 14	7.5YR 4/3	SiL	--	1sbk	so	fr	ss	--	--	0	0	0	pf	--	--	C/S	25
Bt2	14 - 20	10YR 4/3	SiL	--	2sbk	so	fr	ss	--	--	0	0	0	pf	--	s	--	21
AR	20																	

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 13

Location: Twin Springs Road N 43.80440 W117.31052

Soil Type/Classification: Shano **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Loess **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 3,301 ft **Slope:** 2% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: Yes **Depths:** 0 - 8, 8 - 22, 22 - 36, 36 - 45

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 8	7.5YR 3/3	SL	--	2gr	lo	fr	so	--	--	18	0	0	--	7.6	--	C/W	12
Bw1	8 - 22	7.5YR 4/3	SL	--	2sbk	so	fr	ss	--	--	0	0	0	--	7.9	--	C/W	14
Bw2	22 - 36	7.5YR 4/4	L	--	1sbk	so	fr	ss	--	--	0	0	0	--	8.9	es	C/S	18
C	36 - 45	10YR 5/3	SL	--	m	lo	vfr	so	--	--	4	0	0	--	8.9	ev	--	12

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SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon	**Date:** 6/27/2018	**No.** Gm -1 4	
Location: Twin Springs Road N 43.81542 W117.29835			
Soil Type/Classification: Drewsey	**Vegetation:** Thistle and Sagebrush		
Landform: Upland	**Parent Material:** Eolian material	**Climate:** Dry/Arid	
Relief: Backslope	**Elevation:** 3,129 ft	**Slope:** 5%	**Aspect:**
Moisture: Dry	**Groundwater:** Not Encountered	**Drainage:** Well Drained	**Depth to Restrictive Layer:** Not Encountered
Depth to Seasonally High Water Table: Not Encountered	**Root Distribution:** Not Described	**Estimated Permeability:** N/A	**Estimated Infiltration Rate:** N/A
Soils Samples Collected: No	**Depths:**		
Miscellaneous Notes:			

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 14	10YR 4/2	L	--	2gr	lo	vfr	so	--	--	10	0	0	--	--	--	C/W	18
Bw	14 - 20	7.5YR 4/3	vfSL	--	m	lo	vfr	so	--	--	10	0	0	--	--	ev	--	5
AR	20+																	

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 15

Location: Twin Springs Road N 43.82712 W117.29401

Soil Type/Classification: Drewsey **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Eolian material **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 3,067 ft **Slope:** 2% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: Yes **Depths:** 0-5, 5-12, 12-12, 26-38

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 6	10YR 4/2	vfSL	--	2gr	lo	vfr	so	--	--	0	0	0	--	--	--	A/S	6
Bw1	6 - 13	10YR 4/3	vfSL	--	2pl	lo	fr	so	--	--	0	0	0	--	--	--	C/W	8
Bw2	13 - 25	10YR 4/3	fSL	--	2sbk	lo	fr	so	--	--	0	0	0	--	--	--	C/S	6
Bk	25 - 40	10YR 4/3	fSL	--	2sbk	lo	fr	so	--	--	0	0	0	--	--	es	--	6

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 16

Location: Twin Springs Road N 43.83310 W117.28974

Soil Type/Classification: Drewsey - Quincy - Solarview Complex **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Eolian material **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 3,055 ft **Slope:** 3% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 5	10YR 4/2	S	--	1gr	lo	lo	so	--	--	0	0	0	--	--	--	C/W	1
C	5 - 40	10YR 4/2	S	--	sg	lo	lo	so	--	--	0	0	0	--	--	--	--	1

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 17

Location: Twin Springs Road N 43.84055 W117.28532

Soil Type/Classification: Owsel **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Loess **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 2,909 ft **Slope:** 3% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: No **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 6	10YR 4/2	fSL	--	1gr	lo	vfr	so	--	--	0	0	0	--	--	--	C/S	6
E	6 - 18	10YR 4/3	vfSL	--	1sbk	lo	fr	so	--	--	0	0	0	--	--	--	C/S	4
Bt	18 - 26	10YR 4/3	L	--	2sbk	sh	fr	ss	--	--	0	0	0	pl	--	--	C/W	20
Btk	26 - 43	10YR 4/3	L	--	2sbk	sh	fr	ss	--	--	15	0	0	pl	--	es	--	20

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon
Date: 6/27/2018
No. Gm - 18
Location: Twin Springs Road N 43.85203 W117.27554
Soil Type/Classification: Drewsey
Vegetation: Thistle and Sagebrush
Landform: Upland
Parent Material: Loess
Climate: Dry/Arid
Relief: Footslope
Elevation: 2,712 ft
Slope: 2%
Aspect:
Moisture: Dry
Groundwater: Not Encountered
Drainage: Well Drained
Depth to Restrictive Layer: Not Encountered
Depth to Seasonally High Water Table: Not Encountered
Root Distribution: Not Described
Estimated Permeability: N/A
Estimated Infiltration Rate: N/A
Soils Samples Collected: No
Depths:
Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 4	10YR 4/2	vfSL	--	1gr	lo	vfr	so	--	--	0	0	0	--	--	--	C/S	6
Bw1	4 - 19	10YR 4/3	vfSL	--	1sbk	lo	fr	so	--	--	0	0	0	--	--	--	C/W	15
Bw2	19 - 35	10YR 4/3	vfSL	--	2sbk	lo	fr	so	--	--	0	0	0	--	--	s	C/W	14
Bw3	35 - 50	10YR 4/3	vfSL	--	1sbk	lo	fr	so	--	--	0	0	0	--	--	s	--	15

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon	**Date:** 6/27/2018	**No.** Gm - 19	
Location: Twin Springs Road N 43.85804 W117.27580			
Soil Type/Classification: Owsel	**Vegetation:** Thistle and Sagebrush		
Landform: Upland	**Parent Material:** Loess	**Climate:** Dry/Arid	
Relief: Footslope	**Elevation:** 2,722 ft	**Slope:** 3%	**Aspect:**
Moisture: Dry	**Groundwater:** Not Encountered	**Drainage:** Well Drained	**Depth to Restrictive Layer:** Not Encountered
Depth to Seasonally High Water Table: Not Encountered	**Root Distribution:** Not Described	**Estimated Permeability:** N/A	**Estimated Infiltration Rate:** N/A
Soils Samples Collected: No	**Depths:**		
Miscellaneous Notes:			

Horizon	**Depth (in.)**	**Color (dry or moist)**	**USDA Texture**	**Mottles**	**Structure**	**Consistence**			**Roots**	**Pores**	**% Coarse Fragment**			**Clay Films**	**pH**	**Carbonates**	**Boundary**	**% Clay**
						Dry	**Moist**	**Wet**			**GRV**	**Cb**	**St**					
A	0 - 6	7.5YR 4/2	vfSL	--	1pl	lo	vfr	so	--	--	0	0	0	--	--	--	C/W	5
AB	6 - 17	7.5YR 4/2	vfSL	--	2sbk	lo	fr	so	--	--	0	0	0	--	--	--	C/W	6
Bt1	17 - 27	10YR 4/3	L	--	2sbk	so	fr	ss	--	--	0	0	0	pl	--	--	C/W	18
Bt2	27 - 38	10YR 4/3	L	--	2sbk	so	fr	ss	--	--	0	0	0	pl	--	s	--	22

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon

Date: 6/27/2018

No. Gm - 20

Location: Twin Springs Road N 43.87004 W117.27701

Soil Type/Classification: Nyssa

Vegetation: Thistle and Sagebrush

Landform: Upland

Parent Material: Loess

Climate: Dry/Arid

Relief: Footslope

Elevation: 2,595 ft

Slope: 8%

Aspect:

Moisture: Dry

Groundwater: Not Encountered

Drainage: Well Drained

Depth to Restrictive Layer: Not Encountered

Depth to Seasonally High Water Table: Not Encountered

Root Distribution: Not Described

Estimated Permeability: N/A

Estimated Infiltration Rate: N/A

Soils Samples Collected: No

Depths:

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 5	10YR 4/2	vfSL	--	1pl	lo	vfr	so	--	--	0	0	0	--	--	s	C/S	10
Bw	5 - 15	10YR 4/3	SiL	--	1sbk	so	fr	ss	--	--	0	0	0	--	--	s	C/W	22
Bk	15 - 25	10YR 4/3	SiL	--	2sbk	h	fi	ss	--	--	0	0	0	--	--	es	C/S	20
Bkqm	25 - 40	10YR 5/3	L	--	2sbk	vh	vfi	ss	--	--	0	0	0	--	--	ev	--	17

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 21

Location: Twin Springs Road N 43.87608 W117.28272

Soil Type/Classification: Owsel **Vegetation:** Thistle and Sagebrush

Landform: Upland **Parent Material:** Eolian material **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 2,504 ft **Slope:** 2% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: Yes **Depths:** 0-4, 4-16, 16-24, 24-40

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 - 4	10YR 4/2	SL	--	2pl	lo	fr	so	--	--	0	0	0	--	7.8	--	C/S	20
Bt1	4 - 16	10YR 4/3	SL	--	3sbk	so	fr	so	--	--	0	0	0	pf	7.7	--	C/S	12
Bt2	16 - 24	2.5YR 4/3	SL	--	2sbk	so	fr	so	--	--	0	0	0	pf	7.8	--	C/W	18
Bt3	24 - 40	10YR 4/3	L	--	2sbk	so	fr	so	--	--	0	0	0	pf	8.9	--	--	14

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 22

Location: Twin Springs Road N 43.90505 W117.30529

Soil Type/Classification: Powder **Vegetation:** Alfalfa

Landform: Upland **Parent Material:** Alluvium **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 2,323 ft **Slope:** 2% **Aspect:**

Moisture: moist **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: no **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
Ap	0 -11	10YR 3/2	SiL	--	2gr	--	fr	ss	--	--	0	0	0	--	--	--	A/S	27
AB	11 - 17	10YR 3/3	SiL	--	1sbk	--	fr	ss	--	--	0	0	0	--	--	--	C/S	22
Bw1	17 - 39	10YR 4/4	vfSL	--	1sbk	--	fr	ss	--	--	0	0	0	--	--	--	C/W	20
Bw2	39 - 48	10YR 5/4	vfSL	--	1sbk	--	fr	ss	--	--	0	0	0	--	--	e	--	18

Sheet ____ of ____

SOIL DESCRIPTION

Client Calico Resources USA Corp **Project No.** 2018240035 **Project** Grassy Mountian Mine Project **Soil Scientist** Michael Sowers

Area /State: Malheur County, Oregon **Date:** 6/27/2018 **No.** Gm - 23

Location: Twin Springs Road N 43.90860 W117.30633

Soil Type/Classification: Drewsey - Quincy - Solarview Complex **Vegetation:** mixed grasses

Landform: Upland **Parent Material:** Eolian material **Climate:** Dry/Arid

Relief: Footslope **Elevation:** 2,3208 ft **Slope:** 12% **Aspect:**

Moisture: Dry **Groundwater:** Not Encountered **Drainage:** Well Drained **Depth to Restrictive Layer:** Not Encountered

Depth to Seasonally High Water Table: Not Encountered **Root Distribution:** Not Described **Estimated Permeability:** N/A **Estimated Infiltration Rate:** N/A

Soils Samples Collected: no **Depths:**

Miscellaneous Notes:

Horizon	Depth (in.)	Color (dry or moist)	USDA Texture	Mottles	Structure	Consistence			Roots	Pores	% Coarse Fragment			Clay Films	pH	Carbonates	Boundary	% Clay
						Dry	Moist	Wet			GRV	Cb	St					
A	0 -6	10YR 4/2	SL	--	1gr	lo	vfr	so	--	--	0	0	0	--	--	--	C/S	10
Bw	6 - 12	10YR 5/3	SL	--	1sbk	lo	fr	so	--	--	0	0	0	--	--	ev	C/S	10
Bk1	12 - 17	2.5Y 5/2	SL	--	1sbk	so	fr	so	--	--	0	0	0	--	--	ev	C/S	12
Bk2	17 - 20	2.5Y 5/2	SL	--	1sbk	so	fr	so	--	--	10	0	0	--	--	ev	--	12
AR	20																	

LEGEND OF SOIL ABBREVIATIONS

TEXTURE

st	- stones and cobbly
cb	- cobbles and cobbly
gr	- gravel and gravely
vcos	- very coarse sand
cos	- coarse sand
s	- sand
fs	- fine sand
vfs	- very fine sand
lcos	- loamy coarse sand
ls	- loamy sand
lfs	- loamy fine sand
cosl	- coarse sandy loam
sl	- sandy loam
fsl	- fine sandy loam
vfsl	- very fine sandy loam
l	- loam
si	- silt
sil	- silt loam
scl	- sandy clay loam
cl	- clay loam
sicl	- silty clay loam
sc	- sandy clay
sic	- silty clay
c	- clay

MOTTLES

Color

Abundance

f	- few (mottles <2% surface area)
c	- common (mottles 2 to 20% surface area)
m	- many (mottles >20% surface area)

Size

1	- fine, <5 mm in diameter
2	- medium, 5 to 15 mm in diameter
3	- large, >15 mm in diameter

Contrast

f	- faint
d	- distinct
p	- prominent

STRUCTURE

Grade

m	- massive, no aggregation
sg	- single grain, no aggregation
1	- weak
2	- moderate
3	- strong

Size

vf	- very fine
f	- fine
m	- medium
c	- coarse
vc	- very coarse

Type

gr	- granular
cr	- crumb
pl	- platy
pr	- prismatic
cpr	- columnar
abk	- angular blocky
sbk	- subangular blocky

CONSISTENCE

Dry

lo	- loose
so	- soft
sh	- slightly hard
h	- hard
vh	- very hard
eh	- extremely hard

Moist

lo	- loose
vfr	- very friable
fr	- friable
fi	- firm
vfi	- very firm
efi	- extremely firm

Wet

so	- nonsticky
ss	- slightly sticky
s	- sticky
vs	- very sticky
po	- nonplastic
ps	- slightly plastic
p	- plastic
vp	- very plastic

ROOTS

Abundance

1	- few
2	- common
3	- many

Size

vf	- vey fine
f	- fine
m	- medium
c	- coarse

PORES

Frequency

1	- few
2	- common
3	- many

Size

vf	- vey fine
f	- fine
m	- medium
c	- coarse

Shape

vf	- vesicular
i	- irregular, interstitial
t	- tubular

Continuity

dis	- discontinuous
cons	- constricted
cont	- continuous

Orientation

ver	- vertical
hor	- horizontal
ran	- random
obl	- oblique

PERMEABILITY	**inches/hour**
very slow	<0.06
slow	0.06 - 0.2
moderately slow	0.2 - 0.6
moderate	0.6 - 2.0
moderately rapid	2.0 - 6.0
rapid	6.0 - 20.0
very rapid	>20.0

CLAY FILMS

Frequency

v	- very few
1	- few
2	- common
3	- many
4	- continuous

Thickness

n	- thin
mk	- moderately thick
k	- thick

Morphology

pf	- films occur on ped faces
po	- films line pores
br	- films occur as bridges between mineral grains
co	- films are colloidal

CARBONATES

vs	- very slightly effervescent
s	- slightly effervescent
es	- strongly effervescent
ev	- violently effervescent
d	- diffuse

BOUNDARY

Distinctiveness

va	- very abrupt
a	- abrupt
c	- clear
g	- gradual
d	- diffuse

Topography

s	- smooth
w	- wavy
i	- irregular

v

Appendix B.

Laboratory Analysis Results

Western Laboratories, Inc.
211 Highway 95
Parma, Idaho 83660
800-658-3858 • FAX 208-402-5303

Dealer #: CES

Date: 6/29/2018

Dealer: 0-00
CES-Calico Resources
2902 W Main Street
Visalia CA 93291

OFFICIAL TEXTURE REPORT

Lab #	Grower	Field ID	% Sand	% Silt	% Clay	Textural Class
313315	Calico Resoures	GM 5-0-5 soil	50.0	38.0	12.0	Loam
313316	Calico Resoures	GM 5-5-12 soil	44.0	42.0	14.0	Loam
313317	Calico Resoures	GM 5-12-26 soil	60.0	32.0	8.0	Sandy Loam
313318	Calico Resoures	GM 5-12-38 soil	82.0	12.0	6.0	Loamy Sand
313319	Calico Resoures	GM 6-0-15 soil	62.0	16.0	22.0	Sandy Clay Loam
313320	Calico Resoures	GM 6-15-24 soil	64.0	28.0	8.0	Sandy Loam
313321	Calico Resoures	GM 6-24-35 soil	34.0	42.0	24.0	Loam
313322	Calico Resoures	GM 6-35-40 soil	40.0	28.0	32.0	Clay Loam
313323	Calico Resoures	GM 8-0-8 soil	64.0	24.0	12.0	Sandy Loam
313324	Calico Resoures	GM 8-8-19 soil	32.0	54.0	14.0	Silt Loam
313325	Calico Resoures	GM 13-0-8 soil	38.0	44.0	18.0	Loam
313326	Calico Resoures	GM 13-8-22 soil	50.0	38.0	12.0	Loam
313327	Calico Resoures	GM 13-22-36 soil	30.0	56.0	14.0	Silt Loam
313328	Calico Resoures	GM 13-36-45 soil	74.0	8.0	18.0	Sandy Loam
313329	Calico Resoures	GM 21-0-4 soil	54.0	26.0	20.0	Sandy Loam
313330	Calico Resoures	GM 21-4-16 soil	80.0	8.0	12.0	Sandy Loam
313331	Calico Resoures	GM 21-16-24 soil	68.0	14.0	18.0	Sandy Loam
313332	Calico Resoures	GM 21-24-40 soil	38.0	48.0	14.0	Loam

John P. Taberna, Soil Scientist

WESTERN LABORATORIES, INC.
211 Highway 95 • Parma, ID 83660

Dealer #: CES
Name: CES
Address: 2902 W Main Street
Visalia, Ca 93291

Date: 07/02/18

Grower: Calico Resources

Lab #:	**313315**
Field ID:	GM 5-0-5 Soil
Sieve Size	**% Retained**
1"	1.52
1/2"	0.73
#10	4.95
#40	32.96
#60	14.98
#100	22.1
#200	16.73
<#200	6.03

Lab #:	**313316**
Field ID:	GM 5-5-12 Soil
Sieve Siz	**% Retained**
1"	1.75
1/2"	1.17
#10	2.53
#40	20.64
#60	22.4
#100	27.83
#200	18.72
<#200	4.96

Lab #:	**313317**
Field ID:	GM 5-12-26 Soil
Sieve Size	**% Retained**
1"	1.76
1/2"	1.67
#10	5.73
#40	17.56
#60	17.77
#100	38.36
#200	13.83
<#200	3.32

Lab #:	**313318**
Field ID:	GM 5-12-38 Soil
Sieve Siz	**% Retained**
1"	5.5
1/2"	5.24
#10	25.04
#40	25.56
#60	9.53
#100	17.46
#200	9.15
<#200	2.52

Lab #:	**313319**
Field ID:	GM 6-0-15 Soil
Sieve Size	**% Retained**
1"	1.82
1/2"	2.29
#10	6.27
#40	52.35
#60	15.47
#100	14.82
#200	6
<#200	0.98

Lab #:	**313320**
Field ID:	GM 6-15-24 Soil
Sieve Siz	**% Retained**
1"	1.56
1/2"	1.34
#10	2.68
#40	36.58
#60	25.81
#100	20.62
#200	9.73
<#200	1.68

WESTERN LABORATORIES, INC.
211 Highway 95 • Parma, ID 83660

Dealer #: CES
Name: CES
Address: 2902 W Main Street
Visalia, Ca 93291

Date: 07/02/18

Grower: Calico Resources

Lab #:	**313321**
Field ID:	GM 6-24-35 Soil
Sieve Size	**% Retained**
1"	1.78
1/2"	2.2
#10	3.94
#40	40.92
#60	19.88
#100	20.35
#200	9.48
<#200	1.45

Lab #:	**313322**
Field ID:	GM 6-35-40 Soil
Sieve Siz	**% Retained**
1"	5.61
1/2"	4.87
#10	3.52
#40	29.03
#60	15.85
#100	23.3
#200	15.38
<#200	2.44

Lab #:	**313323**
Field ID:	GM 8-0-8 Soil
Sieve Size	**% Retained**
1"	2
1/2"	1.6
#10	4.65
#40	37.86
#60	20.1
#100	19.05
#200	12.54
<#200	2.2

Lab #:	**313324**
Field ID:	GM 8-8-19 Soil
Sieve Siz	**% Retained**
1"	2.26
1/2"	7.16
#10	9.51
#40	33.76
#60	23.55
#100	18.65
#200	4.68
<#200	0.43

Lab #:	**313325**
Field ID:	GM 13-0-8 Soil
Sieve Size	**% Retained**
1"	1.75
1/2"	1.47
#10	3.5
#40	37.18
#60	22.71
#100	22.63
#200	8.56
<#200	2.2

Lab #:	**313326**
Field ID:	GM 13-8-22 Soil
Sieve Siz	**% Retained**
1"	2.29
1/2"	1.93
#10	7.12
#40	28.3
#60	29.75
#100	24.74
#200	5.36
<#200	0.51

WESTERN
LABORATORIES, INC.
211 Highway 95 • Parma, ID 83660

Dealer #: CES
Name: CES
Address: 2902 W Main Street
Visalia, Ca 93291

Date: 07/02/18

Grower: Calico Resources

Lab #:	**313327**
Field ID:	GM 13-22-36 Soil
Sieve Size	**% Retained**
1"	2.57
1/2"	1.18
#10	8.67
#40	34.51
#60	31.48
#100	18.02
#200	3.31
<#200	0.25

Lab #:	**313328**
Field ID:	GM 13-36-45 Soil
Sieve Siz	**% Retained**
1"	2.25
1/2"	2.87
#10	2.62
#40	15.64
#60	32.32
#100	32.56
#200	10.5
<#200	1.23

Lab #:	**313329**
Field ID:	GM 21-0-4 Soil
Sieve Size	**% Retained**
1"	0.1
1/2"	4.14
#10	1.26
#40	21.48
#60	33.27
#100	27.08
#200	11.39
<#200	1.28

Lab #:	**313330**
Field ID:	GM 21-4-16 Soil
Sieve Siz	**% Retained**
1"	0.87
1/2"	0.94
#10	2.28
#40	19.88
#60	35.35
#100	25.38
#200	12.78
<#200	2.52

Lab #:	**313331**
Field ID:	GM 21-16-24 Soil
Sieve Size	**% Retained**
1"	3.84
1/2"	1.3
#10	3.06
#40	14.94
#60	23.85
#100	37.27
#200	15.06
<#200	0.68

Lab #:	**313332**
Field ID:	GM 21-24-40 Soil
Sieve Siz	**% Retained**
1"	5.3
1/2"	1.19
#10	0.96
#40	30
#60	23.44
#100	14.17
#200	24.58
<#200	0.36

WESTERN
LABORATORIES, INC.

211 Highway 95 • Parma, ID 83660

Dealer #: CES Date: 07/02/18
Name: CES
Address: 2902 W Main Street
Visalia,CA 93291

Grower Calico Resources

Lab #	Field ID	pH	%OM	%Lime
313315	GM 5-0-5 Soil	7.8	1.60	0.2
313316	GM 5-5-12 Soil	8.8	4.20	0.0
313317	GM 5-12-26 Soil	8.9	4.64	1.5
313318	GM 5-12-38 Soil	8.6	2.17	2.5
313319	GM 6-0-15 Soil	8.0	5.94	0.2
313320	GM 6-15-24 Soil	8.7	6.29	1.0
313321	GM 6-24-35 Soil	8.8	6.47	2.5
313322	GM 6-35-40 Soil	8.6	8.46	3.5
313323	GM 8-0-8 Soil	7.9	3.50	0.0
313324	GM 8-8-19 Soil	7.8	3.50	0.5
313325	GM 13-0-8 Soil	7.6	3.75	0.2
313326	GM 13-8-22 Soil	7.9	2.38	0.5
313327	GM 13-22-36 Soil	8.9	4.69	1.0

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 5-0-5 soil

Lab #:
315

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	1772	Low	1,800 +
Soluble Salts	0.07	Optimum	< 1.5	Magnesium-ppm	196	Low	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	25	Optimum	< 225
% Organic Matter	1.60	Low		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	417	Optimum	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	?		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	?
Magnesium-% of CEC	10-20	?
Potassium-% of CEC	2-6	?
Sodium-% of CEC (ESP)	< 5	?
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	9 :1	OK	
Ca:K pH >7	15:1	4 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	0 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur		
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur

Elemental Sulfur = Reclamation Sulfur

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 5-5-12 soil

Lab #: 316

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.8	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2074	Optimum	1,800 +
Soluble Salts	0.06	Optimum	< 1.5	Magnesium-ppm	376	Optimum	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	282	High	< 225
% Organic Matter	4.20	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	277	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1404		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	943	1 Ft		
Magnesium-% of CEC	10-20	285	2 Ft		
Potassium-% of CEC	2-6	65	3 Ft		
Sodium-% of CEC (ESP)	< 5	112	Total N PPM		
Hydrogen-% of CEC	< 15		Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	6 :1	OK	
Ca:K pH >7	15:1	7 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	1 :1	Low	Watch Mg

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		83
P.F. Sulfur		
Elemental Sulfur	91	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 5-12-26 soil

Lab #:
317

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.9	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2834	Optimum	1,800 +
Soluble Salts	0.22	Optimum	< 1.5	Magnesium-ppm	388	Optimum	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	732	Very High	< 225
% Organic Matter	4.64	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	129	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC	
Percent Base Saturation	1585

P Index	100

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	1073
Magnesium-% of CEC	10-20	245
Potassium-% of CEC	2-6	25
Sodium-% of CEC (ESP)	< 5	241
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	7 :1	OK	
Ca:K pH >7	15:1	22 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	3 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	111	231
P.F. Sulfur		
Elemental Sulfur	392	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

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AGRICULTURAL SOIL REPORT

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 5-12-38 soil

Lab #:
318

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.6	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	4617	High	1,800 +
Soluble Salts	0.56	Optimum	< 1.5	Magnesium-ppm	548	High	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	1247	Very High	< 225
% Organic Matter	2.17	Low		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	173	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	39432		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	27159	1 Ft		
Magnesium-% of CEC	10-20	5373	2 Ft		
Potassium-% of CEC	2-6	522	3 Ft		
Sodium-% of CEC (ESP)	< 5	6379	Total N PPM		
Hydrogen-% of CEC	< 15		Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	8 :1	OK	
Ca:K pH >7	15:1	27 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	3 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	67	187
P.F. Sulfur		
Elemental Sulfur	828	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur
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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 6-0-15 Soil

Lab #:
319

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.0	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2743	Optimum	1,800 +
Soluble Salts	0.03	Optimum	< 1.5	Magnesium-ppm	790	Very High	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	83	Optimum	< 225
% Organic Matter	5.94	High		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	284	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1086		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	696	1 Ft		
Magnesium-% of CEC	10-20	334	2 Ft		
Potassium-% of CEC	2-6	37	3 Ft		
Sodium-% of CEC (ESP)	< 5	18	Total N PPM		
Hydrogen-% of CEC	< 15		Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	3 :1	Low	Watch Ca
Ca:K pH >7	15:1	10 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	3 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		76
P.F. Sulfur		
Elemental Sulfur	114	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

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AGRICULTURAL SOIL REPORT

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 6-15-24 Soil

Lab #:
320

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.7	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	3189	Optimum	1,800 +
Soluble Salts	0.03	Optimum	< 1.5	Magnesium-ppm	881	Very High	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	194	Optimum	< 225
% Organic Matter	6.29	High		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	287	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1159		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	743
Magnesium-% of CEC	10-20	342
Potassium-% of CEC	2-6	34
Sodium-% of CEC (ESP)	< 5	39
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	4 :1	Low	Watch Ca
Ca:K pH >7	15:1	11 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	3 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		73
P.F. Sulfur		
Elemental Sulfur	159	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 6-24-35 Soil

Lab #: 321

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.8	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	4088	High	1,800 +
Soluble Salts	0.13	Optimum	< 1.5	Magnesium-ppm	819	Very High	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	256	High	< 225
% Organic Matter	6.47	High		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	226	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1296		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	915
Magnesium-% of CEC	10-20	305
Potassium-% of CEC	2-6	26
Sodium-% of CEC (ESP)	< 5	50
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	5 :1	Low	Watch Ca
Ca:K pH >7	15:1	18 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	4 :1	High	Watch K

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	14	134
P.F. Sulfur		
Elemental Sulfur	279	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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AGRICULTURAL SOIL REPORT

PAP-Accredited NAPT 2015

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 6-35-40 Soil

Lab #:
322

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.6	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	4051	High	1,800 +
Soluble Salts	0.49	Optimum	< 1.5	Magnesium-ppm	613	High	250 +
% Lime	H	over 5.5% lime		Sodium-ppm	218	Optimum	< 225
% Organic Matter	8.46	Very High		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	130	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	825		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	627
Magnesium-% of CEC	10-20	158
Potassium-% of CEC	2-6	10
Sodium-% of CEC (ESP)	< 5	29
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	7 :1	OK	
Ca:K pH >7	15:1	31 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	5 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	110	230
P.F. Sulfur		
Elemental Sulfur	245	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur   Elemental Sulfur = Reclamation Sulfur

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 8-0-8 Soil

Lab #:
323

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.9	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2500	Optimum	1,800 +
Soluble Salts	0.02	Optimum	< 1.5	Magnesium-ppm	742	Very High	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	45	Optimum	< 225
% Organic Matter	3.50	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	156	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	2571		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	1667
Magnesium-% of CEC	10-20	824
Potassium-% of CEC	2-6	53
Sodium-% of CEC (ESP)	< 5	26
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	3 :1	Low	Watch Ca
Ca:K pH >7	15:1	16 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	5 :1	High	Watch K

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur

Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	84	204
P.F. Sulfur		
Elemental Sulfur	90	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 8-8-19 Soil

Lab #:
324

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2193	Optimum	1,800 +
Soluble Salts	0.03	Optimum	< 1.5	Magnesium-ppm	594	High	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	46	Optimum	< 225
% Organic Matter	3.50	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	66	Very Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	2171		

BASES	IDEAL	YOURS		NO3 ppm	NH4 ppm
Calcium-% of CEC	65-80	1462	1 Ft		
Magnesium-% of CEC	10-20	660	2 Ft		
Potassium-% of CEC	2-6	23	3 Ft		
Sodium-% of CEC (ESP)	< 5	27	Total N PPM		
Hydrogen-% of CEC	< 15		Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	4 :1	Low	Watch Ca
Ca:K pH >7	15:1	33 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	9 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	174	294
P.F. Sulfur		
Elemental Sulfur	59	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur   Elemental Sulfur = Reclamation Sulfur

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 13-0-8 Soil

Lab #: 325

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.6	Slightly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	1870	Optimum	1,800 +
Soluble Salts	0.05	Optimum	< 1.5	Magnesium-ppm	512	High	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	52	Optimum	< 225
% Organic Matter	3.75	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	272	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1662		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	1069
Magnesium-% of CEC	10-20	488
Potassium-% of CEC	2-6	80
Sodium-% of CEC (ESP)	< 5	26
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	4 :1	Low	Watch Ca
Ca:K pH >7	15:1	7 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	2 :1	Ok	

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur   Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		88
P.F. Sulfur		
Elemental Sulfur	27	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 13-8-22 Soil

Lab #:
326

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.9	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2561	Optimum	1,800 +
Soluble Salts	0.10	Optimum	< 1.5	Magnesium-ppm	795	Very High	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	153	Optimum	< 225
% Organic Matter	2.38	Low		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	137	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	10761		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	6739
Magnesium-% of CEC	10-20	3487
Potassium-% of CEC	2-6	185
Sodium-% of CEC (ESP)	< 5	350
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	3 :1	Low	Watch Ca
Ca:K pH >7	15:1	19 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	6 :1	High	Watch K

Fertilizer Suggestions in Pounds per Acre for the whole season		
Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	103	223
P.F. Sulfur		
Elemental Sulfur	96	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 13-22-36 Soil

Lab #:
327

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.9	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	3399	Optimum	1,800 +
Soluble Salts	0.10	Optimum	< 1.5	Magnesium-ppm	554	High	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	284	High	< 225
% Organic Matter	4.69	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	101	Low	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1718		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	1264
Magnesium-% of CEC	10-20	343
Potassium-% of CEC	2-6	19
Sodium-% of CEC (ESP)	< 5	92
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	6 :1	OK	
Ca:K pH >7	15:1	34 :1	Low	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	5 :1	High	Watch K

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash	139	259
P.F. Sulfur		
Elemental Sulfur	224	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 13-36-45 Soil

Lab #:
328

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.9	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	3648	High	1,800 +
Soluble Salts	0.20	Optimum	< 1.5	Magnesium-ppm	840	Very High	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	473	Very High	< 225
% Organic Matter	3.41	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	442	Optimum	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	4033		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	2587
Magnesium-% of CEC	10-20	993
Potassium-% of CEC	2-6	161
Sodium-% of CEC (ESP)	< 5	292
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	4 :1	Low	Watch Ca
Ca:K pH >7	15:1	8 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	2 :1	Ok	

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	344	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

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AGRICULTURAL SOIL REPORT

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 21-0-4 Soil

Lab #:
329

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	1661	Low	1,800 +
Soluble Salts	0.05	Optimum	< 1.5	Magnesium-ppm	268	Optimum	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	43	Optimum	< 225
% Organic Matter	4.09	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	1027	Very High	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1278		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	795
Magnesium-% of CEC	10-20	214
Potassium-% of CEC	2-6	252
Sodium-% of CEC (ESP)	< 5	18
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	6 :1	OK	
Ca:K pH >7	15:1	2 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	0 :1	Low	Watch Mg

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur   Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur		
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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2015

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 21-4-16 Soil

Lab #:
330

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.7	Slightly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	1136	Very Low	1,800 +
Soluble Salts	0.06	Optimum	< 1.5	Magnesium-ppm	168	Low	250 +
% Lime	VL	0.5 to 1.5 % lime		Sodium-ppm	32	Optimum	< 225
% Organic Matter	4.16	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	559	High	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	801		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	526
Magnesium-% of CEC	10-20	130
Potassium-% of CEC	2-6	133
Sodium-% of CEC (ESP)	< 5	13
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	7 :1	OK	
Ca:K pH >7	15:1	2 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	0 :1	Low	Watch Mg

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur		
Gypsum		
Lime		
Dolomite		
Magnesium	10	10
Zinc		
Manganese		
Copper		
Boron		

"Always practice the laws of Agronomy"
John P. Taberna, Soil Scientist

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AGRICULTURAL SOIL REPORT

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 21-16-24 Soil

Lab #: 331

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	7.8	Moderately Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	2934	Optimum	1,800 +
Soluble Salts	0.09	Optimum	< 1.5	Magnesium-ppm	396	Optimum	250 +
% Lime	L	1.5 to 3.0 % lime		Sodium-ppm	338	High	< 225
% Organic Matter	4.26	Medium		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	495	High	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1833		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	1298
Magnesium-% of CEC	10-20	292
Potassium-% of CEC	2-6	112
Sodium-% of CEC (ESP)	< 5	130
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	7 :1	OK	
Ca:K pH >7	15:1	6 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	1 :1	Low	Watch Mg

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur

Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	205	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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PAP-Accredited
NAPT
2015

Dealer: CES
Reported: 7-3-2018
Test #: 1
Grower: Calico Resoures
Field ID: GM 21-24-40 Soil

Lab #:
332

AGRICULTURAL SOIL REPORT

ELEMENT	ANSWER	INTERP	SHOULD BE	ELEMENT	ANSWER	INTERP	SHOULD BE
pH-Soil	8.9	Strongly Basic		Sulfur-ppm			20 +
pH-SMP				Calcium-ppm	3085	Optimum	1,800 +
Soluble Salts	0.12	Optimum	< 1.5	Magnesium-ppm	282	Optimum	250 +
% Lime	M	3.1 to 5.5 % lime		Sodium-ppm	431	Very High	< 225
% Organic Matter	5.78	High		Zinc-ppm			1.0 - 3.0
Nitrates-ppm			10 - 35	Copper-ppm			0.8 - 2.5
Ammonium-ppm			5 +	Manganese-ppm			6 - 30
Phosphorus-ppm			25 - 40	Iron-ppm			7 +
Phos-ppm-Bray			50 - 100	Boron-ppm			0.7 - 1.5
Potassium-ppm	397	Optimum	300 +	TBS%	100		

Texture		Water Holding Capacity/foot		Bulk Density	

Cation Exchange Capacity - CEC		P Index	100
Percent Base Saturation	1093		

BASES	IDEAL	YOURS
Calcium-% of CEC	65-80	816
Magnesium-% of CEC	10-20	124
Potassium-% of CEC	2-6	54
Sodium-% of CEC (ESP)	< 5	99
Hydrogen-% of CEC	< 15	

	NO3 ppm	NH4 ppm
1 Ft		
2 Ft		
3 Ft		
Total N PPM		
Lbs N / Acre		

Ratio	Ideal	Yours	Evaluation	Recommendations
Ca:Mg	6-20:1	11 :1	OK	
Ca:K pH >7	15:1	8 :1	OK	
Ca:K pH <7	10:1	:1		
Ca:P pH >7	100:1	:1		
Ca:P pH <7	40:1	:1		
P:Zn	15:1	:1		
P:Mn	4:1	:1		
P:Cu	25:1	:1		
Zn:Cu	3:1	:1		
Mn:Zn	3:1	:1		
Mn:Cu	7:1	:1		
K:B	200:1	:1		
Mg:K	2:1	1 :1	Low	Watch Mg

Split apply Nitrogen. Nitrogen, sulfur and boron recs are made for this year. All other nutrient recs can be split over a two-year program. Tissue and soil test in-season gives the best results.

P.F. Sulfur = Plant Food Sulfur

Elemental Sulfur = Reclamation Sulfur

Fertilizer Suggestions in Pounds per Acre for the whole season

Crop	Grass	Grass
Yield Goal	4 Tons	6 Tons
Past Crop		
Acres		
Nitrogen		
Phosphate		
Add Phos for P INDEX		
Potash		
P.F. Sulfur		
Elemental Sulfur	267	
Gypsum		
Lime		
Dolomite		
Magnesium		
Zinc		
Manganese		
Copper		
Boron		

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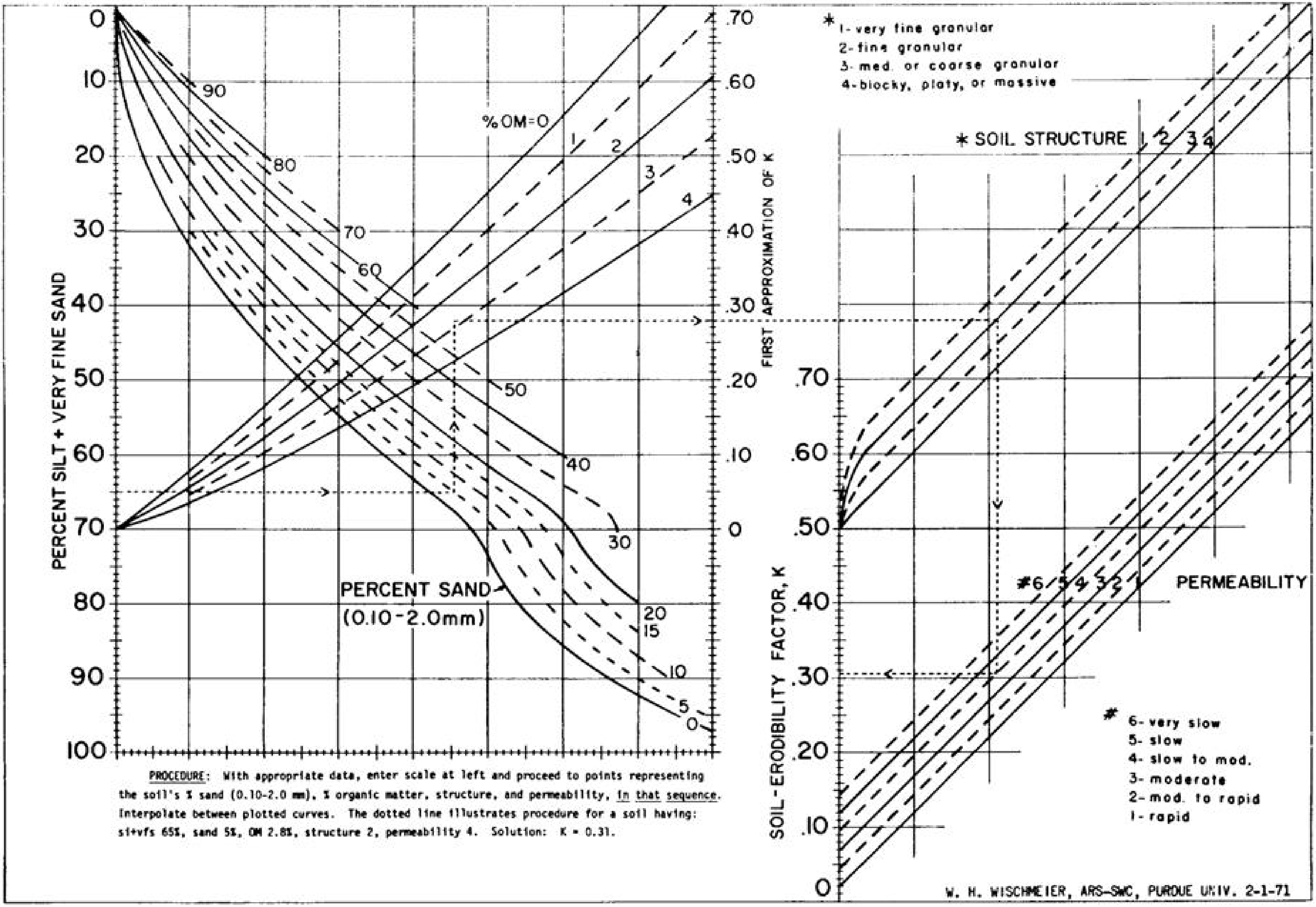
John P. Taberna, Soil Scientist

Appendix C.

Soil Erodibility Nomograph



PROCEDURE: With appropriate data, enter scale at left and proceed to points representing the soil's % sand (0.10-2.0 mm), % organic matter, structure, and permeability, in that sequence. Interpolate between plotted curves. The dotted line illustrates procedure for a soil having: si+vfs 65%, sand 5%, OM 2.8%, structure 2, permeability 4. Solution: K = 0.31.

W. H. WISCHMEIER, ARS-SWC, PURDUE UNIV. 2-1-71